UPKAR'S

QUANTITATIVE APTITUDE TEST

For Bank P.O. & Other Competitive Exams.

By
Dr. N. K. Singh

UPKAR PRAKASHAN, AGRA–2

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Quantitative Aptitude Test

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Average

Formula

Average

$$= \left(\frac{\text{Sum of observations}}{\text{Number of observations}}\right)$$

and sum of all items

= Average × Number of items

1. If a certain distance is covered by two unequal speed u km/hour and v km/hour, then,

$$\text{Average speed} = \frac{2uv}{u+v}$$

Theorem —If a certain distance is covered at u km/hr and the same distance is covered at v km/hr, then the average speed during the whole journey is $\frac{2uv}{u+v}$ km/hr.

Solved Examples

Q. 1. Find the average of first five multiples of 3.

Solution : Average score

$$= \frac{3(1+2+3+4+5)}{5}$$

$$= \left(\frac{3\times 15}{5}\right) = 9$$

Q. 2. A batsman makes a score of 87 runs in the 17th inning and thus increased his average by 3. Find his average after 17th inning.

Solution : Let the average after 17th inning = x

then, average after 16th inning

$= (x-3)$

$\therefore\ 16(x-3) + 87$

$= 17x$

$\Rightarrow \quad x = (87 - 48) = 39$

Hence, the average after 17th inning = 39.

Q. 3. A cricketer makes 72, 59, 18, 101 and 7 runs respectively in five matches played by him. Find his average score.

Solution : Average score

$$= \left(\frac{72+59+18+101+7}{5}\right)$$

$$= \frac{257}{5} = 51{\cdot}4$$

Q. 4. The average of 11 results is 50. If the average of first six results is 49 and that of last six is 52, find the sixth result.

Solution :

Sum of 11 results

$= (11 \times 50) = 550$

Sum of first 6 results

$= (6 \times 49) = 294$

Sum of last 6 results

$= (6 \times 52) = 312$

$\therefore$ 6th result

$= (294 + 312 - 550)$

$= 56.$

Q. 5. The average age of a family of 6 members is 22 years. If the age of the youngest member be 7 years, find the average age of the family at the birth of the youngest member.

Solution : Sum of ages of all members

$= (22 \times 6)$ years

= 132 years

Sum of their age 7 years ago

$= (132 - 7 \times 6) = 90$ years

At that time there were 5 members

$\therefore$ Average age at that time

$= \left(\frac{90}{5}\right)$ years = 18 years.

Q. 6. Sandeep covers a journey Agra to Delhi by car at an average speed of 40 km/hr. He returns back by scooter with an average speed of 24 km/hr. Find his average speed during the whole journey.

Solution : Average speed

$$= \left(\frac{2xy}{x+y}\right)\text{km/hr}$$

$$= \left(\frac{2\times 40\times 24}{40+24}\right)\text{ km/hr.}$$

= 30 km/hr.

Q. 7. 10 sheep and 5 pigs were bought for Rs. 6000. If the average price of a sheep be Rs. 450, find the average price of a pig.

Solution : Total price of 5 pigs

$=$ Rs. $[6000 - (10 \times 450)]$

= Rs. 1500

$\therefore$ Average price of a pig

$= \text{Rs.}\left(\frac{1500}{5}\right)$

= Rs. 300

Exercise

1. The average of 8 number is 21. If each of the numbers is multiplied by 8, the average of the new set of numbers is :
   (A) 8 (B) 21
   (C) 29 (D) 168
2. The average of 50 numbers is 38. If two numbers, namely 45 and 55 are discarded, the average of the remaining number is :
   (A) 36·5 (B) 37·0
   (C) 37·5 (D) 37·52
3. The average score of a cricketer for 10 matches is 43·9 runs. If the average for the first six matches is 53, the average for the last four matches is :
   (A) 17·15 (B) 29·75
   (C) 30·25 (D) 31
4. The average score of a cricketer in 2 matches is 27 and that in 3 others is 32. Then his average score in 5 matches is :
   (A) 11·8 (B) 25
   (C) 29·5 (D) 30
5. The average height of 30 girls out of a class of 40 is 160 cms and that of the remaining girls is 156 cms. The average height of the whole class is :
   (A) 158 cms (B) 158·5 cms
   (C) 159 cms (D) 159·5 cms
6. If $a, b, c\ d, e$ are five consecutive odd numbers, their average is :
   (A) $5(a+4)$
   (B) $\frac{abcd}{5}$
   (C) $5(a+b+c+d+e)$
   (D) None of these
7. The average age of three boys is 15 years. If their ages are in the

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ratio 3 : 5 : 7, the age of the youngest boy is :

(A) 9 years (B) 15 years
(C) 18 years (D) 21 years

8. The average of three numbers is 42. The first is twice the second and the second is twice the third. The difference between the largest and the smallest number is :

(A) 18 (B) 36
(C) 54 (D) 72

9. Out of three numbers, the first is twice the second and is half of the third. If the average of three numbers is 56, the three numbers in order are :

(A) 48, 96, 24 (B) 48, 24, 96
(C) 96, 24, 48 (D) 96, 48, 24

10. The average of first nine multiples of 3 is :

(A) 12·0 (B) 12·5
(C) 15·0 (D) 18·5

11. The average of odd numbers upto 100 is :

(A) 51 (B) 50
(C) 49·5 (D) 49

12. The average of five results is 46 and that of the first four is 45. The fifth result is :

(A) 1 (B) 10
(C) 12·5 (D) 50

13. The average of 30 results is 20 and the average of other 20 results is 30. What is the average of all the results ?

(A) 24 (B) 25
(C) 48 (D) 50

14. The average of numbers 0·64204, 0·64203, 0·64202 and 0·64201 is :

(A) 0·64202 (B) 0·642021
(C) 0·642022 (D) 0·642025

15. The average earning of a mechanic for the first-four days of a week is Rs. 18 and for the last four days is Rs. 22. If he earns Rs. 20 on the fourth day, his average earning for the whole week is :

(A) Rs. 18·95 (B) Rs. 16
(C) Rs. 20 (D) Rs. 25·71

16. The average salary per head of all the workers in a workshop is Rs. 850. If the average salary per head of 7 technicians is Rs. 1000 and the average salary per head of the rest is Rs. 780, the total number of workers in the workshop is :

(A) 18 (B) 20
(C) 22 (D) 24

17. The average weight of A, B, C is 45 kg. If the average weight of A and B be 40 kg and that of B and C be 43 kg, then the weight of B is :

(A) 17 kg (B) 20 kg
(C) 26 kg (D) 31 kg

18. On a journey across Delhi, a taxi average 30 kmph for 60% of the distance, 20 kmph for 20% of it and 10 kmph for the remainder. The average speed for the whole journey is :

(A) 20 km/hr
(B) 22·5 km/hr
(C) 24·625 km/hr
(D) 25 km/hr

19. Average monthly income of a family of 4 earning members was Rs. 735. One of the earning members died and, therefore, the average income came down to Rs. 650. The income of the deceased was :

(A) Rs. 692·80
(B) Rs. 820
(C) Rs. 990
(D) Rs. 1385

20. The average age of 24 students in a class is 10. If the teacher's age is included, the average increases by one. The age of the teacher is :

(A) 25 years (B) 30 years
(C) 35 years (D) 40 years

21. The average of marks obtained by 120 candidates was 35. If the average of marks of passed candidates was 39 and that of failed candidates was 15, the number of candidates who passed the examination is :

(A) 100 (B) 110
(C) 120 (D) 150

22. The average expenditure of a man for the first five months is Rs. 120 and for the next seven months it is Rs. 130. If he saves Rs. 290 in that year, his monthly average income is :

(A) Rs. 140 (B) Rs. 150
(C) Rs. 160 (D) Rs. 170

23. With an average speed of 40 km/hr. a train reaches its destination in time. If it goes with an average speed of 35 km/hr, it is late by 15 minutes. The total journey is :

(A) 30 km (B) 40 km
(C) 70 km (D) 80 km

24. The average salary of 20 workers in an office is Rs. 1900 per month. If the manager's salary is added, the average salary becomes Rs. 2000 p.m. What is the manager's annual salary ?

(A) Rs. 24000
(B) Rs. 25200
(C) Rs. 45600
(D) None of these

25. In a T. V. factory, an average of 60 TVs are produced per day for the first 25 days of the months. A few workers fell ill for the next five days reducing the daily average for the month to 58 sets per day. The average production per day for the last 5 days is :

(A) 45 (B) 48
(C) 52 (D) 58

26. The average age of four children in a family is 12 years. If the spacing between their ages is 4 years, the age of the youngest child is :

(A) 6 years (B) 7 years
(C) 8 years (D) 9 years

27. The average age of four players is 18·5 years. If the age of the coach is also included, the average age increases by 20%. The age of the coach is :

(A) 28 years (B) 31 years
(C) 34 years (D) 37 years

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28. The average weight of a class of 40 students is 40 kg. If the weight of the teacher be included, the average weight increases by 500 gms. The weight of the teacher is :
(A) 40·5 kg (B) 60 kg
(C) 60·5 kg (D) 62 kg

29. The average of the daily income of A, B and C is Rs. 60. If B earns Rs. 20 more than C and A earns double of what C earns; what is the daily income of C ?
(A) Rs. 75
(B) Rs. 60
(C) Rs. 40
(D) None of these

30. The average weight of 8 men is increased by 2 kg when one of the men whose weight is 50 kg is replaced by a new man. The weight of the new man is—
(A) 52 kg (B) 58 kg
(C) 66 kg (D) 68 kg

31. The average weight of 8 persons is increased by 2·5 kg, when one of them whose weight is 56 kg is replaced by a new man. The weight of the new man is—
(A) 66 kg (B) 75 kg
(C) 76 kg (D) 86 kg

32. The average weight of 19 students is 15 kg. By the admission of a new student the average weight is reduced to 14·8 kg. The weight of the new student is—
(A) 10·6 kg (B) 10·8 kg
(C) 11 kg (D) 14·9 kg

33. In a class, there are 20 boys whose average age is decreased by 2 months, when one boy aged 18 years is replaced by a new boy. The age of the new boy is :
(A) 14 years 8 months
(B) 15 years
(C) 16 years 4 months
(D) 17 years 10 months

34. The average age of an adult class is 40 years. 12 new students with an average age of 32 years join the class. Thereby decreasing the average by 4 years. What was the original strength of class ?
(A) 10 (B) 11
(C) 12 (D) 15

35. The average of 6 observations is 12. A new seventh observation is included and the new average is decreased by 1. The seventh observation is :
(A) 1 (B) 3
(C) 5 (D) 6

36. Out of four numbers, the average of first three is 15 and that of the last three is 16. If the last number is 19, the first is :
(A) 15 (B) 16
(C) 18 (D) 19

37. The average of 10 numbers is calculated as 15. It is discovered later on that while calculating the average one number, namely 36 was wrongly read as 26. The correct average is—
(A) 12·4 (B) 14
(C) 16 (D) 18·6

38. The average of 13 results is 68. The average of first seven is 63 and that of the last seven is 70, the seventh result is :
(A) 47 (B) 65·5
(C) 73·5 (D) 94

39. The average of 25 results is 18, that of first twelve is 14 and of last twelve is 17. Thirteenth result is :
(A) 28 (B) 72
(C) 78 (D) 85

40. A man goes to a place at the rate of 4 kmph. He comes back on a bicycle at 16 kmph. His average speed for the entire journey is :
(A) 5 km/hr (B) 6·4 km/hr
(C) 8·5 km/hr (D) 10 km/hr

41. The average temperature of the first three days is 27°C and that of the next three is 29°C. If the average of the whole week is 28·5°C, the temperature of the last day of the week is :
(A) 10·5° C (B) 21° C
(C) 31·5° C (D) 42° C

42. A ship sails out to a mark at the rate of 15 kmph and sails back at the rate of 10 kmph. The average rate of sailing is :
(A) 5 km/hr
(B) 12 km/hr
(C) 12·5 km/hr
(D) 25 km/hr

43. The average consumption of petrol for a car for seven months is 110 litres and for next five months it is 86 litres. The average monthly consumption is :
(A) 96 litres (B) 98 litres
(C) 100 litres (D) 102 litres

44. The average age of 30 students in a class is 12 years. The average age of a group of 5 of the students is 10 years and that of another group of 5 of them is 14 years. The average age of the remaining students is :
(A) 8 years (B) 10 years
(C) 12 years (D) 14 years

45. The average temperature of Monday, Tuesday, Wednesday and Thursday was 38° and that of Tuesday, Wednesday, Thursday and Friday was 40°. If the temperature on Monday was 30°, the temperature of Friday was :
(A) 40° (B) 39°
(C) 38° (D) 30°

46. A shopkeeper earned Rs. 504 in 12 days. His average income for the first four days was Rs. 40 a day. His average income for the remaining days is :
(A) Rs. 40 (B) Rs. 42
(C) Rs. 43 (D) Rs. 45

47. The average of 5 consecutive numbers is n, if the next two numbers are also included, the average of 7 numbers will :
(A) Increase by 2
(B) Increase by 1
(C) Remains the same
(D) Increase by 1·4

48. A man whose bowling average is 12·4 takes 5 wickets for 26 runs

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and thereby decreases his average by 0·4. The number of wickets taken by him, before his last match is :

(A) 85 (B) 78

(C) 72 (D) 64

49. The average weight of three men A, B and C is 84 kg. Another man D joins the group and the new average becomes 80 kg. If another man E, whose weight is 3 kg more than that of D, replace A, then the average weight of B, C, D and E becomes 79 kg. The weight of A is :

(A) 70 kg (B) 72 kg

(C) 75 kg (D) 80 kg

50. There were 35 students in a hostel. If the number of students increased by 7, the expenses of the mess were increased by Rs. 42 per day, while the average expenditure per head diminished by Re. 1. The original expenditure of the mess was :

(A) Rs. 40 (B) Rs. 420

(C) Rs. 432 (D) Rs. 442

51. A batsman has a certain average runs for 11 innings. In the 12th inning he made a score of 90 runs and thereby decreased his average by 5. His average after 12th innings is :

(A) 127 (B) 145

(C) 150 (D) 217

52. The average age of a husband and a wife was 23 years when they were married 5 years ago. The average age of the husband, the wife and a child, who was born during the interval is 20 years now. How old is the child now ?

(A) less than 1 year

(B) 1 year

(C) 3 years

(D) 4 years

53. Ten years ago the average age of a family of 4 members was 24 years. Two children having been born the average age of the family is same to-day. What is the present age of the youngest child if they differ in age by 2 years ?

(A) 1 year

(B) 2 years

(C) 3 years

(D) 5 years

54. The mean temperature of Monday to Wednesday was 37°C and of Tuesday to Thursday was 34°C. If the temperature on Thursday was $\frac{4}{5}$th that of Monday, what was the temperature on Thursday ?

(A) 34° C

(B) 35·5° C

(C) 36° C

(D) 36·5° C

55. Average temperature of first 4 days of a week is 38·6°C and that of the last 4 days is 40·3°C. If the average temperature of the week be 39·1°C, the temperature on 4th day is :

(A) 36·7° C (B) 38·6° C

(C) 39·8° C (D) 41·9° C

56. The average age of 5 members of a committee is the same as it was 3 years ago, because an old member has been replaced by a new member. The difference between the ages of old and new member is :

(A) 2 years (B) 4 years

(C) 8 years (D) 15 years

57. The average age of A, B, C, D five years ago was 45 years. By including X, the present average age of all the five is 49 years. The present age of X is—

(A) 64 years (B) 48 years

(C) 45 years (D) 40 years

58. The average age of 11 players of a cricket team is decreased by two months when two of them aged 17 years and 20 years are replaced by two reserves. The average age of the reserves is :

(A) 17 years 1 month

(B) 17 years 7 months

(C) 17 years 11 months

(D) 18 years 3 months

59. The average age of a family of 6 members is 22 years. If the age of the youngest member be 7 years, the average age of the family at the birth of the youngest member was :

(A) 15 years

(B) 17 years

(C) 17·5 years

(D) 18 years

60. 5 years ago, the average of Ram and Shyam's ages was 20 years. Now, the average age of Ram, Shyam and Mohan is 30 years. What will be Mohan's age 10 years hence ?

(A) 45 years

(B) 50 years

(C) 49 years

(D) 60 years

61. The average height of 40 students is 163 cm. On a particular day, three students A, B, C were absent and the average of the remaining 37 students was found to be 162 cm. If A, B have equal heights and the height of C be 2 cm less than that of A, find the height of A :

(A) 176 cm (B) 166 cm

(C) 180 cm (D) 186 cm

62. Out of three numbers, the first is twice the second and is half of the third. If the average of the three numbers is 56, the three numbers in order are :

(A) 48, 96, 24

(B) 48, 24, 96

(C) 96, 24, 48

(D) 96, 48, 24

63. The average age of A and B is 20 years. If C were to replace A, the average would be 19 and if C were to replace B, the average would be 21. What are the ages of A, B and C ?

(A) 22, 18, 20

(B) 18, 22, 20

(C) 22, 20, 18

(D) 18, 20, 22

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Answers with Hints

1. (D) Average of new members
$= (21 \times 8) = 168$

2. (C) Total of 50 members
$= (50 \times 38) = 1900$
Total of 48 members
$= [1900 - (45 + 55)] = 1800$
$\therefore$ Required average $= \frac{1800}{48}$
$= \frac{225}{6} = 37{\cdot}5$

3. (C) $53 \times 6 + x \times 4 = 10 \times 43{\cdot}9$
$\therefore \quad 4x = 439 - 318$
$\Rightarrow \quad 4x = 121 \ \therefore \ x = 30{\cdot}25$

4. (D) Average $= \frac{2 \times 27 + 3 \times 32}{5}$
$= \frac{150}{5} = 30$

5. (C) Average height of the whole class
$= \frac{30 \times 160 + 10 \times 156}{40} = 159$ cms.

6. (D) Average
$= \frac{a + (a + 2) + (a + 4) + (a + 6) + (a + 8)}{5}$
$= (a + 4)$

7. (A) $\frac{3x + 5x + 7x}{3} = 15$
$\Rightarrow \quad 15x = 15 \times 3$
$\Rightarrow \quad x = 3$

8. (C) Let third number $= x$
Then, second number $= 2x$
and first number $= 4x$
$\therefore \quad \frac{x + 2x + 4x}{3} = 42$
$\Rightarrow \quad 7x = 42 \times 3$
$\Rightarrow \quad x = 18$
So, (largest) – (smallest) $= (4x - x)$
$= 3x = 54$

9. (B) Let second number $= x$
Then, first one $= 2x$ and third number $= 4x$
$\because \quad \frac{x + 2x + 4x}{3} = 56$
$\Rightarrow \quad 7x = 168$
$\Rightarrow \quad x = 24$
So the number are 48, 24, 96.

10. (C) Average
$= \frac{3 + 6 + 9 + 12 + 15 + 18 + 21 + 24 + 27}{9}$
$= \frac{3\,(1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9)}{9}$
$= \left(\frac{45}{3}\right) = 15$

11. (B) Sum of odd numbers upto 100
$= 1 + 3 + 5 + 7 + \ldots\ldots + 95 + 97 + 99$
$= (1 + 99) + (3 + 97) + (5 + 95) + \ldots\ldots$ upto 25 terms
$= 100 + 100 + 100 + \ldots\ldots$ upto 25 terms
$= 2500$
$\therefore$ Average $= \left(\frac{2500}{50}\right) = 50$

12. (D) Fifth result $= (5 \times 46 - 4 \times 45)$
$= (230 - 180) = 50$

13. (A) Total of 50 results $= (30 \times 20 + 20 \times 30)$
$= 1200$

14. (D) Average
$= \left(\frac{0{\cdot}64204 + 0{\cdot}64203 + 0{\cdot}64202 + 0{\cdot}64201}{4}\right)$
$= \frac{2{\cdot}5681}{4} = 0{\cdot}642025$

15. (C) Total earning for the week
$=$ Rs. $(4 \times 18 + 4 \times 22 - 20) =$ Rs. 140
$\therefore$ Average earning
$=$ Rs. $\left(\frac{140}{7}\right) =$ Rs. 20

16. (C) $\because \quad 7 \times 1000 + x \times 780 = (x + 7) \times 850$
$\Rightarrow \quad (850 - 780)\,x = (7000 - 5950)$
$\Rightarrow \quad 70x = 1050$
$\therefore \quad x = 15$
Hence, the total number of workers
$= (7 + 15) = 22$

17. (D) $\because$ Weight of (A + B) $= (2 \times 40)$ kg $= 80$ kg
$\Rightarrow$ Weight of (B + C) $= (2 \times 43)$ kg $= 86$ kg
$\Rightarrow$ Weight of (A + 2B + C) $= (80 + 86)$ kg $= 166$ kg
$\Rightarrow$ Weight of (A + B + C) $= (3 \times 45)$ kg $= 135$ kg
$\therefore$ Weight of B $= (166 - 135)$ kg $= 31$ kg

18. (A) Let total journey $= x$ km
Total time taken
$= \left(\frac{60}{100}x \times \frac{1}{30} + \frac{20}{100}x \times \frac{1}{20} + \frac{20}{100}x \times \frac{1}{10}\right)$ hrs.
$= \left(\frac{x}{50} + \frac{x}{100} + \frac{x}{50}\right)$ hrs. $= \left(\frac{x}{20}\right)$ hrs.

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$\therefore$ Average speed

$= \left(x \times \frac{20}{x}\right)$ km/hr

$= 20$ km/hr.

19. (C) Income of the deceased

$= \text{Rs. } (735 \times 4 - 650 \times 3) = \text{Rs. } 990$

20. (C) Age of the teacher

$= (25 \times 11 - 24 \times 10)$ years $= 35$ years.

21. (A) Let the number of candidates who passed $= x$

then, $\because 39 \times x + 15 \times (120 - x) = 120 \times 35$

$\Rightarrow 24x = 4200 - 1800$

$\therefore x = \left(\frac{2400}{24}\right) = 100$

22. (B) Total income

$= \text{Rs. } (120 \times 5 + 130 \times 7 + 290) = \text{Rs. } 1800$

Average monthly income

$= \text{Rs. } \left(\frac{1800}{12}\right) = \text{Rs. } 150$

23. (C) $\because \frac{x}{35} - \frac{x}{40} = \frac{15}{60}$

$\Rightarrow \frac{5x}{35 \times 40} = \frac{1}{4}$

$\Rightarrow x = \frac{35 \times 40}{4 \times 5} = 70$

$\therefore$ Total journey $= 70$ km.

24. (D) Manager's salary per month

$= \text{Rs. } (21 \times 2000 - 20 \times 1900)$

$= \text{Rs. } 4000$

$\therefore$ Manager's annual salary

$= \text{Rs. } (4000 \times 12) = \text{Rs. } 48000.$

25. (B) Production during these 5 days

$= (30 \times 58 - 25 \times 60) = 240$

$\therefore$ Average for last 5 days $= \frac{240}{5} = 48$

26. (A) $\because x + (x + 4) + (x + 8) + (x + 12)$

$= 4 \times 12$

$\Rightarrow 4x = (48 - 24) = 24$

$\therefore x = 6$ years.

27. (D) New average

$= (120\% \text{ of } 18{\cdot}5) = \left(\frac{120}{100} \times 18{\cdot}5\right) = 22{\cdot}2$

Age of coach

$= (5 \times 22{\cdot}2 - 4 \times 18{\cdot}5) = 37$ years

28. (C) Weight of the teacher

$= (41 \times 40{\cdot}5 - 40 \times 40)$ kg $= 60{\cdot}5$ kg

29. (C) Let C's earning $=$ Rs. x.

Then, B's earning $=$ Rs. $(x + 20)$

and A's earning $=$ Rs. $2x$

$\because 2x + x + 20 + x = 3 \times 60$

$\Rightarrow 4x = 160$

$\therefore x = 40$

Hence, the daily earning of C is Rs. 40.

30. (C) Weight increased $= (8 \times 2)$ kg $= 16$ kg

Weight of new man $= (50 + 16)$ kg $= 66$ kg.

31. (C) Total increase $= (8 \times 2{\cdot}5)$ kg $= 20$ kg

Weight of new man $= (56 + 20)$ kg $= 76$ kg

32. (C) Weight of new student

$= (20 \times 14{\cdot}8 - 19 \times 15)$ kg $= 11$ kg.

33. (A) Total decrease

$= (20 \times 2)$ months

$= 3$ year 4 months

$\therefore$ Age of the new boy

$= (18 \text{ years}) - (3 \text{ years } 4 \text{ months})$

$= 14$ years 8 months.

34. (C) Let original strength $= x$

Then, $40x + 12 \times 32 = (x + 12) \times 36$

$\Rightarrow 40x + 384 = 36x + 432$

$\Rightarrow 4x = 48 \ \therefore x = 12$

35. (C) Seventh observation $= (7 \times 11 - 6 \times 12)$

$= 5$

36. (B) Sum of four numbers $= (15 \times 3 + 19) = 64$

Sum of last three numbers $= (16 \times 3) = 48$

$\therefore$ First number $= (64 - 48) = 16.$

37. (C) Sum of numbers $= (10 \times 15 - 26 + 36)$

$= 160$

$\therefore$ Correct average $= \frac{160}{10} = 16.$

38. (A) Seventh Result $= (7 \times 63 + 7 \times 70 - 13 \times 68)$

$= 47.$

39. (C) Thirteenth Result

$= (25 \times 18 - 12 \times 14 - 12 \times 17)$

$= 78.$

40. (B) Average speed $= \left(\frac{2xy}{x + y}\right)$ km/hr

$= \left(\frac{2 \times 4 \times 16}{4 + 16}\right)$ km/hr

$= 6{\cdot}4$ km/hr.

41. (C) $3 \times 27 + 3 \times 29 + x = 7 \times 28{\cdot}5$

$\therefore x = 31{\cdot}5.$

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42. (B) Average $= \left(\frac{2xy}{x+y}\right)$km/hr

$= \left(\frac{2 \times 15 \times 10}{15+10}\right)$ km/hr

$= 12$ km/hr.

43. (C) Average $= \left(\frac{110 \times 7 + 86 \times 5}{12}\right)$

$= \left(\frac{1200}{12}\right) = 100$ litres.

44. (C) Let average age of the remaining students be x.

Then, $5 \times 10 + 5 \times 14 + 20 \times x = 30 \times 12$

$\Rightarrow 20x = 360 - 120$

$\Rightarrow 20x = 240$

$\Rightarrow x = 12.$

45. (C) $\because$ M + T + W + Th $= (4 \times 38°) = 152°$

$\Rightarrow$ T + W + Th $= (152° - 30°) = 122°$

$\Rightarrow$ T + W + Th + F $= (4 \times 40°) = 160°$

$\Rightarrow$ F $= (160° - 122°) = 38°$

46. (C) Let the average for remaining 8 days be Rs. x a day.

Then, $4 \times 40 + 8 \times x = 504$

$\Rightarrow 8x = 344$

$\Rightarrow x = 43$

$\therefore$ Required average = Rs. 43

47. (B) $x + (x+1) + (x+2) + (x+3) + (x+4)$

$= 5n$

$\Rightarrow 5x + 10 = 5n$

$\Rightarrow x = (n-2)$

Average of 7 consecutive integers

$= \frac{(5x+10) + (x+5) + (x+6)}{7}$

$= \frac{7x+21}{7} = x + 3$

$\therefore$ New average $= (n - 2 + 3) = n + 1$

So, the new average increases by 1.

48. (A) Let the number of wickets taken before the last match = x

Then, $\frac{12{\cdot}4x + 26}{x+5} = 12$

$\Rightarrow x = 85$

49. (C) $\because$ A + B + C $= 3 \times 84 = 252$;

$\Rightarrow$ A + B + C + D $= (4 \times 80) = 320$

$\therefore$ D $= (320 - 252) = 68$

and so E $= (68 + 3) = 71$

Now, B + C + D + E $= (4 \times 79) = 316$

$\therefore$ B + C + D $= (316 - 71) = 245$

So, A $= (320 - 245) = 75$ kg.

50. (B) Let the original expenditure be Rs. x per day,

Then, $\frac{x}{35} - \frac{(x+42)}{42} = 1$

$\Rightarrow 42x - 35(x+42) = 35 \times 42$

$\therefore 7x = 35 \times 42 + 35 \times 42$

$\Rightarrow x = \frac{2 \times 35 \times 42}{7} = 420$

Hence, the original expenditure is Rs. 420

51. (B) $\because 11x + 90 = (x-5) \times 12$

$\Rightarrow x = 150$

$\therefore$ Average after 12th inning

$= (150 - 5) = 145.$

52. (D) Age of child

$= [(20 \times 3) - (23 \times 2 + 5 \times 2)]$ years

$= 4$ years.

53. (C) $\because x + x + 2 = (24 \times 6) - (24 \times 4 + 4 \times 10)$

$= 144 - 136$

$\Rightarrow 2x + 2 = 8$

$\therefore x = 3.$

54. (C) (M + T + W) $= (3 \times 37) = 111°$ …(i)

(T + W + Th) $= (3 \times 34) = 102°$ …(ii)

Let M $= x$

Then, Th $= \frac{4}{5}x$

Subtracting (ii) from (i) we get,

M – Th $= 9°$

$\Rightarrow x - \frac{4}{5}x = 9°$

$\Rightarrow x = 45°$

$\therefore$ Temperature on Thursday

$= \left(\frac{4}{5} \times 45°\right) = 36°$ C

55. (D) $\because 4 \times 38{\cdot}6 + 4 \times 40{\cdot}3 - x = 7 \times 39{\cdot}1$

$\Rightarrow x = 41{\cdot}9$

$\therefore$ Temperature on 4th day $= 41{\cdot}9°$ C

56. (D) Increase during 3 years $= (3 \times 5)$ years

$= 15$ years

So, the difference between ages of old and new member is 15 years.

57. (C) Present age of X

$= [(49 \times 5) - (4 \times 45 + 4 \times 5)]$ years $= 45$ years.

58. (B) Decrease $= (11 \times 2)$ months

$= 1$ year 10 months

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Total age of reserves

$= (17 + 20)$ years $- (1$ year 10 month$)$

$= 35$ years 2 months

Average age of the reserves

$= \frac{1}{2}(35$ years 2 months$)$

$= 17$ years 7 months.

59. (D) Total present age of the family

$= (6 \times 22) = 132$ years

Total age of the family 7 years ago

$= (132 - 7 \times 6) = 90$ years

At that time, the number of members was 5

$\therefore$ Average age at that time

$= \left(\frac{90}{5}\right)$ years $= 18$ years.

60. (B) Total age of Ram and Shyam 5 years ago

$= (2 \times 20) = 40$ years

$\therefore$ Total age of Ram and Shyam at present

$= (40 + 5 + 5) = 50$ years

Total age of Ram, Shyam and Mohan now

$= (3 \times 30) = 90$ years

Mohan's age now

$= (90 - 50)$ years $= 40$ years

Mohan's age 10 years hence

$= (40 + 10)$ years $= 50$ years

61. (A) Let the heights of A, B and C be x cm, x cm and $(x - 2)$ cm respectively

Then, $x + x + (x - 2) = (163 \times 40 - 162 \times 37)$

$\Rightarrow \quad 3x - 2 = 526$

$\therefore \quad x = 176$ cm

62. (B) Let the numbers be $2x$, x and $4x$

$\because \quad \text{Average} = \frac{2x + x + 4x}{3}$

$\Rightarrow \quad \frac{7x}{3} = 56$

$\therefore \quad x = \frac{3 \times 56}{7} = 24$

Hence, the numbers in order are 48, 24 and 96.

63. (A) Let a, b, c are the ages of A, B and C respectively

$a + b = 2 \times 20 = 40 \quad \ldots(1)$

$+ \quad b + c = 2 \times 19 = 38 \quad \ldots(2)$

$+ \quad c + a = 2 \times 21 = 42 \quad \ldots(3)$

[Adding all the 3 equalities]

$+ \quad a + b + c = 60 \quad \ldots(4)$

$- \quad (b + c) = -38$

$\therefore \quad a = 22$

$- \quad (a + c) = -42$

$\therefore \quad b = 18$

and $\quad c = 20$

$\therefore$ Age of A $= 22$ years

Age of B $= 18$ years

Age of C $= 20$ years

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Time & Distance

Formulae

(i) Speed = $\frac{\text{Distance}}{\text{Time}}$

(ii) Time = $\frac{\text{Distance}}{\text{Speed}}$

(iii) Distance = (Speed × Time)

(iv) If a certain distance is covered at x km/hr and the same distance is covered at y km/hr, then the average speed during whole journey is—

$$\left(\frac{2xy}{x+y}\right)\text{km/hr}$$

(v) If the speed of a body is changed in the ratio $a : b$ then the ratio of the time taken changes in the ratio $b : a$.

(vi) x km/hr = $\left(x \times \frac{5}{18}\right)$ m/sec

(vii) x metres/sec.

= $\left(x \times \frac{18}{5}\right)$ km/hr.

Examples

Q. 1. A man cycles from A to B a distance of 21 km in 1 hour 40 min. The road from A is level for 13 km and then it is uphill to B. The man's average speed on levels is 15 km/hr. Find his average uphill speed.

Solution :

Let the average uphill speed be x km/hr.

Then, $\frac{13}{15} + \frac{8}{x} = \frac{5}{3}$

$\Rightarrow \quad \frac{8}{x} = \frac{5}{3} - \frac{13}{15}$

$\Rightarrow \quad \frac{8}{x} = \frac{12}{15}$

$\Rightarrow \quad \frac{8}{x} = \frac{4}{5}$

$\Rightarrow \quad x = \frac{5 \times 8}{4}$

$= 10$

$\therefore$ Average uphill speed

= 10 km/hr.

Q. 2. Walking $\frac{3}{4}$ of his usual speed a peon is 10 min. too late to his office. Find his usual time to cover the distance.

Solution :

Let the usual time be x min.

Time taken at $\frac{3}{4}$ of the usual speed = $\left(\frac{4}{3}x\right)$ min.

$\because \quad \frac{4}{3}x - x = 10$

$\Rightarrow \quad 4x - 3x = 30$

$\Rightarrow \quad x = 30$

Hence, the usual time taken

= 30 min.

Q. 3. A man covers a certain distance between his house and office on scooter. Having an average speed of 30 km/hr. he is late by 10 min. However, with a speed of 40 km/hr, reaches his office 5 min. earlier. Find the distance between his house and office.

Solution :

Let the required distance be x km

Time taken to cover x km at 30 km/hour = $\left(\frac{x}{30}\right)$ hrs.

Time taken to cover x km at 40 km/hour = $\left(\frac{x}{40}\right)$ hrs.

Difference between the times taken = 15 min. = $\frac{1}{4}$ hr.

$\because \quad \frac{x}{30} - \frac{x}{40} = \frac{1}{4}$

$\Rightarrow \quad 4x - 3x = 30$

$\Rightarrow \quad x = 30$

Hence, the required distance is 30 km.

Q. 4. Harish covers a certain distance by car driving at 70 km/hr. and he returns back at the starting point riding on a scooter at 55 km/hr. Find his average speed for the whole journey.

Solution :

Average speed

= $\left(\frac{2 \times 70 \times 55}{70 + 55}\right)$ km/hr.

= 61·6 km/hr.

Q. 5. (i) Convert 45 km/hr. into metres/sec.

(ii) Convert 6 metres/sec into km/hr.

Solution :

(i) 45 km/hr = $\left(45 \times \frac{5}{18}\right)$ m/sec

= 12·5 m/sec

(ii) 6m/sec. = $\left(6 \times \frac{18}{5}\right)$ km/hr.

= 21·6 km/hr.

Exercise

1. Laxman has to cover a distance of 6 km in 45 minutes. If he covers one half of the distance in $\frac{2}{3}$rd time. What should be his speed to cover the remaining distance in the remaining time ?
   (A) 12 km/hr. (B) 16 km/hr.
   (C) 3 km/hr. (D) 8 km/hr.
2. A train covers a distance in 50 minutes. If it runs at a speed of 48 km per hour on an average. The speed at which the train must run to reduce the time of journey to 40 minutes, will be :
   (A) 50 km/hr. (B) 55 km/hr.
   (C) 60 km/hr. (D) 70 km/hr.
3. Excluding stoppages, the speed of a bus is 54 km/hr. and including stoppages it is 45 km/hr. For how many minutes does the bus stop per hour ?
   (A) 9 (B) 10
   (C) 12 (D) 20
4. Two man start together to walk to a certain destination. One at 3·75 km an hour and another at 3 km an hour. The former arrives half an hour before the later. The distance is—
   (A) 9·5 km. (B) 8 km.
   (C) 7·5 km. (D) 6 km.
5. A car covers four successive three km streches at speeds of 10

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km/hr., 20 km/hr, 30 km/hr. and 60 km/hr. respectively. Its average speed over this distance is—
(A) 10 km/hr. (B) 20 km/hr.
(C) 30 km/hr. (D) 25 km/hr.

6. A and B are two stations. A train goes from A to B at 64 km/hr. and returns to A at a slower speed. If its average speed for the whole journey is 56 km/hr. at what speed did it return ?
(A) 48 km/hr. (B) 49·77 km/hr.
(C) 52 km/hr. (D) 47·46 km/hr.

7. A car completes a certain journey in 8 hours. It covers half the distance at 40 km/hr. and the rest at 60 km/hr. The length of the journey is—
(A) 350 km. (B) 420 km.
(C) 384 km. (D) 400 km.

8. Suresh travelled 1200 km by air which formed (2/5) of his trip. One-third of the whole trip he travelled by car and the rest of the journey he performed by train. The distance travelled by train was—
(A) 1600 km. (B) 800 km.
(C) 1800 km. (D) 400 km.

9. Rahim covers a certain distance in 14 hrs 40 min. He covers one half of the distance by train at 60 km/hr. and the rest half by road at 50 km/hr. The distance travelled by him is—
(A) 960 km. (B) 720 km.
(C) 1000 km. (D) 800 km.

10. A man performs $\frac{2}{15}$ of the total journey by rail, $\frac{9}{20}$ by tonga and the remaining 10 km. on foot. This total journey is—
(A) 15·6 km. (B) 12·8 km.
(C) 16·4 km. (D) 24 km.

11. Shard covers two-third of a certain distance at 4 km/hr. and the remaining at 5 km/hr. If he takes 42 minutes in all, the distance is—
(A) 2·5 km. (B) 4·6 km.
(C) 4 km. (D) 3 km.

12. Two cyclists A and B start from the same place at the same time. One going towards north at 18 km/hr. and other going towards south at 20 km/hr. What time will they take to be 95 km. apart?
(A) 4 hrs. 30 min.
(B) 4 hrs. 45 min.
(C) 5 hrs. 16 min.
(D) 2 hrs. 30 min.

13. A boy goes to school with a speed of 3 km/hr. and returns to the village with a speed of 2 km/hr. If he takes 5 hours in all the distance between the village and the school is—
(A) 6 km. (B) 7 km.
(C) 8 km. (D) 9 km.

14. A distance is covered in 2 hours 45 min. at 4 km/hr. How much time will be taken to cover it at 16·5 km/hr. ?
(A) 40 min.
(B) 41 min. 15 sec.
(C) 45 min.
(D) 90 min.

15. If a man takes 4 hours to cover a distance of 15 km. How much time will be needed to cover 63 km. at the same speed ?
(A) 12 hrs. 36 min.
(B) 16 hrs. 48 min.
(C) 16 hrs. 4 min.
(D) 15 hrs. 32 min.

16. A train is moving with a speed of 92·4 km/hr. How many metres will it cover in 10 min. ?
(A) 1540 (B) 15400
(C) 154 (D) 15·4

17. If a man covers 10·2 km. in 3 hours. The distance covered by him in 5 hours is—
(A) 18 km. (B) 15 km.
(C) 16 km. (D) 17 km.

18. A man crosses a street 600 m long in 5 minutes. His speed in km. per hour is—
(A) 7·2 (B) 3·6
(C) 10 (D) 8·4

19. A and B are two towns. Mr. Faruqui covers the distance from A to B on cycle at 16 km/hr. However, he covers the distance from B to A on foot at 9 km/hr. His average speed during the whole journey is—
(A) 12·5 km/hr.
(B) 10·25 km/hr.
(C) 11·52 km/hr.
(D) 12·32 km/hr.

20. A speed of 22·5 m/sec. is the same as—
(A) 40·5 km/hr.
(B) 81 km/hr.
(C) 36·8 km/hr.
(D) 72 km/hr.

21. A speed of 55 m/sec. is the same as—
(A) 198 km/hr.
(B) 11 km/hr.
(C) $15\frac{5}{18}$ km/hr.
(D) 275 km/hr.

22. A speed of 30·6 km/hr. is the same as—
(A) 5·1 m/sec.
(B) 8·5 m/sec.
(C) 110·16 m/sec.
(D) 1·7 m/sec.

23. A speed of 36 km/hr. is the same as—
(A) 10 m/sec.
(B) 7·2 m/sec.
(C) 2 m/sec.
(D) 129·6 m/sec.

24. The distance between two stations A and B is 220 km. A train leaves A towards B at an average speed of 80 km/hr. After half an hour another train leaves B towards A at an average speed of 100 km/hr. The distance of the point where the two trains meet, from A is—
(A) 120 km. (B) 130 km.
(C) 140 km. (D) 150 km.

25. A bullock cart has to cover a distance of 80 km. in 10 hours. If it covers half of the journey in (3/5) the time, what should be its speed to cover the remaining distance in time left ?
(A) 8 km/hr.
(B) 20 km/hr.
(C) 6·4 km/hr.
(D) 10 km/hr.

26. Suresh started cycling along the boundries of a square field from corner point A. After half an hour, he reached the corner point C, diagonally opposite to A. If his speed was 8 km/hr, what is

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the area of the field in square km. ?

(A) 64

(B) 8

(C) 4

(D) Cannot be determined

27. A man goes uphill with an average speed of 35 km/hr. and covers down with an average speed of 45 km/hr. The distance travelled in both the cases being the same, the average speed for the entire journey is—

(A) $38\frac{3}{8}$ km/hr.

(B) $39\frac{3}{8}$ km/hr.

(C) 40 km/hr.

(D) None of these

28. A man walking at 3 km/hr. crosses a square field diagonally in 2 min. The area of the field is—

(A) 25 acres (B) 30 acres

(C) 50 acres (D) 60 acres

29. The ratio between the rates of travelling of A and B is 2 : 3 and therefore A takes 10 min. more than the time taken by B to reach a destination. If A had walked at double the speed, he would have covered the distance in—

(A) 30 min. (B) 25 min.

(C) 15 min. (D) 20 min.

30. A certain distance is covered at a certain speed. If half of this distance is covered in double the time, the ratio of the two speed is—

(A) 4 : 1 (B) 1 : 4

(C) 2 : 1 (D) 1 : 2

31. If a boy takes as much time in running 10 m as a car takes in covering 25 m, the distance covered by the boy during the time the car covers 1 km, is—

(A) 400 m. (B) 40 m.

(C) 250 m. (D) 650 m.

32. A is twice as fast as B and B is thrice as fast as C is. The journey covered by C in 42 minutes, will be covered by A in—

(A) 14 min. (B) 28 min.

(C) 63 min. (D) 7 min.

33. The ratio between the rates of walking of A and B is 2 : 3. If the time taken by B to cover a certain distance is 36 minutes, the time taken by A to cover that much distance is—

(A) 24 min. (B) 54 min.

(C) 48 min. (D) 21·6 min.

34. A man, on tour travels first 160 km. at 64 km/hr. and the next 160 km at 80 km/hr. The average speed for the first 320 km. of the tour is—

(A) 35·55 km/hr.

(B) 71·11 km/hr.

(C) 36 km/hr.

(D) 72 km/hr.

35. A man travels 35 km. partly at 4 km/hr. and at 5 km/hr. If he covers former distance at 5 km/hr. and later distance at 4 km/hr. he could cover 2 km. more in the same time. The time taken to cover the whole distance at original rate is—

(A) 9 hours (B) 7 hours

(C) $4\frac{1}{2}$ hours (D) 8 hours

36. By walking at $\frac{3}{4}$ of his usual speed, a man reaches his office 20 minutes later than usual. This usual time is—

(A) 30 minutes

(B) 60 minutes

(C) 75 minutes

(D) 1 hour 30 min.

37. If a train runs at 40 km/hr. It reaches its destination late by 11 min. but if it runs at 50 km/hr, it is late by 5 min. only. The correct time for the train to cover its journey is—

(A) 13 min. (B) 15 min.

(C) 21 min. (D) 19 min.

38. Ram travels a certain distance at 3 km/hr. and reaches 15 min. late. If he travels at 4 km/hr. he reaches 15 min. earlier. The distance he has to travel is—

(A) 4·5 km. (B) 6 km.

(C) 7·2 km. (D) 12 km.

39. A thief steals a car at 1·30 p.m. and drives it at 45 km. an hour. The theft is discovered at 2 p.m. and the owner sets off in another car at 50 km. an hour. He will overtake the thief at—

(A) 3·30 p.m. (B) 4 p.m.

(C) 4·30 p.m. (D) 6 p.m.

40. A train leaves Meerut at 6 a.m. and reaches Delhi at 10 a.m. Another train leaves Delhi at 8 a.m. and reaches Meerut at 11·30 a.m. At what time do the trains cross one another ?

(A) 9·26 a.m. (B) 9 a.m.

(C) 8·36 a.m. (D) 8·56 a.m.

41. Two trains start at the same time from Aligarh and Delhi and proceed towards each other at 16 km/hr. and 21 km/hr. respectively. When they meet, it is found that one train has travelled 60 km. more than the other. The distance between the two stations is—

(A) 445 km. (B) 444 km.

(C) 440 km. (D) 450 km.

42. X and Y are two stations 500 km. apart. A train starts from X and moves towards Y at 20 km/hr. Another train starts from Y at the same time and moves towards X at 30 km/hr. How far from X will they cross each other ?

(A) 200 km. (B) 30 km.

(C) 120 km. (D) 40 km.

43. A car travels a distance of 840 km. at a uniform speed. If the speed of the car is 10 km/hr. more. It takes two hours less to cover the same distance. The original speed of the car was :

(A) 45 km/hr. (B) 50 km/hr.

(C) 60 km/hr. (D) 75 km/hr.

44. A train is running with the speed of 45 km/hour. What is its speed in metre per second ?

(A) 12·5

(B) 13·5

(C) 20·5

(D) None of these

45. If a motor car covers a distance of 250 m in 25 seconds, what is its speed in kilometre per hour ?

(A) 36·5 (B) 36·8

(C) 37 (D) 36

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46. A train leaves Delhi at 5 a.m. and reaches Kanpur at 10 a.m. Another train leaves Kanpur at 7 a.m. and reaches Delhi at 2 p.m. At what time do the two trains meet ?

(A) 8·45 a.m.

(B) 3·45 p.m.

(C) 6·45 a.m.

(D) Data inadequate

47. A starts from P to walk to Q a distance of 51·75 kilometeres at the rate of 3·75 km. an hour. An hour later B starts from Q for P and walks at the rate of 4·25 km. an hour. When and where will A meet B ?

(A) 26·25 km. from Q

(B) 25·50 km. from Q

(C) 25·30 km. from P

(D) Can't be determined

48. Two boys begin together to write out a booklet containing 817 lines. The first boy starts with first line, writing at the rate of 200 lines an hour and the second boy starts with the last line. He writes line 817 and so on backwards proceeding at the rate of 150 lines an hour. At what line will they meet ?

(A) 466th (B) 465th

(C) 467th (D) 468th

49. Two cars A and B are running towards each other from two different places 88 km. apart. If the ratio of the speeds of the cars A and B is 5 : 6 and the speed of the car B is 90 km. per hour, after how long will the two meet each other ?

(A) $26\frac{2}{3}$ min. (B) 24 min.

(C) 32 min. (D) 36 min.

50. 150 metre long train takes 10 seconds to pass a man who is going in the same direction at the speed of 2 km/hr. What is the speed of the train ?

(A) 52 km/hr

(B) 56 km/hr

(C) 84 km/hr

(D) Data inadequate

Answers with Hints

1. (A) $\because$ Time left $= \left(\frac{1}{3}\times\frac{45}{60}\right)$ hr.

$= \frac{1}{4}$ hr.

Distance left $= 3$ km.

$\therefore$ Speed required $= \left(3 \div \frac{1}{4}\right)$ km/hr.

$= 12$ km/hr.

2. (C) $\because$ Distance $= \left(48 \times \frac{50}{60}\right)$ km.

$= 40$ km.

Required speed $= \left(\frac{40}{40/60}\right)$ km/hr.

$= \left(\frac{40\times 60}{40}\right)$ km/hr.

$= 60$ km/hr.

3. (B) Due to stoppages, it covers 9 km. less per hour

Time taken to cover 9 km.

$= \left(\frac{9}{54}\times 60\right)$ min $= 10$ min.

4. (C) Let the distance be x km. Then

$\because \quad \frac{x}{3} - \frac{x}{3{\cdot}75} = \frac{1}{2}$

$\Rightarrow \quad \frac{3{\cdot}75x - 3x}{3\times 3{\cdot}75} = \frac{1}{2}$

$\Rightarrow \quad 1{\cdot}5x = 3\times 3{\cdot}75$

$\therefore \quad x = \frac{3\times 3{\cdot}75}{1{\cdot}5} = 7{\cdot}5$ km.

5. (B) Total time taken $= \left(\frac{3}{10}+\frac{3}{20}+\frac{3}{30}+\frac{3}{60}\right)$ hrs.

$= \frac{3}{5}$ hrs.

$\therefore$ Average speed $= \left\{\frac{12}{3/5}\right\}$ km/hr.

$= \left(\frac{12\times 5}{3}\right)$ km/hr.

$= 20$ km/hr.

6. (B) Let the required speed be x km/hr.

Then, $\frac{2\times 64\times x}{(64+x)} = 56$

$\Rightarrow \quad 128x = 64\times 56 + 56x$

$\therefore \quad x = \frac{64\times 56}{72} = 49{\cdot}77$ km/hr.

7. (C) Let the length of total journey be x km.

$\because \quad \frac{x}{2}\cdot\frac{1}{40}+\frac{x}{2}\cdot\frac{1}{60} = 8$

$\Rightarrow \quad \frac{x}{80}+\frac{x}{120} = 8$

$\Rightarrow \quad 3x + 2x = 1920$

$\therefore \quad x = 384$ km.

8. (B) Let the total distance be x km.

Then, $\frac{2}{5}x = 1200$

$\Rightarrow \quad x = \frac{1200\times 5}{2} = 3000$ km.

Distance travelled by car

$= \left(\frac{1}{3}\times 3000\right) = 1000$ km.

Distance travelled by train

$= [3000 - (1200 + 1000)]$ km.

$= 800$ km.

9. (D) Let the total distance be x km.

Then, $\frac{x}{2}\times\frac{1}{60}+\frac{x}{2}\times\frac{1}{50} = \frac{44}{3}$

$\Rightarrow \quad \frac{x}{120}+\frac{x}{100} = \frac{44}{3}$

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$\Rightarrow \quad 5x + 6x = 8800$

$\Rightarrow \quad x = 800$

$\therefore$ Required distance = 800 km.

10. (D) Let the total journey be x km. Then,

$$\frac{2}{15}x + \frac{9}{20}x + 10 = x$$

$\Rightarrow \quad 8x + 27x + 600 = 60x$

$\Rightarrow \quad x = 24$

$\therefore$ Total journey = 24 km.

11. (D) Let total distance be x km.

Then, $\frac{2}{3}x \cdot \frac{1}{4} + \frac{1}{3}x \cdot \frac{1}{5} = \frac{42}{60}$

$\Rightarrow \quad \frac{x}{6} + \frac{x}{15} = \frac{7}{10}$

$\Rightarrow \quad 5x + 2x = 21$

$\therefore \quad x = 3$

$\therefore$ Required distance = 3 km.

12. (D) They are 38 km. apart in 1 hr.

$\therefore$ They will be 95 km. apart in $\left(\frac{1}{38} \times 95\right)$ hrs.

= 2 hrs. 30 min.

13. (A) Let the required distance be x km.

Then, $\frac{x}{3} + \frac{x}{2} = 5 \Rightarrow 2x + 3x = 30 \Rightarrow x = 6$ km

14. (A) Distance = $\left(4 \times 2\frac{3}{4}\right)$ km. = $\left(4 \times \frac{11}{4}\right)$ km.

= 11 km

$\therefore$ Req. time = $\frac{11 \text{ km}}{(33/2) \text{ km/hr}}$

= $\frac{2 \times 11}{33}$ hr.

= $\frac{2}{3} \times 60$ minutes

= 40 minutes.

15. (B) Required time = $\left(\frac{4}{15} \times 63\right)$ hrs.

= 16 hrs. 48 min.

16. (B) 92·4 kms/hr. = $\left(92{\cdot}4 \times \frac{5}{18}\right)$ m/sec.

$\therefore$ Req. distance = $92{\cdot}4 \times \frac{5}{18} \times 600$ metres

= 15400 m.

17. (D) Speed = $\left(\frac{10{\cdot}2}{3}\right)$ km/hr.

= 3·4 km/hr.

Distance covered in 5 hours

= (3·4 × 5) km. = 17 km.

18. (A) Speed = $\left(\frac{600}{5 \times 60}\right)$ m/sec.

= $\left(\frac{600}{5 \times 60} \times \frac{18}{5}\right)$ km/hr.

= 7·2 km/hr.

19. (C) Average speed = $\left(\frac{2 \times 16 \times 9}{16 + 9}\right)$ km/hr.

= 11·52 km/hr.

20. (B) 22·5 m/sec. = $\left(22{\cdot}5 \times \frac{18}{5}\right)$ km/hr.

= 81 km/hr.

21. (A) 55 m/sec = $\left(55 \times \frac{18}{5}\right)$ km/hr.

= 198 km/hr.

22. (B) 30·6 km/hr. = $\left(30{\cdot}6 \times \frac{5}{18}\right)$ m/sec.

= 8·5 m/sec.

23. (A) 36 km/hr. = $\left(36 \times \frac{5}{18}\right)$ m/sec.

= 10 m/sec.

24. (A) Let the required distance be x km.

Then, $\frac{x}{80} - \frac{220 - x}{100} = \frac{1}{2}$

$\Rightarrow \quad 5x - 4(220 - x) = 200$

$\Rightarrow \quad 9x = 1080$

$\Rightarrow \quad x = 120$ km.

25. (D) Distance left = $\left(\frac{1}{2} \times 80\right)$ km. = 40 km.

Time left = $\left[\left(1 - \frac{3}{5}\right) \times 10\right]$ hrs.

= 4 hours.

Required speed = (40 ÷ 4) km/hr.

= 10 km/hr.

26. (C) Length of two sides of square

= $\left(8 \times \frac{1}{2}\right)$ km. = 4 km.

$\therefore$ Area of the field = (2 × 2) sq. km.

= 4 sq. km.

27. (B) Average speed = $\left(\frac{2 \times 35 \times 45}{35 + 45}\right)$ km/hr.

= $39\frac{3}{8}$ km/hr.

28. (C) Speed = $\left(3 \times \frac{5}{18}\right)$ m/sec.

= $\left(\frac{5}{6}\right)$ m/sec.

$\therefore$ Distance covered in 2 min.

= (2 × 60) sec.

= $\left(\frac{5}{6} \times 2 \times 60\right)$ m = 100 m.

$\therefore$ Length of diagonal = 100 m

Area of the field = $\frac{1}{2} \times (\text{diagonal})^2$

= $\left(\frac{1}{2} \times 100 \times 100\right) \text{m}^2$

= 5000 m^2 = 50 acres.

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29. (C) Ratio of times taken by A and B $= \frac{1}{2} : \frac{1}{3}$

Suppose B takes x min. Then A takes $(x + 10)$ min.

$\therefore \quad (x + 10) : x = \frac{1}{2} : \frac{1}{3}$

$\Rightarrow \quad \frac{x + 10}{x} = \frac{3}{2}$

$\Rightarrow \quad 2x + 20 = 3x$

$\therefore \quad x = 20$

$\therefore$ Time taken by A $= 20 + 10$

$= 30$ minutes

If A had walked at double speed

Req. time $= \frac{30}{2}$

$= 15$ minutes.

30. (A) Let x km. be covered in y hrs.

Then, 1st speed $= \left(\frac{x}{y}\right)$ km/hr.

2nd speed $= \left(\frac{x}{2} \div 2y\right)$ km/hr.

$= \left(\frac{x}{4y}\right)$ km/hr.

$\therefore$ Ratio of speed $= \frac{x}{y} : \frac{x}{4y} = 1 : \frac{1}{4} = 4 : 1$

31. (A) $25 : 10 :: 1000 : x$

$\Rightarrow \quad x = \frac{10 \times 1000}{25} = 400$ m

32. (D) Let C's speed $= x$ km/hr.

Then, B's speed $= 3x$ km/hr.

and A's speed $= 6x$ km/hr.

$\therefore$ Ratio of speeds of A, B, C

$= 6x : 3x : x = 6 : 3 : 1$

Ratio of times taken $= \frac{1}{6} : \frac{1}{3} : 1$ or $1 : 2 : 6$

$\because 6 : 1 :: 42 : t$

$\Rightarrow \quad 6t = 42$

$\Rightarrow \quad t = 7$ min.

33. (B) Ratio of times taken $= \frac{1}{2} : \frac{1}{3}$

$\because \quad \frac{1}{2} : \frac{1}{3} = x : 36$

$\Rightarrow \quad \frac{1}{3} \times x = \frac{1}{2} \times 36$

$\therefore \quad x = 54$ min.

34. (B) Average speed $= \left(\frac{2 \times 64 \times 80}{64 + 80}\right)$ km/hr.

$= \frac{2 \times 64 \times 80}{144}$ km/hr.

$= 71{\cdot}11$ km/hr.

35. (D) Suppose the man covers first distance in x hrs. and second distance in y hrs.

Then, $4x + 5y = 35$ and $5x + 4y = 37$

Solving these equations, we get

$x = 5$ and $y = 3$

$\therefore$ Total time taken $= (5 + 3)$ hrs. $= 8$ hrs.

36. (B) At a speed of $\frac{3}{4}$ of the usual speed, the time taken is $\frac{4}{3}$ of the usual time

$\therefore \left(\frac{4}{3} \text{ of usual time}\right) - (\text{Usual time}) = 20$ min.

$\Rightarrow \frac{4}{3}x - x = 20 \Rightarrow \frac{1}{3}x = 20$

$\Rightarrow x = 60$ min.

37. (D) Let the required time $= x$ min. Then

distance covered in $(x + 11)$ min. at 40 km/hr.

= distance covered in $(x + 5)$ min. at 50 km/hr.

$\because \quad 40 \times \frac{x + 11}{60} = 50 \times \frac{x + 5}{60}$

$\therefore \quad x = 19$ min.

38. (B) Let the distance be x km.

Then, $\frac{x}{3} - \frac{x}{4} = \frac{30}{60}$

$\Rightarrow \quad \frac{4x - 3x}{12} = \frac{1}{2}$

$\Rightarrow \quad x = 6$ km.

39. (B) Distance covered by thief in (1/2) hour = 20 km.

Now, 20 km. is compensated by the owner at a relative speed of 10 km/hr. in 2 hours

So, he overtakes the thief at 4 p.m.

40. (D) Let the distance between Meerut and Delhi be y km.

Average speed of the train leaving Meerut

$= \left(\frac{y}{4}\right)$ km/hr.

Average speed of the train leaving Delhi

$= \left(\frac{2y}{7}\right)$ km/hr.

Suppose they meet x hrs. after 6 a.m.

Then, $\because \quad \frac{xy}{4} + \frac{2y\,(x - 2)}{7} = y$

$\Rightarrow \quad \frac{x}{4} + \frac{2x - 4}{7} = 1$

$\Rightarrow \quad 15x = 44$

$\therefore \quad x = \frac{44}{15} = 2$ hrs. 56 min.

So, the trains meet at 8·56 a.m.

41. (B) Suppose they meet after x hours.

Then, $21x - 16x = 60$

$\Rightarrow \quad x = 12$

$\therefore$ Required distance $= (16 \times 12 + 21 \times 12)$ km.

$= 444$ km.

42. (A) Suppose they meet x km. from X

Then, $\frac{x}{20} = \frac{(500 - x)}{30}$

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$\Rightarrow \quad 30x = 10000 - 20x$

$\Rightarrow \quad x = 200$ km.

43. (C) Let the original speed be x km/hr.

Then, $\frac{840}{x} - \frac{840}{(x+10)} = 2$

$\Rightarrow \quad 840(x+10) - 840x = 2x(x+10)$

$\Rightarrow \quad x^2 + 10x - 4200 = 0$

$\Rightarrow \quad (x+70)(x-60) = 0$

$\therefore \quad x = 60$ km/hr.

44. (A) Speed of a train in kilometre per hour

$= 45$

Speed of the train in metre per second

$= 45 \times \frac{5}{18}$

$= 12{\cdot}5$

45. (D) Speed of the motor car

$= \frac{250}{25}$ m/sec.

$= 10$ m/sec.

$= 10 \times \frac{18}{5}$ km/hour

$= 36$ km/hour.

46. (A) Let the distance between Delhi and Kanpur be x km.

Suppose the train leaving from Delhi is A and the train leaving from Kanpur be B

A's speed $= \frac{x}{10 \text{ a.m.} - 5 \text{ a.m.}} = \frac{x}{5}$ km/hr.

B's speed $= \frac{x}{2 \text{ p.m.} - 7 \text{ a.m.}} = \frac{x}{7}$ km/hr.

Since B starts two hours later than A, the distance already covered by A at the time of start of B

$= \frac{2x}{5}$ km.

Remaining distance

$= x - \frac{2x}{5} = \frac{3x}{5}$ km.

Relative speed of approach of two trains

$= \left(\frac{x}{5} + \frac{x}{7}\right) = \frac{12x}{35}$ km/hr.

Time taken to cover the remaining distance by both trains.

$= \frac{\frac{3}{5}x}{\frac{12x}{35}} = \frac{3}{5} \times \frac{35}{12} = \frac{7}{4}$ hrs.

$= 1\frac{3}{4}$ hrs.

$= 1$ hr. 45 min.

$\therefore$ The two trains will meet at (7 a.m. + 1 hr. 45 min.)

$= 8{\cdot}45$ a.m.

47. (B) A has already gone 3·75 km. when B starts of the remaining 48 km. A walks 3·75 km. and B walks 4·25 km. in one hour in opposite direction, *i.e.*, they together pass over (3·75 + 4·25) = 8 km. in one hour.

Therefore, 48 km. are passed over in $\frac{48}{8} = 6$ hours.

Therefore, A meets B in 6 hours after B started and, therefore, they meet at a distance of $(4{\cdot}25 \times 6) = 25{\cdot}5$ km. from Q.

48. (C) Let the two meet at the xth line

From the question,

$\frac{x}{200} = \frac{(817 - x)}{150}$

$\Rightarrow \quad 3x = 4(817 - x)$

$\Rightarrow \quad x = \frac{4 \times 817}{7}$

$\therefore \quad x = 466{\cdot}85$

i.e., they will meet at the 467th line.

49. (C) Speed of the car A $= \frac{5}{6} \times 90$

$= 75$ km/hr.

$\therefore$ Reqd. time $= \frac{88}{90 + 75} \times 60$

$= 32$ minutes

50. (B) Let the speed of the train be x km/hr.

$\because$ Length of the train

$= 150 \text{ m} = \frac{150}{1000} = \frac{3}{20}$ km.

and time taken to cross the man

$= 10$ seconds

$= \frac{10}{60 \times 60} = \frac{1}{360}$ hrs.

$\because$ Time $= \frac{\text{Length of the train}}{\text{Speed of the train} - \text{Speed of the man}}$

$\therefore \quad \frac{1}{360} = \frac{\frac{3}{20}}{(x-2)}$

$\Rightarrow (x-2) = \frac{3}{20} \times 360$

$\Rightarrow (x-2) = 54$

$x = 54 + 2$

$= 56$ km/hr.

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Area

Formulae

(1) (i) Area of a rectangle
= (Length × Breadth)

(ii) Length = $\left(\frac{\text{Area}}{\text{Breadth}}\right)$;

Breadth = $\left(\frac{\text{Area}}{\text{Length}}\right)$

(iii) $(\text{Diagonal})^2$
$= (\text{Length})^2 + (\text{Breadth})^2$

(2) Area of a square = $(\text{Side})^2$
$= \frac{1}{2}(\text{Diagonal})^2$

(3) Area of 4 walls of a room
= 2 × (Length + Breadth) × Height
= Perimeter of base × Height

(4) Area of a parallelogram
= (Base × Height)

(5) Area of a rhombus
$= \frac{1}{2}$ × (Product of diagonal)

(6) Area of an equilateral triangle
$= \frac{\sqrt{3}}{4} \times (\text{Side})^2$

(7) If a, b, c are the length of the sides of a triangle and
$s = \frac{1}{2}(a + b + c)$ then
Area of the triangle
$= \sqrt{s(s-a)(s-b)(s-c)}$

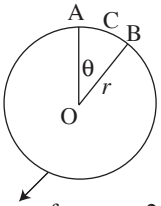
(8) Area of a triangle
$= \left(\frac{1}{2} \times \text{Base} \times \text{Height}\right)$

(9) Area of a trapezium
$= \frac{1}{2}$ (Sum of parallel sides
× Distance between them)

(10) (i) Circumference of a circle
$= 2\pi r$

(ii) Area of a circle = πr^2

(iii) Arc AB = $\frac{2\pi r\theta}{360}$,
where ∠ AOB = θ



Circumference = $2\pi r$

(iv) Area of sector ACBO = $\frac{\pi r^2\theta}{360}$

(v) Area of sector ACBO
$= \left(\frac{1}{2} \times \text{arc AB} \times r\right)$

Examples

Q. 1. Find the area of a rectangle one of whose sides is 3 m and diagonal 5 m.

Solution :

Another side = $\sqrt{(5)^2 - (3)^2}$ m
$= \sqrt{16}$ m = 4 m

∴ Area of the plot
$= (5 \times 4)$ m²
$= 20$ m².

Q. 2. Find the area of a square the length of whose diagonal is 2·4 m.

Solution :

Area = $\frac{1}{2} \times (\text{diagonal})^2$

$= \left[\frac{1}{2} \times (2{\cdot}4)^2\right]$ m²

$= \left(\frac{5{\cdot}76}{2}\right)$ m² = 2·88 m²

Q. 3. Find the area of an equilateral triangle, each of whose sides are 12 m long.

Solution :

Area of the triangle

$= \frac{\sqrt{3}}{4} \times (\text{side})^2$

$= \left(\frac{1{\cdot}73}{4} \times 12 \times 12\right)$ m²

= 62·28 m²

Q. 4. Find the area of a triangle whose sides are 9 cm, 12 cm and 7 cm.

Solution :

Let $a = 9$, $b = 12$ and $c = 7$

Then, $S = \frac{1}{2}(9 + 12 + 7)$ cm
$= 14$ cm

∴ $(s - a) = 5$, $(s - b) = 2$
and $(s - c) = 7$

∴ Area = $\sqrt{s(s-a)(s-b)(s-c)}$
$= \sqrt{14 \times 5 \times 2 \times 7}$ cm²
$= 14\sqrt{5}$ cm² = (14 × 2·23) cm²
= 31·22 cm²

Q. 5. Find the area of a right angled triangle, whose base is 6·5 m and hypotenuse 9 m.

Solution :

Height = $\sqrt{(9)^2 - (6{\cdot}5)^2}$
$= \sqrt{38{\cdot}75} = 6{\cdot}22$ m

∴ Area
$= \frac{1}{2} \times \text{Base} \times \text{Height}$
$= \left(\frac{1}{2} \times 6{\cdot}5 \times 6{\cdot}22\right)$ m²
= 20·215 m²

Exercise

1. The length of a rectangle is doubled while its breadth is halved. What is the percentage change in area ?
   (A) 50
   (B) 75
   (C) No change
   (D) None of these

2. The cost of carpenting a room 15 metres long with a carpet 75 cm wide at 30 paise per metre is Rs. 36. The breadth of the room is—
   (A) 6 metres (B) 8 metres
   (C) 9 metres (D) 12 metres

3. The cost of cultivating a square field at the rate of Rs. 160 per hectare is Rs. 1440. The cost of putting a fence around it at 75 paise per metre is—
   (A) Rs. 900 (B) Rs. 1800
   (C) Rs. 360 (D) Rs. 810

4. The length of hall is (4/3) times its breadth. If the area of the hall be 300 square metres, the difference between the length and the breadth is—
   (A) 15 metres
   (B) 4 metres
   (C) 3 metres
   (D) None of these

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5. If the side of a square is doubled, then the ratio of the resulting square to that of the given square is—
(A) 1 : 2 (B) 2 : 1
(C) 3 : 1 (D) 4 : 1

6. If the side of a square is increased by 25%, then how much per cent does its area get increased ?
(A) 125 (B) 156·25
(C) 50 (D) 56·25

7. A rectangular plot is half as long again as it is broad. The area of the lawn is (2/3) hectares. The length of the plot is—
(A) 100 metres
(B) 66·66 metres
(C) $33\frac{1}{3}$ metres
(D) $\left(\frac{100}{\sqrt{3}}\right)$ metres

8. If the side of a square be increased by 4 cms. the area increases by 60 sq. cms. The side of the square is—
(A) 12 cm
(B) 13 cm
(C) 14 cm
(D) None of these

9. Area of a square is $\frac{1}{2}$ hectare. The diagonal of the square is—
(A) 250 metres
(B) 100 metres
(C) $50\sqrt{2}$ metres
(D) 50 metres

10. A Verandah 40 metres long 15 metres broad is to be paved with stones each measuring 6 dm by 5 dm. The number of stones required is—
(A) 1000
(B) 2000
(C) 3000
(D) None of these

11. The ratio between the length and breadth of a rectangular field is 5 : 4. If the breadth is 20 metres less than the length, the perimeter of the field is—
(A) 260 m
(B) 280 m
(C) 360 m
(D) None of these

12. The length and breadth of a rectangular piece of land are in the ratio of 5 : 3. The owner spent Rs. 3000 for surrounding it from all the sides at Rs. 7·50 per metre. The difference between its length and breadth is—
(A) 50 m (B) 100 m
(C) 150 m (D) 200 m

13. The length of a rectangular plot is twice of its width. If the length of a diagonal is $9\sqrt{5}$ metres, the perimeter of the rectangle is—
(A) 27 m
(B) 54 m
(C) 81 m
(D) None of these

14. The area of a rectangle 144 m long is the same as that of a square having a side 84 m long. The width of the rectangle is—
(A) 7 m
(B) 14 m
(C) 49 m
(D) Cannot be determined

15. The length and breadth of a playground are 36 m and 21 m respectively. Flagstaffs are required to be fixed on all along the boundary at a distance of 3 m apart. The number of flagstaffs will be—
(A) 37 (B) 38
(C) 39 (D) 40

16. The length of a plot is four times its breadth. A playground measuring 1200 square metres occupies one third of the total area of the plot. What is the length of the plot in metres ?
(A) 20
(B) 30
(C) 60
(D) None of these

17. If the length of diagonal AC of a square ABCD is 5·2 cm. then area of the square ABCD is—
(A) 15·12 sq. cm
(B) 13·52 sq. cm
(C) 12·62 sq. cm
(D) 10 sq. cm

18. One side of a rectangular field is 4 metres and its diagonal is 5 metres. The area of the field is—
(A) 12 m^2 (B) 15 m^2
(C) 20 m^2 (D) $4\sqrt{5}$ m^2

19. If the base of a rectangle is increased by 10% and the area is unchanged, then the corresponding altitude must be decreased by—
(A) $9\frac{1}{11}\%$ (B) 10%
(C) 11% (D) $11\frac{1}{9}\%$

20. The length of a rectangle is twice its breadth. If its length is decreased by 5 cm and the breadth is increased by 5 cm, the area of the rectangle is increased by 75 cm^2. Therefore, the length of the rectangle is—
(A) 20 cm (B) 30 cm
(C) 40 cm (D) 50 cm

21. The cost of papering the four walls of a room is Rs. 48. Each one of the length, breadth and height of another room is double that of this room. The cost of papering the walls of this new room is—
(A) Rs. 384 (B) Rs. 288
(C) Rs. 192 (D) Rs. 96

22. Area of four walls of a room is 168 sq. metres. The breadth and height of the room are 8 metres and 6 metres respectively. The length of the room is—
(A) 14 metres (B) 12 metres
(C) 6 metres (D) 3·5 metres

23. Area of four walls of a room is 77 square metres. The length and breadth of the room are 7·5 metres and 3·5 metres respectively. The height of the room is—
(A) 3·5 metres
(B) 5·4 metres
(C) 6·77 metres
(D) 7·7 metres

24. A rectangle has 15 cm as its length and 150 cm^2 as its area. Its area is increased to $1\frac{1}{3}$ times the original area by increasing only its length. Its new perimeter is—
(A) 50 cm (B) 60 cm
(C) 70 cm (D) 80 cm

25. The length of a rectangular room is 4 metres. If it can be partitioned into two equal square

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rooms. What is the length of each partition in metre ?

(A) 1

(B) 2

(C) 4

(D) Data inadequate

26. The length and breadth of a square are increased by 40% and 30% respectively. The area of the resulting rectangle exceeds the area of the square by—

(A) 42%

(B) 62%

(C) 82%

(D) None of these

27. A hall 20 m long and 15 m broad is surrounded by a verandah of uniform width of 2·5 m. The cost of flooring the verandah at the rate of Rs. 3·50 per sq. metre is—

(A) Rs. 500 (B) Rs. 600

(C) Rs. 700 (D) Rs. 800

28. A rectangular lawn 60 metres by 40 metres has two roads each 5 metres wide running in the middle of it. One parallel to length and the other parallel to breadth. The cost of gravelling the roads at 60 paise per sq. metre is—

(A) Rs. 300 (B) Rs. 280

(C) Rs. 285 (D) Rs. 250

29. Of the two square fields the area of the one is 1 hectare, while the another one is broader by 1%. The difference in areas is—

(A) 101 sq. metres

(B) 201 sq. metres

(C) 100 sq. metres

(D) 200 sq. metres

30. If the ratio of the areas of two squares is 9 : 1, the ratio of their perimetres is—

(A) 9 : 1 (B) 3 : 1

(C) 3 : 4 (D) 1 : 3

31. The length of a rectangular field is increased by 60%. By what per cent would the width have to be decreased to maintain the same area ?

(A) $37\frac{1}{2}\%$ (B) 60%

(C) 75% (D) 120%

32. A park is 10 metres long and 8 metres broad. What is the length of the longest pole that can be placed in the park ?

(A) 10 metres

(B) 12·8 metres

(C) 13·4 metres

(D) 18 metres

33. The ratio of the areas of two squares, one having double its diagonal than the other is—

(A) 2 : 1 (B) 3 : 1

(C) 3 : 2 (D) 4 : 1

34. The area of a rectangle is thrice that of a square. Length of the rectangle is 40 cm and the breadth of the rectangle is (3/2) times that of the side of the square. The side of the square in cm is—

(A) 15 (B) 20

(C) 30 (D) 60

35. If the diametre of a circle is increased by 100%. Its area is increased by—

(A) 100% (B) 200%

(C) 300% (D) 400%

36. If the radius of a circle be reduced by 50%. Its area is reduced by—

(A) 25% (B) 50%

(C) 75% (D) 100%

37. The radius of a circle has been reduced from 9 cms to 7 cm. The appropriate percentage decrease in area is—

(A) 31·5% (B) 39·5%

(C) 34·5% (D) 65·5%

38. The difference between the circumference and the radius of a circle is 37 cms. The area of the circle is—

(A) 148 sq. cm

(B) 111 sq. cm

(C) 154 sq. cm

(D) 259 sq. cm

39. The area of a circular field is 13·86 hectares. The cost of fencing it at the rate of 20 paise per metre is—

(A) Rs. 277·20

(B) Rs. 264

(C) Rs. 324

(D) Rs. 198

40. The area of circle is 38·5 sq. cm. Its circumference is—

(A) 6·20 cm (B) 11 cm

(C) 22 cm (D) 121 cm

41. If the circumference of a circle is 352 metre, then its area in m^2 is—

(A) 9856 (B) 8956

(C) 6589 (D) 5986

42. The ratio of the area of a square of side a and equilateral triangle of side a is—

(A) 2 : 1 (B) $2 : \sqrt{3}$

(C) 4 : 3 (D) $4 : \sqrt{3}$

43. Area of a square with side x is equal to the area of a triangle with base x. The altitude of the triangle is—

(A) $\frac{x}{2}$ (B) x

(C) $2x$ (D) $4x$

44. In a triangle ABC, BC = 5 cm, AC = 12 cm and AB = 13 cm. The length of the altitude drawn from B on AC is—

(A) 4 cm (B) 5 cm

(C) 6 cm (D) 7 cm

45. The altitude of an equilateral triangle of side $2\sqrt{3}$ cm is—

(A) $\frac{\sqrt{3}}{2}$ cm (B) $\frac{1}{2}$ cm

(C) $\frac{\sqrt{3}}{4}$ cm (D) 3 cm

46. The length of each side of an equilateral triangle having an area of $4\sqrt{3}$ cm^2, is—

(A) $\frac{4}{\sqrt{3}}$ cm (B) $\frac{\sqrt{3}}{4}$ cm

(C) 3 cm (D) 4 cm

47. The area of an equilateral triangle whose side is 8 cms is—

(A) 64 cm^2 (B) $16\sqrt{3}$ cm^2

(C) 21·3 cm^2 (D) $4\sqrt{3}$ cm^2

48. The perimeter of an isosceles triangle is equal to 14 cm. The lateral side is to the base in the ratio 5 : 4. The area of the triangle is—

(A) $\frac{1}{2}\sqrt{21}$ cm^2

(B) $\frac{3}{2}\sqrt{21}$ cm^2

(C) $\sqrt{21}$ cm^2

(D) $2\sqrt{21}$ cm^2

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49. The sides of a triangular board are 13 metres,14 metres and 15 metres. The cost of painting it at the rate of Rs. 8·75 per m^2 is—
(A) Rs. 688·80
(B) Rs. 735
(C) Rs. 730·80
(D) Rs. 722·50

50. The base of a rightangled triangle is 5 metres and hypotenuse is 13 metres. Its area will be—
(A) 25 m^2
(B) 28 m^2
(C) 30 m^2
(D) None of these

51. If the diagonal of a square is doubled, how does the area of the square change ?
(A) Becomes four fold
(B) Becomes three fold
(C) Becomes two fold
(D) None of the above

52. The largest possible square is inscribed in a circle of unit radius. The area of the square unit is—
(A) 2 (B) π
(C) $(2\sqrt{2})\pi$ (D) $(4\sqrt{2})\pi$

53. A circle and a square have same area. The ratio of the side of the square and the radius of the circle is—
(A) $\sqrt{\pi} : 1$ (B) $1 : \sqrt{\pi}$
(C) $1 : \pi$ (D) $\pi : 1$

54. The radius of the wheel of a vehicle is 70 cm. The wheel makes 10 revolutions in 5 seconds. The speed of the vehicle is—
(A) 29·46 km/hr.
(B) 31·68 km/hr.
(C) 36·25 km/hr.
(D) 32·72 km/hr.

55. The radius of a wheel is 1·4 decimetre. How many times does it revolve during a journey of 0·66 km ?
(A) 375 (B) 750
(C) 1500 (D) 3000

56. A circular disc of area 0·49 π square metres rolls down a length of 1·76 km. The number of revolutions it makes is—
(A) 300 (B) 400
(C) 600 (D) 4000

57. The number of rounds that a wheel of diameter $\frac{7}{11}$ m will make in going 4 km, is—
(A) 1000 (B) 1500
(C) 1700 (D) 2000

58. A wheel makes 1000 revolutions in covering a distance of 88 km. The diameter of the wheel is—
(A) 24 metres (B) 40 metres
(C) 28 metres (D) 14 metres

59. The diameter of a wheel is 63 cms. Distance travelled by the wheel in 100 revolutions is—
(A) 99 metres (B) 198 metres
(C) 63 metres (D) 136 metres

60. A circular road runs rounds a circular ground. If the difference between the circumferences of the outer circle and the inner circle is 66 metres, the width of the road is—
(A) 21 metres (B) 10·5 metres
(C) 7 metres (D) 5·25 metres

61. The inner circumference of a circular race track, 14 m wide is 440 m. Then the radius of the outer circle is—
(A) 70 m (B) 56 m
(C) 77 m (D) 84 m

62. The ratio of the radii of two circles is 1 : 3. The ratio of their areas is—
(A) 1 : 3
(B) 1 : 6
(C) 1 : 9
(D) None of these

63. The area of a square is 50 sq. units. Then the area of the circle drawn on its diagonal is—
(A) 25 π sq. units
(B) 100 π sq. units
(C) 50 π sq. units
(D) None of these

64. A circular wire of radius 42 cm is cut and bent in the form of a rectangle whose sides are in the ratio of 6 : 5. The smaller side of the rectangle is—
(A) 30 cm (B) 60 cm
(C) 72 cm (D) 132 cm

65. The area of the largest circle that can be drawn inside a rectangle with sides 7 m by 6 m is—
(A) $28\frac{2}{7}$ m^2
(B) $64\frac{8}{9}$ m^2
(C) $59\frac{2}{3}$ m^2
(D) None of these

66. The area of the largest circle that can be drawn inside a square of 14 cm length is—
(A) 84 m^2
(B) 154 cm^2
(C) 204 cm^2
(D) None of these

67. If 88 m wire is required to fence a circular plot of land, then the area of the plot is—
(A) 526 m^2
(B) 556 m^2
(C) 616 m^2
(D) None of these

68. If the circumference of a circle is increased by 50%, then its area will be increased by—
(A) 50% (B) 100%
(C) 125% (D) 225%

69. If a regular hexagon is inscribed in a circle of radius, r then its perimeter is—
(A) $3r$ (B) $6r$
(C) $9r$ (D) $12r$

70. The area of the largest triangle that can be inscribed in a semi circle of radius r cm is—
(A) $2r$ cm^2 (B) r^2 cm^2
(C) $2r^2$ cm^2 (D) $\frac{1}{2}r^2$ cm^2

71. Four horses are be tethered at four corners of a square plot of side 63 metres, so that they just cannot reach one another. The area left ungrazed is—
(A) 675·5 m^2 (B) 780·6 m^2
(C) 785·8 m^2 (D) 850·5 m^2

72. Four circular card board pieces, each of radius 7 cm are placed in such a way that each piece touches two other pieces. The area of the space enclosed by the four pieces is—
(A) 21 cm^2 (B) 42 cm^2
(C) 84 cm^2 (D) 168 cm^2

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73. The length of a rope by which a cow must be tethered in order that she may be able to graze an area of 9856 sq. m is—
(A) 56 m (B) 64 m
(C) 88 m (D) 168 m

74. The radius of a circle is increased so that its circumference increases by 5%. The area of the circle will increase by—
(A) 10% (B) 10·25%
(C) 8·75% (D) 10·5%

75. The circumferences of two concentric circles are 176 m and 132 m respectively. What is the difference between their radii ?
(A) 5 metres (B) 7 metres
(C) 8 metres (D) 44 metres

76. The diameter of a circle is 105 cm less than the circumference. What is the diameter of the circle?
(A) 44 cm (B) 46 cm
(C) 48 cm (D) 49 cm

77. The area of the sector of a circle, whose radius is 12 metres and whose angle at the centre is 42 is—
(A) 26·4 sq. metres
(B) 39·6 sq. metres
(C) 52·8 sq. metres
(D) 79·2 sq. metres

78. The length of minute hand of a wall clock is 7 cms. The area swept by the minute hand in 30 minutes is—
(A) 147 sq. cm
(B) 210 sq. cm
(C) 154 sq. cm
(D) 77 sq. cm

79. In a circle of radius 21 cm an arc subtends an angle of 72° at the centre. The length of the arc is—
(A) 13·2 cm (B) 19·8 cm
(C) 21·6 cm (D) 26·4 cm

80. The area of sector of a circle of radius 5 cm, formed by an arc of length 3·5 cms is—
(A) 35 sq. cms
(B) 17·5 sq. cms
(C) 8·75 sq. cms
(D) 55 sq. cms

81. The vertices of rectangle with sides 8 m and 6 m, lie on a circle. The area of the circle, excluding the area of the rectangle is—
(A) 65·3 m^2 (B) 42·4 m^2
(C) 30·6 m^2 (D) 39 m^2

82. The perimeter of a square circumscribed about a circle of radius r is—
(A) $2r$ (B) $4r$
(C) $8r$ (D) $21\pi r$

83. The area of a circle inscribed in an equilateral triangle is 462 cm. The perimeter of the triangle is—
(A) $42\sqrt{3}$ cms
(B) 126 cms
(C) 72·6 cms
(D) 168 cms

84. The area of the circle inscribed in an equilateral triangle of side 24 cms is—
(A) 24 π cm^2 (B) 36 π cm^2
(C) 48 π cm^2 (D) 18 π cm^2

85. A park is in the form of a square one of whose sides is 100 m. The area of the park excluding the circular lawn in the centre of the park is 8614 m^2. The radius of the circular lawn is—
(A) 21 m
(B) 31 m
(C) 41 m
(D) None of these

86. A rectangular carpet has an area of 60 sq. m. Its diagonal and longer side together equal 5 times the shorter side. The length of the carpet is—
(A) 5 m (B) 12 m
(C) 13 m (D) 14·5 m

87. A rectangular carpet has an area of 120 sq. m and a perimeter of 46 m. The length of its diagonal is—
(A) 15 m (B) 16 m
(C) 17 m (D) 20 m

88. If x is the length of a median of an equilateral triangle then its area is—
(A) x^2 (B) $\frac{x^2\sqrt{3}}{2}$
(C) $\frac{x^2\sqrt{3}}{3}$ (D) $\frac{x^2}{2}$

89. A room 5·44 m × 3·74 m is to be paved with square tiles. The least number of tiles required to cover the floor is—
(A) 162 (B) 176
(C) 184 (D) 192

90. Area of smallest square that can circumscribe a circle of area 616 cm^2 is—
(A) 784 cm^2
(B) 824 cm^2
(C) 864 cm^2
(D) None of these

91. Radhika runs along the boundary of a rectangular park at the rate of 12 km/hr and completes one full round in 15 minutes. If the length of the park is 4 times its breadth, the area of the park is—
(A) 360000 m^2
(B) 36000 m^2
(C) 3600 m^2
(D) None of these

92. The ratio of the corresponding sides of two similar triangles is 3 : 4. The ratio of their areas is—
(A) 4 : 3 (B) 3 : 4
(C) 9 : 16 (D) $\sqrt{3}$: 2

93. If D, E and F are respectively the midpoints of the sides BC, CA and AB of a Δ ABC and the area of Δ ABC = 36 m^2, then area of Δ DEF is—
(A) 12 cm^2 (B) 9 cm^2
(C) 18 cm^2 (D) 9 cm^2

94. In Δ ABC, side BC = 10 cm and height AD = 4·4 cm. If AC = 11 cm. Then altitude BE equals—
(A) 5 cm (B) 4 cm
(C) 5·6 cm (D) 5·5 cm

95. ABCD is a trapezium in which AB || CD and AB = 2 CD. If its diagonal intersect each other at O, then ratio of areas of triangles AOB and COD is—
(A) 1 : 2 (B) 2 : 1
(C) 1 : 4 (D) 4 : 1

96. The cross section of canal is a trapezium in shape. If the canal is 10 metres wide at the top and 6 metres wide at bottom and the area of cross section is 640 sq. metres. The depth of canal is—
(A) 40 metres
(B) 80 metres

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(C) 160 metres
(D) 384 metres

97. The area of a trapezium is 384 sq. cm. If its parallel sides are in ratio 3 : 5 and the perpendicular distance between them be 12 cm. The smaller of parallel sides is—
(A) 16 cm (B) 24 cm
(C) 32 cm (D) 40 cm

98. The two parallel sides of a trapezium are 1 metre and 2 metre respectively. The perpendicular distance between them is 6 metres. The area of the trapezium is—
(A) 18 sq. metres
(B) 12 sq. metres
(C) 9 sq. metres
(D) 6 sq. metres

99. A parallelogram has sides 60 m and 40 m and one of its diagonal is 80 m long. Then its area is—
(A) 480 sq. m
(B) 320 sq. m
(C) $600\sqrt{15}$ sq. m
(D) $450\sqrt{15}$ sq. m

100. The adjacent sides of parallelogram are 6 cm and 4 cm and the angle between them is 30°. The area of the parallelogram is—
(A) 12 cm^2
(B) 24 cm^2
(C) 48 cm^2
(D) None of these

101. One side of a parallelogram is 14 cm. Its distance from the opposite side is 16 cm. The area of the parallelogram is—
(A) 112 sq. cm
(B) 224 sq. cm
(C) 56 π sq. cm
(D) 210 sq. cm

102. If a square and a rhombus stand on the same base, then the ratio of the areas of the square and the rhombus is—
(A) Greater than 1
(B) Equal to 1
(C) Equal to $\frac{1}{2}$
(D) Equal to $\frac{1}{4}$

103. The length of the diagonal of a rhombus is 80% of the length of the other diagonal. Then the area of the rhombus is how many times the square of the length of the longer diagonal ?
(A) $\frac{4}{5}$ (B) $\frac{2}{5}$
(C) $\frac{3}{4}$ (D) $\frac{1}{4}$

104. In a rhombus, whose area is 144 sq. cm one of its diagonals is twice as long as the other. The lengths of its diagonals are—
(A) 24 cm, 48 cm
(B) 12 cm, 24 cm
(C) $6\sqrt{2}$ cm $12\sqrt{2}$ cm
(D) 6 cm, 12 cm

105. The perimeter of a rhombus is 52 metres while its longer diagonal is 24 metres. Its other diagonal is—
(A) 5 metres (B) 10 metres
(C) 20 metres (D) 28 metres

106. One side of a rhombus is 10 cms and one of its diagonals is 12 cms. The area of the rhombus is—
(A) 120 sq. cm
(B) 96 sq. cm
(C) 80 sq. cm
(D) 60 sq. cm

Answers with Hints

1. (C) Let length = l and breadth = b
Then, area = lb
New length = $2l$
and new breadth = $\frac{b}{2}$
$\therefore$ New area = $\left(2l \times \frac{b}{2}\right) = lb$
So, there is no change in area.

2. (A) Length of carpet = $\frac{\text{Total Cost}}{\text{Rate}}$
$= \frac{3600}{30} = 120$ m
Area of carpet = $\left(120 \times \frac{75}{100}\right)$ m^2
$= 90$ m^2
$\therefore$ Area of the room = 90 m^2
Hence, breadth of the room
$= \frac{\text{Area}}{\text{Length}} = \left(\frac{90}{15}\right)$ m
$= 6$ m

3. (A) Area = $\left(\frac{1440}{160}\right)$ hectares
= 9 hectares = 90000 m^2
$\therefore$ One side = $\sqrt{90000}$ m
= 300 m
So, Perimeter = (4×300) m = 1200 m
$\therefore$ Cost of fencing = Rs. $\left(1200 \times \frac{75}{100}\right)$
= Rs. 900

4. (D) Let breadth = x metres.
Then, length = $\left(\frac{4}{3}x\right)$ metres
$\because$ $x \times \frac{4}{3}x = 300$
$\Rightarrow$ $x^2 = 300 \times \frac{3}{4} = 225$
$\Rightarrow$ $x = 15$
Hence, req. difference = [(Length) – (Breadth)]
$= \left(\frac{4}{3}x - x\right) = \frac{1}{3}x$
$= \left(\frac{1}{3} \times 15\right)$ m
$= 5$ m

5. (D) Let original length = x metres
New length = $(2x)$ metres

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$\therefore$ Ratio of the area $= \frac{4x^2}{x^2} = \frac{4}{1}$

$= 4 : 1$

6. (D) Let area 100 m^2

Then, side $= 10$ m

New side $= (125\%$ of $10)$

$= \left(\frac{125}{100} \times 10\right)$

$= 12{\cdot}5$ m

New area $= (12{\cdot}5 \times 12{\cdot}5)\ m^2$

$= (12{\cdot}5)^2$ sq. m

$\therefore$ Increase in area $= [12{\cdot}5)^2 - (10)^2]\ m^2$

$= [(12{\cdot}5 + 10)\ (12{\cdot}5 - 10)]\ m^2$

$= (22{\cdot}5 \times 2{\cdot}5)\ m^2$

$= 56{\cdot}25\ m^2$

% Increase $= 56{\cdot}25\%$

7. (A) Let breadth = x metres.

Then, length $= \frac{3}{2}x$ metres

$\therefore \quad x \times \frac{3}{2}x = \frac{2}{3} \times 10000$

$\Rightarrow \quad x^2 = \frac{4}{9} \times 10000$

$\Rightarrow \quad x = \left(\frac{2}{3} \times 100\right)$ m

$\therefore$ Length $= \left(\frac{3}{2} \times \frac{2}{3} \times 100\right)$ m $= 100$ m

8. (D) Let each side = x cm

Then, $(x + 4)^2 - x^2 = 60$

$\Rightarrow \quad x^2 + 8x + 16 - x^2 = 60$

$\therefore \quad x = 5{\cdot}5$ cm

9. (B) Area $= \left(\frac{1}{2} \times 10000\right)\ m^2 = 5000\ m^2$

$\therefore \quad \frac{1}{2} \times (\text{Diagonal})^2 = 5000$

$\Rightarrow \quad (\text{Diagonal})^2 = 10000$

$\Rightarrow \quad$ Diagonal $= 100$ m

10. (B) Length $= (40 \times 10)$ dm $= 400$ dm,

Breadth $= (15 \times 10)$ dm $= 150$ dm

Area of Verandah $= (400 \times 150)\ dm^2$

Area of one stone $= (6 \times 5)\ dm^2$

$\therefore$ Required number of stones

$= \left(\frac{400 \times 150}{6 \times 5}\right) = 2000$

11. (C) $5x - 4x = 20$ m

$\Rightarrow \quad x = 20$ m

$\therefore$ Length $= (5 \times 20)$ m $= 100$ m,

Breadth $= (4 \times 20)$ m $= 80$ m

$\therefore$ Perimeter $= 2\ (100 + 80)$ m $= 360$ m.

12. (A) Let length = $5x$ metres and breadth = $3x$ metres,

Then, perimeter $= 2 \times (5x + 3x)$ m $= 16x$ metres

But perimeter $= \frac{\text{Total Cost}}{\text{Rate}} = \frac{3000}{7{\cdot}50}$ m $= 400$ m

$\because \quad 16x = 400$

$\Rightarrow \quad x = 25$

$\therefore$ (Length) – (Breadth)

$= (5 \times 25 - 3 \times 25)$ m

$= (2 \times 25)$ m $= 50$ m

13. (B) Let breadth = x metres,

Then, length $= 2x$ metres

$\therefore$ Diagonal $= \sqrt{x^2 + 4x^2} = \sqrt{5x^2}$

$= x\sqrt{5}$ metres

So, $\sqrt{5}\,x = 9\sqrt{5}$

$\therefore \quad x = 9$

Thus, breadth $= 9$ m and length $= 18$ m

$\therefore$ Perimeter $= 2\ (18 + 9)$ m $= 54$ m.

14. (C) Area of the square $= (84 \times 84)\ m^2$

Area of the rectangle $= (84 \times 84)\ m^2$

$\therefore$ Width $= \frac{84 \times 84}{144}$ m $= 49$ m

15. (B) Perimeter $= 2 \times (36 + 21)$ m $= 114$ m

$\therefore$ Number of Flagstaffs $= \frac{114}{3} = 38$

16. (D) Area of the plot $= (3 \times 1200)\ m^2 = 3600\ m^2$

Let breadth $= x$ metres,

Then length $= 4x$ metres

$\because \quad 4x \times x = 3600\ m^2$

$\Rightarrow \quad x^2 = 900\ m^2$

$\Rightarrow \quad x = 30$ m

$\therefore$ Length of plot $= 4x$ m

$= (4 \times 30)$ m

$= 120$ m

17. (B) Area $= \frac{1}{2} \times (\text{Diagonal})^2 = \left(\frac{1}{2} \times 5{\cdot}2 \times 5{\cdot}2\right)\ cm^2$

$= 13{\cdot}52\ cm^2$

18. (A) Other side $= \sqrt{5^2 - 4^2} = \sqrt{9} = 3$ m

19. (A) Let base = b and altitude = h

Then, Area $= b \times h$ …(1)

But New base $= \frac{110}{100} \cdot b = \frac{11}{10} \cdot b$

Let New altitude $= H$

Then, $\because \frac{11}{10}\,b \times H = b{\cdot}h$

$\Rightarrow \quad H = \frac{10}{11} \cdot h$

$\therefore$ Decrease $= \left(h - \frac{10}{11}h\right)$

$= \frac{1}{11}h$

$\therefore$ Required decrease per cent

$= \left(\frac{1}{11}h \times \frac{1}{h} \times 100\right)\%$

$= 9\frac{1}{11}\%$.

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20. (C) Let breadth = l, length = $2l$

$\therefore$ Area of rectangle $= 2l \times l$

$= 2l^2$ ...(1)

As per question,

$\because (2l - 5)(l + 5) = 2l^2 + 75$ cm^2

$\Rightarrow 2l^2 - 5l + 10l - 25 = 2l^2 + 75$

$\Rightarrow 5l = 75 + 25$

$= 100$

$\therefore l = \frac{100}{5} = 20$

Hence, length of the rectangle

$= 2l = 2 \times 20 = 40$ cm.

21. (C) Let the length, breadth and height of the room be l, b and h respectively

As per question

Cost of $2(l + b) \times h$ = Rs. 48

$\therefore$ Required cost = Cost of $2(2l + 2b) \times 2h$

= Cost of $4[2(l + b) \times h]$

= $4 \times$ Rs. 48

= Rs. 192.

22. (C) $\because 2(l + 8) \times 6 = 168$ m^2

$\Rightarrow (l + 8) = 14$

$\therefore l = 14 - 8$

= 6 metres

23. (A) $\because 2 \times (7{\cdot}5 + 3{\cdot}5) \times h = 77$ m^2

$\Rightarrow h = \frac{77}{2 \times 11} = \frac{7}{2}$

h = 3·5 metres.

24. (B) Breadth of the rectangle = $\left(\frac{150}{15}\right)$ cm

= 10 cm

New area = $\left(\frac{4}{3} \times 150\right)$ cm^2

= 200 cm^2

New length = $\left(\frac{200}{10}\right)$ cm

= 20 cm

New perimeter = 2 (20 + 10) cm

= 60 cm

25. (B) Let the width of the room be x metres

Then, its area = $(4x)$ m^2

Area of each new square room

= $(2x)$ m^2

Let the side of each new room

= y metres

Then $y^2 = 2x$

Clearly, $2x$ is a complete square when $x = 2$

$\therefore y^2 = 4$

$\Rightarrow y$ = 2 m.

26. (C) Let the side of the square = 100 m

New length = 140 m, New breadth = 130 m

Increase in area = $[(140 \times 130) - (100 \times 100)]$ m^2

= 8200 m^2

$\therefore$ Required Increase per cent

= $\left(\frac{8200}{100 \times 100} \times 100\right)\% = 82\%$

27. (C) Area of verandah = $[(25 \times 20) - (20 \times 15)]$ m^2

= 200 m^2

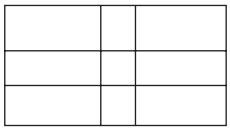
$\therefore$ Cost of flooring = Rs. $(200 \times 3{\cdot}50)$

= Rs. 700

28. (C) Area of the roads

= $(60 \times 5 + 40 \times 5 - 5 \times 5)$ m^2

= 475 m^2



$\therefore$ Cost of gravelling = Rs. $\left(475 \times \frac{60}{100}\right)$

= Rs. 285

29. (B) Area of the square field = 10000 m^2

Side of the square = $\sqrt{10000}$ m = 100 m

Side of another square field

= 101 m

$\therefore$ Required difference of areas

= $[(101)^2 - (100)^2]$ m^2

= $[(101 + 100)(101 - 100)]$ m^2 = 201 m^2

30. (B) Let the area of squares be $(9x)^2$ m^2 and (x^2) m^2

Then, their sides are $(3x)$ m and x metres respectively

$\therefore$ Ratio of their perimeters

= $\frac{12x}{4x}$

= 3 : 1

31. (A) Let length = x and breadth = y

Let, New breadth = z

Then, New length = $\left(\frac{160}{100}x\right)$

= $\frac{8}{5}x$

$\therefore \frac{8}{5}x \times z = xy$

or $z = \frac{5y}{8}$

Decrease in breadth

= $\left(y - \frac{5y}{8}\right)$

= $\frac{3}{8}y$

$\therefore$ Decrease per cent

= $\left(\frac{3}{8}y \times \frac{1}{y} \times 100\right)\%$

= $37\frac{1}{2}\%$

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32. (B) Length of the longest pole
$= \sqrt{(10)^2 + (8)^2}$ m $= \sqrt{164}$ m $= 12{\cdot}8$ m.

33. (D) Let the diagonal of one square be $(2x)$ cm
Then, diagonal of another square= x cm

$\therefore$ Area of first square $= \left[\frac{1}{2} \times (2x)^2\right]$ cm^2
$= (2x^2)$ cm^2

Area of second square $= \left(\frac{1}{2}x^2\right)$ cm^2

$\therefore$ Ratio of areas $= \frac{2x^2}{\left(\frac{1}{2}x^2\right)} = \frac{4}{1} = 4 : 1$

34. (B) Let the side of the square = x cm
Then, breadth of the rectangle
$= \frac{3}{2}x$ cm

$\therefore$ Area of rectangle
$= \left(40 \times \frac{3}{2}x\right)$ cm^2
$= (60x)$ cm^2

$\because$ $60x = 3x^2$
$\therefore$ $x = 20$
Hence, the side of the square
$= 20$ cm

35. (C) Original area $= \pi x \left(\frac{d}{2}\right)^2 = \frac{\pi d^2}{4}$

New area $= \pi \times \left(\frac{2d}{2}\right)^2 = \pi d^2$

Increase in area $= \left(\pi d^2 - \frac{\pi d^2}{4}\right) = \frac{3\pi d^2}{4}$

$\therefore$ Required increase per cent
$= \left(\frac{3\pi d^2}{4} \times \frac{4}{\pi d^2} \times 100\right)\%$
$= 300\%$

36. (C) Original area $= \pi \times r^2$

New area $= \pi \times \left(\frac{r}{2}\right)^2 = \frac{\pi r^2}{4}$

Reduction in area $= \left(\pi r^2 - \frac{\pi r^2}{4}\right) = \frac{3\pi r^2}{4}$

$\therefore$ Reduction per cent $= \left(\frac{3\pi r^2}{4} \times \frac{4}{\pi r^2} \times 100\right)\%$
$= 75\%$

37. (B) Original area $= \left(\frac{22}{7} \times 9 \times 9\right)$ cm^2

New area $= \left(\frac{22}{7} \times 7 \times 7\right)$ cm^2

$\therefore$ Decrease $= \frac{22}{7} \times [(9)^2 - (7)^2]$ cm^2
$= \left(\frac{22}{7} \times 16 \times 2\right)$ cm^2

Decrease per cent
$= \left(\frac{22}{7} \times 16 \times 2 \times \frac{7}{22 \times 9 \times 9} \times 100\right)\%$
$= 39{\cdot}5\%$

38. (C) $\because$ $2\pi r - r = 37$
$\Rightarrow$ $\left(2 \times \frac{22}{7} - 1\right) r = 37$
$\Rightarrow$ $\frac{37}{7} r = 37$
$\therefore$ $r = 7$
So, area of the circle
$= \left(\frac{22}{7} \times 7 \times 7\right)$ cm^2
$= 154$ cm^2

39. (B) $\because$ $\frac{22}{7} \times r^2 = 13{\cdot}86 \times 10000$
$\Rightarrow$ $r^2 = \left(13{\cdot}86 \times 10000 \times \frac{7}{22}\right)$
$\therefore$ $r = 210$ m
$\Rightarrow$ Circumference $= \left(2 \times \frac{22}{7} \times 210\right)$ m
$= 1320$ m
Cost of fencing $= $ Rs. $\left(1320 \times \frac{20}{100}\right)$
$= $ Rs. 264

40. (C) $\because$ $\frac{22}{7} \times r^2 = 38{\cdot}5$
$\Rightarrow$ $r^2 = \left(38{\cdot}5 \times \frac{7}{22}\right)$
$\Rightarrow$ $r = 3{\cdot}5$ cm
$\therefore$ Circumference $= \left(2 \times \frac{22}{7} \times 3{\cdot}5\right)$ cm
$= 22$ cm

41. (A) $2 \times \frac{22}{7} \times r = 352$
$\Rightarrow$ $r = \left(352 \times \frac{7}{22} \times \frac{1}{2}\right) = 56$ m
$\therefore$ Area $= \left(\frac{22}{7} \times 56 \times 56\right)$ m^2
$= 9856$ m^2

42. (D) Ratio of areas $= \frac{a^2}{\frac{\sqrt{3}}{4}a^2} = \frac{4}{\sqrt{3}} = 4 : \sqrt{3}$

43. (C) $\because$ $x^2 = \frac{1}{2} \times x \times h$
$\Rightarrow$ $h = \frac{2x^2}{x} = 2x$

44. (B) $\because$ $s = \frac{1}{2}(13 + 5 + 12)$ cm $= 15$ cm
$(s - a) = 2$ cm, $(s - b) = 10$ cm and
$(s - c) = 3$ cm

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$\Rightarrow$ Area $= \sqrt{15 \times 2 \times 10 \times 3}\,\text{cm}^2 = 30\ \text{cm}^2$

$\Rightarrow \frac{1}{2} \times 12 \times h = 30$

$\therefore \quad h = 5$ cm

45. (D) $\because \quad \frac{1}{2} \times 2\sqrt{3} \times h = \frac{\sqrt{3}}{4} \times (2\sqrt{3})^2$

$\therefore \quad h = 3$ cm.

46. (D) $\because \frac{\sqrt{3}}{4} a^2 = 4\sqrt{3}.$

$\Rightarrow \quad a^2 = 16$

$\therefore \quad a = 4$ cm

47. (B) Req. area $= \left[\frac{\sqrt{3}}{4} \times (8)^2\right] \text{cm}^2 = 16\sqrt{3}\ \text{cm}^2$

48. (D) Let lateral side = $(5x)$ cm and base = $(4x)$ cm

$\therefore \quad 5x + 5x + 4x = 14$ or $x = 1$

So, the sides are 5 cm, 5 cm and 4 cm

$s = \frac{1}{2}(5 + 5 + 4)$ cm $= 7$ cm

$(s - a) = 2$ cm

$(s - b) = 2$ cm

and $(s - c) = 3$ cm

$\therefore$ Required Area $= \sqrt{7 \times 2 \times 2 \times 3}\ \text{cm}^2$

$= 2\sqrt{21}\ \text{cm}^2$

49. (B) $s = \frac{1}{2}(13 + 14 + 15) = 21$, $s - a = 8$, $s - b = 7$, $s - 7 = 6$

$\therefore$ Area to be painted $= \sqrt{s\,(s-a)\,(s-b)\,(s-c)}$

$= \sqrt{21 \times 8 \times 7 \times 6}\ \text{m}^2$

$= 84\ \text{m}^2$

$\therefore$ Cost of painting $=$ Rs. $(84 \times 8{\cdot}75) =$ Rs. 735

50. (C) Altitude $= \sqrt{(13)^2 - (5)^2} = \sqrt{144} = 12$ m

$\therefore$ Area of the triangle $= \left(\frac{1}{2} \times 5 \times 12\right) \text{m}^2$

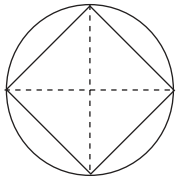
$= 30\ \text{m}^2$

51. (A) Ratio of the areas $= \frac{\frac{1}{2} \times d^2}{\frac{1}{2} \times (2d^2)} = \frac{1}{4}$

$\therefore$ New area becomes 4 fold.

52. (A) $\because$ Diagonal of the square $=$ Diagonal of circle

$= 2$ units



$\therefore$ Area $= \left[\frac{1}{2} \times (2)^2\right] = 2$ sq. units

53. (A) $\because \quad x^2 = \pi r^2$

$\Rightarrow \quad \frac{x}{r} = \sqrt{\pi} = \sqrt{\pi} : 1.$

54. (B) Circumference $= \left(2 \times \frac{22}{7} \times 70\right)$ cm

$= 440$ cm

Distance travelled in 10 revolutions

$= 4400$ cm $= 44$ m

$\therefore \quad$ Speed $= \frac{\text{Distance}}{\text{Time}} = \left(\frac{44}{5}\right)$ m/sec

$= \left(\frac{44}{5} \times \frac{18}{5}\right)$ km/hr

$= 31{\cdot}68$ km/hr

55. (B) $r = 0{\cdot}14$ m

Required number of revolutions

$= \left(\frac{0{\cdot}66 \times 1000}{2} \times \frac{7}{22} \times \frac{1}{0{\cdot}14}\right) = 750$

56. (B) $\pi r^2 = 0{\cdot}49\ \pi \Rightarrow r = 0{\cdot}7$ m

Number of revolutions

$= \frac{1{\cdot}76 \times 1000}{2 \times \frac{22}{7} \times 0{\cdot}7}$

$= 400$

57. (D) Number of rounds

$= \frac{4 \times 1000}{\frac{22}{7} \times \frac{7}{11}} = 2000$

58. (C) Distance covered in one revolution

$= \frac{88 \times 1000}{1000}$ m $= 88$ m

$\because \quad \pi \times d = 88$

$\Rightarrow \frac{22}{7} \times d = 88$

$\therefore \quad d = \left(88 \times \frac{7}{22}\right) = 28$ m

59. (B) Distance travelled in 100 revolutions

$= \left(2 \times \frac{22}{7} \times \frac{63}{2} \times 100\right)$ cm

$= \left(2 \times \frac{22}{7} \times \frac{63}{2} \times 100 \times \frac{1}{100}\right)$ m

$= 198$ m

60. (B) $\because \quad 2\pi R - 2\pi r = 66$

$\Rightarrow \quad 2\pi (R - r) = 66$

$\Rightarrow \quad 2 \times \frac{22}{7} \times (R - r) = 66$

$\therefore \quad (R - r) = \left(66 \times \frac{7}{22} \times \frac{1}{2}\right)$

$= \frac{21}{2} = 10{\cdot}5$ m

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61. (D) $\because 2 \times \frac{22}{7} \times r = 440$

$\Rightarrow \quad r = \left(440 \times \frac{7}{22} \times \frac{1}{2}\right) = 70$ m

$\therefore$ Radius of outer circle

$= (70 + 14)$ m $= 84$ m

62. (C) Ratio of areas

$= \frac{\pi r^2}{\pi (3r^2)} = \frac{\pi r^2}{9\,\pi r^2} = \frac{1}{9} = 1 : 9$

63. (A) $\because \frac{1}{2} \times (\text{Diagonal})^2 = 50$

$\Rightarrow$ (Diagonal) $= 10$ units

$\therefore$ Radius of required circle $= 5$ units

Its area $= [\pi \times (5)^2]$ cm^2 $= (25\,\pi)^2$ units

64. (B) $\because$ Circumference $= \left(2 \times \frac{22}{7} \times 42\right)$ cm $= 264$ cm

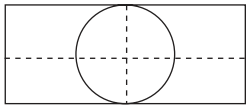
$\Rightarrow \quad 2 \times (6x + 5x) = 264$

$\Rightarrow \quad x = 12$

Smaller side of rectangle $= 5x = 60$ cm

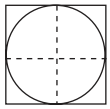
65. (A) $\because$ Radius of circle $= 3$ m

$\therefore$ Area of circle $= \left(\frac{22}{7} \times 3 \times 3\right)$ m^2



$= 28\frac{2}{7}$ m^2

66. (B) $\because$ Radius of circle $= 7$ m



$\therefore$ Its area $= \left(\frac{22}{7} \times 7 \times 7\right)$ cm^2 $= 154$ cm^2

67. (C) $\because 2 \times \frac{22}{7} \times r = 88$

$\Rightarrow r = \left(88 \times \frac{7}{22} \times \frac{1}{2}\right) = 14$ m

$\therefore$ Area $= \left(\frac{22}{7} \times 14 \times 14\right)$ m^2 $= 616$ m^2

68. (C) Original circumference $= 2\pi r$

New circumference $= \left(\frac{150}{100} \times 2\pi r\right) = 3\pi r$

$\because \quad 2\pi R = 3\pi r$

$\Rightarrow \quad R = \frac{3r}{2}$

Original area $= \pi r^2$

New area $= \pi R^2 = \pi \times \frac{9r^2}{4} = \frac{9\pi r^2}{4}$

Increase in area $= \left(\frac{9\pi r^2}{4} - \pi r^2\right) = \frac{5\pi r^2}{4}$

Req. increase per cent

$= \left(\frac{5\pi r^2}{4} \times \frac{1}{\pi r^2} \times 100\right)\%$

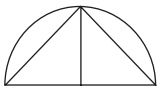
$= 125\%$

69. (B) Length of each side of hexagon $= r$

$\therefore$ Its perimeter $= 6r$

70. (B) Area of the triangle

$= \left(\frac{1}{2} \times 2r \times r\right)$ cm^2



$= r^2$ cm^2

71. (D) Area left ungrazed

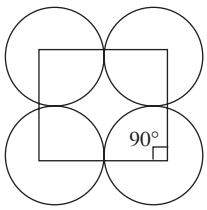
$= \left[63 \times 63 - 4 \times \frac{1}{4} \times \frac{22}{7} \times \left(\frac{63}{2}\right)^2\right]$ m^2

$= \left(63 \times 63 - \frac{99 \times 63}{2}\right)$ m^2

$= 63 \times \left(63 - \frac{99}{2}\right)$ m^2 $= 850{\cdot}5$ m^2

72. (B) Required area enclosed

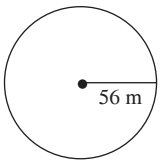
$= [(14 \times 14) - 4 \times (\text{area of quadrant})]$ cm^2



$= \left(196 - 4 \times \frac{22}{7} \times 7 \times 7 \times \frac{90°}{360°}\right)$ cm^2

$= (196 - 154)$ cm^2 $= 42$ cm^2

73. (A) $\because \frac{22}{7} \times r^2 = 9856$



Then $\quad r^2 = \left(9856 \times \frac{7}{22}\right) = 3136$

$\therefore \quad r = 56$ m

74. (B) Let circumference $= 100$ cm.

Then, $\quad \because 2\pi r = 100$

$\Rightarrow \quad r = \frac{100}{2\pi} = \frac{50}{\pi}$

New circumference

$= 105$ cm.

Then, $\quad 2\pi R = 105$

$\Rightarrow \quad R = \frac{105}{2\pi}$

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$\Rightarrow$ Original area $= \left(\pi \times \frac{50}{\pi} \times \frac{50}{\pi}\right) = \frac{2500}{\pi}\ \text{cm}^2$

$\Rightarrow$ New area $= \left(\pi \times \frac{105}{2\pi} \times \frac{105}{2\pi}\right)$

$= \frac{11025}{4\pi}\ \text{cm}^2$

$\Rightarrow$ Increase in area

$= \left(\frac{11025}{4\pi} - \frac{2500}{\pi}\right)\ \text{cm}^2$

$= \frac{1025}{4\pi}\ \text{cm}^2$

Required increase per cent

$= \left(\frac{1025}{4\pi} \times \frac{\pi}{2500} \times 100\right)\% = \frac{41}{4}\%$

$= 10{\cdot}25\%$

75. (B) $\because$ $2\pi R - 2\pi r = (176 - 132)$

$\Rightarrow$ $2\pi (R - r) = 44$

$\Rightarrow$ $(R - r) = \frac{44 \times 7}{2 \times 22}$

$= 7$ m

76. (D) $\because$ $\pi d - d = 105$ cm

$\Rightarrow$ $(\pi - 1)\, d = 105$ cm

$\Rightarrow$ $\left(\frac{22}{7} - 1\right) d = 105$ cm

$\therefore$ $d = \left(\frac{7}{15} \times 105\right)$ cm $= 49$ cm

77. (C) Area of the sector $= \left(\frac{22}{7} \times 12 \times 12 \times \frac{42^\circ}{360^\circ}\right)\ \text{m}^2$

$= 52{\cdot}8\ \text{m}^2$

78. (D) Angle swept in 30 min. $= 180^\circ$

Area swept $= \left(\frac{22}{7} \times 7 \times 7 \times \frac{180^\circ}{360^\circ}\right)\ \text{cm}^2$

$= 77\ \text{cm}^2$

79. (D) Arc length $= \frac{2\pi r\theta^\circ}{360^\circ} = \left(2 \times \frac{22}{7} \times 21 \times \frac{72^\circ}{360}\right)$ cm

$= 26{\cdot}4$ cm

80. (C) Area of sector $= \left(\frac{1}{2} \times \text{arc length} \times \text{radius}\right)\ \text{cm}^2$

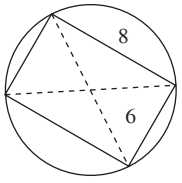
$= \left(\frac{1}{2} \times 3{\cdot}5 \times 5\right)$

$= 8{\cdot}75\ \text{cm}^2$.

81. (C) $\because$ Diagonal of the rectangle

$= \sqrt{8^2 + 6^2}$

$= 10$ m

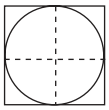


$\Rightarrow$ Radius $= 5$ m

Required area = (Area of circle) – (Area of rectangle)

$= \left(\frac{22}{7} \times 5 \times 5 - 8 \times 6\right)\ \text{m}^2 = \frac{214}{7}\ \text{m}^2 = 30{\cdot}6\ \text{m}^2$

82. (C) $\because$ Side of the square $= 2r$



$\therefore$ Perimeter $= (4 \times 2r) = 8r$

83. (B) $\because$ $\frac{22}{7} \times r^2 = 462$

$\Rightarrow$ $r^2 = \left(462 \times \frac{7}{22}\right) = 147$

$\Rightarrow$ $r = 7\sqrt{3}$ cm

$\therefore$ Height of the triangle $= 3r = 21\sqrt{3}$ cm

Now, $\because$ $a^2 = \frac{a^2}{4} + (3r)^2$

$\Rightarrow$ $\frac{3a^2}{4} = \left(21\sqrt{3}\right)^2$

$\Rightarrow$ $a^2 = \left(1323 \times \frac{4}{3}\right)$

$\Rightarrow$ $a = 21 \times 2 = 42$ cm

$\therefore$ Perimeter $= 3a = 3 \times 42$

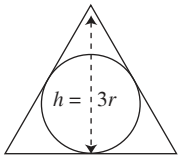
$= 126$ cm

84. (C) $\because$ $\frac{1}{2} \times 24 \times h = \frac{\sqrt{3}}{4} \times 24 \times 24$

$\Rightarrow$ $h = 12\sqrt{3}$

$\Rightarrow$ $3r = 12\sqrt{3}$

$\therefore$ $r = 4\sqrt{3}$ cm



Area of the incircle $= \pi \times (4\sqrt{3})^2\ \text{cm}^2$

$= 48\ \pi\ \text{cm}^2$

85. (A) $\because$ Area of circular lawn $= (10000 - 8614)\ \text{m}^2$

$= 1386\ \text{m}^2$

$\because$ $\frac{22}{7} \times r^2 = 1386\ \text{m}^2$

$\Rightarrow$ $r^2 = \left(1386 \times \frac{7}{22}\right)$

$= (63 \times 7)$

$\therefore$ $r = 21$ m

86. (B) Let the longer side $= l$, shorter side $= b$

and Diagonal $= d$

Then, $l \cdot b = 60$ …(1)

and $d + l = 5b$

$\Rightarrow$ $d = 5b - l$ …(2)

$\Rightarrow$ $d^2 = 25b^2 + l^2 - 10\, l \cdot b$

$\Rightarrow$ $l^2 + b^2 = 25b^2 + l^2 - 10 \times 60$

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$\Rightarrow \quad 24b^2 = 600$

$\therefore \quad b = \sqrt{25} = 5$ m

$\therefore \quad l = \frac{60}{b} = \frac{60}{5} = 12$ m.

87. (C) Let length = a metres and breadth = b metres

Then, $2(a + b) = 46$

$\Rightarrow \quad (a + b) = 23$ and $ab = 120$

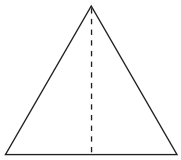
$\therefore$ Diagonal $= \sqrt{a^2 + b^2} = \sqrt{(a + b)^2 - 2ab}$

$= \sqrt{(23)^2 - 2 \times 120}$

$= \sqrt{289} = 17$ m

88. (C) $\because a^2 = \frac{a^2}{4} + x^2 \Rightarrow \frac{3a^2}{4} = x^2$

$\therefore \quad a^2 = \frac{4}{3}x^2$



$\therefore$ Area $= \frac{\sqrt{3}}{4}a^2 = \frac{\sqrt{3}}{4} \times \frac{4}{3}x^2$

$= \frac{x^2\sqrt{3}}{3}$

89. (B) Area of the room = (544×374) cm^2

Size of largest square tile = H. C. F. of 544 & 374 = 34 cm

Area of 1 tile = (34×34) cm^2

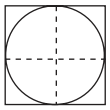
$\therefore$ Least number of tiles required

$= \frac{544 \times 374}{34 \times 34} = 176$

90. (A) $\because \frac{22}{7} \times r^2 = 616$

$\Rightarrow \quad r^2 = \left(616 \times \frac{7}{22}\right) = 196$

$\therefore \quad r = \sqrt{196} = 14$ cm



So diameter = 28 cm

$\therefore$ Area of square $= (28 \times 28)$ cm^2

$= 784$ cm^2

91. (A) Speed $= \left(12 \times \frac{5}{18}\right)$ m/sec

$= \left(\frac{10}{3}\right)$ m/sec

$\therefore$ Perimeter $= \left(\frac{10}{3} \times 15 \times 60\right)$ m $= 3000$ m

$\because \quad 2 \times (x + 4x) = 3000$ m

$\Rightarrow \quad x = 300$ m

So, length = 1200 m and breadth = 300 m

$\therefore$ Area $= (1200 \times 300)$ m$^2 = 360000$ m^2

92. (C) Ratio of areas of similar triangles

= Ratio of the squares of corresponding sides

$= \frac{(3x)^2}{(4x)^2} = \frac{9x^2}{16x^2} = \frac{9}{16} = 9 : 16$

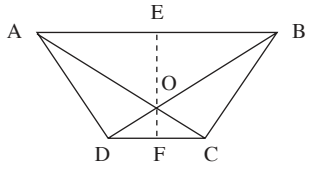
93. (B) Area of a triangle formed by joining the mid points of the sides of the triangle is $\frac{1}{4}$th of area of the original triangle.

94. (B) $\because \frac{1}{2} \times 10 \times 4{\cdot}4 = \frac{1}{2} \times 11 \times h$

$\Rightarrow h = \frac{10 \times 4{\cdot}4}{11} = 4$ cm

95. (D) $\Delta AOB = \frac{1}{2} AB \times OE$

$= \frac{1}{2} \times 2CD \times OE = CD \times OE$



$\Delta COD = \frac{1}{2} \times CD \times OF$

$\therefore \quad \frac{\Delta AOB}{\Delta COD} = \frac{CD \times OE}{\frac{1}{2} \times CD \times OF} = \frac{CD \times 2 \times OF}{\frac{1}{2} \times CD \times OF}$

$= \frac{4}{1} = 4 : 1$

96. (B) $\frac{1}{2} \times (10 + 6) \times d = 640$

$\Rightarrow \quad d = \frac{640 \times 2}{16} = 80$ m

97. (B) $\because \frac{1}{2}(3x + 5x) \times 12 = 384$

$\Rightarrow \quad 8x = 64$

$\therefore \quad x = 8$

$\therefore$ Smaller side $= 3x = 3 \times 8 = 24$ cm.

98. (C) Area of trapezium $= \left[\frac{1}{2}(1 + 2) \times 6\right]$ m$^2 = 9$ m^2

99. (C) AB = 60 m, BC = 40 m and AC = 80 m

$\therefore \quad s = \frac{1}{2}(60 + 40 + 80)$ m $= 90$ m

$(s - a) = 30$ m, $(s - b) = 50$ m and $(s - c) = 10$ m

$\therefore$ Area of $\Delta ABC = \sqrt{[s\ (s - a)\ (s - b)\ (s - c)]}$

$= \sqrt{90 \times 30 \times 50 \times 10}$ m^2

$= 300\sqrt{15}$ m^2

$\therefore$ Area of $||_{gm}$ ABCD $= 600\sqrt{15}$ m^2

100. (A) AB = 6 cm; AD = 4 cm and $\angle BAD = 30°$

Area of $||_{gm}$ ABCD = AB × AD × sin 30°

$= 6 \times 4 \times \sin 30° = 12$cm^2.

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101. (B) Area of $||_{gm} = (14 \times 16)\ cm^2 = 224\ cm^2$

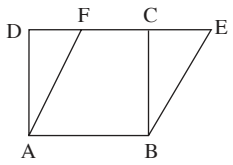
102. (B) Let ABCD be the square and ABEF be the rhombus.

Then, in right triangles ADF and BCE,

we have AD = BC (sides of a square)

and $AF = BE$ (sides of rhombus)

$\therefore \quad DF = CE$



[$\because DF^2 = AF^2 - AD^2$ and $BE^2 - BC^2 = CE^2$]

Thus, $\Delta ADF = \Delta BCE$

$\Rightarrow \quad \Delta ADE + \text{trap } ABCF = \Delta BCE + \text{trap } ABCF$

$\therefore$ Area of sq. ABCD = Area of rhombus ABEF

103. (B) Let length of the longer diagonal = x cm

Then, length of other diagonal

$$= \left(\frac{80}{100}x\right) cm = \left(\frac{4}{5}x\right) cm$$

$$\text{Area of rhombus} = \frac{1}{2}x \times \frac{4}{5}x = \frac{2}{5}x^2$$

$$= \frac{2}{5} \times (\text{Square of the length of longer diagonal})$$

104. (B) $\because \quad \frac{1}{2} \times x \times 2x = 144$

$\Rightarrow \quad x^2 = 144$

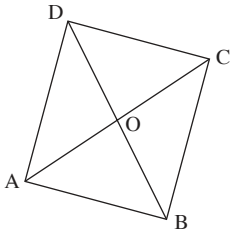
$\Rightarrow \quad x = 12$

$\therefore$ Length of diagonals = 12 cm, 24 cm

105. (B) Side of the rhombus $= \left(\frac{52}{4}\right)$ m = 13 m

AB = 13 m, AC = 24 m.

So, AO = 12 m



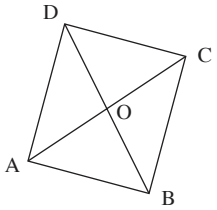
$\therefore \quad OB = \sqrt{AB^2 - AO^2} = \sqrt{169 - 144} = 5m$

So, $BD = 2 \times OB = 10$ m

Hence, other diagonal = 10 m

106. (B) AB = 10 cm, OB = 6 cm, $\angle AOB = 90°$

$\therefore OA = \sqrt{(10)^2 - (6)^2} = \sqrt{64} = 8$ cm



$\because AC = 2 \times OA = 16$ cm and BD = 12 cm

$\therefore$ Area of rhombus $= \left(\frac{1}{2} \times 16 \times 12\right) cm^2 = 96\ cm^2$

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Numbers

Numbers—In Hindu Arabic System, we use ten symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, called digits to represents any number.

Numeral—A group of figures, representing a number is called a numeral.

Representation of a number in figure is called notation and expressing a number in words is called numeration.

We use place value system to represent a number. For a given numeral, we start from the extreme right as Unit's place, Ten's place, Hundred place etc.

Examples

Q. 1. ? – 1398 = 2133

Solution : Let $x - 1398 = 2133$

Then $x = (2133 + 1398) = 3531$

Q. 2. 7048 – ? = 3999

Solution : Let $7048 - x = 3999$

Then, $x = 7048 - 3999 = 3049$.

Q. 3. 9873 + ? = 13200

Solution : Let $9873 + x = 13200$

Then, $x = (13200 - 9873) = 3327$

Q. 4. 78341 – (567 + 2356 + 53172 + 10741) = ?

Solution :

78341

567
2356
53172
10741 = 66836

? = 78341 – 66836
= 11505

Exercise

1. 9856 × 156 + 9856 × 844 =
   (A) 9856000 (B) 9836500
   (C) 9794560 (D) 9698350
2. 6674 × 625 = ?
   (A) 4170160 (B) 4072360
   (C) 4171050 (D) 4171250
3. 9998 × 999 = ?
   (A) 9997001 (B) 9988002
   (C) 9987012 (D) 9898012
4. 8888 + 7777 + 666 + ? = 19000
   (A) 2719
   (B) 2679
   (C) 1669
   (D) None of these
5. 4003 – ? – 1599 = 716
   (A) 1598
   (B) 1688
   (C) 3120
   (D) None of these
6. 36000 – 888 = 37000 – ?
   (A) 2018 (B) 1848
   (C) 1888 (D) 1978
7. ? – 1046 – 398 – 69 = 999
   (A) 2502 (B) 2512
   (C) 2472 (D) 514
8. ? + 6207 – 9038 = 107
   (A) 2724
   (B) 2938
   (C) 2814
   (D) None of these
9. 3571 + ? – 6086 = 115
   (A) 2400
   (B) 2630
   (C) 2515
   (D) None of these
10. 36800 – 9999 – 3333 – 66 = ?
    (A) 30200 (B) 27912
    (C) 23402 (D) 24102
11. ? – 4799 = 1714
    (A) 6513
    (B) 7403
    (C) 3085
    (D) None of these
12. 9501 – ? = 3697
    (A) 13198 (B) 5814
    (C) 5804 (D) 4894
13. 66066 + 6606 + 66 + 6 = ?
    (A) 258126
    (B) 72744
    (C) 72798
    (D) None of these
14. The face value of 8 in the numeral 458926 is—
    (A) 8000 (B) 8
    (C) 1000 (D) 458000
15. The local value of 7 in the numeral 5679032 is—
    (A) 7 (B) 70000
    (C) 10000 (D) 5070000
16. ? × 48 = 173 × 240
    (A) 545 (B) 685
    (C) 865 (D) 495
17. 106 × 106 + 94 × 94 = ?
    (A) 21032 (B) 20032
    (C) 23032 (D) 20072
18. 5358 × 51 = ?
    (A) 273358 (B) 273258
    (C) 273348 (D) 273268
19. 1307 × 1307 = ?
    (A) 1601249 (B) 1607249
    (C) 1701249 (D) 1708249
20. 1299 × 1299 = ?
    (A) 1585301 (B) 1684701
    (C) 1685401 (D) 1687401
21. 1014 × 986 = ?
    (A) 998904 (B) 999804
    (C) 998814 (D) 998804
22. 387 × 387 + 114 × 114 + 2 × 387 × 114 = ?
    (A) 250001 (B) 251001
    (C) 260101 (D) 261001
23. 469157 × 9999 = ?
    (A) 4586970843
    (B) 4686970743
    (C) 4691100843
    (D) 4586870843
24. 2 ? 63 ÷ 11 = 233
    (A) 4 (B) 3
    (C) 6 (D) 5
25. 2013 × ?…… 1 = 62403
    (A) 1 (B) 2
    (C) 3 (D) 4
26. 777777 ÷ 11 = ?
    (A) 7077 (B) 70707
    (C) 7707 (D) 7007

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27. $? \times 11 = 555555$
(A) 505 (B) 5050
(C) 50505 (D) 5005

28. $87 \times ? = 3393$
(A) 39 (B) 49
(C) 27 (D) 67

29. $? \times 147 = 6909$
(A) 37 (B) 47
(C) 27 (D) 67

30. $356 \times 936 - 356 \times 836 = ?$
(A) 35600 (B) 34500
(C) 49630 (D) 93600

31. $\frac{24}{18} = \frac{?}{6}$
(A) 12 (B) 10
(C) 9 (D) 8

32. $\sqrt{\frac{?}{196}} = \frac{72}{56}$
(A) 18 (B) 14
(C) 324 (D) 212

33. If $\frac{x}{y} = \frac{4}{5}$, then the value of $\left(\frac{4}{7} + \frac{2y - x}{2y + x}\right)$ is—
(A) $\frac{3}{7}$ (B) $1\frac{1}{7}$
(C) 1 (D) 2

34. If $\sqrt{3^n} = 81$, then $n = ?$
(A) 2 (B) 4
(C) 6 (D) 8

35. If $\frac{a}{b} = \frac{4}{3}$, then $\frac{3a + 2b}{3a - 2b} = ?$
(A) 6 (B) 3
(C) 5 (D) – 1

36. When simplified, the product $\left(2 - \frac{1}{3}\right)\left(2 - \frac{3}{5}\right)\left(2 - \frac{5}{7}\right) \ldots \left(2 - \frac{997}{999}\right)$ is equal to—
(A) $\frac{5}{999}$
(B) $\frac{1001}{999}$
(C) $\frac{1001}{3}$
(D) None of these

37. $\left(1 - \frac{1}{3}\right)\left(1 - \frac{1}{4}\right)\left(1 - \frac{1}{5}\right) \ldots \left(1 - \frac{1}{n}\right) = ?$
(A) $\frac{1}{n}$ (B) $\frac{2}{n}$
(C) $\frac{2(n-1)}{n}$ (D) $\frac{2}{n(x+1)}$

38. $\frac{137 \times 137 + 137 \times 133 + 133 \times 133}{137 \times 137 \times 137 - 133 \times 133 \times 133} = ?$
(A) 4 (B) 270
(C) $\frac{1}{4}$ (D) $\frac{1}{270}$

39. $\frac{117 \times 117 \times 117 - 98 \times 98 \times 98}{117 \times 117 + 117 \times 98 + 98 \times 98} = ?$
(A) 215 (B) 311
(C) 19 (D) 29

40. $\frac{343 \times 343 \times 343 + 257 \times 257 \times 257}{343 \times 343 - 343 \times 257 + 257 + 257} = ?$
(A) 8600 (B) 800
(C) 600 (D) 2600

41. $42060 \div 15 + 5 = ?$
(A) 2804 (B) 2809
(C) 2103 (D) 289

42. $\frac{?}{54} = \frac{96}{?}$
(A) 72 (B) 27
(C) 36 (D) 63

43. $\frac{\sqrt{?}}{19} = 4$
(A) 76 (B) 5776
(C) 304 (D) 1296

44. $\frac{4050}{\sqrt{?}} = 450$
(A) 49 (B) 100
(C) 81 (D) 9

45. $\frac{80}{?} = \frac{?}{20}$
(A) 40 (B) 400
(C) 800 (D) 1600

46. Which number should replace both the asterisks in $\left(\frac{*}{21}\right) \times \left(\frac{*}{189}\right) = 1$?
(A) 21 (B) 63
(C) 3969 (D) 147

47. Which of the following numbers is exactly divisible by 99 ?
(A) 3572404 (B) 135792
(C) 913464 (D) 114345

48. What least value must be given to * so that the number 91876 * 2 is divisible by 8 ?
(A) 1 (B) 2
(C) 3 (D) 4

49. What least value must be given to * so that the number 97215 * 6 is divisible by 11 ?
(A) 1 (B) 2
(C) 3 (D) 5

50. What least value must be given to $*$ so that the number 6135 $*$ 2 is exactly divisible by 9 ?
(A) 0 (B) 1
(C) 2 (D) 3

51. What least number must be added to 1056 to get a number exactly divisible by 23 ?
(A) 21 (B) 25
(C) 3 (D) 2

52. What least number must be subtracted from 13601 to get a number exactly divisible by 87 ?
(A) 49 (B) 23
(C) 29 (D) 31

53. The least number of five digits exactly divisible by 456 is—
(A) 10142 (B) 10232
(C) 10032 (D) 10012

54. The largest number of four digits exactly divisible by 88 is—
(A) 9768 (B) 8888
(C) 9988 (D) 9944

55. $\frac{392}{\sqrt{?}} = 28$
(A) 144 (B) 196
(C) 24 (D) 48

56. The number $(10^n - 1)$ is divisible by 11 for—
(A) All values of n
(B) Odd values of n
(C) Even values of n
(D) n = multiples of 11

57. Which of the following numbers is prime ?
(A) 119
(B) 187
(C) 247
(D) None of these

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58. The sum of first four prime numbers is—
(A) 10 (B) 11
(C) 16 (D) 17

59. The first prime number is—
(A) 0 (B) 1
(C) 2 (D) 3

60. $\frac{10}{11} = \frac{110}{?}$
(A) 111 (B) 1100
(C) 121 (D) 100

61. If $\sqrt{\left(1 + \frac{27}{169}\right)} = \left(1 + \frac{x}{13}\right)$, then the value of x is—
(A) 1 (B) 3
(C) 5 (D) 7

62. 62976 ÷ ? = 123
(A) 412 (B) 502
(C) 512 (D) 522

63. If $\frac{x}{y} = \frac{3}{4}$, then the value of $\left(\frac{6}{7} + \frac{y-x}{y+x}\right)$ equals—
(A) $\frac{5}{7}$ (B) $1\frac{1}{7}$
(C) 1 (D) 2

64. The largest natural number by which the product of three consecutive even natural numbers is always divisible, is—
(A) 16 (B) 24
(C) 48 (D) 96

65. If $a = 16$ and $b = 5$, the value of $\left(\frac{a^2 + b^2 + ab}{a^3 - b^3}\right)$ is—
(A) $\frac{1}{11}$
(B) $\frac{1}{19}$
(C) $\frac{121}{3971}$
(D) None of these

66. 9873 + x = 13200, then x is—
(A) 3327
(B) 3237
(C) 3337
(D) None of these

67. When a certain number is multiplied by 13, the product consists entirely of fives. The smallest such number is—
(A) 41625 (B) 42515
(C) 42735 (D) 42135

68. What least number must be subtracted from 1294 so that the remainder when divided by 9, 11, 13 will leave in each case the same remainder 6 ?
(A) 0 (B) 1
(C) 2 (D) 3

69. In a division sum, the divisor is 12 times the quotient and 5 times the remainder. If the remainder be 48 then the dividend is—
(A) 240 (B) 576
(C) 4800 (D) 4848

70. If in a long division sum, the dividend is 380606 and the successive remainders from the first to the last are 434, 125 and 413, then the divisor is—
(A) 451 (B) 843
(C) 4215 (D) 3372

Answers with Hints

1. (A) Exp. = 9856 × 156 + 9856 × 844
= 9856 × (156 + 844)
= 9856 × 1000 = 9856000

2. (D) Exp. = 6674 × 625
$= 6674 \times (5)^4 = \frac{6674 \times (10)^4}{2^4}$
$= \frac{66740000}{16} = 4171250$

3. (B) Exp. = 9998 × 999
= 9998 × (1000 – 1)
= 9998 × 1000 – 9998 × 1
= 9998000 – 9998 = 9988002.

4. (C) Let 8888 + 7777 + 666 + x = 19000
Then 17331 + x = 19000
or x = (19000 – 17331) = 1669

5. (B) Let 4003 – x – 1599 = 716
Then x = 4003 – 1599 – 716
= 4003 – (1599 + 716)
= (4003 – 2315) = 1688

6. (C) Let 37000 – x = 36000 – 888
Then x = 37000 – 36000 + 888
= 1888

7. (B) Let x – 1046 – 398 – 69 = 999
Then x = 999 + 1046 + 398 + 69
= 2512.

8. (B) Let x + 6207 – 9038 = 107
Then x = (107 + 9038) – (6207)
= 2938

9. (B) Let 3571 + x – 6086 = 115
Then x = (6086 + 115) – 3571
= (6201 – 3571) = 2630

10. (C)
9999 36800
3333 – 13398
+ 66 23402
13398

11. (A) Let x – 4799 = 1714
Then x = 4799 + 1714 = 6513.

12. (C) Let 9501 – x = 3697
Then x = 9501 – 3697
= 5804

13. (B)
66066
6606
66
+ 6
72744

14. (B) The face value of 8 in 458926 is 8.

15. (B) The local value of 7 in 5679032 is 70000.

16. (C) Let $x \times 48$ = 173 × 240
Then $x = \frac{173 \times 240}{48} = (173 \times 5)$
= 865.

17. (D) $106 \times 106 + 94 \times 94 = (106)^2 + (94)^2$
$= \frac{1}{2}[2\,(a^2 + b^2)] = \frac{1}{2}[(a+b)^2 + (a-b)^2]$

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$= \frac{1}{2}[(106+94)^2 + (106-94)^2]$

$= \frac{1}{2}[(200)^2 + (12)^2]$

$= \frac{1}{2} \times [40000 + 144] = \frac{40144}{2} = 20072.$

18. (B) $5358 \times 51 = 5358 \times (50 + 1)$
$= 5358 \times 50 + 5358 \times 1$
$= 267900 + 5358 = 273258.$

19. (D) $1307 \times 1307 = (1307)^2$
$= (1300 + 7)^2$
$= (1300)^2 + (7)^2 + 2 \times 1300 \times 7$
$= 1690000 + 49 + 18200$
$= 1708249.$

20. (D) $1299 \times 1299 = (1299)^2$
$= (1300 - 1)^2$
$= (1300)^2 + (1)^2 - 2 \times 1300 \times 1$
$= 1690000 + 1 - 2600 = 1687401.$

21. (B) $1014 \times 986 = (1000 + 14) \times (1000 - 14)$
$= (1000)^2 - (14)^2$
$= (1000000 - 196) = 999804.$

22. (B) Given expression
$= a^2 + b^2 + 2ab$
$= (a + b)^2 = (387 + 114)^2 = (501)^2$
$= (500 + 1)^2$
$= (500)^2 + (1)^2 + 2 \times 500 \times 1$
$= 250000 + 1 + 1000 = 251001.$

23. (C) $469157 \times 9999 = 469157 \times (10000 - 1)$
$= 4691570000 - 469157$
$= 4691100843.$

24. (D) Let $\frac{x}{11} = 233$

Then $x = 233 \times 11 = 2563$

$\therefore$ Missing digit is 5.

25. (C) Let $2013 \times x = 62403.$

Then $x = \frac{62403}{2013} = 31$

$\therefore$ Missing digit is 3.

26. (B) $? = \frac{777777}{11} = 70707.$

27. (C) Let $x \times 11 = 555555$

Then $x = \frac{555555}{11} = 50505.$

28. (A) Let $87 \times x = 3393$

Then $x = \frac{3393}{87} = 39.$

29. (B) Let $x \times 147 = 6909.$

Then, $x = \frac{6909}{147} = 47.$

30. (A) $356 \times 936 - 356 \times 836$
$= 356 \times (936 - 836)$
$= 356 \times 100 = 35600.$

31. (D) Let $\frac{24}{18} = \frac{x}{6}$

Then $18x = 24 \times 6$

$\therefore \quad x = \frac{24 \times 6}{18} = 8.$

32. (C) Let $\sqrt{\frac{x}{196}} = \frac{72}{56} = \frac{9}{7}$

Then $\frac{x}{196} = \frac{9}{7} \times \frac{9}{7} = \frac{81}{49}$

So, $x = \frac{81 \times 196}{49} = 324.$

33. (C) Dividing numerator as well as denominator by y, we get

Given Exp. $= \frac{4}{7} + \frac{2y - x}{2y + x}$

$= \frac{4}{7} + \frac{2 - \frac{x}{y}}{2 + \frac{x}{y}} = \frac{4}{7} + \frac{2 - \frac{4}{5}}{2 + \frac{4}{5}}$

$= \frac{4}{7} + \frac{6}{14} = \frac{4}{7} + \frac{3}{7} = \frac{7}{7} = 1.$

34. (D) $\because \quad \sqrt{3^n} = 81$
$\Rightarrow \quad 3^{n/2} = 3^4$
$\Rightarrow \quad \frac{n}{2} = 4$
$\Rightarrow \quad n = 8.$

35. (B) Dividing numerator as well as denominator by b, we get

Given Exp. $= \frac{3a + 2b}{3a - 2b} = \frac{3\frac{a}{b} + 2}{3\frac{a}{b} - 2}$

$= \frac{3 \times \frac{4}{3} + 2}{3 \times \frac{4}{3} - 2} = \frac{4 + 2}{4 - 2} = 3$

36. (C) Given Exp.
$= \left(2 - \frac{1}{3}\right)\left(2 - \frac{3}{5}\right)\left(2 - \frac{5}{7}\right) \ldots \left(2 - \frac{997}{999}\right)$
$= \frac{5}{3} \times \frac{7}{5} \times \frac{9}{7} \times \ldots\ldots \frac{1001}{999} = \frac{1001}{3}.$

37. (B) Given Exp.
$= \left(1 - \frac{1}{3}\right)\left(1 - \frac{1}{4}\right)\left(1 - \frac{1}{5}\right) \ldots \left(1 - \frac{1}{n}\right)$
$= \frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} \times \ldots \times \frac{n-1}{n} = \frac{2}{n}.$

38. (C) Given expression $= \frac{a^2 + ab + b^2}{a^3 - b^3},$

where $a = 137, b = 133$

$= \frac{(a^2 + ab + b^2)}{(a - b)(a^2 + ab + b^2)}$

$= \frac{1}{a - b} = \frac{1}{137 - 133} = \frac{1}{4}$

39. (C) Given expression $= \frac{a^3 - b^3}{a^2 + ab + b^2},$

where $a = 117, b = 98 = \frac{(a - b)(a^2 + ab + b^2)}{(a^2 + ab + b^2)}$

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$= (a-b)$

$= (117-98) = 19.$

40. (C) Given expression $= \dfrac{a^3+b^3}{a^2-ab+b^2}$,

where $a = 343$, $b = 257$ $= \dfrac{(a+b)(a^2-ab+b^2)}{(a^2-ab+b^2)}$

$= (a+b)$

$= (343+257) = 600.$

41. (B) Given expression $= \dfrac{42060}{15} + 5$

$= 2804 + 5 = 2809.$

42. (A) Let $\dfrac{x}{54} = \dfrac{96}{x}$,

Then $x^2 = 54 \times 96$

$\therefore \quad x = \sqrt{54 \times 96} = \sqrt{6 \times 9 \times 6 \times 16}$

$= 6 \times 3 \times 4 = 72.$

43. (B) Let $\dfrac{\sqrt{x}}{19} = 4$

Then $\sqrt{x} = 19 \times 4 = 76$

$\therefore \quad x = 76 \times 76 = 5776.$

44. (C) Let $\dfrac{4050}{\sqrt{x}} = 450$

Then $\sqrt{x} = \dfrac{4050}{450} = 9$

$\therefore \quad x = (9 \times 9) = 81.$

45. (A) Let $\dfrac{80}{x} = \dfrac{x}{20}$

Then $x^2 = 80 \times 20 = 1600$

$\therefore \quad x = \sqrt{1600} = 40.$

46. (B) Let $\dfrac{x}{21} \times \dfrac{x}{189} = 1$

Then, $x^2 = 21 \times 189$

$= 21 \times 21 \times 9$

$\therefore \quad x = (21 \times 3) = 63.$

47. (D) Clearly 114345 is divisible by 9 as well as 11. So, it is divisible by 99.

48. (C) By hit and trial we find that 632 is divisible by 8. So, * must replaced by 3.

49. (C) $(9+2+5+6) - (7+1+x) = 14 - x$ must be divisible by 11. So $x = 3$.

50. (B) $6+1+3+5+x+2 = 17+x$ must be divisible by 9. So $x = 1$.

51. (D) On dividing 1056 by 23, we get 21 as remainder

$\therefore$ Required number to be added $= (23-21) = 2$.

52. (C) 53. (C)

54. (D) Largest number of four digits = 9999

```
88) 9999 (113
    88
   ----
    119
     88
   ----
     319
     264
   ----
      55
```

$\therefore$ Required number $= (9999 - 55) = 9944.$

55. (B) Let $\dfrac{392}{\sqrt{x}} = 28$

Then $\sqrt{x} = \dfrac{392}{28} = 14$

$\Rightarrow \quad x = 14^2 = 196.$

56. (C) For even values of n, the number $(10^n - 1)$ consists of even numbers of nines and hence it will be divisible by 11.

57. (D) 119 is divisible by 7, 187 is divisible by 11, 247 is divisible by 13 and 551 is divisible by 19. So none of the given numbers is prime.

58. (D) First four prime numbers are 2, 3, 5, 7,
Their sum $= (2+3+5+7) = 17$.

59. (C) The first prime number is 2.

60. (C) Let $\dfrac{10}{11} = \dfrac{110}{x}$,

Then $10x = 11 \times 110$

$\therefore \quad x = \dfrac{11 \times 110}{10} = 121.$

61. (A) $\sqrt{\dfrac{196}{169}} = 1 + \dfrac{x}{13}$

$\Rightarrow \quad \dfrac{14}{13} - 1 = \dfrac{x}{13}$

$\Rightarrow \quad \dfrac{1}{13} = \dfrac{x}{13}$ *i.e.* $x = 1.$

62. (C) Let $\dfrac{62976}{x} = 123$

Then $x = \dfrac{62976}{123} = 512.$

63. (C) Given Exp. $= \dfrac{6}{7} + \dfrac{y-x}{y+x}$

$= \dfrac{6}{7} + \dfrac{1-\frac{x}{y}}{1+\frac{x}{y}} = \dfrac{6}{7} + \dfrac{1-\frac{3}{4}}{1+\frac{3}{4}}$

$= \dfrac{6}{7} + \dfrac{1}{7} = 1.$

64. (C) It is $2 \times 4 \times 6 = 48$.

65. (A) Given Exp. $= \left(\dfrac{a^2+b^2+ab}{a^3-b^3}\right)$

$= \dfrac{1}{a-b} = \dfrac{1}{(16-5)} = \dfrac{1}{11}.$

66. (A)

67. (C) By trial, we find that the smallest number consisting entirely of fives and exactly divisible by 13 is 555555. On dividing 555555 by 13, we get 42735 as quotient.

$\therefore$ Req. smallest number = 42735.

68. (B) The number when divided by 9, 11, 13 leaving remainder 6 = (l.c.m. of 9, 11, 13) + 6 = 1293. Required least number = 1294 – 1293 = 1.

69. (D) Let quotient = Q and remainder = R

Then, Divisor = 12 Q = 5 R

Now, R = 48

$\Rightarrow$ 12 Q = 5×48

$\Rightarrow$ Q = 20

Dividend = Divisor $\times$ Quotient + Remainder

$\therefore$ Dividend = $(20 \times 240 + 48)$

= 4848

70. (B)

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Problems Based on Numbers

To Solve the questions based on numbers, the number is written in algebraic form. For example let the number be x.

The numerator of a fraction is written in the following form—

Three-fourth of a number

$$= x \times \frac{3}{4} = \frac{3x}{4}$$

Two-third of a number

$$= x \times \frac{2}{3} = \frac{2x}{3}$$

Double of a number

$$= 2x$$

Thrice of a number

$$= 3x$$

20% of a number

$$= \frac{x \times 20}{100} = \frac{x}{5}$$

and 120% of number

$$= \frac{120x}{100} = \frac{6x}{5}$$

30% of $\frac{3}{4}$ of one-third of a number $= x \times \frac{1}{3} \times \frac{3}{4} \times \frac{30}{100}$

Three consecutive odd numbers are x, $x + 2$ and $x + 4$ or $x - 2$, x and $x + 2$, where x is an odd number.

Similarly three consecutive even numbers are x, $(x + 2)$ and $(x + 4)$ or $x - 2$, x and $(x + 2)$ where x is an even number.

Main Formulae

(i) $(x - y)^2 = (x + y)^2 - 4xy$

(ii) $(x + y)^2 = (x - y)^2 + 4xy$

(iii) $(x + y)^2 = x^2 + 2xy + y^2$

(iv) $(x - y)^2 = x^2 - 2xy + y^2$

and

(v) $xy = \frac{1}{4}[(x + y^2) - (x - y)^2]$

Examples

Q. 1. Two-third of three-fifth of one-fourth of a number is 24. What is 30 per cent of that number ?

Solution :

Let the number be x

$\because \frac{2}{3}$ of $\frac{3}{5}$ of $\frac{1}{4}$ of $x = 24$

$\Rightarrow x = 24 \times 10$

$= 240$

$\therefore$ 30% of 240 $= \frac{240 \times 30}{100}$

$= 72$

Q. 2. The difference between two, two digit numbers is one-third of one of the numbers. What is definite the sum of these two numbers ?

Solution :

Its answer cannot be found because it is not definite that difference of two number is $\frac{1}{3}$ of the first or second. Hence data is inadequate.

Q. 3. The ratio between two digit number and the sum of these digits is 4 : 1. If the unit digit is more than tens digit by 3, what is the number ?

Solution :

Let the number be $(10x + y)$

$\because \frac{10x + y}{(x + y)} = \frac{4}{1}$

$\Rightarrow 10x + y = 4x + 4y$

$\Rightarrow 6x - 3y = 0$

$\Rightarrow 2x - y = 0$

$\Rightarrow y = 2x$ ...(i)

But $y = x + 3$

$\Rightarrow 2x = x + 3$

$\therefore x = 3$

and $y = 2 \times 3 = 6$

$\therefore$ Req. Number

$= 10x + y$

$= 36.$

Q. 4. When 40% of first number is added to the second number, the second number becomes 1·2 times of itself. What is the ratio between the first and second numbers ?

Solution :

Let the first and second numbers be x and y respectively.

$\because x \times \frac{40}{100} + y = 1{\cdot}2\,y$

$\Rightarrow \frac{2}{5} \times x = 1{\cdot}2\,y - y$

$\Rightarrow 2x = 0{\cdot}2y \times 5 = 1$

$\therefore \frac{x}{y} = \frac{1}{2}$

or $x : y = 1 : 2$

Q. 5. The difference between the middle number of three consecutive odd numbers and the middle number of three consecutive even numbers is 7. What will be the difference between the total of these odd numbers and the total of those three even numbers ?

Solution :

Let three consecutive odd numbers be x, $x + 2$ and $x + 4$ and let three consecutive even numbers be y, $y + 2$ and $y + 4$

$\because (x + 2) - (y + 2) = 7$

$\Rightarrow x - y = 7$

$\therefore$ Sum of three consecutive odd numbers.

$= x + x + 2 + x + 4$

$= 3x + 6$

and sum of three consecutive even numbers.

$= y + y + 2 + y + 4$

$= 3y + 6$

$\therefore$ Reqd. difference

$= (3x + 6) - (3y + 6)$

$= 3x - 3y$

$= 3\,(x - y)$

$= 3 \times 7 = 21$

Short Cut Method

Let three consecutive odd numbers be $y - 2$, y and $y + 2$ respectively.

$\therefore$ Total of these odd numbers

$= 3y$

Let three consecutive even numbers be $x - 2$, x and $x + 2$ respectively

$\therefore$ Total of these even numbers

$= 3x$

$\because x - y = 7$

$\therefore 3x - 3y = 21$

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Exercise

1. 11 times a number gives 132. The number is—
   (A) 11
   (B) 12
   (C) 13·2
   (D) None of these

2. A number is as much greater than 31 as is less than 55. The number is—
   (A) 47 (B) 52
   (C) 39 (D) 43

3. $\frac{3}{4}$ of a number is 19 less than the original number. The number is—
   (A) 84 (B) 64
   (C) 76 (D) 72

4. $\frac{1}{4}$ of a number subtracted from $\frac{1}{3}$ of the same number gives 12. The number is—
   (A) 144 (B) 120
   (C) 72 (D) 63

5. If one-fifth of a number decreased by 5 is 5, then the number is—
   (A) 25 (B) 50
   (C) 60 (D) 75

6. 24 is divided into two parts such that 7 times the first part added to 5 times the second part makes 146. The first part is—
   (A) 11 (B) 13
   (C) 16 (D) 17

7. A number is 25 more than its two-fifth. The number is—
   (A) 60 (B) 80
   (C) $\frac{125}{3}$ (D) $\frac{125}{7}$

8. Three fourth of one-fifth of a number is 60. The number is—
   (A) 300 (B) 400
   (C) 450 (D) 1200

9. The difference between the squares of two consecutive number is 35. The numbers are—
   (A) 14, 15 (B) 15, 16
   (C) 17, 18 (D) 18, 19

10. The ratio between two numbers is 3 : 4 and their sum is 420. The greater of the two numbers is—
    (A) 175 (B) 200
    (C) 240 (D) 315

11. The sum of two numbers is 100 and their difference is 37. The difference of their squares is—
    (A) 37 (B) 100
    (C) 63 (D) 3700

12. The difference of two numbers is 8 and $\frac{1}{8}$th of their sum is 35. The numbers are—
    (A) 132, 140 (B) 128, 136
    (C) 124, 132 (D) 136, 144

13. The sum of two numbers is 29 and the difference of their squares is 145. The difference between the numbers is—
    (A) 13 (B) 5
    (C) 8 (D) 11

14. The difference of two numbers is 5 and the difference of their squares is 135. The sum of the numbers is—
    (A) 27 (B) 25
    (C) 30 (D) 32

15. If 1 is added to the denominator of fraction, the fraction becomes $\frac{1}{2}$. If 1 is added to the numerator, the fraction becomes 1. The fraction is—
    (A) $\frac{4}{7}$ (B) $\frac{5}{9}$
    (C) $\frac{2}{3}$ (D) $\frac{10}{11}$

16. $\frac{4}{5}$ of a number exceeds its $\frac{2}{3}$ by 8. The number is—
    (A) 30
    (B) 60
    (C) 90
    (D) None of these

17. If one-fourth of one-third of one-half of a number is 15, the number is—
    (A) 72 (B) 120
    (C) 180 (D) 360

18. A number whose fifth part increased by 5 is equal to its fourth part diminished by 5 is—
    (A) 160 (B) 180
    (C) 200 (D) 220

19. The product of two numbers is 120. The sum of their squares is 289. The sum of the two numbers is—
    (A) 20
    (B) 23
    (C) 169
    (D) None of these

20. The sum of squares of two numbers is 80 and the square of their difference is 36. The product of the two numbers is—
    (A) 22 (B) 44
    (C) 58 (D) 116

21. The sum of two numbers is twice their difference. If one of the numbers is 10, the other number is—
    (A) $3\frac{1}{3}$ (B) 30
    (C) $\frac{1}{3}$ (D) $4\frac{1}{4}$

22. The sum of two numbers is 15 and sum of their square is 113. The numbers are—
    (A) 4, 11 (B) 5, 10
    (C) 6, 9 (D) 7, 8

23. A positive number when decreased by 4, is equal to 21 times the reciprocal of the number. The number is—
    (A) 3 (B) 5
    (C) 7 (D) 9

24. $\frac{4}{5}$ of a certain number is 64. Half of that number is—
    (A) 32 (B) 40
    (C) 80 (D) 16

25. Three-fourth of number is more than two-third of the number by 5. The number is—
    (A) 72 (B) 60
    (C) 84 (D) 48

26. The number $6^{2n} - 1$, where n is any positive integer, is always divisible by—
    (A) 11
    (B) 5

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(C) 7
(D) Both (B) and (C)

27. Which of the following numbers is not a square of any natural number ?
(A) 34692 (B) 4096
(C) 15129 (D) 15376

28. Of the three numbers, the first is twice the second and is half of the third. If the average of three numbers is 56. The smallest number is—
(A) 24 (B) 36
(C) 40 (D) 48

29. If 16% of 40% of a number is 8, the number is—
(A) 200 (B) 225
(C) 125 (D) 320

30. A number exceeds 20% itself by 40. The number is—
(A) 50 (B) 60
(C) 80 (D) 320

31. The number x is exactly divisible by 5 and the remainder obtained on dividing the number y by 5 is 1. What remainder will be obtained when $(x + y)$ is divided by 5 ?
(A) 0 (B) 1
(C) 2 (D) 3

32. What number must be added to numerator and denominator of $\frac{3}{4}$ to give $\frac{11}{12}$?
(A) 5 (B) 6
(C) 7 (D) 8

33. If the unit digit in the product $75 ? \times 49 \times 867 \times 943$ be 1, then the value of ? is—
(A) 1 (B) 3
(C) 7 (D) 9

34. Three numbers are in the ratio 4 : 5 : 6 and their average is 25. The largest number is—
(A) 42 (B) 36
(C) 30 (D) 32

35. The sum of three numbers is 132. If the first number be twice the second and third number be one-third of the first, then the second number is—
(A) 32 (B) 36
(C) 48 (D) 60

36. The sum of three numbers is 68. If the ratio between first and second be 2 : 3 and that between second and third be 5 : 3, then the second number is—
(A) 30 (B) 20
(C) 58 (D) 48

37. Three numbers are in the ratio 3 : 4 : 5. The sum of the largest and the smallest equals the sum of the third and 52. The smallest number is—
(A) 20 (B) 27
(C) 39 (D) 52

38. The sum of three consecutive odd numbers is 57. The middle one is—
(A) 19 (B) 21
(C) 23 (D) 17

39. A certain number of two digits is three times the sum of its digits and if 45 be added to it, then digits are reversed. The number is—
(A) 32 (B) 72
(C) 27 (D) 23

40. If 3 is added to the denominator of a fraction. It becomes $\frac{1}{3}$ and if 4 be added to its numerator, it becomes $\frac{3}{4}$, then fraction is—
(A) $\frac{4}{9}$ (B) $\frac{3}{20}$
(C) $\frac{7}{24}$ (D) $\frac{5}{12}$

41. A fraction becomes 4 when 1 is added to both the numerator and denominator and it becomes 7 when 1 is subtracted from both the numerator and denominator. The numerator of the given fraction is—
(A) 2 (B) 3
(C) 7 (D) 15

42. The sum of squares of two numbers is 68 and the square of their difference is 36. The product of the two numbers is—
(A) 16 (B) 32
(C) 58 (D) 104

43. A number when divided by 6 is diminished by 40. The number is—
(A) 72 (B) 84
(C) 60 (D) 48

44. The sum of seven numbers is 235. The average of the first three is 23 and that of the last three is 42. The fourth number is—
(A) 40 (B) 126
(C) 69 (D) 195

45. Divide 50 into two parts so that the sum of their reciprocals is (1/12)—
(A) 20, 30 (B) 24, 26
(C) 28, 22 (D) 36, 14

46. Two numbers are such that the ratio between them is 3 : 5, but if each is increased by 10, the ratio between them becomes 5 : 7. The numbers are—
(A) 3, 5 (B) 7, 9
(C) 13, 22 (D) 15, 25

47. The ratio between two numbers is 2 : 3. If the consequent is 24, the antecedent is—
(A) 36 (B) 16
(C) 48 (D) 72

48. If a number is subtracted from the square of its one half, the result is 48. The square root of the number is—
(A) 4 (B) 5
(C) 6 (D) 8

49. There are two numbers such that the sum of twice the first and thrice the second is 18, while the sum of thrice the first and twice the second is 17. The larger of the two is—
(A) 4 (B) 6
(C) 8 (D) 12

50. Of the three numbers, the sum of first two is 45. The sum of the second and the third is 55 and the sum of the third and thrice the first is 90. The third number is—
(A) 20 (B) 25
(C) 30 (D) 35

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51. Assuming that A, B and C are different single-digit numerical value other than what is already used in the following equation, C definitely cannot be ?

8 A 2 + 3 B 5 + C 4 – 1271.

(A) 7
(B) 9
(C) Either (A) or (B)
(D) None of these

52. A number when divided by 5 leaves a remainder 3. What is the remainder when the square of the same number is divided by 5 ?

(A) 9 (B) 3
(C) 1 (D) 4

53. In a question divisor is $\frac{2}{3}$ of the dividend and 2 times the remainder. If the remainder is 5, find the dividend.

(A) 15 (B) 25
(C) 18 (D) 24

54. How many figures (digits) are required to number a book containing 200 pages ?

(A) 200 (B) 600
(C) 492 (D) 372

55. The digit in the units place of a number is equal to the digit in the tens place of half of that number and the digit in the tens place of that number is less than the digit in units place of half of the number by 1. If the sum of the digits of the number is seven, then what is the number ?

(A) 52
(B) 16
(C) 34
(D) Data in inadequate

56. A two-digit number is seven times the sum of its digits. If each digit is increased by 2, the number thus obtained is 4 more than six times the sum of its digits. Find the number.

(A) 42
(B) 24
(C) 48
(D) Data adequate

57. If a number is decreased by 4 and divided by 6 the result is 9. What would be the result if 3 is subtracted from the number and then it is divided by 5 ?

(A) $9\frac{2}{5}$ (B) $10\frac{1}{5}$
(C) $11\frac{2}{5}$ (D) 11

58. A number is greater than the square of 44 but smaller than the square of 45. If one part of the number is the square of 6 and the number is a multiple of 5, then find the number.

(A) 1940
(B) 2080
(C) 1980
(D) Cannot be determined

59. If the two digits of the age of Mr. Manoj are reversed then the new age so obtained is the age of his wife. $\frac{1}{11}$ of the sum of their ages is equal to the difference between their ages. If Mr. Manoj is elder than his wife then find the difference between their ages.

(A) Cannot be determined
(B) 10 years
(C) 8 years
(D) 9 years

60. The sum of three consecutive numbers is given. What is the difference between first and third number ?

(A) One
(B) Three
(C) Either (A) or (B)
(D) Two

61. A number gets reduced to its one-third, when 48 is subtracted from it. What is two-third of that number ?

(A) 24
(B) 72
(C) 36
(D) None of these

62. When any number is divided by 12 then dividend becomes $\frac{1}{4}$ of the other number. By how much per cent is first number greater than the second number ?

(A) 200
(B) 150
(C) 300
(D) Data inadequate

63. If the sum of one-half, one-third and one-fourth of a number exceeds the number itself by 4, what could be the number ?

(A) 24
(B) 36
(C) 72
(D) None of these

64. The numbers x, y, z are such that $xy = 96050$ and $xz = 95625$ and y is greater than z by one. Find out the number z.

(A) 425 (B) 220
(C) 525 (D) 225

65. The ratio of two numbers is 3 : 2. If 10 and the sum of the two numbers are added to their product. Square of sixteen is obtained. What could be the smaller number ?

(A) 14 (B) 12
(C) 16 (D) 18

66. $\frac{1}{5}$ of a number is equal to $\frac{5}{8}$ of the second number. If 35 is added to the first number then it becomes 4 times of second number. What is the value of the second number ?

(A) 125 (B) 70
(C) 40 (D) 25

67. In a two digit number, the digital unit place is 1 more than twice of the digit at ten's place. If the digit at unit's and ten's place be interchanged, then the difference between the new number and original number is less than 1 to that of original number. What is the original number ?

(A) 52 (B) 73
(C) 25 (D) 37

68. If the numerator of a fraction is increased by 2 and the denominator is increased by 1, the fraction becomes $\frac{5}{8}$ and if the

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numerator of the same fraction is increased by 3 and the denominator is increased by 1, the fraction becomes $\frac{3}{4}$. What is the original fraction ?

(A) Data inadequate

(B) $\frac{2}{7}$

(C) $\frac{4}{7}$

(D) $\frac{3}{7}$

69. If the numerator of a fraction is increased by 2 and denominator is increased by 3, the fraction becomes 7/9 and if numerator as well as denominator are decreased by 1, the fraction becomes 4/5. What is the original fraction ?

(A) $\frac{13}{16}$ (B) $\frac{9}{11}$

(C) $\frac{5}{6}$ (D) $\frac{17}{21}$

70. If a fraction's numerator is increased by 1 and the denominator is increased by 2 then the fraction becomes $\frac{2}{3}$. But when the numerator is increased by 5 and the denominator is increased by 1, then the fraction becomes $\frac{5}{4}$. What is the value of the original fraction ?

(A) $\frac{3}{7}$

(B) $\frac{5}{8}$

(C) $\frac{5}{7}$

(D) $\frac{6}{7}$

Answers with Hints

1. (B) Let the number be x.

Then, $11x = 132$

$\Rightarrow \quad x = 12.$

2. (D) Let the number be x.

Then, $x - 31 = 55 - x$

$\Rightarrow \quad 2x = 55 + 31 = 86$

$\therefore \quad x = 43.$

3. (C) 4. (A) 5. (B)

6. (B) Let the two part be x and $(24 - x)$,

Then, $7x + 5(24 - x) = 146$

$\Rightarrow \quad 7x + 120 - 5x = 146$

$\Rightarrow \quad 2x = 26$

$\Rightarrow \quad x = 13$

$\therefore \quad$ First part $= x$

$= 13$

7. (C) 8. (B)

9. (C) Let the two numbers be x and $(x + 1)$

Then, $(x + 1)^2 - x^2 = 35$

$\Rightarrow \quad x^2 + 2x + 1 - x^2 = 35$

$\Rightarrow \quad 2x = 34$

or $\quad x = 17$

So, the numbers are 17 and 18.

10. (C) Let the numbers be $3x$ and $4x$.

Then, $3x + 4x = 420$

$\Rightarrow \quad 7x = 420$

$\Rightarrow \quad x = 60$

$\therefore$ Greater number $= 4 \times 60 = 240$

11. (D) Let the numbers be a and b.

Then, $a + b = 100$ and $a - b = 37$

$\therefore \quad a^2 - b^2 = (a + b)(a - b)$

$= 100 \times 37 = 3700$

12. (D) Let the numbers be x and $(x + 8)$.

Then, $\frac{1}{8}[x + (x + 8)] = 35$

$\Rightarrow \quad 2x + 8 = 280$

$\Rightarrow \quad 2x = 272$

$\therefore \quad x = 136$

So, the numbers are 136 and 144.

13. (B) Let the numbers be a and b.

Then, $(a - b) = \frac{(a^2 - b^2)}{a + b} = \frac{145}{29} = 5.$

14. (A) Let the numbers be a and b.

Then, $(a + b) = \frac{(a^2 - b^2)}{(a - b)} = \frac{135}{5} = 27$

15. (C) Let the required fraction be $\frac{x}{y}$.

Then, $\frac{x}{y + 1} = \frac{1}{2}$

$\Rightarrow \quad 2x - y = 1$

$\frac{x + 1}{y} = 1 \quad \ldots(1)$

$\Rightarrow \quad x - y = -1 \quad \ldots(2)$

Solving,

We get $x = 2, y = 3$

$\therefore$ The fraction is $\frac{2}{3}$.

16. (B) Let the number be x,

Then, $\frac{4}{5}x - \frac{2}{3}x = 8$

$\Rightarrow \quad \frac{12x - 10x}{15} = 8$

$\Rightarrow \quad 2x = 120$

$\therefore \quad x = 60$

17. (D) Let the number be x.

Then, $\frac{1}{4}$ of $\frac{1}{3}$ of $\frac{1}{2}$ of $x = 15$

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$\Rightarrow \quad \frac{1}{24}x = 15$

$\Rightarrow \quad x = 24 \times 15 = 360.$

18. (C) Let the number be x.

Then, $\frac{x}{5}+5 = \frac{x}{4}-5$

$\Rightarrow \quad \frac{x}{4}-\frac{x}{5} = 10$

$\Rightarrow \quad \frac{5x-4x}{20} = 10$

$\Rightarrow \quad x = 200$

19. (B) Let the numbers be a and b,

Then, $(a+b)^2 = (a^2+b^2)+2ab$

$= 289 + 2 \times 120$

$= 289 + 240$

$= 529$

$\therefore \quad a+b = \sqrt{529} = 23$

20. (A) Let the numbers be a and b.

Then, $a^2+b^2 = 80$

and $(a-b)^2 = 36$

$\Rightarrow \quad a^2+b^2-2ab = 36$

$\Rightarrow \quad 2ab = (a^2+b^2) - 36$

$= 80 - 36 = 44$

$\therefore$ Product $= ab = 22$

21. (B) Let the other number be x.

Then, $10 + x = 2(x-10)$

$\Rightarrow \quad x = 30$

22. (D) Let the numbers be x and $(15-x)$

Then, $x^2 + (15-x)^2 = 113$

$\Rightarrow \quad x^2 - 15x + 56 = 0$

$\Rightarrow \quad (x-7)(x-8) = 0$

$\therefore \quad x = 8$

or $\quad x = 7$

So, the numbers are 7 and 8.

23. (C) Let the number be x,

Then $\quad x - 4 = \frac{21}{x}$

$\Rightarrow \quad x^2 - 4x - 21 = 0$

$\Rightarrow \quad x^2 - 7x + 3x - 21 = 0$

$\Rightarrow x(x-7) + 3(x-7) = 0$

$\Rightarrow \quad (x-7)(x+3) = 0$

$\therefore \quad x = 7$ (Neglecting $= -3$)

24. (B) Let the number be x.

Then, $\frac{4}{5}x = 64$

$\Rightarrow \quad x = \frac{64 \times 5}{4} = 80$

$\therefore$ Half of the number $= 40$

25. (B) Let the number be x.

Then, $\frac{3}{4}x - \frac{2}{3}x = 5$

$\Rightarrow \quad \frac{9x-8x}{12} = 5$

$\therefore \quad x = 60.$

26. (D) $6^2 - 1 = 35$, which is divisible by both 5 and 7.

27. (A) The square of a natural number never ends in 2.

28. (A) Let the second number be x.

Then, first number $= 2x$ and third number $= 4x$

$\therefore \quad \frac{2x+x+4x}{3} = 56$

$\Rightarrow \quad 7x = 3 \times 56$

$\therefore \quad x = \frac{3 \times 56}{7} = 24$

So, the smallest number is 24.

29. (C) Let $\frac{16}{100} \times \frac{40}{100} \times x = 8$

Then, $x = \frac{8 \times 100 \times 100}{16 \times 40}$

$= 125.$

30. (A) Let the required number be x.

Then, $x - \frac{20}{100}x = 40$

$\Rightarrow \quad 5x - x = 200$

$\therefore \quad x = 50.$

31. (B) Let $\frac{x}{5} = p$ Let y when divided by 5 give q as quotient and 1 as remainder.

Then, $y = 5q + 1$

Now, $x = 5p$ and $y = 5q + 1$

$\therefore \quad x + y = 5p + 5q + 1 = 5(p+q) + 1$

So, required remainder $= 1$

32. (D) Let $\frac{3+x}{4+x} = \frac{11}{12}$.

Then, $12(13+x) = 11(4+x)$

$\Rightarrow \quad x = 44 - 36 = 8.$

33. (D) $x \times 9 \times 7 \times 3$ = a number with unit digit 1. Clearly, the minimum value of x is 9.

34. (C) Let the numbers be $4x$, $5x$ and $6x$

Then, $\frac{4x+5x+6x}{3} = 25$

or $\quad 15x = 75$

or $\quad x = 5$

Then largest number $= 6x = 6 \times 5 = 30.$

35. (B) Let second number be $3x$, then, first one is $6x$ and the third one is $2x$.

$\because \quad 3x + 6x + 2x = 132$

$\Rightarrow \quad 11x = 132$

$\Rightarrow \quad x = 12$

$\therefore$ Second number $= 3x = 3 \times 12 = 36.$

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36. (A) Let the 3 numbers are a,b,c

Then, $\frac{a}{b} = \frac{2}{3}, \frac{b}{c} = \frac{5}{3}$

$\Rightarrow \frac{a}{b} = \frac{2\times5}{3\times5} = \frac{10}{15}$

and $\frac{b}{c} = \frac{5\times3}{3\times3} = \frac{15}{9}$

$\Rightarrow a : b : c = 10 : 15 : 9$

Let the numbers be $10x$, $15x$ and $9x$.

Then, $10x + 15x + 9x = 68$

$\Rightarrow 34x = 68$

$\Rightarrow x = 2$

$\therefore$ Second number $= 15x = 15 \times 2 = 30$.

37. (C) Let the numbers be $3x$, $4x$ and $5x$.

Then, $5x + 3x = 4x + 52$

$\Rightarrow 4x = 52$

$\Rightarrow x = 13$

$\therefore$ Then smallest number $= 3x = 3 \times 13 = 39$.

38. (A) Let the required odd integers be x, $x + 2$ and $x + 4$.

Then, $x + x + 2 + x + 4 = 57$

$\Rightarrow 3x = 51$

$\Rightarrow x = 17$

$\therefore$ The integers are 17, 19, 21.

39. (C) Let unit digit $= x$ and ten's digit $= y$

$3(x + y) = 10y + x, 10y + x + 45 = 10x + y$

$2x - 7y = 0, 9x - 9y = 45$

or $x - y = 5$

Solving these equations, we get

$x = 7, y = 2$

$\therefore$ Required number $= 27$.

40. (D) Let the required fraction be $\frac{x}{y}$

$\because \frac{x}{y+3} = \frac{1}{3}$

$\Rightarrow 3x - y = 3$ …(1)

and, $\frac{x+4}{y} = \frac{3}{4}$

$\Rightarrow 4x - 3y = -16$ …(2)

Solving these equations, we get

$x = 5, y = 12$

$\therefore$ Required fraction $= \frac{5}{12}$

41. (D) Let the required fraction be $\frac{x}{y}$.

Then, $\frac{x+1}{y+1} = 4$

$\Rightarrow x - 4y = 3$

and, $\frac{x-1}{y-1} = 7$

$\Rightarrow x - 7y = -6$

Solving these equations we get $x = 15$, $y = 3$.

42. (A) Let the numbers be a and b.

Then, $a^2 + b^2 = 68$ …(1)

and $(a - b)^2 = 36$

Now, $(a - b)^2 = 36$ …(2)

$\Rightarrow a^2 + b^2 - 2ab = 36$

$\Rightarrow 68 - 2ab = 36$

$\Rightarrow 2ab = 32$

$\Rightarrow ab = 16$.

43. (D) Let the required number be x,

Then, $\frac{x}{6} + 40 = x$

$\Rightarrow x + 240 = 6x$

$\Rightarrow x = 48$.

44. (A) $(23 \times 3 + x + 42 \times 3) = 235 \Rightarrow x = 40$

$\therefore$ Fourth number $= 40$

45. (A) Let the numbers be x and $(50 - x)$,

Then, $\frac{1}{x} + \frac{1}{50-x} = \frac{1}{12}$

$\Rightarrow \frac{50 - x + x}{x(50-x)} = \frac{1}{12}$

$\Rightarrow x^2 - 50x + 600 = 0$

$\Rightarrow x = 30$ or 20

$\therefore$ The numbers are 20, 30.

46. (D) Let the numbers be $3x$ and $5x$.

Then, $\frac{3x+10}{5x+10} = \frac{5}{7}$

$\Rightarrow 7(3x + 10) = 5(5x + 10)$

$\Rightarrow x = 5$

$\therefore$ The numbers are 15 and 25.

47. (B) Let the antecedent be x.

Then, $\frac{x}{24} = \frac{2}{3}$

$\Rightarrow x = \frac{24\times2}{3} = 16$.

48. (A) Let the number be x.

Then, $\left(\frac{x}{2}\right)^2 - x = 48$

$\Rightarrow \frac{x^2}{4} - x = 48$

$\Rightarrow x^2 - 4x - 192 = 0$

$\Rightarrow (x - 16)(x + 12) = 0$

$\Rightarrow x = 16$.

$\therefore$ The square root of the number is 4.

49. (A) Let the numbers be x and y,

Then, $2x + 3y = 18, 3x + 2y = 17$

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Solving, we get $x = 3, y = 4$

$\therefore$ Larger number $= 4$.

50. (C) Let the numbers be x, y, z.

Then, $x + y = 45, y + z = 55, z + 3x = 90$

Now, $y = (45 - x)$ and $z = 55 - y$

$z = 55 - (45 - x) = 10 + x$

$\therefore \quad 10 + x + 3x = 90$

$\Rightarrow \quad x = 20$

So, third number $= z$

$= 10 + x = 30.$

51. (D) Since A + B + C = 16

(Possible value of A, B and C are 0, 6, 7, and 9)

Also A ≠ B, B ≠ C, A ≠ C

If C = 6, A + B should be 10, which is not possible.

If C = 9, A + B should be 7, which is also not possible.

If C = 0, A + B should be 16, which is also not possible.

52. (D) The number is of the form $(5x + 3)$ where x is an integer

$$\therefore \quad \frac{(5x+3)^2}{5} = \frac{25x^2 + 30x + 9}{5}$$

$$= \frac{25x^2}{5} + \frac{30x}{5} + \frac{5+4}{5}$$

$\therefore$ The remainder is 4.

53. (A) According to the question,

$$\text{Divisor} = \frac{2}{3} \times \text{dividend}$$

and $\text{Divisor} = 2 \times \text{remainder}$

or $\frac{2}{3} \times \text{dividend} = 2 \times 5$

$$\therefore \quad \text{Dividend} = \frac{2 \times 5 \times 3}{2} = 15$$

54. (C) Number of one digit pages from

1 to 9 = 9

Number of two digit pages from

10 to 99 = 90

Number of three digit pages from

100 to 200 = 101

$\therefore$ Total number of required figures

$= 9 \times 1 + 90 \times 2 + 101 \times 3 = 492$

55. (A) Let 1/2 of the no. $= 10x + y$

and the no. $= 10v + w$

From the given conditions,

$w = x$ and $v = y - 1$

Thus the no. $= 10(y - 1) + x$ …(A)

$\therefore \quad 2(10x + y) = 10(y - 1) + x$

$\Rightarrow \quad 8y - 19x = 10$ …(i)

$v + w = 7$

$\Rightarrow \quad y - 1 + x = 7$

$\therefore \quad x + y = 8$ …(ii)

Solving equations (i) and (ii), we get

$x = 2$ and $y = 6$

$\therefore$ From equation (A)

Number $= 10(y - 1) + x = 52.$

56. (A) Let the two-digit number be $10x + y$

$10x + y = 7(x + y)$

$\Rightarrow \quad x = 2y$ …(i)

$10(x + 2) + (y + 2) = 6(x + y + 4) + 4$

or $\quad 10x + y + 22 = 6x + 6y + 28$

$\Rightarrow \quad 4x - 5y = 6$ …(ii)

Solving equations (i) and (ii)

We get $x = 4$ and $y = 2$.

57. (D) Let the number be x.

$$\therefore \quad \frac{x-4}{6} = 9$$

$\Rightarrow \quad x = 58$

Again $\quad \frac{x-3}{5} = \frac{58-3}{5} = 11.$

58. (C) Let the number be x.

$44^2 < x < 45^2 \Rightarrow \quad 1936 < x < 2025$ …(i)

From equation (i), the required number will be any number between 1936 and 2025. Since one part of the number is the square of 6 means one factor is 36

$\therefore$ L.C.M. of 36 and 5 = 180

$\therefore$ Number will be multiple of 180 *i.e.*, $180 \times 11 = 1980$ the only value which satisfies the equation (i).

59. (D) Let the age of Mr. Manoj be $(10x + y)$ yrs.

$\therefore$ His wife's age $= (10y + x)$ years

Then, $(10x + y + 10y + x)\frac{1}{11}$

$= 10x + y - 10y - x$

$\Rightarrow \quad x + y = 9x - 9y$

$\Rightarrow \quad 8x = 10y$

$\Rightarrow \quad \frac{x}{y} = \frac{5}{4}$

$\therefore x = 5$ and $y = 4$ (because any other multiple of 5 will make x of two digits).

$\therefore$ Diff. $10x + y - 10y - x = 9x - 9y = 9(x - y)$

$= 9(5 - 4) = 9$ yrs.

60. (D) Let the three consecutive numbers be x, $x + 1$ and $x + 2$ respectively

$\therefore$ Diff. between first and third numbers

$= x + 2 - x = 2.$

61. (D) Let the number be x.

Then, $\quad x - \frac{x}{3} = 48; \ \frac{2}{3}x = 48.$

62. (D) Here neither the remainder nor the dividend nor the second number is given. So, can't be determined.

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63. (D) Let the number be x

$$\therefore \quad \left(\frac{1}{2}+\frac{1}{3}+\frac{1}{4}\right)x = \left(\frac{6+4+3}{12}\right)x$$

$$= \frac{13}{12}x$$

According to the question,

$$\frac{13}{12}x - x = 4$$

$$\therefore \quad x = 48$$

64. (D) $xy = 96050$ …(i)

and $xz = 95625$ …(ii)

and $y - z = 1$ …(iii)

Dividing (i) by (ii) we get

$$\frac{y}{z} = \frac{96050}{95625} = \frac{3842}{3825} = \frac{226}{225} \quad \text{…(iv)}$$

Combining (iii) and (iv) we get $z = 225$.

65. (B) Let the two numbers be $3x$ and $2x$

According to the question,

$$10 + (3x + 2x) + (3x \times 2x) = (16)^2$$

$$\Rightarrow \quad 6x^2 + 5x - 246 = 0$$

$$\Rightarrow \quad 6x^2 + 41x - 36x - 246 = 0$$

$$\Rightarrow \quad x(6x + 41) - 6(6x + 41) = 0$$

$$\Rightarrow \quad (6x + 41)(x - 6) = 0$$

$$\therefore \quad x = 6 \text{ or } \frac{-41}{6}$$

(But – ve value cannot be accepted)

$\therefore$ Smaller number $= 2x = 2 \times 6 = 12$.

66. (C) $\frac{1}{5}x = \frac{5}{8}y \quad \therefore \quad \frac{x}{y} = \frac{25}{8}$ … (i)

$x + 35 = 4y$

or $\frac{25}{8}y + 35 = 4y$

$\therefore \quad y = 40.$

67. (D) Let the original number be $10x + y$

$$y = 2x + 1 \quad \text{…(i)}$$

and $(10y + x) - (10x + y) = 10x + y - 1$

$$\Rightarrow \quad 9y - 9x = 10x + y - 1$$

$$\Rightarrow \quad 19x - 8y = 1 \quad \text{…(ii)}$$

Putting the value of (i) in equation (ii) we get

$$19x - 8(2x + 1) = 1$$

$$\Rightarrow \quad 19x - 16x - 8 = 1$$

$$\Rightarrow \quad 3x = 9,$$

$$\Rightarrow \quad x = 3$$

So $y = 2 \times 3 + 1 = 7$

$\therefore$ Original number $= 10 \times 3 + 7 = 37$

68. (D) Let the original fraction be $\frac{x}{y}$

Then $\frac{x+2}{y+1} = \frac{5}{8}$

$$\Rightarrow \quad 8x - 5y = 11 \quad \text{…(i)}$$

Again $\frac{x+3}{y+1} = \frac{3}{4}$

$$\Rightarrow \quad 4x - 3y = 9 \quad \text{…(ii)}$$

Solving equations, (i) and (ii), we get,

$$x = 3 \text{ and } y = 7$$

$$\therefore \quad \text{Fraction} = \frac{3}{7}.$$

69. (C) Let the numerator and denominator be x and y respectively.

Then, $\frac{x+2}{y+3} = \frac{7}{9}$

$$\Rightarrow \quad 9(x + 2) = 7(y + 3)$$

$$\Rightarrow \quad 9x - 7y = 3 \quad \text{…(i)}$$

Again, $\frac{x-1}{y-1} = \frac{4}{5}$

$$\Rightarrow \quad 5x - 4y = 1 \quad \text{…(ii)}$$

Solving (i) and (ii) we get,

$$x = 5, y = 6$$

$$\text{Reqd. fraction} = \frac{5}{6}$$

70. (C) Let the fraction be $\frac{x}{y}$

Then, $\frac{x+1}{y+2} = \frac{2}{3}$

$$\Rightarrow \quad 3x + 3 = 2y + 4$$

$$\Rightarrow \quad 3x = 2y + 1 \quad \text{…(i)}$$

Also, we have $\frac{x+5}{y+1} = \frac{5}{4}$

$$\Rightarrow \quad 4x + 20 = 5y + 5$$

$$\Rightarrow \quad 4x = 5y - 15 \quad \text{…(ii)}$$

From (i) and (ii), we get

$$\because \quad \frac{2y+1}{3} = \frac{5y-15}{4}$$

$$\Rightarrow \quad 8y + 4 = 15y - 45$$

$$\Rightarrow \quad 7y = 49$$

$$\therefore \quad y = 7$$

and $x = \frac{2y+1}{3} = \frac{2 \times 7 + 1}{3} = 5$

$\therefore$ Required original fraction

$$= \frac{x}{y} = \frac{5}{7}$$

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Decimal Fraction

Decimal fractions : Fractions in which denominators are powers of 10 are called decimal fractions.

$\frac{1}{10}, \frac{1}{100}, \frac{1}{1000}$ etc. are respectively the tenth, the hundredth and the thousandth part of 1.

$\frac{7}{10}$ is 7 tenth written as ·7 (Called decimal seven)

$\frac{13}{100}$ is 13 hundredth, written as ·13 (Called decimal one-three)

$\frac{9}{100}$ is 9 hundredth, written as ·09 (Called decimal zero-nine)

$\frac{4}{1000}$ is 4 thousandth, written as ·004 (Called decimal zero-zero four) and so on.

53·678 = 50 + 3 + ·6 + ·07 + ·008.

Examples

Q. 1. Express each of the following as a vulgar fraction :

(i) $0\cdot\overline{17}$, (ii) $0\cdot12\overline{54}$, (iii) $2\cdot53\overline{6}$

Solution :

(i) $0\cdot\overline{17} = \frac{17-1}{90} = \frac{16}{90} = \frac{8}{45}$

(ii) $0\cdot12\overline{54} = \frac{1254-12}{9900}$

$= \frac{1242}{9900} = \frac{69}{550}$

(iii) $2\cdot53\overline{6} = 2 + 0\cdot53\overline{6}$

$= 2 + \frac{536-53}{900}$

$= 2 + \frac{483}{900}$

$= 2 + \frac{161}{300} = 2\frac{161}{300}$.

Q. 2. Arrange the fractions $\frac{3}{8}, \frac{7}{12}, \frac{2}{3}, \frac{14}{19}, \frac{16}{25}$ and $\frac{1}{2}$ in ascending order of magnitude.

Solution :

Converting each of the given fraction into decimal form, we get

$\frac{3}{8} = 0\cdot375, \frac{7}{12} = 0\cdot583, \frac{2}{3} = 0\cdot666, \frac{14}{19} = 0\cdot736, \frac{16}{25} = 0\cdot64$ and $\frac{1}{2} = 0\cdot5$

Clearly $0\cdot375 < 0\cdot5 < 0\cdot583 < 0\cdot64 < 0\cdot666 < 0\cdot736$

$\therefore \frac{3}{8} < \frac{1}{2} < \frac{7}{12} < \frac{16}{25} < \frac{2}{3} < \frac{14}{19}$

Q. 3. (i) 0·001 ÷ ? = 0·1

(ii) ? ÷ ·025 = 40

Solution :

(i) Let $\frac{0\cdot001}{x} = 0\cdot1$

Then, $x = \frac{0\cdot001}{0\cdot100} = \frac{1}{100} = \cdot01$

(ii) Let $\frac{x}{\cdot025} = 40$,

Then $x = 40 \times \cdot025 = 1$

Q. 4. Given that 172 × 38 = 6536, find 1·72 × ·38.

Solution :

Sum of decimal places

= (2 + 2) = 4

$\therefore$ 1·72 × ·38 = ·6536.

Q. 5. Subtract :

(i) 16·3629 from 21·003

(ii) 8·2967 from 11.

Solution :

(i) 21·003
− 16·3629
4·6401

(ii) 11·0000
− 8·2967
2·7033

Exercise

1. 0·8 × ? = 0·0004
   (A) ·0005 (B) ·005
   (C) ·5 (D) ·00005
2. 0·09 × 0·008 = ?
   (A) 0·072 (B) 0·0072
   (C) 0·00072 (D) 0·72
3. ? % of 10·8 = 32·4
   (A) 3 (B) 30
   (C) 300 (D) 0·3
4. ? ÷ ·0025 = 800
   (A) ·2 (B) ·02
   (C) 2000 (D) 2
5. 0·001 ÷ ? = 0·01
   (A) 10 (B) ·1
   (C) ·01 (D) ·001
6. 0·000033 ÷ 0·11 = ?
   (A) ·003 (B) ·03
   (C) ·0003 (D) ·3
7. 25 ÷ ·0005 = ?
   (A) 50
   (B) 500
   (C) 5000
   (D) None of these
8. 12 ÷ 0·09 of 0·3 × 2 = ?
   (A) 0·8
   (B) 0·08
   (C) 8
   (D) None of these
9. 50·8 ÷ 2540 = ?
   (A) 2 (B) ·2
   (C) 0·002 (D) 0·02
10. 0·0169 ÷ 0·013 = ?
    (A) ·13 (B) ·013
    (C) 1·3 (D) 13
11. 15·60 × 0·30 = ?
    (A) 4·68 (B) 0·458
    (C) 0·468 (D) 0·0468
12. 3 × 0·3 × 0·03 × 0·003 × 30 = ?
    (A) ·0000243 (B) ·000243
    (C) ·00243 (D) ·0243
13. 16·7 + 12·38 − ? = 10·09
    (A) 17·89 (B) 18·99
    (C) 16·98 (D) 20·09
14. 0·6 + 0·66 + 0·066 + 6·606 = ?
    (A) 6·744 (B) 6·738
    (C) 7·932 (D) 7·388
15. The H. C. F. of 0·54, 1·8 and 7·2 is—
    (A) 1·8 (B) ·18
    (C) ·018 (D) 18
16. What decimal of an hour is a second ?
    (A) ·0025 (B) ·0256
    (C) ·00027 (D) ·000126

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17. Which of the following fractions is the smallest ?
(A) $\frac{11}{13}$ (B) $\frac{9}{11}$
(C) $\frac{3}{4}$ (D) $\frac{5}{7}$

18. Which of the following fractions are in ascending order ?
(A) $\frac{16}{19}, \frac{11}{14}, \frac{17}{22}$
(B) $\frac{11}{14}, \frac{16}{19}, \frac{17}{22}$
(C) $\frac{17}{22}, \frac{11}{14}, \frac{16}{19}$
(D) $\frac{16}{19}, \frac{17}{22}, \frac{11}{14}$

19. $\frac{\cdot 24 \times \cdot 35}{\cdot 14 \times \cdot 15 \times \cdot 02}$ is equal to—
(A) 2 (B) 20
(C) 200 (D) 2000

20. Exp. = $\frac{\cdot 35 \times \cdot 0015}{\cdot 25 \times \cdot 07}$ written as a percentage is—
(A) 0·3%
(B) 3%
(C) 30%
(D) None of these

21. If 2805 ÷ 2·55 = 1100, then 280·5 ÷ 25·5 is equal to—
(A) 1·01 (B) 1·1
(C) 0·11 (D) 11

22. The square root of $\frac{0{\cdot}324 \times 0{\cdot}081 \times 4{\cdot}624}{1{\cdot}5625 \times 0{\cdot}0289 \times 72{\cdot}9 \times 64}$ is—
(A) 24
(B) 2·4
(C) 0·024
(D) None of these

23. $\sqrt{\frac{0{\cdot}289}{0{\cdot}00121}} = ?$
(A) $\frac{170}{11}$ (B) $\frac{17}{110}$
(C) $\frac{17}{1100}$ (D) $\frac{17}{11}$

24. If $\sqrt{4096} = 64$, then the value of $\sqrt{40{\cdot}96} + \sqrt{0{\cdot}4096} + \sqrt{0{\cdot}004096} + \sqrt{0{\cdot}00004096}$ is—
(A) 7·09 (B) 7·1014
(C) 7·1104 (D) 7·12

25. If $\sqrt{15} = 3{\cdot}88$, the value of $\sqrt{\frac{5}{3}}$ is—
(A) 0·43 (B) 1·89
(C) 1·29 (D) 1·63

26. If $\sqrt{5} = 2{\cdot}24$, then the value of $\frac{3\sqrt{5}}{2\sqrt{5} - 0{\cdot}48}$ is—
(A) 0·168 (B) 1·68
(C) 16·8 (D) 168

27. If 12276 ÷ 155 = 79·2 the value of 122·76 ÷ 15·5 is—
(A) 7·092 (B) 7·92
(C) 79·02 (D) 79·2

28. If $\frac{1}{3{\cdot}718} = \cdot 2689$, then the value of $\frac{1}{\cdot 0003718}$ is—
(A) 2689 (B) 2·689
(C) 26890 (D) ·2689

29. $0{\cdot}15 \div \frac{0{\cdot}5}{15} = ?$
(A) 4·5 (B) 45
(C) 0·03 (D) 0·45

30. $\frac{20 + 8 \times 0{\cdot}5}{20 - ?} = 12$
(A) 8
(B) 18
(C) 2
(D) None of these

31. $\frac{17{\cdot}28 \div ?}{3{\cdot}6 \times 0{\cdot}2} = 200$
(A) 120 (B) 1·20
(C) 12 (D) 0·12

32. $\frac{3420}{19} = \frac{?}{0{\cdot}01} \times 7$
(A) $\frac{35}{9}$
(B) $\frac{18}{7}$
(C) $\frac{63}{5}$
(D) None of these

33. $\frac{\cdot 538 \times \cdot 538 - \cdot 462 \times \cdot 462}{1 - \cdot 924} = ?$
(A) ·076 (B) 1·042
(C) 1 (D) 2

34. $\frac{(0{\cdot}05)^2 + (0{\cdot}41)^2 + (0{\cdot}073)^2}{(0{\cdot}005)^2 + (0{\cdot}041)^2 + (0{\cdot}0073)^2} = ?$
(A) 0·1 (B) 10
(C) 100 (D) 1000

35. $8{\cdot}32 \times 0{\cdot}999 = ?$
(A) 0·831168 (B) 8·31618
(C) 8·31168 (D) 8·31668

36. $(9{\cdot}75 \times 9{\cdot}75 - 2 \times 9{\cdot}75 \times 5{\cdot}75 + 5{\cdot}75 \times 5{\cdot}75) = ?$
(A) 13·25 (B) 3·625
(C) 4 (D) 16

37. $13{\cdot}065 \times 13{\cdot}065 - 3{\cdot}065 \times 3{\cdot}065 = ?$
(A) 161·3 (B) 159·5
(C) 141·6 (D) 100

38. $\frac{\cdot 896 \times \cdot 752 + \cdot 896 \times \cdot 248}{\cdot 7 \times \cdot 034 + \cdot 7 \times \cdot 966} = ?$
(A) 1·28 (B) 0·976
(C) 12·8 (D) 9·76

39. $\frac{\cdot 356 \times \cdot 356 - 2 \times \cdot 356 \times \cdot 106 + \cdot 106 \times \cdot 106}{\cdot 632 \times \cdot 632 + 2 \times \cdot 632 \times \cdot 368 + \cdot 368 \times \cdot 368} = ?$
(A) ·25 (B) ·0765
(C) ·345 (D) ·0625

40. $\frac{3{\cdot}65 \times 3{\cdot}65 + 2{\cdot}35 \times 2{\cdot}35 - 2 \times 2{\cdot}35 \times 3{\cdot}65}{1{\cdot}69} = ?$
(A) 1·69 (B) 2·35
(C) 3·65 (D) 1

41. $\frac{0{\cdot}5 \times 0{\cdot}5 \times 0{\cdot}5 + 0{\cdot}6 \times 0{\cdot}6 \times 0{\cdot}6}{0{\cdot}5 \times 0{\cdot}5 - 0{\cdot}3 + 0{\cdot}6 \times 0{\cdot}6} = ?$
(A) 0·3 (B) 1·1
(C) 0·1 (D) 0·61

42. $\frac{\cdot 125 + \cdot 027}{\cdot 5 \times \cdot 5 - 1{\cdot}5 + \cdot 09} = ?$
(A) ·08 (B) 1
(C) ·2 (D) ·8

43. $\left(\frac{0{\cdot}47 \times 0{\cdot}47 \times 0{\cdot}47 - 0{\cdot}33}{0{\cdot}47 \times 0{\cdot}47 + 0{\cdot}47 \times 0{\cdot}33 + 0{\cdot}33 \times 0{\cdot}33} \times 0{\cdot}33 \times 0{\cdot}33\right) = ?$
(A) 0·14 (B) 0·8
(C) 15·51 (D) 1

44. $\left(\frac{1{\cdot}04 \times 1{\cdot}04 + 1{\cdot}04 \times 0{\cdot}04}{1{\cdot}04 \times 1{\cdot}04 \times 1{\cdot}04 - 0{\cdot}04} + 0{\cdot}04 \times 0{\cdot}04 \times 0{\cdot}04\right) = ?$
(A) 0·10 (B) 0·1
(C) 1 (D) 0·01

45. $\frac{(0{\cdot}87)^3 + (0{\cdot}13)^3}{(0{\cdot}87)^2 + (0{\cdot}13)^2 - 0{\cdot}87 \times 0{\cdot}13} = ?$
(A) 0·13 (B) 0·74
(C) 0·87 (D) 1

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46. $(0{\cdot}04)^3 = ?$
(A) 0·064 (B) 0·0064
(C) 0·00064 (D) 0·000064

47. The value of $\frac{47}{10000}$ is—
(A) ·0047 (B) ·0470
(C) ·00047 (D) ·000047

48. $\frac{3}{3 + \frac{0{\cdot}3 - 3{\cdot}03}{3 \times 0{\cdot}91}} = ?$
(A) 1·5 (B) 15
(C) ·75 (D) 1·75

49. $\left\{ \frac{(0{\cdot}1)^2 - (0{\cdot}01)^2}{0{\cdot}0001} + 1 \right\}$ is equal to—
(A) 100 (B) 101
(C) 1010 (D) 1101

50. The L. C. M. of 3·0, 0·09 and 2·7 is—
(A) 2·7 (B) ·27
(C) ·027 (D) 27

51. G. C. D. of 1·08, ·36 and ·9 is—
(A) ·03 (B) ·9
(C) ·18 (D) ·108

52. $0{\cdot}1\overline{36} = ?$
(A) $\frac{136}{1000}$ (B) $\frac{136}{999}$
(C) $\frac{136}{990}$ (D) $\frac{3}{22}$

53. $(0{\cdot}\overline{63} + 0{\cdot}\overline{37}) = ?$
(A) 1 (B) $1{\cdot}\overline{01}$
(C) $\cdot\overline{101}$ (D) 1·01

54. $(0{\cdot}3\overline{467} + 0{\cdot}1\overline{333}) = ?$
(A) 0·48 (B) $0{\cdot}48\overline{01}$
(C) $0{\cdot}4\overline{8}$ (D) 0·48

55. $(3{\cdot}\overline{57} - 2{\cdot}\overline{14}) = ?$
(A) 1·43 (B) $1{\cdot}43\overline{01}$
(C) $1{\cdot}\overline{43}$ (D) 1·43

56. $(2{\cdot}\overline{47} + 3{\cdot}\overline{53} + 0{\cdot}\overline{05}) = ?$
(A) 6 (B) $6{\cdot}\overline{06}$
(C) 0·66 (D) $6{\cdot}\overline{01}$

57. The value of $4{\cdot}1\overline{2}$ is—
(A) $4\frac{11}{99}$
(B) $5\frac{2}{9}$
(C) $4\frac{11}{90}$
(D) None of these

58. 1 litre of water weighs 1 kg. How many cubic millimetres of water will weigh 0·1 gm ?
(A) 0·1 (B) 1
(C) 10 (D) 100

59. What should be subtracted from the multiplication of 0·527 and 2·013 to get 1 ?
(A) 0·060851 (B) 2·060851
(C) 0·939085 (D) 1·9339085

60. $0{\cdot}\overline{53} = ?$
(A) $\frac{53}{100}$ (B) $\frac{53}{90}$
(C) $\frac{53}{99}$ (D) $\frac{26}{45}$

61. $(\cdot\overline{6} + \cdot\overline{7} + \cdot\overline{8} + \cdot\overline{3}) = ?$
(A) $2\frac{3}{10}$ (B) $2\frac{33}{100}$
(C) $2\frac{2}{3}$ (D) $2{\cdot}\overline{33}$

62. If $1{\cdot}5x = 0{\cdot}04\ y$ then the value of $\frac{y-x}{y+x}$ is—
(A) $\frac{730}{77}$
(B) $\frac{73}{77}$
(C) $\frac{7{\cdot}3}{77}$
(D) None of these

63. If $\sqrt{0{\cdot}05 \times 0{\cdot}5 \times a} = 0{\cdot}5 \times 0{\cdot}05 \times \sqrt{b}$ then $\frac{a}{b} = ?$
(A) ·0025
(B) ·025
(C) ·25
(D) None of these

64. $2{\cdot}53 \times {\cdot}154$ is the same as—
(A) $253 \times {\cdot}00154$
(B) $25{\cdot}3 \times 1{\cdot}54$
(C) $253 \times {\cdot}0154$
(D) $253 \times {\cdot}0154$

65. $\frac{? - 0{\cdot}11}{1{\cdot}6} = 1{\cdot}6$
(A) 2·56
(B) 1·76
(C) 0·267
(D) None of these

66. $\frac{{\cdot}23 - {\cdot}023}{{\cdot}0023 \div 23} = ?$
(A) 0·207 (B) 207
(C) 2070 (D) 0·0207

67. $\frac{(3{\cdot}537 - {\cdot}948)^2 + (3{\cdot}537 + {\cdot}948)^2}{(3{\cdot}537)^2 + ({\cdot}948)^2} = ?$
(A) 4·485 (B) 2·589
(C) 4 (D) 2

68. $({\cdot}803 \times {\cdot}647 + {\cdot}803 \times {\cdot}353) = ?$
(A) ·803 (B) 1
(C) ·45 (D) 1·450

69. $\frac{6{\cdot}5 \times 4{\cdot}7 + 6{\cdot}5 \times 5{\cdot}3}{1{\cdot}3 \times 7{\cdot}9 - 1{\cdot}3 \times 6{\cdot}9} = ?$
(A) 3·9 (B) 39
(C) 34·45 (D) 50

70. The greatest fraction out of $\frac{2}{5}, \frac{5}{6}, \frac{11}{12}$ and $\frac{7}{8}$ is—
(A) $\frac{7}{8}$ (B) $\frac{11}{12}$
(C) $\frac{5}{6}$ (D) $\frac{2}{5}$

71. The place value of 3 in 0·07359 is—
(A) 3 (B) $\frac{3}{100}$
(C) $\frac{3}{1000}$ (D) $\frac{3}{10000}$

72. $({\cdot}6 \times {\cdot}6 \times {\cdot}6 \times {\cdot}4 \times {\cdot}4 \times {\cdot}4 + 3 \times {\cdot}6 \times {\cdot}4 \times ({\cdot}6 + {\cdot}4) = ?$
(A) 21·736 (B) 2·1736
(C) ·21736 (D) 1

73. $({\cdot}58 \times {\cdot}58 \times {\cdot}58 - {\cdot}42 \times {\cdot}42 \times {\cdot}42 - 3 \times {\cdot}58 \times {\cdot}42 \times {\cdot}16) = ?$
(A) 0·004096 (B) 1·3976
(C) 0·16 (D) 1

74. By how much is 12% of 24·2 more than 10% of 14·2 ?
(A) 0·1484 (B) 14·84
(C) 1·484 (D) 2·762

75. $3{\cdot}5 + 21 \times 1{\cdot}3 = ?$
(A) 7·28
(B) 6·13
(C) 72·8
(D) None of these

76. What decimal fraction is 40 ml of a litre ?
(A) ·4
(B) ·04
(C) ·05
(D) None of these

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Answers with Hints

1. (A) Let $0{\cdot}8 \times x = 0{\cdot}0004$

   Then, $x = \dfrac{0{\cdot}0004}{0{\cdot}8} = \dfrac{0{\cdot}004}{8} = {\cdot}0005$

2. (C) $\because 9 \times 8 = 72$

   $\therefore 0{\cdot}09 \times 0{\cdot}008 = 0{\cdot}00072$ (Five places of decimal)

3. (C) Let $x\%$ of $10{\cdot}8 = 32{\cdot}4$

   Then, $\dfrac{x}{100} \times 10{\cdot}8 = 32{\cdot}4$

   or $x = \dfrac{32{\cdot}4 \times 100}{10{\cdot}8} = 300$

4. (D) Let $\dfrac{x}{{\cdot}0025} = 800$

   Then, $x = 800 \times {\cdot}0025$

   $= \dfrac{800 \times 25}{10000} = 2$

5. (B) Let $\dfrac{0{\cdot}001}{x} = 0{\cdot}01$

   Then, $x = \dfrac{0{\cdot}001}{0{\cdot}01} = \dfrac{0{\cdot}001}{0{\cdot}010}$

   $= \dfrac{1}{10} = 0{\cdot}1$

6. (C) $\dfrac{0{\cdot}000033}{0{\cdot}11} = \dfrac{0{\cdot}0033}{11} = {\cdot}0003$

7. (D) $\dfrac{25}{{\cdot}0005} = \dfrac{250000}{5} = 50000$

8. (D) Given expression $= 12 \div 0{\cdot}027 \times 2$

   $= \dfrac{12}{0{\cdot}027} \times 2 = \dfrac{24000}{27}$

   $= \dfrac{8000}{9}$

9. (D) $\dfrac{50{\cdot}8}{2540} = \dfrac{508}{25400} = \dfrac{2}{100} = {\cdot}02$

10. (C) $\dfrac{0{\cdot}0169}{0{\cdot}0130} = \dfrac{169}{130} = \dfrac{13}{10} = 1{\cdot}3$

11. (A) $\because 1560 \times 30 = 46800$

    $\therefore 15{\cdot}60 \times 0{\cdot}30 = 4{\cdot}6800$

    $= 4{\cdot}68$ (Four places of decimal)

12. (C) $3 \times 3 \times 3 \times 3 \times 30 = 2430$

    $\therefore 3 \times 0{\cdot}3 \times 0{\cdot}03 \times 0{\cdot}003 \times 30$

    $= 0{\cdot}002430$ (Six places of decimal)

13. (B) Let $16{\cdot}7 + 12{\cdot}38 - x = 10{\cdot}09$

    $\therefore x = (16{\cdot}7 + 12{\cdot}38 - 10{\cdot}09) = 18{\cdot}99$

14. (C) $0{\cdot}6$
    $0{\cdot}66$
    $0{\cdot}066$
    $6{\cdot}606$
    $7{\cdot}932$

15. (B) The given numbers are $0{\cdot}54$, $1{\cdot}80$ and $7{\cdot}20$

    H. C. F. of 54, 180 and 720 is 18

    $\therefore$ H. C. F. of given numbers $= 0{\cdot}18$

16. (C) Required decimal $= \dfrac{1}{60 \times 60} = {\cdot}00027$

17. (D) $\dfrac{11}{3} = 0{\cdot}846,$

    $\dfrac{9}{11} = 0{\cdot}818,$

    $\dfrac{3}{4} = 0{\cdot}75$

    and $\dfrac{5}{7} = 0{\cdot}714$

    Clearly, $0{\cdot}714$ is the smallest and hence $\dfrac{5}{7}$ is smallest fraction.

18. (C) $\dfrac{16}{19} = 0{\cdot}842,$

    $\dfrac{11}{14} = 0{\cdot}785$

    and $\dfrac{17}{22} = 0{\cdot}772$

    $\therefore 0{\cdot}772 < 0{\cdot}785 < 0{\cdot}842$

    or $\dfrac{17}{22} < \dfrac{11}{14} < \dfrac{16}{19}$.

19. (C) $\dfrac{{\cdot}24 \times {\cdot}35}{{\cdot}14 \times {\cdot}15 \times {\cdot}02} = \dfrac{24 \times 35 \times 100}{14 \times 15 \times 2} = 200$

20. (B) Exp. $= \dfrac{{\cdot}35 \times {\cdot}0015}{{\cdot}25 \times {\cdot}07} = \dfrac{35 \times 15}{25 \times 700}$

    $= \left(\dfrac{3}{100} \times 100\right)\% = 3\%$

21. (D) $\dfrac{280{\cdot}5}{25{\cdot}5} = \dfrac{2805}{255}$

    $= \dfrac{2805}{2{\cdot}55 \times 100} = \dfrac{1100}{100} = 11$

22. (C) Given expression $= \dfrac{324 \times 81 \times 4624}{15625 \times 289 \times 729 \times 64}$

    $= \dfrac{9}{15625}$

    $\therefore$ Its square root $= \dfrac{3}{125} = {\cdot}024$

23. (A) $\sqrt{\dfrac{0{\cdot}289}{0{\cdot}00121}} = \sqrt{\dfrac{0{\cdot}28900}{0{\cdot}00121}}$

    $= \sqrt{\dfrac{28900}{121}} = \dfrac{\sqrt{28900}}{\sqrt{121}}$

    $= \dfrac{170}{11}$

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24. (C) Given expression

$= \sqrt{\frac{4096}{100}} + \sqrt{\frac{4096}{10000}} + \sqrt{\frac{4096}{1000000}} + \sqrt{\frac{4096}{100000000}}$

$= \frac{\sqrt{4096}}{10} + \frac{\sqrt{4096}}{100} + \frac{\sqrt{4096}}{1000} + \frac{\sqrt{4096}}{10000}$

$= \frac{64}{10} + \frac{64}{100} + \frac{64}{1000} + \frac{64}{10000}$

$= 6{\cdot}4 + {\cdot}64 + {\cdot}064 + {\cdot}0064 = 7{\cdot}1104.$

25. (C) $\sqrt{\frac{5}{3}} = \frac{\sqrt{5}}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{15}}{3}$

$= \frac{3{\cdot}88}{3} = 1{\cdot}29$

26. (B) $\frac{3\sqrt{5}}{2\sqrt{5} - 0{\cdot}48} = \frac{3 \times 2{\cdot}24}{2 \times 2{\cdot}24 - 0{\cdot}48}$

$= \frac{6{\cdot}72}{4{\cdot}48 - 0{\cdot}48} = \frac{6{\cdot}72}{4} = 1{\cdot}68$

27. (B) $\frac{122{\cdot}76}{15{\cdot}50} = \frac{12276}{1550}$

$= \frac{12276}{155} \times \frac{1}{10} = \frac{79{\cdot}2}{10} = 7{\cdot}92$

28. (A) $\frac{1}{{\cdot}003718} = \frac{10000}{3{\cdot}718} = \left(10000 \times \frac{1}{3{\cdot}718}\right)$

$= 10000 \times {\cdot}2689 = 2689.$

29. (A) $? = 0{\cdot}15 \div \frac{0{\cdot}5}{15} = \frac{15}{100} \div \frac{5}{150}$

$= \frac{15}{100} \times \frac{150}{5} = 4{\cdot}5$

30. (B) Let $\frac{20 + 8 \times 0{\cdot}5}{20 - x} = 12.$

Then, $24 = 12\,(20 - x)$

$\therefore \quad 12x = 216$

$\Rightarrow \quad x = 18$

31. (D) Let $\frac{17{\cdot}28 \div x}{3{\cdot}6 \times 0{\cdot}2} = 200$

Then, $\frac{17{\cdot}28}{x} = 200 \times 3{\cdot}6 \times 0{\cdot}2$

$\therefore x = \frac{17{\cdot}28}{200 \times 3{\cdot}6 \times 0{\cdot}2} = \frac{1728}{200 \times 36 \times 2} = 0{\cdot}12.$

32. (D) Let $\frac{3420}{19} = \frac{x}{0{\cdot}01} \times 7$

Then, $x = \frac{3420}{19} \times \frac{0{\cdot}01}{7} = \frac{180}{700} = \frac{9}{35}$

33. (C) Given expression

$= \frac{({\cdot}538)^2 - ({\cdot}462)^2}{{\cdot}076} = \frac{({\cdot}538 + {\cdot}462)\,({\cdot}538 - {\cdot}462)}{{\cdot}076}$

$= \frac{{\cdot}076}{{\cdot}076} = 1$

34. (C) Given expression

$= \frac{(a^2 + b^2 + c^2)}{\left(\frac{a}{10}\right)^2 + \left(\frac{b}{10}\right)^2 + \left(\frac{c}{10}\right)^2}$

$= \frac{100 \times (a^2 + b^2 + c^2)}{(a^2 + b^2 + c^2)} = 100$

35. (C) Given expression $= 8{\cdot}32 \times 0{\cdot}999$

$= 8{\cdot}32 \times (1 - 0{\cdot}001) = 8{\cdot}32 - 8{\cdot}32 \times 0{\cdot}001$

$= 8{\cdot}32 - {\cdot}00832 = 8{\cdot}31168.$

36. (D) Given expression

$= (a^2 - 2ab + b^2)$ where $a = 9{\cdot}75$ and $b = 5{\cdot}75$

$= (a - b)^2 = (9{\cdot}75 - 5{\cdot}75)^2 = (4)^2 = 16$

37. (A) Given expression

$= (13{\cdot}065)^2 - (3{\cdot}065)^2$

$= (13{\cdot}065 + 3{\cdot}065) \times (13{\cdot}065 - 3{\cdot}065)$

$= (16{\cdot}13 \times 10) = 161{\cdot}3$

38. (A) Given expression

$= \frac{{\cdot}896 \times ({\cdot}752 + {\cdot}248)}{{\cdot}7 \times ({\cdot}034 + {\cdot}966)} = \frac{{\cdot}896 \times 1}{{\cdot}700 \times 1}$

$= \frac{896}{700} = 1{\cdot}28$

39. (D) Given expression

$= \frac{({\cdot}356)^2 - 2 \times {\cdot}356 \times {\cdot}106 + ({\cdot}106)^2}{({\cdot}632)^2 + 2 \times {\cdot}632 \times {\cdot}368 + ({\cdot}368)^2}$

$= \left(\frac{a^2 - 2ab + b^2}{c^2 + 2cd + d^2}\right) = \frac{(a - b)^2}{(c + d)^2}$

$= \frac{({\cdot}356 - {\cdot}106)^2}{({\cdot}632 + {\cdot}368)^2}$

$= ({\cdot}25)^2 = {\cdot}0625$

40. (D) Given expression

$= \frac{(3{\cdot}65)^2 + (2{\cdot}35)^2 - 2 \times 3{\cdot}65 \times 2{\cdot}35}{1{\cdot}69}$

$= \frac{a^2 + b^2 - 2ab}{1{\cdot}69}$, where $a = 3{\cdot}65$ and $b = 2{\cdot}35$

$= \frac{(a - b)^2}{1{\cdot}69} = \frac{(3{\cdot}65 - 2{\cdot}35)^2}{1{\cdot}69} = \frac{(1{\cdot}3)^2}{1{\cdot}69} = \frac{1{\cdot}69}{1{\cdot}69} = 1$

41. (B) Given expression

$= \frac{(0{\cdot}5)^3 + (0{\cdot}6)^3}{(0{\cdot}5)^2 - 0{\cdot}5 \times 0{\cdot}6 + (0{\cdot}6)^2}$

$= \left(\frac{a^3 + b^3}{a^2 - ab + b^2}\right)$

$= (a + b)$

$= (0{\cdot}5 + 0{\cdot}6)$

$= 1{\cdot}1.$

42. (D) Given expression

$= \frac{(0{\cdot}5)^3 + (0{\cdot}3)^3}{(0{\cdot}5)^2 - 0{\cdot}5 \times 0{\cdot}3 + (0{\cdot}3)^2}$

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$= \dfrac{a^3 + b^3}{a^2 - ab + b^2} = \dfrac{(a+b)(a^2 - ab + b^2)}{(a^2 - ab + b^2)}$

$= (a + b) = (0{\cdot}5 + 0{\cdot}3) = 0{\cdot}8$

43. (A) Given expression

$= \dfrac{(0{\cdot}47)^3 - (0{\cdot}33)^3}{(0{\cdot}47)^2 + 0{\cdot}47 \times 0{\cdot}33 + (0{\cdot}33)^2}$

$= \dfrac{(a^3 - b^3)}{(a^2 + ab + b^2)} = \dfrac{(a-b)(a^2 + ab + b^2)}{(a^2 + ab + b^2)}$

$= (a - b) = (0{\cdot}47 - 0{\cdot}33) = 0{\cdot}14.$

44. (C) Given expression

$= \dfrac{(1{\cdot}04)^2 + 1{\cdot}4 \times 0{\cdot}04 + (0{\cdot}04)^2}{(1{\cdot}04)^3 - (0{\cdot}04)^3}$

$= \dfrac{a^2 + ab + b^2}{a^3 - b^3} = \dfrac{(a^2 + ab + b^2)}{(a-b)(a^2 + ab + b^2)}$

$= \dfrac{1}{a-b} = \dfrac{1}{1{\cdot}04 - 0{\cdot}04} = 1$

45. (D) Given expression

$= \dfrac{a^3 + b^3}{a^2 + b^2 - ab}$ where $= 0{\cdot}87$ and $b = 0{\cdot}13$

$= \dfrac{(a+b)(a^2 + b^2 - ab)}{(a^2 + b^2 - ab)} = (a + b)$

$= (0{\cdot}87 + 0{\cdot}13) = 1$

46. (D) $(0{\cdot}04)^3 = 0{\cdot}04 \times 0{\cdot}04 \times 0{\cdot}04 = {\cdot}000064.$

47. (A) $\dfrac{47}{10000} = {\cdot}0047$

48. (A) Given expression

$= \dfrac{3}{3 - \dfrac{2{\cdot}73}{3 \times 0{\cdot}91}} = \dfrac{3}{3 - \dfrac{273}{3 \times 91}} = \dfrac{3}{3-1}$

$= \dfrac{3}{2} = 1{\cdot}5$

49. (A) Given expression $= \left(\dfrac{0{\cdot}01 - 0{\cdot}0001}{0{\cdot}0001} + 1\right)$

$= \left(\dfrac{{\cdot}0099}{{\cdot}0001} + 1\right) = (99 + 1)$

$= 100$

50. (D) The given numbers are 3·00, 0·09 and 2·70

L. C. M. of 300, 9 and 270 is 2700

$\therefore$ Required L. C. M. = 27·00 = 27

51. (C) The given numbers are 1·08, ·36 and 0·9

G. C. D. of 108, 36 and 90 is 18

$\therefore$ Required G. C. D. = 0·18

52. (D) $0{\cdot}\overline{136} = \dfrac{136 - 1}{990} = \dfrac{135}{990} = \dfrac{3}{22}$

53. (B) Given Exp. $= 0{\cdot}\overline{63} + 0{\cdot}\overline{37}$

$= \dfrac{63}{99} + \dfrac{37}{99}$

$= \dfrac{100}{99} = 1\dfrac{1}{99} = 1{\cdot}\overline{01}$

54. (B) Given Exp. $= 0{\cdot}3\overline{467} + 0{\cdot}1\overline{333}$

$= \dfrac{3467 - 34}{9900} + \dfrac{1333 - 13}{9900}$

$= \dfrac{3433 + 1320}{9900} = \dfrac{4753}{9900}$

$= \dfrac{4801 - 48}{9900} = 0{\cdot}4\overline{801}.$

55. (C) Given Exp. $3{\cdot}\overline{57} - 2{\cdot}\overline{14} = 3 + \dfrac{57}{99} - 2 - \dfrac{14}{99}$

$= 1 + \dfrac{57}{99} - \dfrac{14}{99}$

$= 1 + \dfrac{43}{99} = 1{\cdot}\overline{43}$

56. (B) Given Exp. $= 2{\cdot}\overline{47} + 3{\cdot}\overline{53} + 0{\cdot}\overline{05}$

$= 5 + \dfrac{47}{99} + \dfrac{53}{99} + \dfrac{05}{99}$

$= 5 + \dfrac{105}{99} = 5 + 1\dfrac{06}{99}$

$= 6\dfrac{06}{99} = 6{\cdot}\overline{06}.$

57. (C) $4{\cdot}1\overline{2} = 4 + 0{\cdot}1\overline{2} = 4 + \dfrac{12 - 1}{90} = 4\dfrac{11}{90}$

58. (D) 1000 gm is the weight of = 1000 cu. cm of water

1 gm is the weight of 1 cu. cm. of water

$=$ 1000 cu. mm.

$\dfrac{1}{10}$ gm is the weight of $= \dfrac{1000}{10}$ cu. mm of water

$=$ 100 cu. mm of water

59. (A) $\because 0{\cdot}527 \times 2{\cdot}013 = 1{\cdot}060851$

Hence, the required number = 0·060851.

60. (C) $0{\cdot}\overline{53} = \dfrac{53}{99}$.

61. (C) $\cdot\overline{6} + \cdot\overline{7} + \cdot\overline{8} + \cdot\overline{3} = \left(\dfrac{6}{9} + \dfrac{7}{9} + \dfrac{8}{9} + \dfrac{3}{9}\right)$

$= \dfrac{24}{9} = \dfrac{8}{3} = 2\dfrac{2}{3}.$

62. (B) $\dfrac{x}{y} = \dfrac{0{\cdot}04}{1{\cdot}5} = \dfrac{4}{150} = \dfrac{2}{75}$

$\therefore$ Given Exp. $\dfrac{y-x}{y+x} = \dfrac{1 - \dfrac{x}{y}}{1 + \dfrac{x}{y}} = \dfrac{1 - \dfrac{2}{75}}{1 + \dfrac{2}{75}}$

$= \dfrac{73/75}{77/75} = \left(\dfrac{73}{75} \times \dfrac{75}{77}\right) = \dfrac{73}{77}$

63. (B) $\sqrt{\cdot05 \times \cdot5 \times a} = \cdot5 \times \cdot05 \times \sqrt{b}$

$\Rightarrow \sqrt{\cdot025 \times a} = 0{\cdot}25 \times \sqrt{b}$

$\Rightarrow 0{\cdot}025a = \cdot025 \times \cdot025 \times b$

$\therefore \dfrac{a}{b} = \dfrac{\cdot025 \times \cdot025}{\cdot025} = \cdot025$

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64. (A) Clearly $2{\cdot}53 \times {\cdot}154$ is the same as $253 \times {\cdot}00154$ as both contain same number of decimal places.

65. (D) Let $\dfrac{x - 0{\cdot}11}{1{\cdot}6} = 1{\cdot}6$

Then, $x - 0{\cdot}11 = 1{\cdot}6 \times 1{\cdot}6 = 2{\cdot}56$

$\therefore \quad x = 2{\cdot}56 + 0{\cdot}11 = 2{\cdot}67.$

66. (C) Given expression $= \dfrac{\dfrac{{\cdot}207}{{\cdot}0023}}{23} = \dfrac{{\cdot}207}{{\cdot}0001}$

$= \dfrac{{\cdot}2070}{{\cdot}0001} = 2070.$

67. (D) Given expression $= \dfrac{(a-b)^2 + (a+b)^2}{(a^2 + b^2)}$

(where $a = 3{\cdot}537$ and $b = 0{\cdot}948$)

$= \dfrac{2\,(a^2 + b^2)}{(a^2 + b^2)} = 2$

68. (A) Given expression $= {\cdot}803 \times ({\cdot}647 + {\cdot}353)$

$= {\cdot}803 \times 1 = {\cdot}803$

69. (D) Given expression $= \dfrac{6{\cdot}5 \times (4{\cdot}7 + 5{\cdot}3)}{13 \times (7{\cdot}9 - 6{\cdot}9)}$

$= \dfrac{6{\cdot}5 \times 10}{1{\cdot}3 \times 1} = 50.$

70. (B) $\dfrac{2}{5} = 0{\cdot}4, \ \dfrac{5}{6} = 0{\cdot}833, \ \dfrac{11}{12} = 0{\cdot}916$

and $\dfrac{7}{8} = 0{\cdot}875$

Clearly, the greatest fraction is 0·916, *i.e.* $\dfrac{11}{12}$.

71. (C) The place value of 3 in the given decimal fraction is ·003 *i.e.*, $\dfrac{3}{1000}$.

72. (D) Given expression

$= ({\cdot}6)^3 + ({\cdot}4)^3 + 3 \times {\cdot}6 \times {\cdot}4 \times ({\cdot}6 + {\cdot}4)$

$= a^3 + b^3 + 3ab\,(a + b) = (a + b)^3$

$= ({\cdot}6 + {\cdot}4)^3 = 1^3 = 1.$

73. (A) Given expression

$= ({\cdot}58)^3 - ({\cdot}42)^3 - 3 \times {\cdot}58 \times {\cdot}42 \times ({\cdot}58 - {\cdot}42)$

$= a^3 - b^3 - 3ab\,(a - b) = (a - b)^3$

(where $a = {\cdot}58$ and $b = {\cdot}42$)

$= ({\cdot}58 - {\cdot}42)^3 = {\cdot}16 \times {\cdot}16 \times {\cdot}16 = 0{\cdot}004096$

74. (C) Required difference $= \left(\dfrac{12}{100} \times 24{\cdot}2 - \dfrac{10}{100} \times 14{\cdot}2\right)$

$= 2{\cdot}904 - 1{\cdot}42 = 1{\cdot}484.$

75. (D) Given Expression $= 3{\cdot}5 + 21 \times 1{\cdot}3$

$= 3{\cdot}5 + 27{\cdot}3 = 30{\cdot}8.$

76. (B) Required fraction $= \dfrac{40}{1000}$

$= \dfrac{4}{100} = {\cdot}04$

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Unitary Method

The method in which the value of a unit is first found is called the Unitary Method. Threfore, in solving any question by this method the value of 1 unit is first found and then the value of require units is to be found.

The following points are to be kept in mind while solving the questions by this method :

(1) The term in which the answer is to be calculated is always put to the right hand side.

(2) The term to the right hand side is never put in the denominator.

(3) If on reducing to the unit, a smaller result is expected, then the right hand term is divided by the left hand term.

(4) If on reducing to the unit, a greater result is expected, then the right hand term is multiplied by the left hand term.

Examples

Q. 1. The price of one dozen pens is Rs. 540. What will be the price of 319 such pens ?

Solution :

$\because$ Price of 12 pens = Rs. 540

$\Rightarrow$ Price of 1 pen $= \frac{540}{12}$

$\therefore$ Price of 319 pens $= \frac{540 \times 319}{12}$

$= $ Rs. 14355

Q. 2. 12 machines take 30 hours to print a certain job how long will take 16 machines to print the same job ?

Solution :

$\because$ 12 machines print in = 30 hours

$\therefore$ 1 machine will print in

$= 30 \times 12$ hours

$\therefore$ 16 machines will print in

$= \frac{30 \times 12}{16} = \frac{45}{2}$

$= 22\frac{1}{2}$ hours

Q. 3. A chair costs Rs. 341 and a table costs Rs. 852. What will be the approximate cost of 5 dozens of chairs and 4 dozens of tables ?

Solution :

5 dozens $= 12 \times 5 = 60$

and, 4 dozens $= 12 \times 4 = 48$

$\because$ Cost of one chair

= Rs. 341

$\therefore$ Cost of 60 chairs

$= 341 \times 60$

= Rs. 20460

and cost of 1 table

= Rs. 852

$\therefore$ Cost of 48 tables

$= 852 \times 48$

= Rs. 40896

$\therefore$ Cost of 5 dozens of chairs and 4 dozens of tables

= 20460 + 40896

= Rs. 61356

Q. 4. A tank can be filled by 20 buckets each of capacity 13·5 litres. If the capacity of each bucket be 9 litres, how many buckets will fill the same tank ?

Solution :

$\because$ To fill the tank the number of buckets each of capacity 13·5 litres required is 20

$\therefore$ To fill the tank the number of buckets each of capacity 1 litre required is $= 20 \times 13{\cdot}5$

$\therefore$ To fill the tank the number of buckets each of capacity 9 litres

Required no. of buckets

$= \frac{20 \times 13{\cdot}5}{9}$

= 30

Q. 5. If 4 men or 7 women do a work in 60 days in how many days will 8 men and 7 women finish the same work ?

Solution :

Work of 4 men

= Work of 7 women

$\therefore$ Work of 1 man

$= $ Work of $\frac{7}{4}$ women

$\therefore$ Work of 8 men

$= $ Work of $\frac{7}{4} \times 8$

= 14 women

$\therefore$ Work of 8 men and 7 women

= Work of (14 + 7)

= Work of 21 women

$\because$ 7 women complete the work in = 60 days

$\Rightarrow$ 1 woman will complete the work in $= 60 \times 7$ days

$\therefore$ 21 women will complete the work in $= \frac{60 \times 7}{21}$

= 20 days.

Exercise

1. When a 192 metres long rod is cut down into small pieces of length 3·2 metres each. Then how many pieces are available ?
   (A) 52
   (B) 68
   (C) 62
   (D) None of these

2. The cost of 2 tables is equal to the cost of 5 chairs. If the difference of the cost of one table and one chair is Rs. 1200, then the cost of one chair is—
   (A) Rs. 500 (B) Rs. 400
   (C) Rs. 800 (D) Rs. 600

3. If the cost of $\frac{1}{4}$th of kg is Rs. 0·60, then what is the cost of 200 gm ?
   (A) 42 paise (B) 48 paise
   (C) 40 paise (D) 50 paise

4. If the cost of three dozens mangoes is Rs. 245, what will be the approximate cost of 363 mangoes ?
   (A) Rs. 2200 (B) Rs. 2000
   (C) Rs. 2400 (D) Rs. 2600

5. If the weight of 13 metres long rod is 23·4 kg. What is the weight of 6 metres long rod ?
   (A) 7·2 kg. (B) 10·8 kg.
   (C) 12·4 kg. (D) 18·0 kg.

6. Cost of 1 chair is Rs. 214 and cost of one table is Rs. 937, then

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what is the approximate cost of 6 dozen chairs and 4 dozen tables?

(A) Rs. 60000

(B) Rs. 58000

(C) Rs. 55000

(D) Rs. 62000

7. Cost of $\frac{1}{4}$ dozen of bananas is Rs. 2·35, then what is the approximate cost of 42 dozen of bananas ?

(A) Rs. 430 (B) Rs. 540

(C) Rs. 380 (D) Rs. 400

8. Five dozen toys are packed in a box and 98 boxes are kept in a tempo. How many tempos can lift 29400 toys in one round ?

(A) 4 (B) 5

(C) 7 (D) 6

9. Cost of 7000 bricks is Rs. 5740. Cost of luggage to carry the bricks to the building place is Rs. 805. What is the cost at per thousand bricks ?

(A) Rs. 900

(B) Rs. 800

(C) Rs. 935

(D) Rs. 750

10. 357 mangoes cost Rs. 1517·25, then what is the approximate cost of 49 dozen of mangoes ?

(A) Rs. 2500 (B) Rs. 2600

(C) Rs. 3000 (D) Rs. 2200

Answers with Hints

1. (D) No. of pieces $= \frac{192}{3 \cdot 2} = 60$

2. (C) Let the cost of the table be Rs. x and the cost of the chair $=$ Rs. y

From Ist condition, $2x = 5y$

$$x = \frac{5y}{2}$$

From IInd condition,

$$x - y = \text{Rs. } 1200$$

$$\frac{5y}{2} - y = 1200$$

$$\frac{3y}{2} = 1200$$

$$y = \text{Rs. } 800$$

3. (B) $\because$ 1 kg $=$ 1000 grams

$\Rightarrow \frac{1}{4}$ kg $= 1000 \times \frac{1}{4} = 250$ grams

$\because$ The cost of 250 grams $=$ 60 paise

$\therefore$ The cost of 200 grams $= \frac{60}{250} \times 200$

$=$ 48 paise

4. (C) Three dozen $= 3 \times 12 = 36$

$\because$ The cost of 36 mangoes $=$ Rs. 245

$\therefore$ The cost of 1 mango $=$ Rs. $\frac{245}{36}$

$\therefore$ The cost of 363 mangoes $=$ Rs. $\frac{245}{36} \times 363$

$=$ Rs. 2470·42

$\simeq$ Rs. 2400. (Approximately)

5. (B) $\because$ Weight of 13 m long rod $= 23 \cdot 4$ kg

$\therefore$ Weight of 1 m long rod $= \frac{23 \cdot 4}{13}$ kg

$\therefore$ Weight of 6 m long rod $= \frac{23 \cdot 4 \times 6}{13}$

$= 10 \cdot 8$ kg

6. (A) $\because$ Cost of 6 dozen chairs

$= 6 \times 12 \times 214 =$ Rs. 15408

and cost of 4 dozen tables

$= 4 \times 12 \times 937 =$ Rs. 44976

$\therefore$ Total cost

$= 15408 + 44976$

$=$ Rs. $15408 + 44976 =$ Rs. 60384

$\simeq$ Rs. 6000 (Approximately)

7. (D) $\because$ 1 dozen $= 12$

$\Rightarrow \frac{1}{4}$ dozen $= \frac{1}{4} \times 12 = 3$

$\because$ Cost of 3 bananas $=$ Rs. 2·35

$\Rightarrow$ Cost of 1 banana $=$ Rs. $\frac{2 \cdot 35}{3}$

$\therefore$ Cost of 42×12 bananas

$= \frac{2 \cdot 35 \times 42 \times 12}{3}$

$=$ Rs. 394·80

$=$ Rs. 400 (Approximately)

8. (B) $\because$ Five dozen $= 5 \times 12 = 60$

$\Rightarrow$ No. of toys can be kept in 1 box = 60

$\therefore$ No. of toys can be kept in 98 boxes

$= 60 \times 98 = 5880$

$\because$ 5880 toys can be lifted by $=$ 1 tempo

$\therefore$ 29400 toys can be lifted by $= \frac{1}{5880} \times 29400$

$=$ 5 tempos

9. (C) $\because$ Total cost of 7000 bricks

$= 5740 + 805 =$ Rs. 6545

$\Rightarrow$ Total cost of 1 brick $=$ Rs. $\frac{6545}{7000}$

$\therefore$ Total cost of 1000 bricks $= \frac{6545}{7000} \times 1000$

$=$ Rs. 935

10. (A) 49 dozen $= 49 \times 12 = 588$

$\because$ The cost of 357 mangoes = Rs. 1517·25

$\Rightarrow$ The cost of 1 mango

$= \frac{1517 \cdot 25}{357} =$ Rs. 4·25

$\therefore$ The cost of 588 mangoes

$= 4 \cdot 25 \times 588 =$ Rs. 2499

$\simeq$ Rs. 2500 (Approximately)

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Square Root and Cube Root

Square Root of a Number—The square root of a number is that number, the product of which by itself, is equal to the given number.

The square root of x is denoted by $\sqrt{x}$.

Thus, $\sqrt{9} = 3, \sqrt{16} = 4, \sqrt{10000} = 100$ etc.

Square Root by Factorization—When a given number is a perfect square we resolve it into prime factors and take the product of prime factors. Choosing one out of every pair.

Examples

Q. 1. Given that $\sqrt{15} = 3{\cdot}8729$, evaluate $\left(\frac{\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}}\right)$.

Solution : $\frac{(\sqrt{5}+\sqrt{3})}{(\sqrt{5}-\sqrt{3})}$

$= \frac{(\sqrt{5}+\sqrt{3})}{(\sqrt{5}-\sqrt{3})} \times \frac{(\sqrt{5}+\sqrt{3})}{(\sqrt{5}+\sqrt{3})}$

$= \frac{(\sqrt{5}+\sqrt{3})^2}{(5-3)}$

$= \frac{5+3+2\times\sqrt{5}\times\sqrt{3}}{2}$

$= (4+\sqrt{15})$

$= (4 + 3{\cdot}8729) = 7{\cdot}8729.$

Q. 2. By what least number should 9720 multiplied to get a perfect cube. Find the cube root of the number so obtained.

Solution : We have

2	9720
2	4860
2	2430
3	1215
3	405
3	135
5	45
3	9
	3

$9720 = 2\times2\times2\times3\times3\times3\times5\times3\times3$

To make it a perfect cube, the given number must be multiplied by $5\times5\times3$ *i.e.*, 75.

Cube root of the new number

$= 2\times3\times5\times3 = 90$

Q. 3. If $\sqrt{1369} = 37$, find the value of

$$\sqrt{13{\cdot}69} + \sqrt{{\cdot}1369} + \sqrt{{\cdot}001369}$$

Solution : Given expression

$= \sqrt{\frac{1369}{100}} + \sqrt{\frac{1369}{10000}} + \sqrt{\frac{1369}{1000000}}$

$= \frac{\sqrt{1369}}{\sqrt{100}} + \frac{\sqrt{1369}}{\sqrt{10000}} + \frac{\sqrt{1369}}{\sqrt{1000000}}$

$= \left(\frac{37}{10} + \frac{37}{100} + \frac{37}{1000}\right)$

$= (3{\cdot}7 + 0{\cdot}37 + 0{\cdot}037) = 4{\cdot}107$

Q. 4. If $\sqrt{21} = 4{\cdot}582$ find the value of $\sqrt{\frac{3}{7}}$.

Solution :

$\sqrt{\frac{3}{7}} = \frac{\sqrt{3}}{\sqrt{7}} = \frac{\sqrt{3}}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}}$

$= \frac{\sqrt{3}\times\sqrt{7}}{7} = \frac{\sqrt{21}}{7}$

$= \frac{4{\cdot}582}{7} = 0{\cdot}6546$

Q. 5. Evaluate

(i) $\sqrt{486} \times \sqrt{6}$

(ii) $\frac{\sqrt{1323}}{\sqrt{75}}$.

Solution : (i) $\sqrt{486} \times \sqrt{6}$

$= \sqrt{486\times6}$

$= \sqrt{6\times81\times6}$

$= \sqrt{6\times6\times9\times9)}$

$= (6\times9) = 54$

(ii) $\frac{\sqrt{1323}}{\sqrt{75}} = \sqrt{\frac{1323}{75}}$

$= \sqrt{\frac{441}{25}} = \frac{\sqrt{441}}{\sqrt{25}}$

$= \frac{21}{5}$

Q. 6. Evaluate $\sqrt{{\cdot}4}$ upto four places of decimal.

Solution : Making even number of decimal places, we have

$\sqrt{{\cdot}4} = \sqrt{{\cdot}40}.$

6	·40	(·6324)
	36	
123	400	
	369	
1262	3100	
	2524	
12644	57600	
	50576	

$\therefore \quad \sqrt{{\cdot}4} = 0{\cdot}6324.$

Cube Root—The cube root of a number x is the number whose cube is x.

We denote the cube root of x by $\sqrt[3]{x}$.

Cube Root by Factorization—Resolve the given number into prime factors and take the product of prime numbers, choosing one out of three of each type.

Thus, $\sqrt[3]{8} = \sqrt[3]{2\times2\times2} = 2$

and $\sqrt[3]{343} = \sqrt[3]{7\times7\times7} = 7$

Exercise

1. If $\sqrt{\frac{x}{169}} = \frac{54}{39}$, then x is equal to—

   (A) 108 (B) 324

   (C) 2916 (D) 4800

2. $\frac{112}{\sqrt{196}} \times \frac{\sqrt{576}}{12} \times \frac{\sqrt{256}}{8} = ?$

   (A) 8 (B) 12

   (C) 16 (D) 32

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3. $\sqrt{248+\sqrt{52}+\sqrt{144}}$ —
(A) 14 (B) 16
(C) 16·6 (D) 18·8

4. $\sqrt{176+\sqrt{2401}}$ = ?
(A) 14 (B) 15
(C) 18 (D) 24

5. Given that $\sqrt{4096}=64$, the value of $\sqrt{4096}+\sqrt{40{\cdot}96}+\sqrt{{\cdot}004096}$ is—
(A) 70·4 (B) 70·464
(C) 71·104 (D) 71·4

6. $\sqrt{{\cdot}04}$ = ?
(A) ·02
(B) ·2
(C) ·002
(D) None of these

7. If $\sqrt{256}\div\sqrt{x}=2$, then x is equal to—
(A) 64 (B) 128
(C) 512 (D) 1024

8. $\frac{\sqrt{288}}{\sqrt{128}}$ = ?
(A) $\frac{\sqrt{3}}{2}$ (B) $\frac{3}{\sqrt{2}}$
(C) $\frac{3}{2}$ (D) $\sqrt{\frac{3}{2}}$

9. $\sqrt{10}\times\sqrt{15}$ = ?
(A) $5\sqrt{6}$ (B) $6\sqrt{5}$
(C) 5 (D) $\sqrt{30}$

10. $\frac{\sqrt{?}}{200}=0{\cdot}02$—
(A) 0·4 (B) 4
(C) 16 (D) 1·6

11. $\frac{250}{\sqrt{?}}=10$—
(A) 25 (B) 250
(C) 625 (D) 2500

12. $\sqrt{10}\times\sqrt{250}$ = ?
(A) 46·95 (B) 43·75
(C) 50·25 (D) 50

13. $\frac{\sqrt{4375}}{\sqrt{7}}$ = ?
(A) 24·75 (B) 27·25
(C) 25 (D) 35

14. $\sqrt{64009}$ = ?
(A) 803 (B) 363
(C) 253 (D) 347

15. $\sqrt{\frac{4}{3}}-\sqrt{\frac{3}{4}}$ = ?
(A) $\frac{1}{2\sqrt{3}}$ (B) $-\frac{1}{2\sqrt{3}}$
(C) 1 (D) $\frac{5\sqrt{3}}{3}$

16. If $\sqrt{2}=1{\cdot}4142$, then the approximate value of $\sqrt{\frac{2}{9}}$ is—
(A) 0·2321 (B) 0·4714
(C) 0·3174 (D) 0·4174

17. If $\sqrt{3}=1{\cdot}732$, then the approximate value of $\frac{1}{\sqrt{3}}$ is—
(A) 0·617 (B) 0·313
(C) 0·577 (D) 0·173

18. If $\sqrt{24}=4{\cdot}899$, then the value of $\sqrt{\frac{8}{3}}$ is—
(A) 0·544 (B) 2·666
(C) 1·633 (D) 1·333

19. $\frac{\sqrt{32}+\sqrt{48}}{\sqrt{8}+\sqrt{12}}$ = ?
(A) $\sqrt{2}$ (B) 2
(C) 4 (D) 8

20. $\frac{?}{\sqrt{2{\cdot}25}}=550$
(A) 825 (B) 82·5
(C) 3666·66 (D) 2

21. If $\sqrt{(75{\cdot}24+x)}=8{\cdot}71$, then the value of x is—
(A) ·6241
(B) 6·241
(C) 62·41
(D) None of these

22. $\sqrt{\frac{36{\cdot}1}{102{\cdot}4}}$ = ?
(A) $\frac{29}{32}$ (B) $\frac{19}{72}$
(C) $\frac{19}{32}$ (D) $\frac{29}{62}$

23. $\sqrt{\frac{{\cdot}289}{{\cdot}00121}}$ = ?
(A) 1·7 (B) $\frac{17}{11}$
(C) $\frac{170}{11}$ (D) $\frac{17}{10}$

24. If $\sqrt{3}=1{\cdot}732$ and $\sqrt{2}=1{\cdot}414$, the value of $\frac{1}{\sqrt{3}+\sqrt{2}}$ is—
(A) 0·064 (B) 0·308
(C) 0·318 (D) 2·146

25. If $\sqrt{6}=2{\cdot}55$, then the value of $\sqrt{\frac{2}{3}}+3\sqrt{\frac{3}{2}}$ is—
(A) 4·48
(B) 4·49
(C) 4·50
(D) None of these

26. If $\sqrt{2^n}=64$, then the value of n is—
(A) 2 (B) 4
(C) 6 (D) 12

27. $\sqrt{\frac{25}{15625}}=\sqrt{\frac{?}{30625}}$
(A) 2 (B) 35
(C) 49 (D) 1225

28. $\sqrt{1\frac{9}{16}}$ = ?
(A) $1\frac{3}{4}$
(B) $1\frac{1}{4}$
(C) 1·125
(D) None of these

29. $\frac{1872}{\sqrt{?}}=234$
(A) 324 (B) 64
(C) 8 (D) 256

30. $\frac{\sqrt{324}}{1{\cdot}5}=\frac{?}{\sqrt{256}}$
(A) 192 (B) 432
(C) 288 (D) 122

31. $\sqrt{\frac{1{\cdot}21\times0{\cdot}9}{1{\cdot}1\times0{\cdot}11}}$ = ?
(A) 2 (B) 3
(C) 9 (D) 11

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32. $\sqrt{\frac{0{\cdot}324 \times 0{\cdot}081 \times 4{\cdot}624}{1{\cdot}5625 \times 0{\cdot}0289 \times 72{\cdot}9 \times 64}} = ?$

(A) 24
(B) 2·40
(C) 0·024
(D) None of these

33. If $\sqrt{15625} = 125$, then the value of $\left[\sqrt{15625} + \sqrt{156{\cdot}25} + \sqrt{1{\cdot}5625}\right.$ is $\left.\right]$

(A) 1·3875 (B) 13·875
(C) 138·75 (D) 156·25

34. $\frac{\sqrt{1296}}{?} = \frac{?}{2{\cdot}25}$

(A) 6 (B) 7
(C) 8 (D) 9

35. If $\sqrt{\left(1 + \frac{27}{169}\right)} = \left(1 + \frac{x}{13}\right)$, then x equals—

(A) 1 (B) 3
(C) 5 (D) 7

36. $\sqrt{2\sqrt{2\sqrt{2\sqrt{2\sqrt{2}}}}} = ?$

(A) 0 (B) 1
(C) 2 (D) $2^{31/32}$

37. The value of $\sqrt{0{\cdot}9}$ is—

(A) 0·3 (B) 0·03
(C) 0·33 (D) 0·94

38. If $\sqrt{2401} = \sqrt{7^x}$, then the value of x is—

(A) 3 (B) 4
(C) 5 (D) 6

39. If $\sqrt{2} = 1{\cdot}4142$, the value of $\frac{7}{3 + \sqrt{2}}$ is—

(A) 1·5858 (B) 4·4142
(C) 3·4852 (D) 3·5858

40. $\sqrt{\cdot 00059049} = ?$

(A) ·243
(B) ·0243
(C) ·00243
(D) ·000243

41. $\sqrt{0{\cdot}01 + \sqrt{0{\cdot}0064}} = ?$

(A) 0·3
(B) 0·03
(C) $\sqrt{0{\cdot}18}$
(D) None of these

42. $\sqrt{0{\cdot}0009} \div \sqrt{0{\cdot}01} = ?$

(A) 3
(B) 0·3
(C) $\frac{1}{3}$
(D) None of these

43. Which of the following numbers, where in some of the digit have been suppressed by Symbols, can possibly be the perfect square of a 3 digit odd number ?

(A) 65×××1 (B) 9××1
(C) 10×××4 (D) 9××××××5

44. $\sqrt{\left(12 + \sqrt{12 + \sqrt{12 + \ldots}}\right)} = ?$

(A) 3
(B) 4
(C) 6
(D) Greater than 6

45. If $\sqrt{0{\cdot}04 \times 0{\cdot}4 \times a} = 0{\cdot}4 \times 0{\cdot}04 \times \sqrt{b}$, then the value of $\frac{a}{b}$ is—

(A) 0·016
(B) 1·60
(C) 0·16
(D) None of these

46. $\left[3 + \frac{1}{\sqrt{3}} + \frac{1}{3 + \sqrt{3}} + \frac{1}{\sqrt{3} - 3}\right]$ equals—

(A) 0 (B) 1
(C) 3 (D) $3 + \sqrt{3}$

47. If $a = \frac{\sqrt{5} + 1}{\sqrt{5} - 1}$ and $b = \frac{\sqrt{5} - 1}{\sqrt{5} + 1}$, then the value of $\frac{a^2 + ab + b^2}{a^2 - ab + b^2}$ is—

(A) $\frac{3}{4}$ (B) $\frac{4}{3}$
(C) $\frac{3}{5}$ (D) $\frac{5}{3}$

48. $\frac{1}{\sqrt{9} - \sqrt{8}} = ?$

(A) $\frac{1}{2}\left(3 - 2\sqrt{2}\right)$
(B) $\frac{1}{3 + 2\sqrt{2}}$
(C) $\left(3 - 2\sqrt{2}\right)$
(D) $\left(3 + 2\sqrt{2}\right)$

49. $\frac{\sqrt{5} - \sqrt{3}}{\sqrt{5} + \sqrt{3}}$ is equal to—

(A) $4 + \sqrt{15}$ (B) $4 - \sqrt{15}$
(C) $\frac{1}{2}$ (D) 1

50. The least perfect square number divisible by 3, 4, 5, 6, 8 is—

(A) 900 (B) 1200
(C) 2500 (D) 3600

51. $\frac{\sqrt{24} + \sqrt{216}}{\sqrt{96}} = ?$

(A) $2\sqrt{6}$ (B) $6\sqrt{2}$
(C) 2 (D) $\frac{2}{\sqrt{6}}$

52. The least number to be subtracted from 16800 to make it a perfect square is—

(A) 249 (B) 159
(C) 169 (D) 219

53. The least number by which 216 must be divided to make the result a perfect square is—

(A) 3 (B) 4
(C) 6 (D) 9

54. The least number by which 176 be multiplied to make the result a perfect square is—

(A) 8 (B) 9
(C) 10 (D) 11

55. What smallest number must be added to 269 to make it a perfect square ?

(A) 31 (B) 16
(C) 7 (D) 20

56. The smallest number of 4 digits which is a perfect square is—

(A) 1000 (B) 1016
(C) 1024 (D) 1036

57. The largest number of 5 digits, which is a perfect square is—

(A) 99999 (B) 99764
(C) 99976 (D) 99856

58. The value of $\sqrt{\frac{0{\cdot}16}{0{\cdot}4}}$ is—

(A) 0·2 (B) 0·02
(C) 0·63 (D) $\frac{2\sqrt{5}}{5}$

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59. The value of $\sqrt{0{\cdot}064}$ is—
(A) 0·8 (B) 0·08
(C) 0·008 (D) 0·252

60. The value of $\sqrt{0{\cdot}121}$ is—
(A) 0·11 (B) 1·1
(C) 0·347 (D) 0·011

61. What is the smallest number by which 3600 be divided to make it a perfect cube ?
(A) 9 (B) 50
(C) 30 (D) 450

62. By what least number must 21600 be multiplied to make it a perfect cube ?
(A) 6 (B) 10
(C) 30 (D) 60

63. $\sqrt[3]{1-\frac{91}{216}} = ?$
(A) $1-\frac{5}{6}$
(B) $\frac{5}{6}$
(C) $1-\frac{\sqrt[3]{91}}{6}$
(D) None of these

64. $\sqrt[3]{4\frac{12}{125}} = ?$
(A) $1\frac{3}{5}$ (B) $1\frac{2}{5}$
(C) $2\frac{2}{5}$ (D) $1\frac{4}{5}$

65. The cube root of ·000027 is—
(A) ·3
(B) ·03
(C) ·003
(D) None of these

66. The length of diagonal of a square is 8 cm. The length of the side of the square is—
(A) 2 cm (B) 2·8 cm
(C) 1·414 cm (D) 5·64 cm

67. A general wishes to draw up his 36562 soldiers in the form of a solid square. After arranging them, he found that some of them are left over. How many are left ?
(A) 36
(B) 65
(C) 81
(D) 97

68. A group of students decided to collect as many paise from each member of group as is the number of members. If the total collection amounts to Rs. 22·09, the number of members in the group is—
(A) 37
(B) 47
(C) 107
(D) 43

69. A gardener wants to plant 17956 trees and arranges them in such a way that the are as many rows as there are treres in a row. The number of trees in a row is—
(A) 144 (B) 136
(C) 154 (D) 134

Answers with Hints

1. (B) $\sqrt{\frac{x}{169}} = \frac{54}{39} \Rightarrow \frac{x}{169} = \frac{54}{39} \times \frac{54}{39}$

$\therefore \quad x = \left(\frac{54}{39} \times \frac{54}{39} \times 169\right) = 324$

2. (D) Given expression $= \left(\frac{112}{14} \times \frac{24}{12} \times \frac{16}{8}\right) = 32.$

3. (B) $\sqrt{248 + \sqrt{52 + \sqrt{144}}} = \sqrt{248 + \sqrt{52 + 12}}$
$= \sqrt{248 + \sqrt{64}}$
$= \sqrt{248 + 8} = \sqrt{256}$
$= 16$

4. (B) $\sqrt{176 + \sqrt{2401}} = \sqrt{176 + 49}$
$= \sqrt{225} = 15$

5. (B) $\sqrt{4096} + \sqrt{40{\cdot}96} + \sqrt{{\cdot}004096}$
$= \sqrt{4096} + \sqrt{\frac{4096}{100}} + \sqrt{\frac{4096}{1000000}}$
$= \sqrt{4096} + \frac{\sqrt{4096}}{\sqrt{100}} + \frac{\sqrt{4096}}{\sqrt{1000000}}$
$= 64 + \frac{64}{10} + \frac{64}{1000} = 64 + 6{\cdot}4 + {\cdot}064$
$= 70{\cdot}464$

6. (B) $\sqrt{{\cdot}04} = \sqrt{\frac{4}{100}} = \frac{\sqrt{4}}{\sqrt{100}} = \frac{2}{10} = {\cdot}2.$

7. (A) $\frac{\sqrt{256}}{\sqrt{x}} = 2 \text{ or } 16 = 2\sqrt{x} \text{ or } \sqrt{x} = 8 \text{ or } x = 64.$

8. (C) $\frac{\sqrt{288}}{\sqrt{128}} = \sqrt{\frac{9}{4}} = \frac{3}{2}$

9. (A) $\sqrt{10} \times \sqrt{15} = \sqrt{10 \times 15} = \sqrt{150}$
$= \sqrt{25 \times 6} = \sqrt{25} \times \sqrt{6} = 5 \cdot \sqrt{6}$

10. (C) Let $\frac{\sqrt{x}}{200} = 0{\cdot}02$, then $\sqrt{x} = 200 \times 0{\cdot}02 = 4.$

So, $x = 16$

11. (A) Let $\frac{250}{\sqrt{x}} = 10.$

Then $\sqrt{x} = \frac{250}{10} = 25$

12. (D) $\sqrt{10} \times \sqrt{250} = \sqrt{10 \times 250} = \sqrt{2500} = 50$

13. (C) $\frac{\sqrt{4375}}{\sqrt{7}} = \sqrt{\frac{4375}{7}} = \sqrt{625} = 25$

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14. (C)

$$\begin{array}{r|l} 2 & \overline{6}\ \overline{40}\ \overline{09}\ (253 \\ & 4 \\ \hline 45 & 240 \\ & 225 \\ \hline 503 & 1509 \\ & 1509 \\ \hline & \times \end{array}$$

$\therefore \quad \sqrt{64009} = 253$

15. (A) $\dfrac{\sqrt{4}}{\sqrt{3}} - \dfrac{\sqrt{3}}{\sqrt{4}} = \dfrac{2}{\sqrt{3}} - \dfrac{\sqrt{3}}{2} = \dfrac{4-3}{2\sqrt{3}} = \dfrac{1}{2\sqrt{3}}$

16. (B) $\sqrt{\dfrac{2}{9}} = \dfrac{\sqrt{2}}{\sqrt{9}} = \dfrac{\sqrt{2}}{3} = \dfrac{1{\cdot}4142}{3} = 0{\cdot}4714$

17. (C) $\dfrac{1}{\sqrt{3}} = \dfrac{1}{\sqrt{3}} \times \dfrac{\sqrt{3}}{\sqrt{3}} = \dfrac{\sqrt{3}}{3} = \dfrac{1{\cdot}732}{3} = 0{\cdot}577$

18. (C) $\sqrt{\dfrac{8}{3}} = \dfrac{\sqrt{8}}{\sqrt{3}} \times \dfrac{\sqrt{3}}{\sqrt{3}} = \dfrac{\sqrt{24}}{3} = \dfrac{4{\cdot}899}{3} = 1{\cdot}633$

19. (B) $\dfrac{\sqrt{32}+\sqrt{48}}{\sqrt{8}+\sqrt{12}} = \dfrac{\sqrt{16\times 2}+\sqrt{16\times 3}}{\sqrt{4\times 2}+\sqrt{4\times 3}}$

$= \dfrac{4\sqrt{2}+4\sqrt{3}}{2\sqrt{2}+2\sqrt{3}} = \dfrac{4\left(\sqrt{2}+\sqrt{3}\right)}{2\left(\sqrt{2}+\sqrt{3}\right)} = 2$

20. (A) Let $\dfrac{x}{\sqrt{2{\cdot}25}} = 550.$

Then, $\dfrac{x}{1{\cdot}5} = 550$

$\therefore \quad x = (550 \times 1{\cdot}5) = \left(\dfrac{550\times 15}{10}\right) = 825$

21. (A) $75{\cdot}24 + x = 8{\cdot}71 \times 8{\cdot}71$

$x = 75{\cdot}8641 - 75{\cdot}24$

$\Rightarrow \quad x = {\cdot}6241$

22. (C) $\sqrt{\dfrac{36{\cdot}1}{102{\cdot}4}} = \sqrt{\dfrac{361}{1024}} = \dfrac{\sqrt{361}}{\sqrt{1024}} = \dfrac{19}{32}$

23. (C) $\sqrt{\dfrac{{\cdot}289}{{\cdot}00121}} = \sqrt{\dfrac{{\cdot}28900}{{\cdot}00121}} = \sqrt{\dfrac{28900}{121}}$

$= \dfrac{\sqrt{28900}}{\sqrt{121}} = \dfrac{170}{11}$

24. (C) $\dfrac{1}{\sqrt{3}+\sqrt{2}} = \dfrac{1}{\left(\sqrt{3}+\sqrt{2}\right)} \times \dfrac{\left(\sqrt{3}-\sqrt{2}\right)}{\left(\sqrt{3}-\sqrt{2}\right)}$

$= \dfrac{\sqrt{3}-\sqrt{2}}{3-2} = \left(\sqrt{3}-\sqrt{2}\right)$

$= (1{\cdot}732 - 1{\cdot}414) = 0{\cdot}318$

25. (D) $\sqrt{\dfrac{2}{3}} + 3\sqrt{\dfrac{3}{2}} = \dfrac{\sqrt{2}}{\sqrt{3}} \times \dfrac{\sqrt{3}}{\sqrt{3}} + 3\dfrac{\sqrt{3}}{\sqrt{2}} \times \dfrac{\sqrt{2}}{\sqrt{2}}$

$= \dfrac{\sqrt{6}}{3} + \dfrac{3\sqrt{6}}{2} = \dfrac{2{\cdot}55}{3} + \dfrac{3\times 2{\cdot}55}{2}$

$= \dfrac{2{\cdot}55}{3} + \dfrac{7{\cdot}65}{2} = \dfrac{5{\cdot}10 + 22{\cdot}95}{6}$

$= \dfrac{28{\cdot}05}{6} = 4{\cdot}675$

26. (D) $\sqrt{2^n} = 64 = 2^6 \Rightarrow 2^{n/2} = 2^6$

$\Rightarrow \quad \dfrac{n}{2} = 6$

$\Rightarrow \quad n = 12$

27. (C) Let $\sqrt{\dfrac{25}{15625}} = \sqrt{\dfrac{x}{30625}}$

Then, $\dfrac{25}{15625} = \dfrac{x}{30625}$

$\Rightarrow \quad \dfrac{1}{625} = \dfrac{x}{30625}$

$\therefore \quad x = \dfrac{30625}{625} = 49$

28. (B) $\sqrt{1\dfrac{9}{16}} = \sqrt{\dfrac{25}{16}} = \dfrac{\sqrt{25}}{\sqrt{16}} = \dfrac{5}{4} = 1\dfrac{1}{4}$

29. (B) Let $\dfrac{1872}{\sqrt{x}} = 234.$

Then, $\sqrt{x} = \dfrac{1872}{234} = 8$

$\therefore \quad x = (8 \times 8) = 64$

30. (A) $\dfrac{\sqrt{324}}{1{\cdot}5} = \dfrac{x}{\sqrt{256}}$

$\Rightarrow \quad \dfrac{18}{1{\cdot}5} = \dfrac{x}{16}$

$\therefore \quad x = \dfrac{18\times 16}{1{\cdot}5} = \left(\dfrac{18\times 16\times 10}{15}\right) = 192$

31. (B) Given expression $= \sqrt{\dfrac{121\times 9}{11\times 11}} = \sqrt{9} = 3$

32. (C) Given expression $= \sqrt{\dfrac{324\times 81\times 4624}{15625\times 289\times 729\times 64}}$

(Sum of decimal places being equal in Num. and Denom.)

$= \dfrac{18\times 9\times 68}{125\times 17\times 27\times 8} = \dfrac{3}{125}$

$= 0{\cdot}024$

33. (C) Given expression

$= \sqrt{15625} + \sqrt{\dfrac{15625}{100}} + \sqrt{\dfrac{15625}{10000}}$

$= \left(125 + \dfrac{125}{10} + \dfrac{125}{100}\right)$

$= (125 + 12{\cdot}5 + 1{\cdot}25) = 138{\cdot}75$

34. (D) Let $\dfrac{\sqrt{1296}}{x} = \dfrac{x}{2{\cdot}25}$

Then, $\dfrac{36}{x} = \dfrac{x}{2{\cdot}25}$ or $x^2 = 36 \times \dfrac{225}{100}$

$\therefore \quad x = \sqrt{\dfrac{36\times 225}{100}} = \dfrac{6\times 15}{10} = 9$

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35. (A) $\sqrt{\left(1+\frac{27}{169}\right)} = \left(1+\frac{x}{13}\right)$

$\therefore \quad \sqrt{\frac{196}{169}} = \left(1+\frac{x}{13}\right)$

$\Rightarrow \quad \frac{14}{13} = \left(1+\frac{x}{13}\right)$

$\Rightarrow \quad \frac{x}{13} = \left(\frac{14}{13}-1\right) = \frac{1}{13}$

$\Rightarrow \quad x = \left(13\times\frac{1}{13}\right) = 1$

36. (D) Given expression $= \sqrt{2\times\sqrt{2\times\sqrt{2\sqrt{(2\times 2^{1/2})}}}}$

$= \sqrt{2\times\sqrt{2\sqrt{(2\times 2^{3/4})}}}$

$= \sqrt{2\times\sqrt{2\times 2^{7/8}}}$

$= \sqrt{2\times 2^{15/16}} = 2^{31/32}$

37. (D) $\sqrt{0{\cdot}9} = \sqrt{0{\cdot}90} = \sqrt{\frac{90}{100}} = \frac{\sqrt{90}}{10} = \frac{9{\cdot}4}{10} = 0{\cdot}94$

38. (B) $\sqrt{2401} = \sqrt{7^x} \Rightarrow 7^x = 2401 = 7^4 \Rightarrow x = 4$

39. (A) $\frac{7}{3+2} = \frac{7}{\left(3+\sqrt{2}\right)}\times\frac{(3-\sqrt{2})}{(3-\sqrt{2})}$

$= \frac{7\left(3-\sqrt{2}\right)}{7}$

$= 3-\sqrt{2} = (3-1{\cdot}4142) = 1{\cdot}5858$

40. (B) $\sqrt{\cdot 00059049} = \sqrt{\frac{59049}{100000000}}$

$= \frac{\sqrt{59049}}{10000} = \frac{243}{10000} = 0{\cdot}0243$

41. (A) Given expression $= \sqrt{0{\cdot}01+0{\cdot}08}$

$= \sqrt{0{\cdot}09} = 0{\cdot}3$

42. (B) Given expression $= \frac{\sqrt{0{\cdot}0009}}{\sqrt{0{\cdot}01}} = \sqrt{\frac{0{\cdot}0009}{0{\cdot}0100}}$

$= \sqrt{\frac{9}{100}} = \frac{\sqrt{9}}{\sqrt{100}}$

$= \frac{3}{10} = 0{\cdot}3$

43. (A) The square of an odd number cannot have 4 as the unit digit. The square of a 3 digit number will have at least 5 digit and at the most 6 digits. So, answer (A) is correct.

44. (B) Let given expression $= x$

Then, $\sqrt{12+x} = x \Rightarrow 12+x = x^2$

$\Rightarrow \quad x^2-x-12 = 0 \Rightarrow (x-4)(x+3) = 0$

So, $x = 4$ (neglecting $x = -3$)

45. (A) $\because \quad \sqrt{0{\cdot}016\,a} = 0{\cdot}016\times\sqrt{b}$

$\Rightarrow \quad \frac{\sqrt{a}}{\sqrt{b}} = \frac{0{\cdot}016}{\sqrt{0{\cdot}016}} = \sqrt{0{\cdot}016}$

Thus, $\therefore \quad \sqrt{\frac{a}{b}} = \sqrt{0{\cdot}016}$ and so $\frac{a}{b} = 0{\cdot}016$

46. (C) Given Exp. $= 3+\frac{1}{\sqrt{3}}+\frac{1}{3+\sqrt{3}}+\frac{1}{\sqrt{3}-3}$

$= 3+\frac{1}{\sqrt{3}}\times\frac{\sqrt{3}}{\sqrt{3}}+\frac{1}{3+\sqrt{3}}\times\frac{3-\sqrt{3}}{3-\sqrt{3}}+\frac{1}{\sqrt{3}-3}\times\frac{\sqrt{3}+3}{\sqrt{3}+3}$

$= 3+\frac{\sqrt{3}}{3}+\frac{3-\sqrt{3}}{6}+\frac{\sqrt{3}+3}{-6}$

$= \frac{18+2\sqrt{3}+3-\sqrt{3}-\sqrt{3}-3}{6} = \frac{18}{6} = 3$

47. (B) $a = \frac{\sqrt{5}+1}{\sqrt{5}-1}\times\frac{\sqrt{5}+1}{\sqrt{5}+1} = \frac{\left(\sqrt{5}+1\right)^2}{(5-1)}$

$= \frac{5+1+2\sqrt{5}}{4} = \left(\frac{3+\sqrt{5}}{2}\right)$

$b = \frac{\sqrt{5}-1}{\sqrt{5}+1}\times\frac{\sqrt{5}-1}{\sqrt{5}-1} = \frac{\left(\sqrt{5}-1\right)^2}{(5-1)}$

$= \frac{5+1-2\sqrt{5}}{4} = \frac{3-\sqrt{5}}{2}$

$a^2+b^2 = \frac{\left(3+\sqrt{5}\right)^2+\left(3-\sqrt{5}\right)^2}{4}$

$= \frac{2\,(9+5)}{4} = 7$ and $ab = 1$

$\therefore \quad \frac{a^2+ab+b^2}{a^2-ab+b^2} = \frac{7+1}{7-1} = \frac{8}{6} = \frac{4}{3}$

48. (D) Exp. $= \frac{1}{\sqrt{9}-\sqrt{8}}$

$= \frac{1}{\sqrt{9}-\sqrt{8}}\times\frac{\sqrt{9}+\sqrt{8}}{\sqrt{9}+\sqrt{8}} = \frac{3+2\sqrt{2}}{9-8}$

$= \left(3+2\sqrt{2}\right)$

49. (B) Exp. $= \frac{\sqrt{5}-\sqrt{3}}{\left(\sqrt{5}+\sqrt{3}\right)}$

$= \frac{\left(\sqrt{5}-\sqrt{3}\right)}{\left(\sqrt{5}+\sqrt{3}\right)} = \frac{\left(\sqrt{5}-\sqrt{3}\right)^2}{(5-3)}$

$= \frac{5+3-2\sqrt{15}}{2} = \frac{2\left(4-\sqrt{15}\right)}{2}$

$= \left(4-\sqrt{15}\right)$

50. (D) L.C.M. of 3, 4, 5, 6, 8 is 120.

Now, $120 = 2\times 2\times 2\times 3\times 5$

$\therefore$ Required number $= 2\times 2\times 2\times 3\times 5\times 2\times 3\times 5$

$= 3600$

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51. (C) $\dfrac{\sqrt{24}+\sqrt{216}}{\sqrt{96}} = \dfrac{\sqrt{4\times6}+\sqrt{36\times6}}{\sqrt{16\times6}}$

$= \dfrac{2\sqrt{6}+6\sqrt{6}}{4\sqrt{6}}$

$= \dfrac{8\sqrt{6}}{4\sqrt{6}} = 2$

52. (B)

1	16800	(129
	1	
22	68	
	48	
249	2400	
	2241	
	159	

∴ Required number to be subtracted = 159.

53. (C) $216 = 2\times2\times2\times3\times3\times3$

Clearly, in order to make it a perfect square, it must be divided by 2×3 *i.e.*, 6.

54. (D) $176 = 2\times2\times2\times2\times11$

So, in order to make it a perfect square, it must be multiplied by 11.

55. (D)

1	2 69	(16
	1	
26	169	
	159	
	13	

∴ Required number to be added = $(17)^2 - 269 = 20$.

56. (C) The smallest number of 4 digits = 1000

3	1000	(31
	9	
61	100	
	61	
	39	

∴ Required number = $(32)^2 = 1024$.

57. (D) The largest number of 5 digits = 99999

3	99999	(316
	9	
61	99	
	61	
626	3899	
	3756	
	143	

∴ Required number = (99999 – 143) = (99856).

58. (C) $\sqrt{\dfrac{0{\cdot}16}{0{\cdot}4}} = \sqrt{\dfrac{0{\cdot}16}{0{\cdot}40}} = \sqrt{\dfrac{16}{40}} = \sqrt{\dfrac{4}{10}} = \sqrt{0{\cdot}4}$

$= \sqrt{0{\cdot}40} = \sqrt{\dfrac{40}{100}} = \dfrac{\sqrt{40}}{10} = \dfrac{6{\cdot}3}{10} = 0{\cdot}63$

59. (D) $\sqrt{0{\cdot}064} = \sqrt{0{\cdot}0640} = \sqrt{\dfrac{640}{10000}} = \dfrac{\sqrt{640}}{100}$

$= \dfrac{25{\cdot}2}{100} = 0{\cdot}252.$

60. (C) $\sqrt{0{\cdot}121} = \sqrt{0{\cdot}1210} = \sqrt{\dfrac{1210}{10000}} = \dfrac{\sqrt{1210}}{100}$

$= \dfrac{34{\cdot}7}{100} = 0{\cdot}347.$

61. (D) $3600 = 2\times2\times2\times2\times3\times3\times5\times5.$

To make it a perfect cube, the given number must be divided by $2\times3\times3\times5\times5 = 450$.

62. (B) $21600 = 6\times6\times6\times10\times10$

To, make the given number a perfect cube, it must be multiplied by 10.

63. (B) $\left(1-\dfrac{91}{216}\right)^{1/3} = \left(\dfrac{125}{216}\right)^{1/3}$

$= \left(\dfrac{5\times5\times5}{6\times6\times6}\right)^{1/3} = \dfrac{5}{6}$

64. (A) $\left(4\dfrac{12}{125}\right)^{1/3} = \left(\dfrac{512}{125}\right)^{1/3} = \dfrac{(8\times8\times8)^{1/3}}{(5\times5\times5)^{1/3}}$

$= \dfrac{8}{5} = 1\dfrac{3}{5}$

65. (B) $(\cdot000027)^{1/3} = \left(\dfrac{27}{1000000}\right)^{1/3} = \dfrac{(3^3)^{1/3}}{(10^6)^{1/3}}$

$= \dfrac{3}{100} = \cdot03$

66. (D) $a^2 + a^2 = (8)^2 \Rightarrow 2a^2 = 64 \Rightarrow a^2 = 32$

$\therefore \quad a = \sqrt{32} = 4\sqrt{2} = (4\times1{\cdot}41) = 5{\cdot}64$ cm

67. (C)

1	36562	(191
	1	
29	265	
	261	
381	462	
	381	
	81	

∴ Number of men left over

$= 36562 - (191)^2$

$= 36562 - 36481$

$= 81.$

68. (B) Number of members = $\sqrt{2209} = 47$.

69. (D)

1	17956	(134
	1	
23	79	
	69	
264	1056	
	1056	
	×	

∴ Required no. of trees = 134

∴ Number of trees in a row = 134.

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Simplification

In Simplifying an expression first of all vinculum or bar must be removed.

Example. We know that :

$$-6-8 = -14$$

But $-\overline{6-8} = -(-2) = 2$

After removing the bar, the brackets must be removed strictly in the order ( ), { } and [ ].

After removing the brackets, we must use the following operations, strictly in the order, given below—

(i) Of, (ii) Division, (iii) Multiplication, (iv) Addition and (v) Subtraction.

Remark—Remember the word 'BODMAS', where B, O, D, M, A and S stand for bracket, Of, division, multiplication, Addition and Subtraction respectively.

Strictly follow the above order of operations.

Examples

Q. 1. Evaluate

$$\frac{0{\cdot}125 + 0{\cdot}027}{0{\cdot}25 - {\cdot}15 + {\cdot}09}$$

Solution : Given expression

$$= \frac{(0{\cdot}5)^3 + (0{\cdot}3)^3}{(0{\cdot}5)^2 - 0{\cdot}5 \times 0{\cdot}3 + (0{\cdot}3)^2}$$

$$= \frac{a^3 + b^3}{a^2 - ab + b^2}$$

(where $a = 0{\cdot}5$ and $b = 0{\cdot}3$)

$$= (a + b) = (0{\cdot}5 + 0{\cdot}3) = 0{\cdot}8$$

Q. 2. Evaluate

$$\frac{{\cdot}7541 \times {\cdot}7541 \times {\cdot}7541 - {\cdot}2459 \times {\cdot}2459 \times {\cdot}2459}{{\cdot}7541 \times {\cdot}7541 + {\cdot}7541 \times {\cdot}2459 + {\cdot}2459 \times {\cdot}2459}$$

Solution : Given expression

$$= \frac{a^3 - b^3}{a^2 + ab + b^2}$$

(where $a = {\cdot}7541$ and $b = {\cdot}2459$)

$$= \frac{(a-b)(a^2 + ab + b^2)}{(a^2 + ab + b^2)}$$

$$= (a - b)$$

$$= 0{\cdot}7541 - 0{\cdot}2459$$

$$= 0{\cdot}5082$$

Q. 3. Simplify

$$\frac{4\frac{1}{7} - 2\frac{1}{4}}{3\frac{1}{2} + 1\frac{1}{7}} \div \frac{1}{2 + \dfrac{1}{2 + \dfrac{1}{5 - \frac{1}{5}}}}$$

Solution : Given expression

$$= \frac{\frac{29}{7} - \frac{9}{4}}{\frac{7}{2} + \frac{8}{7}} \div \frac{1}{2 + \dfrac{1}{2 + \frac{5}{24}}}$$

$$= \left(\frac{53}{28} \times \frac{14}{65}\right) \div \frac{1}{2 + \frac{24}{53}}$$

$$= \frac{53}{130} \div \frac{53}{130} = \left(\frac{53}{130} \times \frac{130}{53}\right)$$

$$= 1$$

Q. 4. Evaluate

$$\left(\frac{0{\cdot}47 \times 0{\cdot}47 + 0{\cdot}35 \times 0{\cdot}35 - 2 \times 0{\cdot}47 \times 0{\cdot}35}{0{\cdot}12}\right)$$

Solution : Given expression

$$= \frac{(0{\cdot}47)^2 + (0{\cdot}35)^2 - 2 \times 0{\cdot}47 \times 0{\cdot}35}{0{\cdot}12}$$

$$= \frac{(0{\cdot}47 - 0{\cdot}35)^2}{0{\cdot}12}$$

$$= \frac{0{\cdot}12 \times 0{\cdot}12}{0{\cdot}12} = 0{\cdot}12$$

Q. 5. Simplify

$$3{\cdot}5 \div {\cdot}7 \text{ of } 7 + {\cdot}5 \times {\cdot}3 - {\cdot}1$$

Solution : Given expression

$$= 3{\cdot}5 \div 4{\cdot}9 + {\cdot}15 - {\cdot}1$$

$$= \frac{3{\cdot}5}{4{\cdot}9} + 0{\cdot}15 - {\cdot}1$$

$$= \frac{5}{7} + \frac{3}{20} - \frac{1}{10}$$

$$= \left(\frac{100 + 21 - 14}{140}\right) = \frac{107}{140}$$

Q. 6. Simplify

$$1 \div \frac{3}{7} \text{ of } \left(2\frac{3}{10} + 2\frac{3}{5}\right) + \frac{1}{5} \div 1\frac{2}{5} - \frac{2}{7}$$

Solution : Given expression

$$= 1 \div \frac{3}{7} \text{ of } \left(\frac{23}{10} + \frac{13}{5}\right) + \frac{1}{5} \div \frac{7}{5} - \frac{2}{7}$$

$$= 1 \div \frac{3}{7} \text{ of } \frac{49}{10} + \frac{1}{5} \times \frac{5}{7} - \frac{2}{7}$$

$$= 1 \div \frac{21}{10} + \frac{1}{7} - \frac{2}{7}$$

$$= 1 \times \frac{10}{21} + \frac{1}{7} - \frac{2}{7} = \frac{10}{21} + \frac{1}{7} - \frac{2}{7}$$

$$= \left(\frac{10 + 3 - 6}{21}\right) = \frac{7}{21} = \frac{1}{3}$$

Q. 7. Simplify

$$1 \div [1 + 1 \div \{1 + 1 \div (1 + 1 \div 3)\}].$$

Solution : Given expression

$$= 1 \div \left[1 + 1 \div \left\{1 + 1 \div \left(1 + \frac{1}{3}\right)\right\}\right]$$

$$= 1 \div \left[1 + 1 \div \left\{1 + 1 \div \frac{4}{3}\right\}\right]$$

$$= 1 \div \left[1 + 1 \div \frac{7}{4}\right]$$

$$= 1 \div \left[1 + \frac{4}{7}\right] = 1 \div \frac{11}{7}$$

$$= 1 \times \frac{7}{11} = \frac{7}{11}$$

Q. 8. Simplify

$$2 - \left[3 - \left\{6 - \left(5 - \overline{4-3}\right)\right\}\right]$$

Solution : Given expression

$$= 2 - [3 - \{6 - (5 - 1)\}]$$

$$= 2 - [3 - \{6 - 4\}]$$

$$= 2 - [3 - 2] = (2 - 1) = 1$$

Exercise

1. $\dfrac{7 + 7 + 7 \div 7}{5 + 5 + 5 \div 5} = ?$

(A) 1 (B) $\frac{1}{5}$

(C) $\frac{15}{11}$ (D) $\frac{3}{11}$

2. $\dfrac{(272 - 32)(124 + 176)}{17 \times 15 - 15} = ?$

(A) 0

(B) 2·25

(C) 300

(D) None of these

3. $\dfrac{69 - 14 \times 3 + 2}{9 \times 5 - (5)^2} = ?$

(A) 1·45 (B) 2·75

(C) 26·5 (D) 265

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4. $\frac{48 - 12 \times 3 + 9}{12 - 9 \div 3} = ?$
(A) 3 (B) 21
(C) $\frac{7}{3}$ (D) $\frac{1}{3}$

5. $\cdot 01 \times \cdot 3 \div \cdot 4 \times \cdot 5 = ?$
(A) ·015 (B) ·0375
(C) ·00375 (D) ·1

6. $\cdot 05 \times 5 - \cdot 005 \times 5 = ?$
(A) 2·25 (B) ·225
(C) 2·025 (D) ·29875

7. $4 - 3{\cdot}6 \div 4 + 0{\cdot}2 \times 0{\cdot}5 = ?$
(A) 3·2 (B) ·2
(C) 1·65 (D) ·15

8. $0{\cdot}5 \times 0{\cdot}5 + 0{\cdot}5 \div 5 = ?$
(A) 0·15 (B) 0·25
(C) 0·35 (D) 0·45

9. $8 \div 4\,(3 - 2) \times 4 + 3 - 7 = ?$
(A) −3 (B) −4
(C) 4 (D) 5

10. $(20 \div 5) \div 2 + (16 \div 8) \times 2 + (10 \div 5) \times (3 \div 2) = ?$
(A) 9 (B) 12
(C) 15 (D) 18

11. $3120 \div 26 + 13 \times 30 = ?$
(A) 2400
(B) 3900
(C) 536
(D) None of these

12. $7 + 7 \div 7 \times 7 = ?$
(A) $\frac{2}{7}$ (B) 14
(C) $7\frac{1}{7}$ (D) 42

13. $5005 - 5000 \div 10{\cdot}00 = ?$
(A) 0·5 (B) 50
(C) 5000 (D) 4505

14. $171 \div 19 \times 9 = ?$
(A) 0 (B) 1
(C) 18 (D) 81

15. $108 \div 36 \text{ of } \frac{1}{3} + \frac{2}{5} \times 3\frac{3}{4} = ?$
(A) $8\frac{3}{4}$ (B) $6\frac{1}{4}$
(C) $2\frac{1}{2}$ (D) $10\frac{1}{2}$

16. $\left(1\frac{3}{5} - \frac{2}{3} \div \frac{12}{13} + \frac{7}{5} \times \frac{1}{3}\right)$ is equal to—
(A) $1\frac{31}{90}$ (B) $\frac{19}{30}$
(C) $\frac{11}{30}$ (D) 30

17. $3\frac{1}{4} + 4\frac{1}{6} + ? + \frac{1}{4} = 10$
(A) $2\frac{1}{6}$ (B) $4\frac{1}{3}$
(C) $1\frac{1}{3}$ (D) $2\frac{1}{3}$

18. The value of
$48 \div 12 \times \left(\frac{9}{8} \text{ of } \frac{4}{3} \div \frac{3}{4} \text{ of } \frac{2}{3}\right)$ is—
(A) $1\frac{1}{3}$ (B) $5\frac{1}{3}$
(C) 3 (D) 12

19. $10 - [9 - \{8 - (7 - 6)\}] - 5$ is equal to—
(A) −5 (B) 1
(C) 3 (D) 9

20. $3 \div \left[(8 - 5) \div \left\{(4 - 2) \div \left(2 + \frac{8}{13}\right)\right\}\right] = ?$
(A) $\frac{13}{17}$ (B) $\frac{68}{13}$
(C) $\frac{17}{13}$ (D) $\frac{13}{68}$

21. $1 + 1 \div \left\{1 + 1 \div \left(1 + \frac{1}{3}\right)\right\} = ?$
(A) $1\frac{1}{3}$ (B) $1\frac{4}{7}$
(C) $1\frac{1}{8}$ (D) $1\frac{2}{3}$

22. $2 \text{ of } \frac{3}{4} \div \frac{3}{4} + \frac{1}{4} = ?$
(A) $\frac{3}{2}$ (B) $\frac{5}{2}$
(C) $\frac{8}{3}$ (D) $\frac{9}{4}$

23. $\frac{1}{2} + \frac{1}{2} \div \frac{1}{2} = ?$
(A) 2 (B) $\frac{1}{2}$
(C) $\frac{3}{2}$ (D) $\frac{3}{4}$

24. $\frac{17{\cdot}28 \div ?}{3{\cdot}6 \times 0{\cdot}2} = 2$
(A) 120 (B) 1·20
(C) 12 (D) 0·12

25. $\left\{7\frac{1}{2} + \frac{1}{2} \div \frac{1}{2} \text{ of } \frac{1}{4} - \frac{2}{5} \times 2\frac{1}{3} \div 1\frac{7}{8} \text{ of } \left(1\frac{2}{5} - 1\frac{1}{3}\right)\right\} = ?$
(A) $3\frac{1}{5}$
(B) $2\frac{1}{24}$
(C) $4\frac{1}{30}$
(D) None of these

26. $\frac{3}{4} \div 2\frac{1}{4} \text{ of } \frac{2}{3} - \frac{\frac{1}{2} - \frac{1}{3}}{\frac{1}{2} + \frac{1}{3}} \times 3\frac{1}{3} + \frac{5}{6} = ?$
(A) $\frac{7}{18}$ (B) $\frac{49}{54}$
(C) $\frac{2}{3}$ (D) $\frac{1}{6}$

27. $\frac{5}{6} \div \frac{6}{7} \times ? - \frac{8}{9} \div 1\frac{3}{5} + \frac{3}{4} \times 3\frac{1}{3} = 2\frac{7}{9}$
(A) $\frac{7}{6}$
(B) $\frac{6}{7}$
(C) 1
(D) None of these

28. $15\frac{2}{3} \times 3\frac{1}{6} + 6\frac{1}{3} = 11\frac{7}{18} + ?$
(A) $39\frac{5}{9}$
(B) $137\frac{4}{9}$
(C) $29\frac{7}{9}$
(D) None of these

29. $\left(4{\cdot}59 \times 1{\cdot}8 \div 3{\cdot}6 + 5{\cdot}4 \text{ of } \frac{1}{9} - \frac{1}{5}\right) = ?$
(A) 3·015
(B) 2·705
(C) 2·695
(D) None of these

30. $4\frac{2}{17} \div 1\frac{2}{5} \times 2\frac{2}{33} = ?$
(A) $4\frac{2}{33}$ (B) $6\frac{2}{33}$
(C) $6\frac{1}{11}$ (D) $8\frac{1}{11}$

31. $\frac{31}{10} \times \frac{3}{10} + \frac{7}{5} \div 20 = ?$
(A) 0 (B) 1
(C) 100 (D) $\frac{107}{200}$

32. $\frac{69842 \times 69842 - 30158 \times 30158}{69842 - 30158} = ?$
(A) 100000 (B) 69842
(C) 39684 (D) 30158

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33. $\dfrac{\frac{1}{2}\div 4+20}{\frac{1}{2}\times 4+20}=?$

(A) $\frac{81}{88}$ (B) $2\frac{3}{11}$

(C) $\frac{161}{176}$ (D) 1

34. The value of $\dfrac{9^2\times 18^4}{3^{16}}$ is—

(A) $\frac{2}{3}$ (B) $\frac{4}{9}$

(C) $\frac{16}{81}$ (D) $\frac{32}{243}$

35. $\frac{1}{1\cdot2\cdot3}+\frac{1}{2\cdot3\cdot4}+\frac{1}{3\cdot4\cdot5}+\frac{1}{4\cdot5\cdot6}$ is equal to—

(A) $\frac{7}{30}$ (B) $\frac{11}{30}$

(C) $\frac{13}{30}$ (D) $\frac{17}{30}$

36. The value of $1+\frac{1}{4\times3}+\frac{1}{4\times3^2}+\frac{1}{4\times3^3}$ upto four places of decimals is—

(A) 1·1202

(B) 1·1203

(C) 1·1204

(D) None of these

37. The simplification of $1+\dfrac{1}{2+\dfrac{1}{1-\frac{1}{3}}}$ yields the result—

(A) $\frac{2}{7}$ (B) $\frac{7}{9}$

(C) $\frac{9}{7}$ (D) $\frac{13}{7}$

38. The value of $1+\dfrac{1}{1+\dfrac{1}{1+\frac{1}{9}}}$ is—

(A) $\frac{29}{19}$ (B) $\frac{10}{19}$

(C) $\frac{29}{10}$ (D) $\frac{10}{9}$

39. $7\frac{1}{2}-\left[2\frac{1}{4}\div\left\{1\frac{1}{4}-\frac{1}{2}\left(1\frac{1}{2}-\frac{1}{3}-\frac{1}{6}\right)\right\}\right]$ is equal to—

(A) $\frac{2}{9}$ (B) 1

(C) $4\frac{1}{2}$ (D) $1\frac{77}{288}$

40. $\dfrac{50}{?}=\dfrac{?}{12\frac{1}{2}}$

(A) $\frac{25}{2}$ (B) $\frac{4}{25}$

(C) 4 (D) 25

41. $\dfrac{\frac{1}{5}\div\frac{1}{5}\text{ of }\frac{1}{5}}{\frac{1}{5}\text{ of }\frac{1}{5}\div\frac{1}{5}}=?$

(A) 1 (B) 5

(C) $\frac{1}{5}$ (D) 25

42. $\dfrac{\frac{1}{4}+\frac{1}{4}\div\frac{5}{4}}{\frac{1}{4}\times\frac{1}{4}+2\frac{1}{4}}=?$

(A) $\frac{16}{25}$

(B) $\frac{32}{185}$

(C) $\frac{36}{185}$

(D) None of these

43. The value of $\dfrac{1}{3+\dfrac{2}{2+\frac{1}{2}}}$ is—

(A) $\frac{5}{19}$ (B) $\frac{19}{5}$

(C) $\frac{4}{5}$ (D) $\frac{5}{4}$

44. If $\frac{x}{y}=\frac{4}{5}$, then the value of $\left(\frac{4}{7}+\frac{2y-x}{2y+x}\right)$ is—

(A) $\frac{3}{7}$ (B) 1

(C) $1\frac{1}{7}$ (D) 2

45. If $\frac{a}{b}=\frac{1}{3}$, then $\frac{3a+2b}{3a-2b}$ is equal to—

(A) 3 (B) −3

(C) −5 (D) −1

46. If $\frac{x}{2y}=\frac{3}{2}$, the value of $\frac{2x+y}{x-2y}$ equals—

(A) $\frac{1}{7}$

(B) 7

(C) 7·1

(D) None of these

47. When Simplified, the product $\left(2-\frac{1}{3}\right)\left(2-\frac{3}{5}\right)\left(2-\frac{5}{7}\right)\ldots\left(2-\frac{999}{1001}\right)$ is equal to—

(A) $\frac{991}{1001}$

(B) $\frac{1001}{13}$

(C) $\frac{1003}{3}$

(D) None of these

48. $\dfrac{885\times885\times885+115\times115\times115}{885\times885+115\times115-885\times115}$ is equal to—

(A) 115 (B) 770

(C) 885 (D) 1000

49. How many $\frac{1}{8}$'s are there in $37\frac{1}{2}$?

(A) 300

(B) 400

(C) 500

(D) Cannot be determined

50. $\frac{3}{48}$ is what part of $\frac{1}{12}$?

(A) $\frac{3}{7}$

(B) $\frac{1}{12}$

(C) $\frac{4}{3}$

(D) None of these

51. A boy was asked to multiply a given number by $\left(\frac{8}{17}\right)$. Instead he divided the given number by $\left(\frac{8}{17}\right)$ and got the result 225 more than what he should have got if he had multiplied the number by $\left(\frac{8}{17}\right)$. The given number was—

(A) 8 (B) 17

(C) 64 (D) 136

52. In an examination, a student was asked to find $\left(\frac{3}{14}\right)$ of a certain number, by mistake he found $\left(\frac{3}{4}\right)$ of it. His answer was 150 more

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than the correct answer. The given number is—

(A) 180 (B) 240
(C) 280 (D) 290

53. If we multiply a fraction by itself and divide the product by its reciprocal, the fraction thus obtained is $18\frac{26}{27}$. The original fraction is—

(A) $\frac{8}{27}$
(B) $2\frac{2}{3}$
(C) $1\frac{1}{3}$
(D) None of these

54. In a college $\frac{1}{5}$th of the girls and $\frac{1}{8}$th of the boys took part in a Social Camp. What of the total number of students in the college took part in the camp ?

(A) $\frac{13}{40}$
(B) $\frac{13}{80}$
(C) $\frac{2}{13}$
(D) Data inadequate

55. The smallest fraction which should be subtracted from the sum of $1\frac{3}{4}$, $2\frac{1}{2}$, $5\frac{7}{12}$, $3\frac{1}{3}$ and $2\frac{1}{4}$ to make the result a whole number is—

(A) $\frac{5}{12}$ (B) $\frac{7}{12}$
(C) $\frac{1}{2}$ (D) 7

56. In a family, the father took $\frac{1}{4}$ of the cake and he had 3 times as much as others had. The total number of family members is—

(A) 3 (B) 7
(C) 10 (D) 12

57. Ravi earns twice as much in January as in each of the other months. What part of his annual earnings he earns in that month ?

(A) $\frac{2}{13}$ (B) $\frac{1}{10}$
(C) $\frac{5}{7}$ (D) $\frac{1}{5}$

58. In a certain office $\left(\frac{1}{3}\right)$ of the workers are women $\left(\frac{1}{2}\right)$ of the women are married and $\left(\frac{1}{3}\right)$ of the married women have children. If $\left(\frac{3}{4}\right)$ of the men are married and $\left(\frac{2}{3}\right)$ of the married men have children. What part of workers are without children ?

(A) $\frac{5}{18}$ (B) $\frac{4}{9}$
(C) $\frac{11}{18}$ (D) $\frac{17}{36}$

59. Gopal was asked to find $\frac{7}{9}$ of a fraction. But he made a mistake of dividing the given fraction by $\frac{7}{9}$ and got an answer which exceeded the correct answer by $\frac{8}{21}$. The correct answer is—

(A) $\frac{3}{7}$
(B) $\frac{7}{12}$
(C) $\frac{2}{21}$
(D) $\frac{1}{3}$

60. The highest score in an inning was $\frac{3}{11}$ of the total and the next highest was $\frac{3}{11}$ of the remainder. If the scores differed by 9, then the total score is—

(A) 99
(B) 110
(C) 121
(D) 132

Answers with Hints

1. (C) Given expression $= \dfrac{7+7+\frac{7}{7}}{5+5+\frac{5}{5}} = \dfrac{15}{11}$

2. (C) Given expression $= \dfrac{240\times 300}{240} = 300$

3. (A) Given expression $= \dfrac{69-42+2}{45-25} = \dfrac{29}{20} = 1{\cdot}45$

4. (C) Given expression $= \dfrac{48-36+9}{12-3} = \dfrac{21}{9} = \dfrac{7}{3}$

5. (C) Given expression $= {\cdot}01 \times \dfrac{{\cdot}3}{{\cdot}4} \times {\cdot}5$
$= \dfrac{{\cdot}0015}{{\cdot}4} = {\cdot}00375$

6. (B) Given expression $= {\cdot}25 - {\cdot}025 = 0{\cdot}225$

7. (A) Given expression $= 4 - \dfrac{3{\cdot}6}{4} + 0{\cdot}2 \times 0{\cdot}5$
$= 4 - 0{\cdot}9 + 0{\cdot}1 = 3{\cdot}2$

8. (C) Given Exp. $= 0{\cdot}5 \times 0{\cdot}5 + 0{\cdot}5 + 5$
$= 0{\cdot}5 \times 0{\cdot}5 + \dfrac{0{\cdot}5}{5}$
$= 0{\cdot}25 + 0{\cdot}1 = 0{\cdot}35$

9. (C) Given expression $= 8 \div 4 \times 1 \times 4 + 3 - 7$
$= 8 \times \frac{1}{4} \times 1 \times 4 + 3 - 7$
$= 8 + 3 - 7 = 4$

10. (A) Given expression $= \frac{4}{2} + 2 \times 2 + 2 \times \frac{3}{2}$
$= 2 + 4 + 3 = 9$

11. (D) $? = 3120 \div 26 + 13 \times 30$
$= 120 + 13 \times 30$
$= 120 + 390 = 510$

12. (B) $? = 7 + 7 \div 7 \times 7$
$= 7 + 7 \times \frac{1}{7} \times 7 = 7 + 7 = 14$

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13. (D) Given expression $= 5005 - \frac{5000}{10} = 5005 - 500$
$= 4505$

14. (D) $? = 171 \div 19 \times 9 = 171 \times \frac{1}{19} \times 9 = 81$

15. (D) Given expression $= 108 \div 12 + \frac{2}{5} \times \frac{15}{4}$
$= 9 + \frac{3}{2} = \frac{21}{2} = 10\frac{1}{2}$

16. (A) Given expression $= \frac{8}{5} - \frac{2}{3} \times \frac{13}{12} + \frac{7}{5} \times \frac{1}{3}$
$= \frac{8}{5} - \frac{13}{18} + \frac{7}{15}$
$= \frac{144 - 65 + 42}{90}$
$= \frac{121}{90} = 1\frac{31}{90}$

17. (D) Let $\frac{13}{4} + \frac{25}{6} + x + \frac{1}{4} = 10$, then
$x = 10 - \left(\frac{13}{4} + \frac{25}{6} + \frac{1}{4}\right) = 10 - \left(\frac{39 + 50 + 3}{12}\right)$
$= \left(10 - \frac{92}{12}\right) = \frac{7}{3} = 2\frac{1}{3}$

18. (D) Given expression $= \frac{48}{12} \times \left(\frac{3}{2} \div \frac{1}{2}\right)$
$= 4 \times \left(\frac{3}{2} \times 2\right) = 12$

19. (C) Given expression $= 10 - [9 - \{8 - 1\}] - 5$
$= 10 - [9 - 7] - 5$
$= 10 - 2 - 5 = 3$

20. (A) Given expression
$= 3 \div \left[3 \div \left\{2 \div \frac{34}{13}\right\}\right]$
$= 3 \div \left[3 \div \left\{2 \times \frac{13}{34}\right\}\right]$
$= 3 \div \left[3 \div \frac{13}{17}\right] = 3 \div \left[3 \times \frac{17}{13}\right]$
$= 3 \times \frac{13}{51} = \frac{13}{17}$

21. (B) Given expression $= 1 + 1 \div \left\{1 + 1 \div \frac{4}{3}\right\}$
$= 1 + 1 \div \left\{1 + \frac{3}{4}\right\}$
$= 1 + 1 \div \frac{7}{4} = 1 + 1 \times \frac{4}{7}$
$= 1 + \frac{4}{7} = 1\frac{4}{7}$

22. (D) Given expression $= \frac{3}{2} \times \frac{4}{3} + \frac{1}{4} = 2 + \frac{1}{4} = \frac{9}{4}$

23. (C) Given expression $= \frac{1}{2} + 1 = \frac{3}{2}$

24. (C) Let $\frac{17 \cdot 28 \div x}{3 \cdot 6 \times 0 \cdot 2} = 2$
Then $\frac{17 \cdot 28}{x} = 1 \cdot 44$
$\therefore \quad x = \frac{17 \cdot 28}{1 \cdot 44} = 12$

25. (C) Given expression
$= \frac{15}{2} + \frac{1}{2} \div \frac{1}{8} - \frac{2}{5} \times \frac{7}{3} \div \frac{15}{8} \times \left(\frac{7}{5} - \frac{4}{3}\right)$
$= \frac{15}{2} + 4 - \frac{2}{5} \times \frac{7}{3} \div \frac{15}{8} \times \frac{1}{15}$
$= \frac{15}{2} + 4 - \frac{2}{5} \times \frac{7}{3} \div \frac{1}{8} = \frac{15}{2} + 4 - \frac{2}{5} \times \frac{7}{3} \times \frac{8}{1}$
$= \frac{15}{2} + 4 - \frac{112}{15} = \frac{23}{2} - \frac{112}{15} = \frac{121}{30} = 4\frac{1}{30}$

26. (C) Given expression
$= \frac{3}{4} \div \frac{9}{4} \text{ of } \frac{2}{3} - \frac{\left(\frac{1}{6}\right)}{\left(\frac{5}{6}\right)} \times \frac{10}{3} + \frac{5}{6}$
$= \frac{3}{4} \times \frac{2}{3} - \frac{1}{6} \times \frac{6}{5} \times \frac{10}{3} + \frac{5}{6} = \frac{1}{2} - \frac{2}{3} + \frac{5}{6}$
$= \frac{3 - 4 + 5}{6} = \frac{4}{6} = \frac{2}{3}$

27. (B) Let $\frac{5}{6} \div \frac{6}{7} \times x - \frac{8}{9} \div \frac{8}{5} + \frac{3}{4} \times \frac{10}{3} = \frac{25}{9}$
Then, $\frac{5}{6} \times \frac{7}{6} \times x - \frac{8}{9} \times \frac{5}{8} + \frac{5}{2} = \frac{25}{9}$
$\Rightarrow \quad \frac{35}{36} x = \frac{25}{9} + \frac{5}{9} - \frac{5}{2}$
$\Rightarrow \quad \frac{35}{36} x = \left(\frac{50 + 10 - 45}{18}\right) = \frac{5}{6}$
$\therefore \quad x = \left(\frac{5}{6} \times \frac{36}{35}\right) = \frac{6}{7}$

28. (D) Let $\frac{47}{3} \times \frac{19}{6} + \frac{19}{3} = \frac{205}{18} + x$
Then, $x = \frac{893}{18} + \frac{19}{3} - \frac{205}{18}$
$\Rightarrow \quad x = \frac{893 + 114 - 205}{18}$
$\therefore \quad x = \frac{802}{18} = 44\frac{5}{9}$

29. (C) Given expression $= 4 \cdot 59 \times \frac{1 \cdot 8}{3 \cdot 6} + 0 \cdot 6 - 0 \cdot 2$
$= 2 \cdot 295 + 0 \cdot 6 - 0 \cdot 2 = 2 \cdot 695$

30. (B) Given expression $= \frac{70}{17} \div \frac{7}{5} \times \frac{68}{33}$
$= \frac{70}{17} \times \frac{5}{7} \times \frac{68}{33} = \frac{200}{33} = 6\frac{2}{33}$

31. (B) Given expression $= \frac{93}{100} + \frac{7}{5} \times \frac{1}{20}$
$= \frac{93}{100} + \frac{7}{100} = 1$

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32. (A) Given expression

$$= \frac{(69842)^2 - (30158)^2}{(69842 - 30158)}$$

$$= \frac{(69842 - 30158)\,(69842 + 30158)}{(60842 - 30158)}$$

$$= 100000$$

33. (C) Given expression $= \dfrac{\frac{1}{2}\times\frac{1}{4} + 20}{2 + 20} = \dfrac{161}{8}\times\dfrac{1}{22}$

$$= \frac{161}{176}$$

34. (C) Given expression $= \dfrac{(3^2)^2 \times (3\times 3\times 2)^4}{3^{16}}$

$$= \frac{3^4 \times 3^8 \times 2^4}{3^{16}}$$

$$= \frac{2^4}{3^4} = \frac{16}{81}$$

35. (A) Given expression

$$= \frac{4\times5\times6 + 5\times6 + 2\times6 + 2\times3}{2\times3\times4\times5\times6}$$

$$= \frac{168}{24\times30} = \frac{7}{30}$$

36. (B) Given expression $= \dfrac{108 + 9 + 3 + 1}{108} = \dfrac{121}{108}$

$$= 1{\cdot}1203$$

37. (C) Given expression $= 1 + \dfrac{1}{2 + \frac{1}{\frac{2}{3}}} = 1 + \dfrac{1}{2 + \frac{3}{2}}$

$$= 1 + \frac{1}{\frac{7}{2}} = 1 + \frac{2}{7} = \frac{9}{7}$$

38. (A) Given expression $= 1 + \dfrac{1}{1 + \frac{1}{\left(\frac{10}{9}\right)}}$

$$= 1 + \frac{1}{1 + \frac{9}{10}} = 1 + \frac{1}{\frac{19}{10}}$$

$$= 1 + \frac{10}{19} = \frac{29}{19}$$

39. (C) Given expression

$$= \frac{15}{2} - \left[\frac{9}{4} \div \left\{\frac{5}{4} - \frac{1}{2}\left(\frac{3}{2} - \frac{1}{3} - \frac{1}{6}\right)\right\}\right]$$

$$= \frac{15}{2} - \left[\frac{9}{4} \div \left\{\frac{5}{4} - \frac{1}{2}\times 1\right\}\right]$$

$$= \frac{15}{2} - \left[\frac{9}{4} \div \left\{\frac{5}{4} - \frac{1}{2}\right\}\right]$$

$$= \frac{15}{2} - \left[\frac{9}{4} \div \frac{3}{4}\right] = \frac{15}{2} - \left[\frac{9}{4}\times\frac{4}{3}\right]$$

$$= \left(\frac{15}{2} - 3\right) = \frac{9}{2} = 4\frac{1}{2}$$

40. (D) Let $\dfrac{50}{x} = \dfrac{x}{\left(\frac{25}{2}\right)}$

$$\Rightarrow \quad x^2 = 50 \times \frac{25}{2} = 625$$

$$\therefore \quad x = \sqrt{625} = 25$$

41. (D) Given expression $= \dfrac{\frac{1}{5} \div \frac{1}{25}}{\frac{1}{25} \div \frac{1}{5}} = \dfrac{\frac{1}{5}\times 25}{\frac{1}{25}\times 5}$

$$= (5\times 5) = 25$$

42. (C) Given expression $= \dfrac{\frac{1}{4} + \frac{1}{4}\times\frac{4}{5}}{\frac{1}{16} + \frac{9}{4}} = \dfrac{\frac{1}{4} + \frac{1}{5}}{\frac{37}{16}}$

$$= \frac{9}{20}\times\frac{16}{37} = \frac{36}{185}$$

43. (A) Given expression $= \dfrac{1}{3 + \frac{2}{\left(\frac{5}{2}\right)}} = \dfrac{1}{3 + \frac{4}{5}}$

$$= \frac{1}{\left(\frac{19}{5}\right)} = \frac{5}{19}$$

44. (B) Given Exp. $= \dfrac{4}{7} + \dfrac{2y - x}{2y + x}$

$$= \frac{4}{7} + \frac{2 - \frac{x}{y}}{2 + \left(\frac{x}{y}\right)} = \frac{4}{7} + \frac{2 - \frac{4}{5}}{2 + \frac{4}{5}}$$

$$= \frac{4}{7} + \frac{6}{5}\times\frac{5}{14} = \frac{4}{7} + \frac{3}{7} = 1$$

45. (B) Given Exp. $= \dfrac{3a + 2b}{3a - 2b}$

$$= \frac{3\left(\frac{a}{b}\right) + 2}{3\left(\frac{a}{b}\right) - 2} = \frac{3\times\frac{1}{3} + 2}{3\times\frac{1}{3} - 2} = \frac{3}{-1} = -3$$

46. (B) Dividing Num and Denom by y we get.

Given expression

$$= \frac{2x + y}{x - 2y} = \frac{2\left(\frac{x}{y}\right) + 1}{\left(\frac{x}{y}\right) - 2} = \frac{2\times 3 + 1}{3 - 2} = \frac{7}{1} = 7$$

$$\left[\because \frac{x}{2y} = \frac{3}{2} \Rightarrow \frac{x}{y} = \left(\frac{3}{2}\times 2\right) = 3\right]$$

47. (C) Given expression $= \dfrac{5}{3}\times\dfrac{7}{5}\times\dfrac{9}{7}\times\ldots\times\dfrac{1003}{1001}$

$$= \frac{1003}{3}$$

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48. (D) Given expression $= \left(\frac{a^3+b^3}{a^2+b^2-ab}\right)$

$= \frac{(a+b)(a^2+b^2-ab)}{(a^2+b^2-ab)}$

$= (a+b) = (885+115)$

$= 1000$

49. (A) Number of $\frac{1}{8}$s $= \frac{75}{2} \div \frac{1}{8} = \frac{75}{2} \times 8 = 300$

50. (D) Let x of $\frac{1}{12} = \frac{3}{48}$. Then, $x = \frac{3}{48} \times 12 = \frac{3}{4}$

51. (D) $\because x \times \frac{17}{8} - x \times \frac{8}{17} = 225 \Rightarrow \frac{225}{136}x = 225$

$\therefore x = \left(225 \times \frac{136}{225}\right) = 136$

52. (C) $\because \frac{3}{4}x - \frac{3}{14}x = 150$

$\Rightarrow \frac{15}{28}x = 150$

$\Rightarrow \frac{21-6}{28}x = 150$

$\therefore x = \left(150 \times \frac{28}{15}\right) = 280$

53. (B) $\because x \times x \div \frac{1}{x} = 18\frac{26}{27}$

$\Rightarrow x^3 = \frac{512}{27}$

$\Rightarrow x^3 = \left(\frac{8}{3}\right)^3$

$\therefore x = \frac{8}{3} = 2\frac{2}{3}$

54. (C) Out of the 5 girls, 1 took part in the camp.
Out of the 8 boys, 1 took part in the camp.
Out of 13 students, 2 took part in the camp.
$\therefore \frac{2}{13}$ of total number of students took part in the camp.

55. (A) $\because \frac{7}{4} + \frac{5}{2} + \frac{67}{12} + \frac{10}{3} + \frac{9}{4}$

$= \left(\frac{21+30+67+40+27}{12}\right) = \frac{185}{12}$

This is nearly greater than 15. Let required fraction be x.

then, $\frac{185}{12} - x = 15,$

$\therefore x = \left(\frac{185}{12} - 15\right) = \frac{5}{12}$

56. (C) Let there be x members, other than father.

Father's share $= \frac{1}{4}$, other's share $= \frac{3}{4}$.

Each of other's share $= \frac{3}{4x}$

$\because 3 \times \frac{3}{4x} = \frac{1}{4}$

$\therefore x = 9$

Hence, the total number of members

$= x + 1 = 10.$

57. (A) Suppose Ravi earns Rs. x in each of the 11 months.

Then earning in January $=$ Rs. $2x$.

$\therefore$ Total annual income $= (11x + 2x) =$ Rs. $13x$

Part of total earning in January

$= \frac{2x}{13x} = \frac{2}{13}$

58. (C) Let, total number of workers be x.

Then, number of women $= \frac{x}{3}$

Number of men $= \frac{2x}{3}$

Number of women having children

$= \frac{1}{3}$ of $\frac{1}{2}$ of $\frac{1}{3}x = \frac{x}{18}$

Number of men having children

$= \frac{2}{3}$ of $\frac{3}{4}$ of $\frac{2x}{3} = \frac{x}{3}$

Number of workers having children

$= \frac{x}{18} + \frac{x}{3} = \frac{7}{18}x$

Number of workers having no children

$= \left(x - \frac{7}{18}x\right) = \frac{11x}{18}$

$= \left(\frac{11}{18}\text{ of all workers}\right)$

59. (B) $\because$ Let the fraction $= x$

$\therefore \frac{9}{7}x - \frac{7}{9}x = \frac{8}{21}$

$\Rightarrow \frac{32}{63}x = \frac{8}{21}$

$\Rightarrow x = \frac{8}{21}x\frac{63}{32} = \frac{3}{4}$

$\therefore$ Correct answer $= \frac{7}{9}x = \frac{7}{9} \times \frac{3}{4} = \frac{7}{12}$

60. (C) Let total score be x.

Then, highest score $= \frac{3}{11}x$

Remainder $= \left(x - \frac{3x}{11}\right) = \frac{8}{11}x$

Next highest score $= \frac{3}{11}$ of $\frac{8}{11}x = \frac{24}{121}x$

Now, $\because \frac{3x}{11} - \frac{24x}{121} = 9$

$\Rightarrow \frac{9x}{121} = 9$

$\therefore x = 121$

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Ratio and Proportion

Important Points/Facts

Ratio—The ratio of two quantities in the same units is a fraction that one quantity is of the other.

Thus, a to b is a ratio $\left(\frac{a}{b}\right)$, written as $a : b$.

The first term of a ratio is called antecedent, while the second term is known as consequent.

Thus, the ratio 4 : 7 represents $\frac{4}{7}$ with antecedent 4 and consequent 7.

Rule—The multiplication or division of each term of a ratio by a same non-zero number does not affect the ratio.

Thus, 3 : 5 is the same as 6 : 10 or 9 : 15 or 12 : 20 etc.

Proportion : The equality of two ratios is called proportion.

Thus, 2 : 3 = 8 : 12 is written as 2 : 3 : : 8 : 12 and we say that 2, 3, 8 and 12 are in proportion.

In a proportion, the first and fourth terms are known as extremes, while second and third terms are known as means.

In a proportion, we always have

Product of means = Product of Extremes.

Examples

Q. 1. Three utensils contain equal mixtures of milk and water in the ratio 6 : 1 : 5 : 2 and 3 : 1 respectively. If all the solutions are mixed together, find the ratio of milk and water in the final mixture.

Solution :

In final mixture we have quantity

$$\text{of milk} = \left(\frac{6}{7}+\frac{5}{7}+\frac{3}{4}\right) = \frac{65}{28}$$

quantity of

$$\text{water} = \left(\frac{1}{7}+\frac{2}{7}+\frac{1}{4}\right) = \frac{19}{28}$$

$$\therefore \text{Milk : Water} = \frac{65}{28} : \frac{19}{28}$$

$$= 65 : 19$$

Q. 2. A mixture contains alcohol and water in the ratio 4 : 3. If 7 litres of water is added to the mixture, the ratio of alcohol and water becomes 3 : 4. Find the quantity of alcohol in the mixture.

Solution : Let the quantity of alcohol and water be $4x$ and $3x$ litres respectively. Then,

$$\frac{4x}{3x+7} = \frac{3}{4}$$

$$\Rightarrow \quad x = 3$$

$\therefore$ Quantity of alcohol in the mixture = 12 litres.

Q. 3. In a mixture of 35 litres the ratio of milk and water is 4 : 1 now, 7 litres of water is added to the mixture. Find the ratio of milk and water in the new mixture.

Solution : Milk in 35 litres of mix. $= \left(35 \times \frac{4}{5}\right) = 28$ litres.

Water in this mix. = (35 – 28) = 7 litres

New mixture contains milk = 28 litres

Water in new mixture = (7 + 7) litres = 14 litres.

$\therefore$ Ratio of milk and water in new mix. = 28 : 14 = 2 : 1.

Q. 4. Find three numbers in the ratio 2 : 3 : 5 the sum of whose squares is 608.

Solution : Let the numbers be $2x$, $3x$ and $5x$.

Then, $4x^2 + 9x^2 + 25x^2 = 608$

$$\Rightarrow \quad 38x^2 = 608$$

$$\Rightarrow \quad x^2 = \frac{608}{38} = 16$$

$$\therefore \quad x = 4$$

So, the numbers are 8, 12 and 20.

Q. 5. A bag contains rupee, 50 paise and 25 paise coins in the ratio 5 : 6 : 8. If the total amount is Rs. 420. Find the number of coins of each type.

Solution : Ratio of

$$\text{values} = 5 : \frac{6}{2} : \frac{8}{4}$$

$$= 5 : 3 : 2$$

Divide Rs. 420 in the ratio

5 : 3 : 2

$$\text{1st part} = \text{Rs.} \left(420 \times \frac{5}{10}\right)$$

$$= \text{Rs. } 210$$

$$\text{2nd part} = \text{Rs.} \left(420 \times \frac{3}{10}\right)$$

$$= \text{Rs. } 126$$

$$\text{3rd part} = \text{Rs.} \left(420 \times \frac{2}{10}\right)$$

$$= \text{Rs. } 84$$

$\therefore$ Number of one-rupee coins = 210

Number of 50 paise coins = (126 × 2) = 252.

Number of 25 paise coins = (84 × 4) = 336

Q. 6. Divide Rs. 455 in the ratio 4 : 3.

Solution : Sum of the terms of the ratio = (4 + 3) = 7

$$\therefore \quad \text{First part} = \text{Rs.} \left(455 \times \frac{4}{7}\right)$$

$$= \text{Rs. } 260$$

$$\text{Second part} = \text{Rs.} \left(455 \times \frac{3}{7}\right)$$

$$= \text{Rs. } 195$$

Q. 7. If $a : b = 2 : 3$ and $b : c = 5 : 7$, find $a : c$ and $a : b : c$.

Solution : $\frac{a}{b} = \frac{2}{3}$

and $\frac{b}{c} = \frac{5}{7}$

$$\therefore \quad \frac{a}{c} = \left(\frac{a}{b} \times \frac{b}{c}\right)$$

$$= \left(\frac{2}{3} \times \frac{5}{7}\right) = \frac{10}{21}$$

Hence $a : c = 10 : 21$

Now L.C.M. of 3 and 5 is 15

$\therefore \quad a : b = 2 : 3 = 10 : 15$

and $b : c = 5 : 7 = 15 : 21$

Hence $a : b : c = 10 : 15 : 21$.

Q. 8. A stick 1·4 m long caste a shadow 1·3 m long at the same time when a pole casts a shadow 5·2 m long. Find the length of the pole.

Solution : Clearly more is the length of shadow, more is the length of the object.

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Let the length of the pole be x metres

Then $1{\cdot}3 : 5{\cdot}2 :: 1{\cdot}4 : x$

$\therefore \quad 1{\cdot}3 \times x = 5{\cdot}2 \times 1{\cdot}4$

or $\quad x = \dfrac{5{\cdot}2 \times 1{\cdot}4}{1{\cdot}3} = 5{\cdot}6$

Hence the length of the pole is 5·6 m.

Exercise

1. The ratio of money with Ram and Gopal is 7 : 17 and that with Gopal and Krishan is 7 : 17. If Ram has Rs. 490, Krishan has—
   (A) Rs. 2890 (B) Rs. 2330
   (C) Rs. 1190 (D) Rs. 2680

2. Rs. 5625 is divided among A, B and C so that A may receive $\frac{1}{2}$ as much as B and C together receive and B receives $\frac{1}{4}$ of what A and C together receive. The share of A is more than that of B by—
   (A) Rs. 750 (B) Rs. 775
   (C) Rs. 1500 (D) Rs. 1600

3. A certain amount was divided between Kavita and Reena in the ratio 4 : 3. If Reena's share was Rs. 2400. The amount is—
   (A) Rs. 5600
   (B) Rs. 3200
   (C) Rs. 9600
   (D) None of these

4. The prices of a scooter and a television set are in the ratio 3 : 2. If a scooter costs Rs. 6000 more than the television set the price of the television set is—
   (A) Rs. 6000
   (B) Rs. 10000
   (C) Rs. 12000
   (D) Rs. 18000

5. If $8 : x = x : 18$, then x is equal to—
   (A) 144 (B) 72
   (C) 26 (D) 12

6. The surface areas of two spheres are in the ratio 1 : 4. The ratio of their volumes is—
   (A) 1 : 2 (B) 1 : 4
   (C) 1 : 8 (D) 1 : 6

7. A right cylinder and a right circular cone have the same radius and the same volume. The ratio of the height of the cylinder to that of the cone is—
   (A) 3 : 5 (B) 2 : 5
   (C) 3 : 1 (D) 1 : 3

8. A circle and a square have same area. Therefore, the ratio of the side of the square and the radius of the circle is—
   (A) $\sqrt{\pi} : 1$ (B) $1 : \sqrt{\pi}$
   (C) $1 : \pi$ (D $\pi : 1$

9. In a class, the number of boys is more than the number of girls by 12% of the total strength. The ratio of boys to girls is—
   (A) 11 : 14 (B) 14 : 11
   (C) 25 : 28 (D) 28 : 25

10. A, B and C can do a work in 20, 25 and 30 days respectively. They undertook to finish the work together for Rs. 2220, then the share of A exceeds that of B by—
    (A) Rs. 120 (B) Rs. 180
    (C) Rs. 300 (D) Rs. 600

11. Three friends divide Rs. 624 among themselves in the ratio $\frac{1}{2} : \frac{1}{3} : \frac{1}{4}$. The share of the third friend is—
    (A) Rs. 288 (B) Rs. 192
    (C) Rs. 148 (D) Rs. 144

12. The monthly salary of A, B, C is in the proportion of 2 : 3 : 5. If C's monthly salary is Rs. 1200 more than that of A, then B's annual salary is—
    (A) Rs. 14400
    (B) Rs. 24000
    (C) Rs. 1200
    (D) Rs. 2000

13. A bag contains 25 paise, 10 paise and 5 paise coins in the ratio 1 : 2 : 3. If their total value is Rs. 30, the number of 5 paise coins is—
    (A) 50 (B) 100
    (C) 150 (D) 200

14. The ratio of two numbers is 3 : 4 and their sum is 420. The greater of the two numbers is—
    (A) 175 (B) 200
    (C) 240 (D) 315

15. If a carton containing a dozen mirrors is dropped, which of the following cannot be the ratio of broken mirrors to unbroken mirrors ?
    (A) 2 : 1 (B) 3 : 1
    (C) 3 : 2 (D) 7 : 5

16. Two whole numbers whose sum is 64, cannot be in the ratio—
    (A) 5 : 3 (B) 7 : 1
    (C) 3 : 4 (D) 9 : 7

17. The weight of a 13 m long iron rod is 23·4 kg. The weight of 6 m long of such rod will be—
    (A) 7·2 kg (B) 12·4 kg
    (C) 10·8 kg (D) 18 kg

18. The mean proportional between 0·32 and 0·02 is—
    (A) 0·34 (B) 0·3
    (C) 0·16 (D) 0·08

19. The third proportional to 0·8 and 0·2 is—
    (A) 0·4 (B) 0·8
    (C) 0·05 (D) 0·032

20. The fourth proportional to 0·2, 0·12 and 0·3 is—
    (A) 0·13 (B) 0·15
    (C) 0·18 (D) 0·8

21. What number should be subtracted from each of the numbers 54, 71, 75 and 99 so that the remainders may be proportional ?
    (A) 1 (B) 2
    (C) 3 (D) 6

22. What number should be added to each one of 6, 14, 18 and 38 to make them equally proportionate ?
    (A) 1 (B) 2
    (C) 3 (D) 4

23. A fraction bears the same ratio to $\frac{1}{27}$ as $\frac{3}{7}$ does to $\frac{5}{9}$. The fraction is—
    (A) $\frac{7}{45}$ (B) $\frac{1}{35}$
    (C) $\frac{45}{7}$ (D) $\frac{5}{21}$

24. What must be added to each term of the ratio 7 : 13 so that the ratio becomes 2 : 3 ?
    (A) 1 (B) 2
    (C) 3 (D) 5

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25. In a ratio which is equal to 5 : 8. If the antecedent is 40 then consequent is—
(A) 25
(B) 64
(C) 48
(D) None of these

26. Out of the ratio 7 : 15, 15 : 23, 17 : 25 and 21 : 29 the smallest one is—
(A) 17 : 25 (B) 7 : 15
(C) 15 : 23 (D) 21 : 29

27. If $\frac{1}{5} : \frac{1}{x} = \frac{1}{x} : \frac{1}{1{\cdot}25}$, then the value of x is—
(A) 1·25 (B) 1·5
(C) 2·5 (D) 2·25

28. If one-third of A, one-fourth of B and one-fifth of C are equal, then A : B : C is—
(A) 3 : 4 : 5 (B) 4 : 3 : 5
(C) 5 : 4 : 3 (D) $\frac{1}{3} : \frac{1}{4} : \frac{1}{5}$

29. The ratio which $\left(\frac{1}{3} \text{ of Rs. } 9{\cdot}30\right)$ bears to (0·6 of Rs. 1·55) is—
(A) 1 : 3 (B) 10 : 3
(C) 3 : 10 (D) 3 : 1

30. Two numbers are in the ratio 3 : 5. If each number is increased by 10, the ratio becomes 5 : 7. The numbers are—
(A) 3, 5 (B) 7, 9
(C) 13, 22 (D) 15, 25

31. If $x : y = 2 : 3$ and $2 : x = 1 : 2$, then the value of y is—
(A) 4 (B) 6
(C) $\frac{1}{3}$ (D) $\frac{3}{2}$

32. If 2A = 3B and 4B = 5C, then A : C is—
(A) 3 : 4 (B) 8 : 15
(C) 15 : 8 (D) 4 : 3

33. If 2A = 3B = 4C, then A : B : C is—
(A) 2 : 3 : 4 (B) 4 : 3 : 2
(C) 6 : 4 : 3 (D) 3 : 4 : 6

34. If A : B = 2 : 3, B : C = 4 : 5 and C : D = 6 : 7, then A : D is equal to—
(A) 2 : 7 (B) 7 : 8
(C) 16 : 35 (D) 4 : 13

35. If $A = \frac{1}{3} B$ and $B = \frac{1}{2} C$, then A : B : C is—
(A) 1 : 3 : 6 (B) 2 : 3 : 6
(C) 3 : 2 : 6 (D) 3 : 1 : 2

36. If A : B = 5 : 7 and B : C = 6 : 11, then A : B : C is—
(A) 55 : 77 : 66
(B) 30 : 42 : 77
(C) 35 : 49 : 42
(D) None of these

37. If A : B = 7 : 9 and B : C = 3 : 5 then. A : B : C is—
(A) 7 : 9 : 5
(B) 21 : 35 : 45
(C) 7 : 9 : 15
(D) 7 : 3 : 15

38. 0·6 of a number equals 0·09 of another number. The ratio of the numbers is—
(A) 2 : 3 (B) 1 : 15
(C) 20 : 3 (D) 3 : 20

39. If 10% of x is the same as 20% of y then $x : y$ is equal to—
(A) 1 : 2 (B) 2 : 1
(C) 5 : 1 (D) 10 : 1

40. If A : B = 2 : 3 and B : C = 4 : 5, then C : A is equal to—
(A) 15 : 8 (B) 12 : 10
(C) 8 : 5 (D) 8 : 15

41. One year ago the ratio between Laxman's and Gopal's salary was 3 : 4. The ratio of their individual salaries between last year's and this year's salaries are 4 : 5 and 2 : 3 respectively. At present the total of their salary is Rs. 4,160. The salary of Laxman now is—
(A) Rs. 1040 (B) Rs. 1600
(C) Rs. 2560 (D) Rs. 3120

42. The ratio between Sumit's and Prakash's age at present is 2 : 3. Sumit is 6 years younger than Prakash. The ratio of Sumit's age to Prakash's age after 6 years will be—
(A) 1 : 2 (B) 2 : 3
(C) 3 : 4 (D) 3 : 8

43. The ages of Vivek and Sumit are in the ratio 2 : 3. After 12 years, their ages will be in the ratio 11 : 15. The age of Sumit is—
(A) 32 years (B) 42 years
(C) 48 years (D) 56 years

44. The ratio of father's age to son's age is 4 : 1. The product of their ages is 196. The ratio of their ages after 5 years will be—
(A) 3 : 1 (B) 10 : 3
(C) 11 : 4 (D) 14 : 5

45. The ratio between the ages of Kamla and Savitri is 6 : 5 and the sum of their ages is 44 years. The ratio of their ages after 8 years will be—
(A) 5 : 6 (B) 7 : 8
(C) 8 : 7 (D) 14 : 13

46. A father's age was 5 times his son's age 5 years ago and will be 3 times son's age after 2 years the ratio of their present ages is—
(A) 5 : 2 (B) 5 : 3
(C) 10 : 3 (D) 11 : 5

47. The average age of 3 girls is 20 years and their ages are in the proportion 3 : 5 : 7. The age of youngest girl is—
(A) 4 years
(B) 6 years 8 months
(C) 8 years 3 months
(D) 12 years

48. A man has some hens and cows. If the number of heads be 48 and number of feet equal 140 the number of hens will be—
(A) 22 (B) 23
(C) 24 (D) 26

49. 6 men, 8 women, 6 children complete a job for a sum of Rs. 950. If their individual wages are in ratio 4 : 3 : 2, the total money earned by the children is—
(A) Rs. 190 (B) Rs. 195
(C) Rs. 215 (D) Rs. 230

50. The ratio between two numbers is 3 : 4 and their L.C.M. is 180. The first number is—
(A) 15 (B) 20
(C) 45 (D) 60

51. In a mixture of 60 litres. The ratio of milk and water is 2 : 1. What amount of water must be added to make the ratio 1 : 2 ?
(A) 42 litres (B) 56 litres
(C) 60 litres (D) 77 litres

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52. A sum of Rs. 1300 is divided between A, B and C and D such that

$$\frac{\text{A's Share}}{\text{B's Share}} = \frac{\text{B's Share}}{\text{C's Share}} = \frac{\text{C's Share}}{\text{D's Share}} = \frac{2}{3}$$

Then A's share is—

(A) Rs. 140 (B) Rs. 160
(C) Rs. 240 (D) Rs. 320

53. Two equal glasses are respectively $\frac{1}{3}$ and $\frac{1}{4}$ full of milk. They are then filled up with water and the contents mixed in a tumbler. The ratio of milk and water in the tumbler is—

(A) 7 : 5 (B) 7 : 17
(C) 3 : 7 (D) 11 : 23

54. The ratio of milk and water in 85 kg of adulterated milk is 27 : 7. The amount of water which must be added to make the ratio 3 : 1 is—

(A) 5 kg (B) 6·5 kg
(C) 7·25 kg (D) 8 kg

55. A mixture contains milk and water in the ratio 5 : 1. On adding 5 litres of water the ratio of milk and water becomes 5 : 2. The quantity of milk in the mixture is—

(A) 16 litres
(B) 25 litres
(C) 32·5 litres
(D) 22·75 litres

56. The proportion of Zinc and Copper in a brass piece is 13 : 7. How much zinc will be there in 100 kg of such a piece ?

(A) 20 kg (B) 35 kg
(C) 55 kg (D) 65 kg

57. A's money is to B's money as 4 : 5 and B's money is to C's money as 2 : 3. If A has Rs. 800, C has—

(A) Rs. 1000 (B) Rs. 1200
(C) Rs. 1500 (D) Rs. 2000

58. 15 litres of a mixture contains 20% alcohol and the rest water. If 3 litres of water be mixed in it. The percentage of alcohol in the new mixture will be—

(A) 17 (B) $16\frac{2}{3}$
(C) $18\frac{1}{2}$ (D) 15

59. Vinay got thrice as many marks in Maths as in English. The proportion of this marks in Maths and History is 4 : 3. If his total marks in Maths, English and History are 250. What are his marks in English ?

(A) 120 (B) 90
(C) 40 (D) 80

60. One-fourth of the boys and three-eight of the girls in a school participated in the annual sports. What proportional part of the total student population of the school participated in the annual sports ?

(A) $\frac{4}{12}$
(B) $\frac{5}{8}$
(C) $\frac{8}{12}$
(D) Data inadequate

61. Gold is 19 times as heavy as water and copper 9 times as heavy as water. The ratio in which these two metals be mixed so that the mixture is 15 times as heavy as water is—

(A) 1 : 2 (B) 2 : 3
(C) 3 : 2 (D) 19 : 135

62. If $a : b = c : d$, then $\frac{ma + nc}{mb + nd}$ is equal to—

(A) $m : n$ (B) $na : mb$
(C) $a : b$ (D) $md : nc$

63. Rs. 1050 is divided among P, Q and R. The share of P is $\frac{2}{5}$ of the combined share of Q and R. Thus P gets—

(A) Rs. 200 (B) Rs. 300
(C) Rs. 320 (D) Rs. 420

64. Divide Rs. 600 among A, B and C so that Rs. 40 more than $\frac{2}{5}$th of A's share, Rs. 20 more than $\frac{2}{7}$th of B's share and Rs. 10 more than $\frac{9}{17}$th of C's share may all be equal. What is A's share ?

(A) Rs. 280 (B) Rs. 150
(C) Rs. 170 (D) Rs. 200

65. 729 ml of a mixture contains milk and water in the ratio 7 : 2. How much more water is to be added to get a new mixture containing milk and water in the ratio of 7 : 3 ?

(A) 60 ml (B) 70 ml
(C) 81 ml (D) 90 ml

66. A and B are two alloys of gold and copper prepared by mixing metals in proportions 7 : 2 and 7 : 11 respectively. If equal quantities of the alloys are melted to form a third alloy C, the proportion of gold and copper in C will be—

(A) 5 : 9 (B) 5 : 7
(C) 7 : 5 (D) 9 : 5

67. Rs. 1870 has been divided into three parts in such away that half of the first part, one-third of the second part and one-sixth of the third part are equal. The third part is—

(A) Rs. 510 (B) Rs. 680
(C) Rs. 850 (D) Rs. 1020

68. Rs. 385 has been divided among A, B, C in such a way that A receives $\frac{2}{9}$th of what B and C together receive. Then A's share is—

(A) Rs. 70
(B) Rs. 77
(C) Rs. 82·50
(D) Rs. 85

69. Some money is divided among A, B and C in such a way that 5 times A's share 3 times, B's share and 2 times C's share are all equal. The ratio between the shares of A, B, C is—

(A) 5 : 3 : 2
(B) 2 : 2 : 5
(C) 15 : 10 : 6
(D) 6 : 10 : 15

70. 94 is divided into two parts in such a way that fifth part of the first and eighth part of the second are in the ratio 3 : 4. The first part is—

(A) 27 (B) 30
(C) 36 (D) 48

71. Rs. 680 has been divided among A, B, C such that A gets $\frac{2}{3}$ of

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what B gets and B gets $\frac{1}{4}$ of what C gets. Then B's share is—

(A) Rs. 60 (B) Rs. 80

(C) Rs. 120 (D) Rs. 160

72. Rs. 2430 has been divided among A, B, C in such a way that if their shares be diminished by Rs. 5, Rs. 10 and Rs. 15 respectively. The remainders are in the ratio 3 : 4 : 5. Then A's share is—

(A) Rs. 800 (B) Rs. 600

(C) Rs. 595 (D) Rs. 605

73. The sides of triangle are in the ratio $\frac{1}{3} : \frac{1}{4} : \frac{1}{5}$ and its perimeter is 94 cm. the length of smallest side is—

(A) 18·8 cm. (B) 23·5 cm.

(C) 24 cm. (D) 31·3 cm.

74. The speeds of three cars are in the ratio 3 : 4 : 5. The ratio between times taken by them to travel the same distance is—

(A) 3 : 4 : 5

(B) 5 : 4 : 3

(C) 12 : 15 : 20

(D) 20 : 15 : 12

75. Rs. 53 is divided among A, B and C in such a way that B gets Rs. 7 more than what B gets and B gets Rs. 8 more than what C gets. The ratio of their shares is—

(A) 16 : 9 : 18

(B) 25 : 18 : 10

(C) 18 : 25 : 10

(D) 15 : 8 : 30

76. A sum of money is divided among A, B, C so that to each rupee A gets, B gets 65 paise and C gets 35 paise. If C's share is Rs. 28, the sum is—

(A) Rs. 120 (B) Rs. 140

(C) Rs. 160 (D) Rs. 180

77. The incomes of A and B are in the ratio 3 : 2 and their expenditures in the ratio 5 : 3. If each saves Rs. 1,000. A's income is—

(A) Rs. 3000 (B) Rs. 4000

(C) Rs. 6000 (D) Rs. 9000

78. The ratio of the first and second class fares between two stations is 4 : 1 and that of the number of passengers travelling by first and second class is 1 : 40. If Rs. 1100 is collected as fare, the amount collected from first class passengers is—

(A) Rs. 275

(B) Rs. 315

(C) Rs. 137.50

(D) Rs. 100

79. The students in three classes are in the ratio 2 : 3 : 5 if 20 students are increased in each class. The ratio changes to 4 : 5 : 7. The total number of students before the increase were—

(A) 10

(B) 90

(C) 100

(D) None of these

80. The cost of making an article is divided between materials, labour and overheads in the ratio of 3 : 4 : 1. If the materials cost Rs. 67·50, the cost of articles is—

(A) Rs. 180

(B) Rs. 122·50

(C) Rs. 380

(D) Rs. 540

Answers with Hints

1. (A) Ram : Gopal = 7 : 17 = 49 :119

Gopal : Krishan = 7 : 17 = 119 : 289

$\therefore$ Ram : Gopal : Krishan = 49 : 119 : 289

$\Rightarrow$ Ram : Krishan = 49 : 289

Thus, 49 : 289 = 490 : x

$\therefore$ $x = \frac{289 \times 490}{49}$

= Rs. 2890

2. (A) $\because$ $A = \frac{1}{2}(B + C) \Rightarrow B + C = 2A$

$\Rightarrow$ $A + B + C = 3A$

Thus $3A = 5625 \Rightarrow A$ = Rs. 1875

Again $B = \frac{1}{4}(A + C) \Rightarrow A + C = 4B$

$\Rightarrow$ $A + B + C = 5B$

$\therefore$ $5B = 5625 \Rightarrow B$ = Rs. 1125

Thus A's share is more than that of B by Rs. (1875 – 1125) *i.e.* Rs. 750.

3. (A) Let their shares be Rs. $4x$ and Rs. $3x$.

Then $3x = 2400$

$\Rightarrow$ $x = 800$

$\therefore$ Total amount = $7x$ = Rs. 5600

4. (C) Let the price of a scooter be Rs. $3x$ and that of a television set be Rs. $2x$.

Then $3x - 2x = 6000 \Rightarrow x = 6000$

$\therefore$ Cost of a television set = $2x$ = Rs. 12000

5. (D) $\because$ $18 \times 8 = x^2$

$\therefore$ $x = \sqrt{144} = 12$

6. (C) $\frac{4\pi r^2}{4\pi R^2} = \frac{1}{4}$

$\Rightarrow$ $\frac{r^2}{R^2} = \frac{1}{4}$

$\Rightarrow$ $\frac{r}{R} = \frac{1}{2}$

$\Rightarrow$ $\frac{r^3}{R^3} = \frac{1}{8}$

Hence, $\frac{v}{V} = \frac{\frac{4}{3}\pi r^3}{\frac{4}{3}\pi R^3}$

$= \frac{1}{8}$

Thus their volumes are in the ratio 1 : 8.

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7. (D) Let the heights of the cylinder and cone be h and H respectively.

$\because \quad \pi r^2 h = \frac{1}{3}\pi r^2 \text{ H}$

$\Rightarrow \quad \frac{h}{\text{H}} = \frac{1}{3}$

$\therefore \quad h : \text{H} = 1 : 3.$

So their heights are in the ratio 1 : 3.

8. (A) Let the side of the square be x and let the radius of the circle be y

Then, $x^2 = \pi y^2 \Rightarrow \frac{x^2}{y^2} = \pi$

$\Rightarrow \quad \frac{x}{y} = \sqrt{\pi}$

$\therefore \quad x : y = \sqrt{\pi} : 1$

9. (B) Let the number of boys and girls be x and y respectively. Then

$\because \quad (x - y) = 12\% \text{ of } (x + y)$

$\Rightarrow \quad x - y = \frac{3}{25}(x + y)$

$\Rightarrow \quad 25x - 25y = 3x + 3y$

$\Rightarrow \quad 22x = 28y \therefore \frac{x}{y} = \frac{28}{22} = \frac{14}{11}$

10. (B) Ratio of shares of A, B and C

$= \frac{1}{20} : \frac{1}{25} : \frac{1}{30} = 15 : 12 : 10$

$\therefore \quad \text{A's share} = \text{Rs.} \left(2220 \times \frac{15}{37}\right) = \text{Rs. } 900$

$\text{B's share} = \text{Rs.} \left(2220 \times \frac{12}{37}\right) = \text{Rs. } 720$

Thus, the share of A exceeds that of B by Rs. (900 – 720) = Rs. 180.

11. (D) $\text{Ratio} = \frac{1}{2} : \frac{1}{3} : \frac{1}{4} = 6 : 4 : 3$

$\therefore \quad \text{Share of third friend} = \text{Rs.} \left(624 \times \frac{3}{13}\right)$

$= \text{Rs. } 144$

12. (A) Let the monthly salary of A, B, C be Rs. $2x$, Rs. $3x$ and Rs. $5x$ respectively.

Then, $5x - 2x = 1200 \Rightarrow x = 400$

$\therefore \quad \text{B's monthly salary} = 3x = \text{Rs. } 1200$

Hence, B's annual salary = Rs. (12×1200)

$= \text{Rs. } 14400$

13. (C) $\text{Ratio of their values} = \frac{1}{4} : \frac{2}{10} : \frac{3}{20} = 5 : 4 : 3$

$\therefore \quad \text{Value of 5 paise coins} = \text{Rs.} \left(30 \times \frac{3}{12}\right)$

$= \text{Rs. } 7{\cdot}50$

$\therefore \quad \text{Number of 5 paise coins} = \frac{750}{5} = 150$

14. (C) $\text{Greater number} = \left(420 \times \frac{4}{7}\right) = 240$

15. (C) For dividing 12 into two whole numbers, the sum of the terms of the ratio must be a factor of 12.

So, they cannot be in the ratio 3 : 2.

16. (C) For dividing 64 into two whole numbers, the sum of the terms of the ratio must be a factor of 64.

$\therefore$ So they cannot be in the ratio 3 : 4.

17. (C) Less length, less weight

$\because \quad 13 : 6 :: 23{\cdot}4 : x$

$\Rightarrow \quad 13x = 6 \times 23{\cdot}4$

$\therefore \quad x = \frac{6 \times 23{\cdot}4}{13} = 10{\cdot}8 \text{ kg}$

18. (D) $\text{Mean proportional} = \sqrt{0{\cdot}32 \times 0{\cdot}02} = \sqrt{0{\cdot}0064}$

$= 0{\cdot}08$

19. (C) Let $0{\cdot}8 : 0{\cdot}2 :: 0{\cdot}2 : x$

Then $0{\cdot}8\,x = 0{\cdot}2 \times 0{\cdot}2$

$\therefore \quad x = \frac{0{\cdot}2 \times 0{\cdot}2}{0{\cdot}8} = \frac{0{\cdot}04}{0{\cdot}80} = \frac{4}{80} = 0{\cdot}05$

20. (C) Let $0{\cdot}2 : 0{\cdot}12 :: 0{\cdot}3 : x$

$\because \quad 0{\cdot}2x = 0{\cdot}12 \times 0{\cdot}3$

$\therefore \quad x = \frac{0{\cdot}12 \times 0{\cdot}3}{0{\cdot}2} = 0{\cdot}18$

21. (C) $\because \quad \frac{54 - x}{71 - x} = \frac{75 - x}{99 - x}$

$\Rightarrow \quad (54 - x)(99 - x) = (75 - x)(71 - x)$

$\Rightarrow \quad x^2 - 153x + 5346 = x^2 - 146x + 5325$

$\Rightarrow \quad 7x = 21$

$\therefore \quad x = 3$

22. (B) $\because \quad \frac{6 + x}{14 + x} = \frac{18 + x}{38 + x}$

$\Rightarrow \quad (6 + x)(38 + x) = (18 + x)(14 + x)$

$\Rightarrow \quad x^2 + 44x + 228 = x^2 + 32x + 252$

$\Rightarrow \quad 12x = 24 \therefore x = 2$

23. (B) $\because \quad x : \frac{1}{27} = \frac{3}{7} : \frac{5}{9}$

$\Rightarrow \quad \frac{5}{9}x = \frac{1}{27} \times \frac{3}{7}$

$\Rightarrow \quad \frac{5}{9}x = \frac{1}{63} \therefore x = \left(\frac{1}{63} \times \frac{9}{5}\right) = \frac{1}{35}$

24. (D) $\because \quad \frac{7 + x}{13 + x} = \frac{2}{3}$

$\Rightarrow \quad 3(7 + x) = 2(13 + x) \therefore x = 5$

25. (B) $\because \quad \frac{5}{8} = \frac{5 \times 8}{8 \times 8} = \frac{40}{64}$

$\therefore \quad \text{Consequent} = 64$

26. (B) $7 : 15 = \frac{7}{15} = 0{\cdot}466$

$15 : 23 = \frac{15}{23} = 0{\cdot}652$

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$17 : 25 = \frac{17}{25} = 0{\cdot}68$

and $21 : 29 = \frac{21}{29} = 0{\cdot}724$

$\therefore$ The smallest one is 7 : 15.

27. (C)

28. (A) $\because \quad \frac{1}{3}A = \frac{1}{4}B = \frac{1}{5}C = x$

Then $A = 3x, B = 4x$ and $C = 5x$

$\therefore \quad A : B : C = 3x : 4x : 5x = 3 : 4 : 5$

29. (B) Req. ratio $\frac{\frac{1}{3} \text{ of Rs. } 9{\cdot}30}{0{\cdot}6 \text{ of Rs. } 1{\cdot}55} = \frac{3{\cdot}10}{0{\cdot}93} = \frac{310}{93} = \frac{10}{3}$

30. (D) Let the numbers be $3x$ and $5x$

Then $\frac{3x+10}{5x+10} = \frac{5}{7} \Rightarrow 7(3x+10) = 5(5x+10)$

$\Rightarrow \quad 4x = 20 \therefore x = 5$

So, the numbers are 15, 25.

31. (B) $\because \quad \frac{x}{y} = \frac{2}{3}$ and $\frac{2}{x} = \frac{1}{2}$

$\Rightarrow \quad \frac{x}{y} \times \frac{2}{x} = \frac{2}{3} \times \frac{1}{2}$

$\Rightarrow \quad \frac{2}{y} = \frac{1}{3} \therefore y = 6$

32. (C) $\because \quad 2A = 3B$ and $4B = 5C$

$\Rightarrow \quad 8A = 12B$ and $12B = 15C$

$\Rightarrow \quad 8A = 12B = 15C = x$

$\therefore \quad A = \frac{x}{8}, B = \frac{x}{12}, C = \frac{x}{15}$

So, $A : C = \frac{x}{8} : \frac{x}{15} = 15 : 8$

33. (C) Let $2A = 3B = 4C = x$

Then $A = \frac{x}{2}, B = \frac{x}{3}$ and $C = \frac{x}{4}$

$\therefore \quad A : B : C = \frac{x}{2} : \frac{x}{3} : \frac{x}{4}$

Hence $A : B : C = 6 : 4 : 3$

34. (C) $\because \quad \frac{A}{D} = \left(\frac{A}{B} \times \frac{B}{C} \times \frac{C}{D}\right) = \left(\frac{2}{3} \times \frac{4}{5} \times \frac{6}{7}\right) = \frac{16}{35}$

$\therefore \quad A : D = 16 : 35$

35. (A) Let $A = x$

Then $B = 3x, C = 2B = 6x$

$\therefore \quad A : B : C = x : 3x : 6x = 1 : 3 : 6$

36. (B) L.C.M. of 7 and 6 is 42

$\therefore \quad A : B = 5 : 7 = 30 : 42$

and $B : C = 6 : 11 = 42 : 77$

Hence $A : B : C = 30 : 42 : 77$

37. (C) $A : B = 7 : 9$

and $B : C = 3 : 5 = 9 : 15$

$\therefore \quad A : B : C = 7 : 9 : 15$

38. (D) $0{\cdot}6x = 0{\cdot}09y$

$\Rightarrow \quad \frac{x}{y} = \frac{0{\cdot}09}{0{\cdot}60} = \frac{9}{60} = \frac{3}{20} = 3 : 20$

39. (B) 10% of x = 20% of y

$\Rightarrow \quad \frac{10}{100}x = \frac{20}{100}y$

$\Rightarrow \quad \frac{x}{10} = \frac{y}{5} \Rightarrow \frac{x}{y} = \frac{10}{5} = \frac{2}{1}$

Hence $x : y = 2 : 1$

40. (A) $\frac{A}{B} = \frac{2}{3}$ and $\frac{B}{C} = \frac{4}{5}$

$\therefore \quad \frac{A}{C} = \left(\frac{A}{B} \times \frac{B}{C}\right) = \left(\frac{2}{3} \times \frac{4}{5}\right) = \left(\frac{8}{15}\right)$

So, $\frac{C}{A} = \frac{15}{8}$

Hence $C : A = 15 : 8$

41. (B) Let the salaries of Laxman and Gopal one year before be x_1, y_1 respectively.

$\therefore \quad \frac{x_1}{y_1} = \frac{3}{4} \quad \ldots(1)$

$x_2 + y_2 = 4160 \quad \ldots(2)$

$y_2 = \frac{3}{2}y_1 = \frac{3}{2} \times \left(\frac{4}{3}x_1\right) = \frac{3}{2} \times \frac{4}{3} \times \left(\frac{4}{5}x_2\right)$

$= \frac{3}{2} \times \frac{4}{3} \times \frac{4}{5}x_2 = \frac{8}{5}x_2$

$\therefore x_2 + y_2 = x_2 + \frac{8}{5}x_2 = \left(1 + \frac{8}{5}\right) = \frac{13}{5}x_2 = \text{Rs. } 4160$

$\therefore x_2 = \frac{5}{13} \times 4160 = 5 \times 320 = \text{Rs. } 1600.$

42. (C) Let their ages be $2x$ and $3x$ years

$\because \quad 3x - 2x = 6 \Rightarrow x = 6$

$\therefore$ Sumit's age = 12 years,

Prakash's age = 18 years

After 6 years, Sumit's age = 18 years

After 6 years, Prakash's age = 24 years

$\therefore$ Required ratio of their ages = 18 : 24 = 3 : 4

43. (C) Let their ages be $2x$ and $3x$ years

$\frac{2x+12}{3x+12} = \frac{11}{15}$

$\Rightarrow \quad 15(2x+12) = 11(3x+12)$

$\Rightarrow \quad 3x = 48$

$\therefore \quad x = 16$

$\therefore$ Age of Sumit = $3x = 48$ years

44. (C) Let their ages be $4x$ and x years.

$\because \quad 4x \times x = 196$

$\therefore \quad x^2 = 49 \Rightarrow x = 7$

Their ages are 28 years and 7 years.

Ratio of their ages after 5 years = 33 : 12 = 11 : 4

45. (C) Let their ages be $6x$ and $5x$ years

$\because \quad 6x + 5x = 44 \therefore x = 4$

So their present ages are 24 years and 20 years

Ratio of their ages after 8 years = 32 : 28 = 8 : 7.

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46. (C) Let son's age 5 years ago = x years.
Then father's age at that time = $(5x)$ years.
After 2 years, son's age = $(x + 7)$ years.
After 2 years, father's age = $(5x + 7)$ years
$\because$ $3(x + 7) = 5x + 7 \therefore x = 7$
Father's age now = $(5x + 5) = 40$ years
Son's age now = $(x + 5) = 12$ years
$\therefore$ Ratio of their present ages = $40 : 12 = 10 : 3$

47. (D) Their total age = (3×20) years = 60 years
Let their ages be $3x$, $5x$ and $7x$ years. Then $3x + 5x + 7x = 60 \Rightarrow x = 4$
$\therefore$ Youngest girl is = $3x = 12$ years old.

48. (D) Let the number of hens = x and number of cows = y
Then $x + y = 48$ and $2x + 4y = 140$
Solving these equations, we get $2y = 44 \therefore y = 22$
So, $x = (48 - 22) = 26$
$\therefore$ Number of hens = 26

49. (A) Ratio of wages of 6 men, 8 women and 6 children
$= 6 \times 4 : 8 \times 3 : 6 \times 2 = 24 : 24 : 12$
$= 2 : 2 : 1$
$\therefore$ Total money earned by children = Rs. $\left(950 \times \frac{1}{5}\right)$
= Rs. 190

50. (C) Let the numbers be $3x$ and $4x$
Then, their L.C.M. = $12x$
$\Rightarrow$ $12x = 180 \therefore x = 15$
Hence, the first number = 45

51. (C) Milk = $\left(60 \times \frac{2}{3}\right)$ litres = 40 litres
Water = $(60 - 40)$ litres = 20 litres
$\because$ $\frac{40}{20 + x} = \frac{1}{2}$
$\Rightarrow$ $20 + x = 80 \therefore x = 60$
Hence, water to be added = 60 litres.

52. (B) $\because$ A : B = 2 : 3, B : C = 2 : 3
and C : D = 2 : 3
$\Rightarrow$ A : B = 8 : 12, B : C = 12 : 18
and C : D = 18 : 27
$\therefore$ A : B : C : D = 8 : 12 : 18 : 27
So A's share = Rs. $\left(1300 \times \frac{8}{65}\right)$ = Rs. 160

53. (B) First glass contains milk = $\frac{1}{3}$ and water = $\frac{2}{3}$
Second glass contains milk = $\frac{1}{4}$ and water = $\frac{3}{4}$
$\therefore$ Now tumbler contains water = $\left(\frac{2}{3} + \frac{3}{4}\right) = \frac{17}{12}$
$\therefore$ Ratio of milk and water = $\frac{7}{12} : \frac{17}{12} = 7 : 17$

54. (A) Milk = $\left(85 \times \frac{27}{34}\right)$ kg = $\frac{135}{2}$ kg = 67·5 kg
Water = $\left(85 \times \frac{7}{34}\right)$ kg = $\left(\frac{35}{2}\right)$ kg = 17·5 kg
$\because$ $\frac{67{\cdot}5}{(17{\cdot}5 + x)} = \frac{3}{1}$
$\Rightarrow$ $3(17{\cdot}5 + x) = 67{\cdot}5 \therefore x = 5$
$\therefore$ Water to be added = 5 kg.

55. (B) Let quantity of milk and water be $5x$ and x litres
Then $\frac{5x}{x + 5} = \frac{5}{2}$
$\Rightarrow$ $10x = 5x + 25 \therefore x = 5$
$\therefore$ Quantity of milk = $5x = 25$ litres

56. (D) $\because$ 20 kg of brass contains zinc = 13 kg
$\therefore$ 100 kg of brass contains zinc = $\left(\frac{13}{20} \times 100\right)$ kg.
= 65 kg.

57. (C) A : B = 4 : 5 = 8 : 10 and B : C = 2 : 3 = 10 : 15
$\therefore$ A : B : C = 8 : 10 : 15
If A has Rs. 8, C has Rs. 15
If A has Rs. 800 C has Rs. $\left(\frac{15}{8} \times 100\right)$ = Rs. 1500

58. (B) Alcohol = $\left(\frac{20}{100} \times 15\right)$ litres = 3 litres,
Water = 12 litres
New mix. contains alcohol = 3 litres,
Water = 15 litres
$\therefore$ Percentage of alcohol in new mix.
= $\left(\frac{3}{18} \times 100\right)$ %
= $16\frac{2}{3}$ %

59. (C) M = 3E and $\frac{M}{H} = \frac{4}{3}$
$\therefore$ $H = \frac{3}{4}M = \frac{3}{4} \times 3E = \frac{9}{4}E$
Now M + E + H = 250
$\Rightarrow$ $3E + E + \frac{9}{4}E = 250$
$\Rightarrow$ $25E = 1000 \therefore E = 40$

60. (D) Data is inadequate.

61. (C) Let, 1 gm of gold be mixed with x gm of copper to give $(1 + x)$ gm of mixture.
Now, 1G = 19W and 1C = 9W and mixture = 15W
Now, 1 gm gold + x gm copper = $(1 + x)$ gm mixture
$\because$ $19W + 9W \times x = (1 + x) \times 15W$
Thus $4W = 6W\,x \therefore x = \frac{4W}{6W} = \frac{4}{6} = \frac{2}{3}$
So the required ratio is $1 : \frac{2}{3}$ *i.e.* 3 : 2

62. (C) Let $\frac{a}{b} = \frac{c}{d} = k$
Then $a = b\,k$ and $c = dk$
$\therefore$ $\frac{ma + nc}{mb + nd} = \frac{mbk + ndk}{mb + nd} = k\left(\frac{mb + nd}{mb + nd}\right)$
$= k = \frac{a}{b} = a : b$

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63. (B) $\because$ $P : (Q + R) = 2 : 5$

$\therefore$ P's share $= \text{Rs.} \left(1050 \times \frac{2}{7}\right) = \text{Rs. } 300$

64. (B) $\because$ $\frac{2}{5}A + 40 = \frac{2}{7}B + 20 = \frac{9}{17}C + 10 = x$

$\therefore$ $A = \frac{5}{2}(x - 40)$, $B = \frac{7}{2}(x - 20)$

and $C = \frac{17}{9}(x - 10)$

$\Rightarrow \frac{5}{2}(x - 40) + \frac{7}{2}(x - 20) + \frac{17}{9}(x - 10) = 600$

$\Rightarrow 45x - 1800 + 63x - 1260 + 34x - 340 = 10800$

$\Rightarrow 142x = 14200 \therefore x = \frac{14200}{142} = 100$

Hence A's share $= \frac{5}{2}(100 - 40) = \text{Rs. } 150$

65. (C) Milk $= \left(729 \times \frac{7}{9}\right) = 567$ ml

Water $= \left(729 \times \frac{2}{9}\right) = 162$ ml

$\because$ $\frac{567}{162 + x} = \frac{7}{3}$

$\Rightarrow 3 \times 567 - 7 \times 162 = 7x$

$\Rightarrow 1701 - 1134 = 7x$

$\therefore 7x = 1701 - 1134 \therefore x = \frac{567}{7} = 81$ ml

66. (C) Gold in C $= \left(\frac{7}{9} + \frac{7}{18}\right) = \frac{21}{18} = \frac{7}{6}$

Copper in C $= \left(\frac{2}{9} + \frac{11}{18}\right) = \frac{15}{18} = \frac{5}{6}$

$\therefore$ Gold : Copper $= \frac{7}{6} : \frac{5}{6} = 7 : 5$

67. (D) $\because$ $\frac{1}{2}A = \frac{1}{3}B = \frac{1}{6}C = x$

$\Rightarrow A = 2x, B = 3x, C = 6x$

$\therefore A : B : C = 2 : 3 : 6$

Third part $= \text{Rs.} \left(1870 \times \frac{6}{11}\right) = \text{Rs. } 1020$

68. (A) $A : (B + C) = 2 : 9$

$\therefore$ A's share $= \text{Rs.} \left(385 \times \frac{2}{11}\right) = \text{Rs. } 70$

69. (D) $\because$ $5A = 3B = 2C = x$

$\Rightarrow A = \frac{x}{5}$, $B = \frac{x}{3}$ and $C = \frac{x}{2}$

$\therefore A : B : C = \frac{x}{5} : \frac{x}{3} : \frac{x}{2} = 6 : 10 : 15$

70. (B) $\because$ $\frac{1}{5}A : \frac{1}{8}B = 3 : 4$

$\Rightarrow \frac{8A}{5B} = \frac{120}{160}$

$\Rightarrow \frac{A}{B} = \frac{120}{160} \times \frac{5}{8} = \frac{15}{32}$

$\therefore$ First part $= \text{Rs.} \left(94 \times \frac{15}{47}\right) = \text{Rs. } 30$

71. (C) Suppose C gets Re. 1. Then B gets Re. $\left(\frac{1}{4}\right)$

$\because$ A gets $= \text{Re.} \left(\frac{2}{3} \times \frac{1}{4}\right) = \text{Re. } \frac{1}{6}$

$\therefore A : B : C = \frac{1}{6} : \frac{1}{4} : 1 = 2 : 3 : 12$

Hence B's share $= \text{Rs.} \left(680 \times \frac{3}{17}\right) = \text{Rs. } 120$

72. (D) $\because$ Remainder $= \text{Rs. } [2430 - (5 + 10 + 15)]$
$= \text{Rs. } 2400$

$\therefore$ A's share $= \text{Rs.} \left[\left(2400 \times \frac{3}{12}\right) + 5\right]$
$= \text{Rs. } 605$

73. (C) Ratio of sides $\frac{1}{3} : \frac{1}{4} : \frac{1}{5} = 20 : 15 : 12$

Length of smallest side $= \left(94 \times \frac{12}{47}\right)$ cm.
$= 24$ cm.

74. (D) Ratio of time taken $= \frac{1}{3} : \frac{1}{4} : \frac{1}{5} = 20 : 15 : 12$

75. (B) Suppose C gets Rs. x

Then, B gets Rs. $(x + 8)$ and A gets Rs. $(x + 15)$

$\Rightarrow x + x + 8 + x + 15 = 53 \therefore x = 10$

So, A gets Rs. 25, B gets Rs. 18 and C gets Rs. 10

$\therefore A : B : C = 25 : 18 : 10$

76. (C) $A : B : C = 100 : 65 : 35 = 20 : 13 : 7$

If C's share is Rs. 7, the sum is Rs. 40

If C's share is Rs. 28, the sum is Rs. $\left(\frac{40}{7} \times 28\right)$
$= \text{Rs. } 160$

77. (C) Let their incomes be $3x$, $2x$ and expenditures $5y$, $3y$ respectively. Then,

$3x - 5y = 1000$ and $2x - 3y = 1000$

Solving these equations we get $x = 2000$, $y = 1000$

$\therefore$ A's Income $= 3x = \text{Rs. } 6000$

78. (D) Ratio of amounts collected from 1st and 2nd class
$= (4 \times 1 : 1 \times 40) = (1 : 10)$

$\therefore$ Amount collected as 1st class fare
$= \text{Rs.} \left(1100 \times \frac{1}{11}\right) = \text{Rs. } 100$

79. (C) Let the number of students be $2x$, $3x$ and $5x$

$\because$ $(2x + 20) : (3x + 20) : (5x + 20) = 4 : 5 : 7$

$\Rightarrow \frac{2x + 20}{4} = \frac{3x + 20}{5} = \frac{5x + 20}{7}$

$\Rightarrow 5(2x + 20) = 4(3x + 20) \therefore x = 10$

Hence, total number of students before increase
$= 10x = 100.$

80. (A) If material cost Rs. 3, the cost of the article is
$= \text{Rs. } (3 + 4 + 1) = \text{Rs. } 8$

If material cost Rs. 67·50, the cost of the article
$= \text{Rs.} \left(\frac{8}{3} \times 67{\cdot}50\right) = \text{Rs. } 180$

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Logarithm

Important Points/Facts

We are familiar with a simple exponential identity $a^x = b$, Here 'a' is called the base 'x' the exponent and 'b' the result.

Now, just as we can say $\sqrt{4} = 2$, which is basically another way of saying $2 \times 2 = 4$ we can say

$$\log_a b = x$$

It is another way of saying $a^x = b$

Thus a log or logarithm is an equivalent way of expressing an exponential identity and the following two expressions are completely equivalent.

$$a^x = b \Leftrightarrow \log_a b = x$$

$\log_a b$ generally expressed as log of b to the base a generally, the base is taken as 10 in which case the subscript for the base is not written.

Hence log b means $\log_{10} b$. Thus, if no base is given assume that the base is 10.

Examples

Q. 1. If $\log_3 a = 4$, find the value of a.

Solution :

$\log_3 a = 4 \Rightarrow 3^4 = a$

$\therefore \quad a = 81$

Q. 2. Find the value of $2^{\log_2 5}$.

Solution :

Let, $2^{\log_2 5} = x$

$\therefore \quad \log_2 (x) = \log_2 (5)$

$\Rightarrow \quad x = 5$

$\therefore \quad 2^{\log_2 5} = 5$

Short Method : Applying the formula we can directly get the answer

$$2^{\log_2 5} = 5$$

Q. 3. Find the value of $\log_{25} 125 - \log_8 4$

Solution :

$\log_{25} (125) - \log_8 (4)$

$= \log_{5^2} (5^3) - \log_{2^3} (2^2)$

$= \frac{3}{2} - \frac{2}{3}$ (from the formula) $= \frac{5}{6}$

Q. 4. If $\log x = \log 5 + 2 \log 3 - \frac{1}{2} \log 25$, find the value of x.

Solution :

$\log x = \log 5 + 2 \log 3 - \frac{1}{2} \log 25$

$= \log 5 + \log 3^2 - \log (25)^{1/2}$

$= \log 5 + \log 9 - \log 5 = \log 9$

$\therefore \quad x = 9$

Q. 5. If $\log_{10} m = b - \log_{10} n$, find the value of m.

Solution :

We have, $\log_{10} m = b - \log_{10} n$

$\Rightarrow \quad \log_{10} m + \log_{10} n = b$

$\Rightarrow \quad \log_{10} (mn) = b$

$\Rightarrow \quad 10^b = mn$

$\therefore \quad m = \frac{10^b}{n}$

Q. 6. If $\log_{10} (m) = b + \log_{10} (n)$, find the value of m.

Solution :

We have $\log_{10} m = b + \log_{10} n$

$\Rightarrow \log_{10} m - \log_{10} n = b$

$\Rightarrow \quad \log \left(\frac{m}{n}\right) = b$

$\Rightarrow \quad \frac{m}{n} = 10^b$

$\therefore \quad m = n\, 10^b$

$\log \left(\frac{m}{n}\right) \neq \frac{\log m}{\log n}$

Q. 7. If $\log_{10} m = b \log_{10} n$, find the value of m.

Solution :

We have $\frac{\log_{10} m}{\log_{10} n} = b$

$\Rightarrow \quad \log_n m = b$

$\therefore \quad m = n^b$

Q. 8. If log $(x + 2)$ = log (x) + log (2) then find the value of x.

Solution :

We have log $(x + 2)$ = log (x) + log (2) = log $(2x)$ or $x + 2 = 2x$

$\therefore \quad x = 2$

Short Method : Applying the formula, we have

$$x = \frac{2}{2-1} = 2$$

Q. 9. If log $(x - 2)$ = log x – log (2) then find the value of x.

Solution :

We have,

$\log (x - 2) = \log (x) - \log (2)$

$= \log x/2$

$\Rightarrow \quad x - 2 = \frac{x}{2}$

$\Rightarrow \quad 2x - 4 = x$

$\therefore \quad x = 4$

Short Method : Applying the formula, we have

$$x = \frac{(2)^2}{2-1} = 4$$

Q. 10. Find the no. of digits in 2^{47} (Given that $\log_{10} 2 = 0{\cdot}3010$)

Solution :

Applying the rule, we have the required answer = (Integral part of $47 \log_{10} 2$) + 1

$= (47 \times 0{\cdot}3010) + 1$

$= [14{\cdot}1470 + 1]$

$= 14 + 1 = 15$

Exercise

1. If $A = \log_{27} 625 + 7 \log_{11} 13$ and $B = \log_9 125 + 13 \log_{10} 7$ then which of the following is true ?
   (A) A > B (B) A < B
   (C) A = B (D) Can't say
2. If log 2 = 0·3010, then the number of digits in 2^{64} is—
   (A) 18 (B) 19
   (C) 20 (D) 21
3. Find the number of digits in 8^{10}. (Given that $\log_{10} 2 = 0{\cdot}3010$) :
   (A) 19 (B) 20
   (C) 17 (D) 10
4. Find the no. of digits in 8^{57} (given that $\log_{10} 2 = 0{\cdot}3010$)
   (A) 52 (B) 50
   (C) 51 (D) 53

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5. If $\log (x-5) = \log (x) - \log (5)$ and $\log (y-6) = \log (y) - \log (6)$ then which of the following is correct ?
(A) $x > y$ (B) $x < y$
(C) $x = y$ (D) Can't say

6. If $\log (x+4) = \log (4) + \log (x)$ and $\log (x+6) = \log (y) + \log (6)$ then which of the following is correct ?
(A) $x = y$ (B) $x < y$
(C) $x > y$ (D) Can't say

7. The value of $\frac{\log_a x}{\log_{ab} x} - \log_a b$ is—
(A) 0 (B) 1
(C) a (D) ab

8. The value of $\log_2 3 \times \log_3 2 \times \log_3 4 \times \log_4 3$ is—
(A) 1 (B) 2
(C) 3 (D) 4

9. If $a^x = b$, $b^y = c$, $c^z = a$, then the value of xyz is—
(A) 0 (B) 1
(C) 2 (D) 4

10. If $\log_x y = 100$ and $\log_2 x = 10$ then the value of y is—
(A) 2^{10} (B) 2^{1000}
(C) 2^{100} (D) 2^{10000}

11. If $\log_x 4 = 0{\cdot}4$ then the value of x is—
(A) 4 (B) 16
(C) 1 (D) 32

12. If $\log_{12} 27 = a$ then $\log_6 16$ is—
(A) $\frac{4(3-a)}{3+a}$ (B) $\frac{4(3+a)}{3-a}$
(C) $\frac{3+a}{4(3-a)}$ (D) $\frac{3-a}{4(3+a)}$

13. Given that $\log_{10} 2 = 0{\cdot}3010$, then $\log_2 10$ is equal to—
(A) 0·3010 (B) 0·6990
(C) $\frac{1000}{301}$ (D) $\frac{699}{301}$

14. The value of $\log \frac{9}{8} - \log \frac{27}{32} + \log \frac{3}{4}$ is—
(A) 0 (B) 1
(C) 2 (D) 3

15. The simplified form of $\log \frac{75}{16} - 2 \log \frac{5}{9} + \log \frac{32}{343}$ is—
(A) log 2 (B) 2 log 2
(C) log 3 (D) log 5

16. If $\log 2 = 0{\cdot}3010$ then $\log 5$ equals to—
(A) 0·3010
(B) 0·6990
(C) 0·7525
(D) Given log 2, it is not possible to calculate log 5

17. If $\log_{10} 2 = 0{\cdot}3010$ and $\log_{10} 7 = 0{\cdot}8451$, then the value of $\log_{10} 2{\cdot}8$ is—
(A) 0·4471 (B) 1·4471
(C) 2·4471 (D) 14·471

18. If $\log_{10} 2 = 0{\cdot}301$, then the value of $\log_{10} (50)$ is—
(A) 0·699 (B) 1·301
(C) 1·699 (D) 2·301

19. Find the value of $\log \left(\frac{a^2}{bc}\right) + \log \left(\frac{b^2}{ac}\right) + \log \left(\frac{c^2}{ab}\right)$:
(A) 0 (B) 1
(C) abc (D) $a^2b^2c^2$

20. Find the value of $\log 8 + \log \frac{1}{8}$—
(A) 0 (B) 1
(C) 2 (D) log (64)

21. The equation $\log_a x + \log_a (1+x) = 0$ can be written as—
(A) $x^2 + x - 1 = 0$
(B) $x^2 + x + 1 = 0$
(C) $x^2 + x - e = 0$
(D) $x^2 + x + e = 0$

22. Find the value of $\log x + \log \left(\frac{1}{x}\right)$—
(A) 0 (B) 1
(C) – 1 (D) $\frac{1}{2}$

23. Find the value of $\frac{1}{2} \log 25 - 2 \log_{10} 3 + \log_{10} 18$—
(A) 0 (B) 1
(C) 2 (D) $\frac{1}{2}$

24. If $\log 90 = 1{\cdot}9542$ then $\log 3$ equals to—
(A) 0·9771 (B) 0·6514
(C) 0·4771 (D) 0·3181

25. If $\log (0{\cdot}57) = \bar{1}{\cdot}756$, then the value of $\log 57 + \log (0{\cdot}57)^3 + \log \sqrt{0{\cdot}57}$ is—
(A) 0·902 (B) 1·902
(C) $\bar{1}{\cdot}146$ (D) $\bar{2}{\cdot}146$

26. If $\log 2 = x$, $\log 3 = y$ and $\log 7 = z$, then the value of $\log (4 \times \sqrt[3]{63})$ is—
(A) $-2x + \frac{2}{3}y + \frac{1}{3}z$
(B) $2x + \frac{2}{3}y + \frac{1}{3}z$
(C) $2x + \frac{2}{3}y - \frac{1}{3}z$
(D) $2x - \frac{2}{3}y + \frac{1}{3}z$

27. If $\log 3 = 0{\cdot}477$ and $(1000)^x = 3$, then x equals to—
(A) 0·159 (B) 10
(C) 0·0477 (D) 0·0159

28. If $2\log_4 x = 1 + \log_4 (x-1)$, find the value of x.
(A) 2 (B) 1
(C) 4 (D) 3

29. If $5^{5-x} = 2^{x-5}$, find the value of x.
(A) 5
(B) 0
(C) 1
(D) Can't be determined

30. If $\log_8 x + \log_4 x + \log_2 x = 11$, then the value of x is—
(A) 2 (B) 4
(C) 8 (D) 64

31. If $10^{0{\cdot}3010} = 2$, then find the value of $\log_{0{\cdot}125} 125$.
(A) $\frac{699}{301}$ (B) $-\frac{699}{301}$
(C) – 1 (D) – 2

32. Find the value of $\log_{0{\cdot}125} 64$—
(A) – 2
(B) 2
(C) 0
(D) Can't be determined

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33. Find the value of $\log_{32} 2^8 + \log_{243} 3^7 - \log_{36} 1296$—
(A) 3 (B) 2
(C) 1 (D) 0

34. Find the value of $\log_{49} 16807 - \log_9 27$—
(A) 0 (B) 1
(C) $\frac{3}{2}$ (D) – 1

35. Find the value of $\log_9 81 - \log_4 32$—
(A) $\frac{1}{2}$ (B) $-\frac{3}{2}$
(C) $-\frac{1}{2}$ (D) 2

36. $\log_{10} 10 + \log_{10} 100 + \log_{10} 1000 + \log_{10} 10000 + \log_{10} 100000$ is equal to—
(A) 15
(B) log 11111
(C) $\log_{10}1111$
(D) $14 \log_{10} 100$

37. $\log_{10} x + \log_{10} y = z$, then x is equal to—
(A) $\frac{z}{y}$
(B) $\frac{10}{z}$
(C) $\frac{10^2}{x}$
(D) None of these

38. $\log_{-1/3} 81$ is equal to—
(A) – 27 (B) – 4
(C) 4 (D) 127

39. If $\log_{10} \{\log_{10} [\log_{10} (\log_{10} x)]\} = 0$, then the value of x is—
(A) 10^{10} (B) $10^{10^{10}}$
(C) 10^{-10} (D) 10^{10^2}

40. The value of $25 \log_5 4$ is—
(A) 16
(B) 5
(C) 25
(D) None of these

41. The value of $\log_{10} 0{\cdot}000001$ is—
(A) 6 (B) – 6
(C) 5 (D) – 5

42. The value of $\log_{10} (0{\cdot}00001)$ is—
(A) – 5
(B) – 6
(C) – 7
(D) None of these

43. The value of $\log_6 \log_5 15625$ is—
(A) 1
(B) 2
(C) 3
(D) None of these

44. If $\log_{10000} x = -\frac{1}{4}$, then x is—
(A) $\frac{1}{100}$
(B) $\frac{1}{10}$
(C) $\frac{1}{20}$
(D) None of these

45. $\log_x \left(\frac{16}{25}\right) = -\frac{1}{2}$, then x is—
(A) $\frac{625}{256}$
(B) $\frac{256}{625}$
(C) $\frac{526}{265}$
(D) None of these

46. The value of $\log_2 \left(\frac{1}{64}\right)$ is—
(A) 6
(B) – 6
(C) 7
(D) None of these

47. If $\log_a 3 = \frac{1}{3}$, then value of a is—
(A) 27
(B) 81
(C) 72
(D) None of these

48. If $\log_{10} x = 7$, then value of x is—
(A) 10^{10}
(B) 10^7
(C) 7^{10}
(D) None of these

49. If $p^x = q$, then—
(A) $\log_p, x = q$
(B) $\log_x q = p$
(C) $\log_p q = x$
(D) $\log_q p = x$

50. Given that $\log_{10} 2 = 0{\cdot}3010$ the value of $\log_{10} 5$ is—
(A) 0·3241 (B) 0·6911
(C) 0·6990 (D) 0·7525

51. (log tan 1°. log tan 2°..... log tan 50°) is—
(A) 0 (B) 1
(C) 2 (D) – 1

52. The mantissa of log 3274 is 0·5150, then the value of log 32·74 is—
(A) 1·5150
(B) 2·5150
(C) 0·5150
(D) $\bar{1}$·5150

53. If $\log_{10} (10x) = 2{\cdot}7532$, then $\log_{10} (10000x)$ is—
(A) 4·7532
(B) 5·7532
(C) $3 \times 2{\cdot}7532$
(D) None of these

54. If $\frac{\log 125}{\log 5} = x$, then x is equal to—
(A) 2 (B) 3
(C) 4 (D) $\frac{1}{2}$

55. If $\log_5 (x^2 + x) - \log_5 x = 2$, then the value of x is—
(A) 24 (B) 25
(C) 23 (D) 120

56. $(\log_5 3) \times (\log_3 625)$ is equal to—
(A) 1 (B) 2
(C) 3 (D) 4

57. $\log_9 27 - \log_{27} 9$ is equal to—
(A) $\frac{6}{5}$ (B) $\frac{5}{6}$
(C) 3 (D) 3^2

58. The value of $3^{-1/2} \log_3 9$ is—
(A) 3
(B) $\frac{1}{3}$
(C) $\frac{2}{3}$
(D) None of these

59. If $10^x = 1{\cdot}73$ and $\log_{10} 1730 = 3{\cdot}2380$, then x is equal to—
(A) 1·2380 (B) 0·2380
(C) 2·380 (D) 2·2380

60. If $\log a$, $\log b$, $\log c$ are in A.P. then—
(A) a, b, c are in G.P.
(B) a^2, b^2, c^2 are in G.P.

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(C) a, b, c are in A.P.

(D) None of these

61. The population of a town at the beginning of the year 1986 was 2,65,000. If the rate of increase be 52 per thousand of the population. Find the population at the beginning of the year 1991.
(A) 3,40,400 (B) 3,41,400
(C) 3,42,400 (D) 3,43,400

62. What rate per cent per annum compound interest will Rs. 2000 amount to Rs. 3,000 in 3 years if the interest is reckoned half yearly ?
(A) 12% (B) 13%
(C) 14% (D) 15%

63. The compound interest on Rs. 12,000 for 10 years at the rate of 12% per annum compounded annually is—
(A) 25350 (B) 23550
(C) 2550 (D) 25550

64. The number of digits in the numeral for $(8{\cdot}75)^{16}$—
(A) 47 digit (B) 48 digit
(C) 49 digit (D) 50 digit

65. The number of digits in the numeral for 2^{64}—
(A) 18 digit (B) 19 digit
(C) 20 digit (D) 21 digit

66. The value of $\sqrt[5]{42{\cdot}7}$—
(A) 2·1187 (B) 2·1287
(C) 2·8711 (D) 2·2287

67. The value of $\sqrt[3]{0{\cdot}0847}$—
(A) ·4392 (B) ·4239
(C) ·2349 (D) ·4329

68. The value of $\frac{\log_a n}{\log_{ab} n}$ is given by—
(A) $1 + \log_a b$ (B) $1 + \log_b a$
(C) $\log_a b$ (D) $\log_b a$

69. Given $\log_{10} 2 = 0{\cdot}30103$, $\log_{10} 3 = 0{\cdot}47712$. Find the number of digit, in $3^{12} \times 2^8$—
(A) 6
(B) 7
(C) 8
(D) 9

70. The value of $\frac{1}{\log_2 \pi} + \frac{1}{\log_6 \pi}$ is—
(A) greater than 1
(B) less than 1
(C) between 5 and 6
(D) None of these

Answers with Hints

1. (B) $A = \log_{27} 625 + 7 \log_{11}{}^{13}$
$= \log_{3^3} 5^4 + 7 \log_{11} 13$
$= \frac{4}{3} \log_3 5 + 7 \log_{11} 13$
$B = \log_9 125 + 13 \log_{11} 7 = \log_{3^2} 5^3 + 13 \log_{11} 7$
$= \frac{3}{2} \log_3 5 + 13 \log_{11} 7$
Let $\log_3 5 = x$ and by the above rule
$7 \log_{11} 13 = 13 \log_{11} 7$
Therefore, $A = \frac{4}{3} x + 13 \log_{11} 7$
and $B = \frac{3}{2} x + 13 \log_{11} 17$
Clearly, A < B hence (B) is the correct answer.

2. (C) Required answer = $[64 \log_{10} 2] + 1$
$= [64 \times 0{\cdot}3010] + 1 = [19{\cdot}264] + 1 = 19 + 1 = 20$

3. (D) $8^{10} = (2^3)^{10} = 2^{30}$
$\therefore$ Required answer = $[30 \log_{10} 2 + 1]$
$= [30 \times 0{\cdot}3010] + 1 = (9{\cdot}03) + 1 = 9 + 1 = 10$

4. (A) $8^{57} = (2^3)^{57} = 2^{171}$
$\therefore$ Required answer = $(171 \log_{10} 2 + 1)$
$= [171 \times 0{\cdot}3010] + 1 = [51{\cdot}4710] + 1$
$= 51 + 1 = 52$

5. (B) $\because \quad x = \frac{25}{4} = 6\frac{1}{4}$
and $y = \frac{36}{5} = 7\frac{1}{5}$
$\therefore \quad x < y$

6. (C) $\because \quad x = \frac{4}{4-1} = \frac{4}{3}$
$y = \frac{5}{5-1} = \frac{5}{4}$
$\therefore \quad x > y$

7. (B) $\because \quad \log_a x = \frac{\log_{ab} x}{\log_{ab} a}$
$\therefore$ The given expression $= \frac{\log_{ab} x}{\log_{ab} a} - \log_a b$
$= \frac{1}{\log_{ab} a} - \log_a b = \log_a ab - \log_a b = \log_a \frac{ab}{b}$
$= \log_a a = 1$

8. (A) Given Exp. $= \frac{\log 3}{\log 2} \times \frac{\log 2}{\log 3} \times \frac{\log 4}{\log 3} \times \frac{\log 3}{\log 4} = 1$

9. (B) $\because \quad a^x = b \Rightarrow \log_a b = x$
$\Rightarrow \quad b^y = c \Rightarrow \log_b c = y$
$\Rightarrow \quad c^z = a \Rightarrow \log_c a = z$
$\therefore \quad x \times y \times z = \log_a b \times \log_b c \times \log_c a = 1$

10. (B) $\log_x y = 100, \log_2 x = 10$
$\Rightarrow \frac{\log y}{\log x} = 100$ and $\frac{\log x}{\log 2} = 10$
$\Rightarrow \frac{\log y}{\log 2} = 100 \times 10 = 1000$
$\Rightarrow \log_2 y = 1000 \therefore y = 2^{1000}$

11. (D) $\because \quad \log_x 4 = \frac{\log 4}{\log x} = \frac{2}{5}$
$\Rightarrow \quad \frac{2 \log 2}{\log x} = \frac{2}{5}$
$\Rightarrow \quad \log x = 5 \log 2 = \log 2^5 = \log 32$
$\therefore \quad x = 32$

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12. (A) $\because \quad \log_{12} 27 = a$

$\Rightarrow \quad \frac{\log 27}{\log 12} = a$

$\Rightarrow \quad a \log 12 = \log 3^3$

$\Rightarrow \quad a \log (3 \times 4) = 3 \log 3$

$\Rightarrow \quad a [\log 3 + \log 4] = 3 \log 3$

$\Rightarrow \quad a \log 4 + a \log 3 = 3 \log 3$

$\Rightarrow \quad a \log 2^2 = (3 - a) \log 3$

$\Rightarrow \quad 2a \log 2 = (3 - a) \log 3$

$\therefore \quad \frac{\log 2}{\log 3} = \frac{3 - a}{2a} \qquad \ldots (1)$

Now $\log_6 16 = \frac{\log 16}{\log 6} = \frac{\log 2^4}{\log (2 \times 3)} = \frac{4 \log 2}{\log 2 + \log 3}$

$= \frac{4 \frac{\log 2}{\log 3}}{\frac{\log 2}{\log 3} + 1} = \frac{4\left(\frac{3 - a}{2a}\right)}{\frac{3 - a}{2a} + 1} = \frac{4 (3 - a)}{(3 + a)}$

13. (C) $\log_2 10 = \frac{\log 10}{\log 2} = \frac{1}{\log 2} = \frac{1 \cdot 0000}{0 \cdot 3010} = \frac{1000}{301}$

14. (A) Given expression,

$= \log \left(\frac{9}{8} \div \frac{27}{32} \times \frac{3}{4}\right) = \log \left(\frac{9}{8} \times \frac{3}{4} \times \frac{32}{27}\right)$

$= \log 1 = 0$

15. (A) Given Exp. $= \log \frac{75}{16} - 2 \log \frac{5}{9} + \log \frac{32}{343}$

$= \log \frac{25 \times 3}{4 \times 4} - \log \frac{25}{81} + \log \frac{16 \times 2}{81 \times 3}$

$= \log (25 \times 3) - \log (4 \times 4) - \log (25) + \log 81$
$+ \log (16 \times 2) - \log (81 \times 3)$

$= \log 25 + \log 3 - \log 16 - \log 25 + \log 81$
$+ \log 16 + \log 2 - \log 81 - \log 3$

$= \log 2$

16. (B) $\log 5 = \log \frac{10}{2} = \log 10 - \log 2$

$= 1 - 0 \cdot 3010 = 0 \cdot 6990$

17. (A) $\log_{10} 2 \cdot 8 = \log_{10} \frac{28}{10} = \log 28 - \log 10$

$= \log (7 \times 4) - \log 10 = \log 7 + 2 \log 2 - \log 10$

$= 0 \cdot 8451 + 2 \times 0 \cdot 3010 - 1$

$= 0 \cdot 8451 + 0 \cdot 6020 - 1 = 0 \cdot 4471$

18. (C) $\log_{10} 50 = \log_{10} \frac{50 \times 2}{2} = \log 100 - \log 2$

$= \log_{10} 10^2 - \log 2$

$= 2 - 0 \cdot 301 = 1 \cdot 699$

19. (A) Given expression $= \log \left(\frac{a^2 b^2 c^2}{a^2 b^2 c^2}\right) = \log 1 = 0$

20. (A) $\log 8 + \log \left(\frac{1}{8}\right) = \log \left(8 \times \frac{1}{8}\right) = \log 1 = 0$

21. (A) $\log_a x + \log_a (1 + x) = 0$

$\Rightarrow \quad \log_a x (x + 1) = \log_a 1$ (since $\log 1 = 0$)

$\Rightarrow \quad x (x + 1) = 1$

$\therefore \quad x^2 + x - 1 = 0$

22. (A) $\log x + \log \frac{1}{x} = \log x + \log 1 - \log x$

$= \log 1 = 0$

23. (B) $\frac{1}{2} \log_{10} 25 - 2 \log_{10} 3 + \log_{10} 18$

$= \log_{10} (25)^{1/2} - \log_{10} (3)^2 + \log_{10} 18$

$= \log_{10} 5 - \log_{10} 9 + \log_{10} 18$

$= \log_{10} \left(\frac{5 \times 18}{9}\right) = \log_{10} 10 = 1$

24. (C) $\log 90 = 1 \cdot 9542$

$\Rightarrow \quad \log (3^2 \times 10) = 1 \cdot 9542$

$\Rightarrow \quad 2 \log 3 + \log 10 = 1 \cdot 9542$

$\therefore \quad \log 3 = \frac{0 \cdot 9542}{2} = 0 \cdot 4771$

25. (A) Given Exp.

$= \log \left(\frac{57 \times 100}{100}\right) + 3 \log (0 \cdot 57) + \frac{1}{2} \log (0 \cdot 57)$

$= \log (0 \cdot 57) + \log 10^2 + 3 \log (0 \cdot 57)$
$+ \frac{1}{2} \log (0 \cdot 57)$

$= \left(1 + 3 + \frac{1}{2}\right) \log (0 \cdot 57) + 2$ [$\because \log 10^2 = 2$]

$= (4 \cdot 5 \times \bar{1} \cdot 756) + 2 = 4 \cdot 5 \times (-1 + 0 \cdot 756) + 2$

$= 3 \cdot 402 - 4 \cdot 5 + 2$

$= 0 \cdot 902$

26. (B) Exp. $= \log (4 \times \sqrt[3]{63}) = \log [2^2 \times (3 \times 3 \times 7)^{1/3}]$

$= \log 2^2 + \log (3 \times 3 \times 7)^{1/3}$

$= 2 \log 2 + \frac{1}{3} \log (3^2 \times 7)$

$= 2 \log 2 + \frac{1}{3} [\log 3^2 + \log 7]$

$= 2 \log 2 + \frac{2}{3} \log 3 + \frac{1}{3} \log 7$

$= 2x + \frac{2}{3} y + \frac{1}{3} z$

27. (A) $\because \quad (1000)^x = 3$

$\Rightarrow \quad x \log 10^3 = \log 3$

$\Rightarrow \quad 3x = \log 3$

$\therefore \quad x = \frac{\log 3}{3} = \frac{0 \cdot 477}{3} = 0 \cdot 159$

28. (A) $\because \quad 2 \log_4 x = 1 + \log_4 (x - 1)$

$\Rightarrow \quad \log_4 x^2 = \log_4 4 + \log_4 (x - 1)$

$\Rightarrow \quad x^2 = 4 (x - 1)$

$\Rightarrow \quad x^2 - 4x + 4 = 0$

$\Rightarrow \quad (x - 2)^2 = 0$

$\therefore \quad x = 2$

29. (A) $\because \quad 5^{5 - x} = 2^{x - 5}$

$\Rightarrow \quad 5^{5 - x} = 2^{-(5 - x)}$

$\Rightarrow \quad (5 - x) \log 5 = -(5 - x) \log 2$

$\Rightarrow \quad (5 - x) \log 5 + (5 - x) \log 2 = 0$

$\Rightarrow \quad (5 - x) \{\log 5 + \log 2\} = 0$

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$\Rightarrow \quad (5-x)\left\{\log\frac{10}{2}+\log 2\right\} = 0$

$\Rightarrow \quad (5-x)\{\log 10-\log 2+\log 2\} = 0$

$\Rightarrow \quad 5-x = 0$

$\therefore \quad x = 5$

30. (D) $\because \quad \log_{2^3} x^1+\log_{2^2} x^1+\log_2 x = 11$

$\Rightarrow \quad \frac{1}{3}\log_2 x+\frac{1}{2}\log_2 x+\log_2 x = 11$

$\Rightarrow \quad \left(\frac{1}{3}+\frac{1}{2}+1\right)\log_2 x = 11$

$\Rightarrow \quad \frac{11}{6}\log_2 x = 11$

$\Rightarrow \quad \log_2 x = \frac{11\times 6}{11}=6$

$\therefore \quad x = 2^6 = 64$

31. (B) Exp. $= \log_{0\cdot 125} 125 = \log_{2^{-3}} 5^3 = -\frac{3}{3}\log_2 5$

$= -\log_2 5$

$\because \quad 10^{0\cdot 3010} = 2$

$\Rightarrow \quad \log_{10} 2 = 0\cdot 3010$

$\because \quad \log_{10} 5 = \log_{10}\frac{10}{2} = \log_{10} 10-\log_{10} 2$

$= 1-0\cdot 3010 = 0\cdot 6990$

$\therefore \quad -\log_2 5 = -\frac{\log_{10}5}{\log_{10}2}=-\frac{0\cdot 6990}{0\cdot 3010}=-\frac{699}{301}$

32. (A) Exp. $= \log_{0\cdot 125} 64 = \log_{2^{-3}} 2^6$

$= \frac{6}{(-3)}\log_2 2 = -2\ [\because \log_2 2 = 1]$

33. (C) Exp. $= \log_{32} 2^8+\log_{243} 3^7-\log_{36} 1296$

$= \log_{2^5} 2^8+\log_{3^5} 3^7-\log_{36} 36^2$

$= \frac{8}{5}\log_2 2+\frac{7}{5}\log_3 3-2\log_{36} 36$

$= \frac{8}{5}+\frac{7}{5}-2 = 1$

34. (B) Exp. $= \log_{49} 16807-\log_9 27$

$= \log_{7^2} 7^5-\log_{3^2} 3^3 = \frac{5}{2}\log_7 7-\frac{3}{2}\log_3 3$

$= \frac{5}{2}-\frac{3}{2} = 1$

35. (C) $\log_{3^2} 3^4-\log_{2^2} 2^5 = \frac{4}{2}-\frac{5}{2}=-\frac{1}{2}$

36. (A)

37. (D) $\log_{10} xy = z$

$\Rightarrow \quad xy = 10^z$

$\Rightarrow \quad x = \frac{10^z}{y}$

38. (B) Let $\log_{-1/3} 81 = x$

$\Rightarrow \quad 81 = \left(-\frac{1}{3}\right)^x$

$\Rightarrow \quad 3^4 = \left(-\frac{1}{3}\right)^x = 3^{-x}$

$\therefore \quad x = -4$

39. (B) If $\log_{10}\{\log_{10}[\log_{10}(\log_{10} x)]\} = 0$

$\Rightarrow \quad \log_{10}\{\log_{10}(\log_{10} x)\} = 1$

$\Rightarrow \quad \log_{10}(\log_{10} x) = 10$

$\Rightarrow \quad \log_{10} x = 10^{10}$

$\therefore \quad x = 10^{10^{10}}$

40. (A) Exp. $= (25)\log_5 4 = 5^2\log_5 4$

$= 5\log_5 4^2$

$= 16$

41. (B) Exp. $= \log_{10} 10^{-6} = -6$

42. (A) Exp. $= \log_{10} 10^{-5} = -5$

43. (A) $\log_6\log_5 15625 = \log_6\log_5 (5)^6$

$= \log_6 6(\log_5 5) = 1$

44. (B) $\because \quad \log_{10^4} x = -\frac{1}{4}$

$\Rightarrow \quad x = (10^4)^{-\frac{1}{4}}$

$= \frac{1}{10}$

45. (A) $\because \quad \log_x\left(\frac{16}{25}\right) = -\frac{1}{2}$

$\Rightarrow \quad \frac{16}{25} = (x)^{-1/2} = \frac{1}{x^{1/2}}$

$\therefore \quad x = \frac{625}{256}$

46. (B) $\log_2\left(\frac{1}{64}\right) = \log_2 1-\log_2 2^6$

$= 0-6 = -6$

47. (A) $\because \quad \log_a 3 = \frac{1}{3}$

$\Rightarrow \quad 3 = (a)^{1/3}$

$\Rightarrow \quad a = 27$

48. (B) $\log_{10} x = 7$

then $x = 10^7$

49. (C) $\because \quad p^x = q$

$\Rightarrow \quad \log_p p^x = \log_p q$

$\Rightarrow \quad x\log_p p = \log_p q$

$\therefore \quad x = \log_p q \qquad (\because \log_p p = 1)$

50. (C) $\log_{10} 5 = \log_{10}\left(\frac{10}{2}\right)$

$= \log_{10} 10-\log_{10} 2$

$= 1-0\cdot 3010$

$= 0\cdot 6990$

51. (A) $\because \quad \log\tan 45 = 0$

Hence, Whole expression = (something) $\times$ zero

52. (A)

53. (B) $\log_{10}(10^3.\ 10x) = \log_{10} 10^3+\log_{10}(10x)$

$= 3+2\cdot 7532$

$= 5\cdot 7532$

54. (B) If $\frac{\log 125}{\log 5} = x$

then $x = \frac{3\log 5}{\log 5} = 3$

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55. (A) $\because \quad \log_5\left(\frac{x^2+x}{x}\right) = 2$

$\Rightarrow \quad \log_5 (x+1) = 2$

$\Rightarrow \quad x+1 = 25$

$\therefore \quad x = 24$

56. (D) $(\log_5 3) \times \log_3 5^4 = \frac{\log 3}{\log 5} \times 4 \frac{\log 5}{\log 3}$

$= 4$

57. (B) $\log_9 27 - \log_{27} 9 = \log_9 27 - \frac{1}{\log_9 27}$

But $\log_9 27 = \log_9 (9 \times 3)$

$= \log_9 9 + \log_9 3$

$= \log_9 9 + \log_9 9^{1/2}$

$= 1 + \frac{1}{2} = \frac{3}{2}$

$\therefore \quad \log_9 27 - \log_{27} 9 = \frac{3}{2} - \frac{2}{3}$

$= \frac{9-4}{6}$

$= \frac{5}{6}$

Short-cut Method :

Given Exp. $= \log_9 27 - \log_{27} 9$

$= \frac{\log 27}{\log 9} - \frac{\log 9}{\log 27}$

$= \frac{3 \log 3}{2 \log 3} - \frac{2 \log 3}{3 \log 3}$

$= \frac{3}{2} - \frac{2}{3} = \frac{5}{6}$

58. (B) $3^{-1/2} \log_3 9 = 3 \log_3 9^{-1/2}$

$= 9^{-1/2} = \frac{1}{3}$

59. (B) $\because \quad 10^x = \frac{1730}{1000}$

$\therefore \quad \log 10^x = \log_{10} 1730 - \log_{10} 1000$

$\Rightarrow \quad x = 3{\cdot}2380 - 3$

$= 0{\cdot}2380$

60. (A) $\because \log a, \log b, \log c$ are in A.P. Then,

$\Rightarrow \quad \log b - \log a = \log c - \log b$

$\Rightarrow \quad \log \frac{b}{a} = \log \frac{c}{b}$

$\Rightarrow \quad \frac{b}{a} = \frac{c}{b}$

$\Rightarrow \quad b^2 = ac$

$\therefore \quad a, b, c$ are in G.P.

61. (B) We have r = Rate of increase

$= \frac{52}{1000} \times 100$

$= 5{\cdot}2, n = 5, P_0 = 265000$

$\because \quad P = 265000 \left(1 + \frac{5{\cdot}2}{100}\right)^5$

$\Rightarrow \quad \log P = \log 265000 + 5 (\log 105{\cdot}2 - \log 100)$

$= 5{\cdot}4232 + 5 (2{\cdot}0220 - 2)$

$= 5{\cdot}4232 + 0{\cdot}1100$

$= 5{\cdot}5332$

$\therefore \quad P = \text{antilog } (5{\cdot}5332) = 341400$

62. (C) $\because \quad 3000 = 2000 \left(1 + \frac{r}{200}\right)^6$

$\Rightarrow \quad \frac{3}{2} = \left(1 + \frac{r}{200}\right)^6$

$\Rightarrow \quad 1 + \frac{r}{200} = \left(\frac{3}{2}\right)^{1/6}$

$\Rightarrow \quad \log \left(1 + \frac{r}{200}\right) = \frac{1}{6} (\log 3 - \log 2)$

$\Rightarrow \quad \log \left(1 + \frac{r}{200}\right) = \frac{1}{6} (0{\cdot}4771 - {\cdot}3010)$

$= 0{\cdot}02935$

$\Rightarrow \quad \left(1 + \frac{r}{200}\right) = \text{antilog } (\cdot 02935)$

$\Rightarrow \quad 1 + \frac{r}{200} = 1{\cdot}070 = 1 + \frac{7}{100}$

$\therefore \quad r = 14\%$

63. (A) $\because \quad A = 12{,}000 \left(1 + \frac{12}{100}\right)^{10}$

$= 12000 \left(\frac{28}{25}\right)^{10}$

$\Rightarrow \quad \log A = \log 12000 + 10 [\log 28 - \log 25]$

$\Rightarrow \quad \log A = 4{\cdot}0792 + 10 (1{\cdot}4472 - 1{\cdot}3979)$

$= 4{\cdot}0792 + 0{\cdot}493$

$= 4{\cdot}5722$

$\therefore \quad A = \text{antilog } 4{\cdot}5722 = 37342$

C. I. $= 37342 - 12000 = 25342$

$\simeq 25350$

64. (B)

65. (C) $\because \quad x = 2^{64}$

$\Rightarrow \quad \log x = \log_2 {}^{64}$

$\Rightarrow \quad \log x = 64 \log 2$

$= 64 \times {\cdot}3010 = 19{\cdot}264$

$\therefore$ No. of digits $= 19 + 1 = 20$

66. (A) Let $x = \sqrt[5]{42{\cdot}5}$

then $\log x = \log (42{\cdot}5)^{1/5}$

$= \frac{1}{5} \log 42{\cdot}5$

$= \frac{1}{5} \times (1{\cdot}6304) = 0{\cdot}3260$

$\therefore \quad x = \text{antilog } (0{\cdot}3260) = 2{\cdot}1187$

67. (A) Same as Q. 66.

68. (A) $\frac{\log_a n}{\log_{ab} n} = \frac{\frac{\log n}{\log a}}{\frac{\log n}{\log (a.b)}}$

$= \frac{\log (a.b)}{\log a}$

$= \frac{\log a + \log b}{\log a}$

$= 1 + \frac{\log b}{\log a} = 1 + \log_a b$

69. (D)

70. (A)

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H. C. F. & L. C. M.

Factors and Multiples—If a number x divides another number y exactly, we say that x is a factor of y. Also in this case y is called a multiple of x.

Highest Common Factor (H. C. F. or G. C. D. or G. C. M.)—The H. C. F. of two or more than two numbers is the greatest number that divides each one of them exactly.

The Highest Common Factor is also known as Greatest Common Divisor or Greatest Common Measure.

H. C. F. by Factorization—Express each of the given numbers as the product of prime factors. Now, choose common factors and take the product of these factors to obtain the required H. C. F.

Examples

Q. 1. Find the smallest number exactly divisible by 12, 15, 20 and 27.

Solution : Required number = L. C. M. of 12, 15, 20 and 27 = 540.

Q. 2. Find the largest number which can exactly divide 513, 783 and 1107.

Solution : Required number H. C. F. of 513, 783 and 1107 = 27.

Q. 3. Three drums contains 36 litres, 45 litres and 72 litres of oil. What biggest measure can measure all the different quantities exactly ?

Solution : Biggest measure

= (H. C. F. of 36, 45, 72) litres

= 9 litres.

Q. 4. The H. C. F. of two numbers is 4 and their L. C. M. is 576. If one of the numbers is 64, find the other number.

Solution : The other number

$$= \frac{\text{H. C. F.} \times \text{L. C. M.}}{\text{Given number}}$$

$$= \frac{4 \times 576}{64} = 36.$$

Q. 5. Find the least number which when divided by 6, 7, 8, 9 and 12 leaves the same remainder 2 in each case.

Solution : Required number

= (L. C. M. of 6, 7, 8, 9 and 12) + 2

= (504 + 2) = 506.

Q. 6. Reduce $\frac{777}{1147}$ to lowest terms.

Solution : H. C. F. of 777 and 1147 is 37.

On dividing the numerator and denominator by 37, we get

$$\frac{777}{1147} = \frac{21}{31}$$

Exercise

1. Which of the following fractions is the greatest of all ?
$\frac{7}{8}, \frac{6}{7}, \frac{4}{5}, \frac{5}{6}$ —
(A) $\frac{6}{7}$ (B) $\frac{4}{5}$
(C) $\frac{5}{6}$ (D) $\frac{7}{8}$

2. L. C. M. of $\frac{2}{3}, \frac{4}{9}, \frac{5}{6}$ and $\frac{7}{12}$ is—
(A) $\frac{1}{18}$ (B) $\frac{1}{36}$
(C) $\frac{35}{9}$ (D) $\frac{140}{3}$

3. L. C. M. of $\frac{3}{4}, \frac{6}{7}, \frac{9}{8}$ is—
(A) 18 (B) 3
(C) $\frac{3}{56}$ (D) $\frac{9}{28}$

4. H. C. F. of $\frac{1}{2}, \frac{3}{4}, \frac{5}{6}, \frac{7}{8}, \frac{9}{10}$ is—
(A) $\frac{1}{2}$ (B) $\frac{1}{10}$
(C) $\frac{9}{120}$ (D) $\frac{1}{120}$

5. H. C. F. of $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}$ is—
(A) 1 (B) 12
(C) $\frac{4}{5}$ (D) $\frac{1}{60}$

6. L. C. M. of 3^3, 4, 4^2 and 3 is—
(A) 12
(B) 48
(C) 432
(D) None of these

7. L. C. M. of 22, 54, 108, 135 and 198 is—
(A) 330 (B) 1980
(C) 5940 (D) 11880

8. L. C. M. of 87 and 145 is—
(A) 870 (B) 1305
(C) 435 (D) 1740

9. Which of the following is a pair of co-primes ?
(A) (14, 35) (B) (18, 25)
(C) (31, 93) (D) (32, 62)

10. H. C. F. of 2^3, 3^2 and 15 is—
(A) 2^3 (B) 3^2
(C) 1 (D) 360

11. H. C. F. of 42, 63 and 140 is—
(A) 14 (B) 9
(C) 21 (D) 7

12. H. C. F. of 1485 and 4356 is—
(A) 189 (B) 89
(C) 99 (D) 83

13. $\frac{1095}{1168}$ in simplest form is—
(A) $\frac{13}{16}$ (B) $\frac{15}{16}$
(C) $\frac{17}{26}$ (D) $\frac{25}{26}$

14. $\frac{561}{748}$ when reduced to lowest terms is—
(A) $\frac{13}{14}$ (B) $\frac{3}{4}$
(C) $\frac{11}{14}$ (D) $\frac{23}{24}$

15. The product of two numbers is 4928. If 8 be their H. C. F. find how many pairs of such numbers—
(A) 3 (B) 4
(C) 2 (D) 1

16. Among how many children may 429 mangoes and also 715 oranges be equally divided ?
(A) 143 (B) 15
(C) 18 (D) 153

17. In a long division sum the successive remainders from the first to the last were 312, 383 and 1. The dividend be 86037, find the divisor and the quotient—
(A) 548, 157
(B) 274, 1

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(C) 1096, 158
(D) None of these

18. Find the number lying between 900 and 1000 which when divided by 38 and 57, leaves in each case a remainder 23—
(A) 935 (B) 945
(C) 925 (D) 955

19. Find the sum of three numbers which are prime to one another such that the product of the first two is 437 and that of the last two is 551—
(A) 91 (B) 81
(C) 71 (D) 70

20. Find the two numbers whose L. C. M. is 1188 and H. C. F. is 9—
(A) 27, 396
(B) 9, 27
(C) 36, 99
(D) Data inadequate

21. What least number must be subtracted from 1936, so that the remainder when divided by 9, 10, 15 will leave in each case the same remainder 7 ?
(A) 46 (B) 53
(C) 39 (D) 44

22. In a school 391 boys and 323 girls have been divided into the largest possible equal classes. So that there are equal number of boys and girls in each class. What is the number of classes ?
(A) 23 girls classes, 19 boys classes
(B) 23 boys classes, 19 girls classes
(C) 17 boys classes, 23 girls classes
(D) 23 boys classes, 17 girls classes

23. An inspector of schools wishes to distribute 84 balls and 180 bats equally among a number of boys. Find the greatest number receiving the gift in this way—
(A) 14 (B) 15
(C) 16 (D) 12

24. In finding H. C. F. of two numbers, the last divisor is 49 and the quotients 17, 3, 2. Find the numbers—
(A) 343, 5929
(B) 434, 2959
(C) 433, 5299
(D) Can't be determined

25. In a long divison sum the dividend is 529565 and the successive remainders from the first to the last are 246, 222, 542. Find the divisor and the quotient—
(A) 561, 943, (B) 669, 493
(C) 516, 943 (D) 561, 493

26. The product of two numbers is 7168 and their H. C. F. is 16. Find the sum of all possible numbers—
(A) 640
(B) 860
(C) 460
(D) Data inadequate

27. The sum of two numbers is 1215 and their H. C. F. is 81. How many pairs of such numbers can be formed ? Find them—
(A) 1 (B) 2
(C) 3 (D) 4

28. The numbers 11284 and 7655 when divided by a certain number of three digits, leave the same remainder. Find the number and the remainder—
(A) 119, 15 (B) 191, 15
(C) 192, 52 (D) 191, 51

29. 21 mangoes trees, 42 apples trees and 56 orange trees have to be planted in rows such that each row contains the same number of trees one variety only. Minimum number of rows in which the above trees may be planted is—
(A) 15 (B) 17
(C) 3 (D) 20

30. Five bells begin to toll together and toll respectively at intervals of 6, 7, 8, 9 and 12 seconds. How many times they will toll together in one hour, excluding the one at the start ?
(A) 3 (B) 5
(C) 7 (D) 9

31. The least perfect square number which is divisible by 3, 4, 5, 6 and 8 is—
(A) 900 (B) 1200
(C) 25 (D) 3600

32. The greatest possible length which can be used to measure exactly the lengths 7m, 3m 85cm, 12m 95 cm, is—
(A) 15 cm (B) 25 cm
(C) 35 cm (D) 42 cm

33. Three different containers contain different qualities of mixtures of milk and water, whose measurements are 403 kg, 434 kg and 465 kg. What biggest measure must be there to measure all the different quantities exactly ?
(A) 1 kg (B) 7 kg
(C) 31 kg (D) 41 kg

34. Three pieces of timber 42 m, 49 m and 63 m long have to be divided into planks of the same length. What is the greatest possible length of each plank ?
(A) 7 m (B) 14 m
(C) 42 m (D) 63 m

35. The largest number which exactly divides 210, 315, 147 and 168 is—
(A) 3 (B) 7
(C) 21 (D) 4410

36. The sum of two numbers is 216 and their H. C. F. is 27. The numbers are—
(A) 54, 162
(B) 108, 108
(C) 27, 189
(D) None of these

37. The H. C. F. of two numbers is 12 and their difference is also 12. The numbers are—
(A) 66, 78, (B) 70, 82
(C) 94, 106 (D) 84, 96

38. The product of two-digit numbers is 2160 and their G. C. M. is 12. The numbers are—
(A) 72, 30
(B) 36, 60
(C) 96, 25
(D) None of these

39. The H. C. F. of two numbers is 16 and their L. C. M. is 160. If one of the numbers is 32, then the other numbers is—
(A) 48 (B) 80
(C) 96 (D) 112

40. The product of two numbers is 1600 and their H. C. F. is 5. The L. C. M. of the numbers is—
(A) 320 (B) 1605
(C) 1595 (D) 8000

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41. H. C. F. of three numbers is 12. If they be in the ratio 1 : 2 : 3, the numbers are—
(A) 12, 24, 36 (B) 10, 20, 30
(C) 5, 10, 15 (D) 4, 8, 12

42. About the number of pairs which have 16 as their H. C. F. and 136 as their L. C. M. We can definitely say that—
(A) Only one such pair exists
(B) Only two such pair exists
(C) Many such pairs exists
(D) No such pair exists

43. L. C. M. of $\frac{2}{7}, \frac{3}{14}$ and $\frac{5}{3}$ is—
(A) 45 (B) 35
(C) 30 (D) 25

44. Which of the fractions $\frac{1}{2}, \frac{3}{7}, \frac{3}{5}, \frac{4}{9}$ is the smallest ?
(A) $\frac{4}{9}$ (B) $\frac{3}{5}$
(C) $\frac{3}{7}$ (D) $\frac{1}{2}$

45. Which of the following is in descending order ?
(A) $\frac{3}{5}, \frac{5}{7}, \frac{7}{9}$ (B) $\frac{7}{9}, \frac{5}{7}, \frac{3}{5}$
(C) $\frac{5}{7}, \frac{7}{9}, \frac{3}{5}$ (D) $\frac{7}{9}, \frac{3}{5}, \frac{5}{7}$

46. Which of the following is in ascending order ?
(A) $\frac{5}{7}, \frac{7}{8}, \frac{9}{11}$ (B) $\frac{5}{7}, \frac{9}{11}, \frac{7}{8}$
(C) $\frac{7}{8}, \frac{5}{7}, \frac{9}{11}$ (D) $\frac{9}{11}, \frac{7}{8}, \frac{5}{7}$

47. The smallest number which is divisible by 12, 15, 20 and is a perfect square is—
(A) 400 (B) 900
(C) 1600 (D) 3600

48. The least number of square tiles required to pave the ceiling of room 15 m 17 cm long and 9 m 2 cm broad is—
(A) 656 (B) 738
(C) 814 (D) 902

49. The largest number which divides 77,147 and 252 to leave the same remainder in each case is—
(A) 9 (B) 15
(C) 25 (D) 35

50. The greatest number which can divide 1354, 1866 and 2762 leaving the same remainder 10 in each case is—
(A) 64 (B) 124
(C) 156 (D) 260

51. When in each box 5 or 6 dozens of oranges were packed three dozens were remaining. Therefore, bigger boxes were taken to pack 8 or 9 dozens of oranges. However still three dozens oranges remained. What was the least number of dozens of oranges to be packed ?
(A) 216 (B) 243
(C) 363 (D) 435

52. Three persons A, B, C run along a circular path 12 km long. They start their race from the same point and at the same time with a speed of 3 km/hr. 7 km/hr. and 13 km/hr. respectively. After what time will they meet again ?
(A) 12 hrs (B) 9 hrs
(C) 24 hrs (D) 16 hrs

53. Four bells toll at intervals of 6, 8, 12 and 18 minutes respectively. If they start tolling together at 12 a. m. Find after what interval will they toll together and how many times will they toll together in 6 hours ?
(A) 6 times
(B) 5 times
(C) 4 times
(D) Data inadequate

54. Three pieces of timber 24 metres, 28·8 metres and 33·6 metres long have to be divided into planks of the same length. What is the greatest possible length of each plank ?
(A) 8·4 km (B) 4·8 m
(C) 4·5 m (D) 5·4 m

55. Find the least number of square tiles required for terrace 15 m long and 9 m broad—
(A) 841
(B) 714
(C) 814
(D) None of these

56. A merchant has three kinds of wine; of the first kind 403 gallons, of the second 527 gallons and of the third 589 gallons. What is the least number of full casks of equal size in which this can be stored without mixing ?
(A) 21 (B) 29
(C) 33 (D) 31

57. The circumferences of the fore and hind wheels of a carriage are $6\frac{3}{14}$ metres and $8\frac{1}{18}$ metres respectively. At any given moment a chalk mark is put on the point of contact of each wheel with the ground. Find the distance travelled by the carriage so that both the chalkmaks are again on the ground at the same time—
(A) 218 m (B) 217·5 m
(C) 218·25 m (D) 217 m

58. The sum and difference of the L. C. M. and the H. C. F. of two numbers are 592 and 518 respectively. If the sum of two numbers be 296, find the numbers—
(A) 111, 185
(B) 37, 259
(C) Data inadequate
(D) None of these

59. The smallest number, which when divided by 20, 25, 35 and 40 leaves the remainder 14, 19, 29 and 34 respectively is—
(A) 1394 (B) 1404
(C) 1406 (D) 1664

60. The least number, which when divided by 35, 45 and 55 leaves the remainder 18, 28 and 38 respectively, is—
(A) 2468 (B) 3448
(C) 3265 (D) 3482

61. The smallest number, which when diminished by 3, is divisible by 21, 28, 36 and 45 is—
(A) 420 (B) 1257
(C) 1260 (D) 1263

62. The least number, which when divided by 16, 18 and 21 leaves the remainders 3, 5 and 8 respectively, is—
(A) 893 (B) 992
(C) 995 (D) 1024

63. Six bells commence tolling together and toll at intervals of 2, 4,

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6, 8, 10 and 12 seconds respectively. In 30 minutes, how many times do they toll together ?

(A) 4 (B) 10
(C) 15 (D) 16

64. The greatest number of four digits which is divisible by each one of the numbers 12, 18, 21 and 28 is—

(A) 9848 (B) 9864
(C) 9828 (D) 9636

65. The least multiple of 7, which leaves a remainder of 4, when divided by 6, 9, 15 and 18 is—

(A) 74 (B) 94
(C) 184 (D) 364

66. The least number which when divided by 15, 27, 35 and 42, leaves in each case a remainder 7 is—

(A) 1883 (B) 1897
(C) 1987 (D) 2007

67. The largest natural number, which exactly divides the product of any four consecutive natural numbers, is—

(A) 6 (B) 12
(C) 24 (D) 120

68. The measuring rods are 64 cm, 80 cm and 96 cm in length. The least length of cloth that can be measured exact number of times using any one of the above rods is—

(A) 0·96 m (B) 19·20 m
(C) 9·60 m (D) 96·00 m

69. The number of prime factors in $2^{222} \times 3^{333} \times 5^{555}$ is—

(A) 3 (B) 1107
(C) 1110 (D) 1272

70. The total number of prime factors of the product $(8)^{20}$, $(15)^{24}$, $(7)^{15}$ is—

(A) 59 (B) 98
(C) 123 (D) 138

71. The number of prime factors in the expression $(6)^{10} \times (7)^{17} \times (11)^{27}$ is—

(A) 54 (B) 64
(C) 71 (D) 81

72. What least number must be subtracted from 1294 so that the remainder when divided by 9, 11, 13 will leave in each case the same remainder 6 ?

(A) 0 (B) 1
(C) 2 (D) 3

73. The H. C. F. and L. C. M. of two numbers are 44 and 264 respectively. If the first number is divided by 2, the quotient is 44. The other number is—

(A) 33 (B) 66
(C) 132 (D) 264

74. The least number which when divided by 5, 6, 7 and 8 leaves a remainder 3, but when divided by 9 leaves no remainder is—

(A) 1677 (B) 1683
(C) 2523 (D) 3363

75. The greatest number by which if 1657 and 2037 are divided the remainders will be 6 and 5 respectively, is—

(A) 127
(B) 235
(C) 260
(D) 305

76. The traffic lights at three different road crossings change after every 48 sec., 72 sec. and 108 sec. respectively. If they all change simultaneously at 8 : 20 : 00 hrs. then they will again change simultaneously at—

(A) 8 : 27 : 12 hrs.
(B) 8 : 27 : 24 hrs.
(C) 8. 27 : 36 hrs.
(D) 8 : 27 : 48 hrs.

Answers with Hints

1. (D) $\frac{7}{8} = 0{\cdot}875, \frac{6}{7} = 0{\cdot}857, \frac{4}{5} = 0{\cdot}8$ and $\frac{5}{6} = 0{\cdot}833$

Now, $0{\cdot}875 > 0{\cdot}857 > 0{\cdot}833 > 0{\cdot}8$

So, $\frac{7}{8}$ is the greatest.

2. (D) $\text{L.C.M.} = \frac{\text{L. C. M. of 2, 4, 5, 7}}{\text{H. C. F. of 3, 9, 6, 12}} = \frac{140}{3}$

3. (A) $\text{L.C.M.} = \frac{\text{L. C. M. of 3, 6, 9}}{\text{H. C. F. of 4, 7, 8}} = \frac{18}{1} = 18$

4. (D) $\text{H.C.F.} = \frac{\text{H. C. F. of 1, 3, 5, 7, 9}}{\text{L. C. M. of 2, 4, 6, 8, 10}} = \frac{1}{120}$

5. (D) $\text{H.C.F.} = \frac{\text{H. C. F. of 1, 2, 3, 4}}{\text{L. C. M. of 2, 3, 4, 5}} = \frac{1}{60}$

6. (C) $\text{L.C.M.} = 3^3 \times 2^4 = 27 \times 16 = 432$

7. (C)

2	22,	54,	108,	135,	198
3	11,	27,	54,	135,	99
3	11,	9,	18,	45,	33
3	11,	3,	6,	15,	11
11	11,	1,	2,	5,	11
	1,	1,	2,	5,	1

$\therefore$ $\text{L.C.M.} = 2 \times 3 \times 3 \times 3 \times 11 \times 2 \times 5$
$= 5940$

8. (C) H.C.F. of 87 and 145 is 29

$\therefore$ $\text{L.C.M.} = \frac{87 \times 145}{29} = 435$

9. (B) H. C. F. of 18 and 25 is 1
So, 18 and 25 are co-primes.

10. (C) Clearly, 1 is the highest common factor of 2^3, 3^2, and 15.

11. (D) H. C. F. of 42 and 63 is 21.
$\because$ H. C. F. of 21 and 140 is 7.
$\therefore$ H. C. F. of 42, 63 and 140 is 7.

12. (C) H. C. F. of 1485 and 4356 is 99.

13. (B) H. C. F. of 1095 and 1168 is 73.
Dividing Nume. and Denom. by 73
we get $\frac{1095}{1168} = \frac{15}{16}$

14. (B) H. C. F. of 561, 748 is 187.
Dividing Nume. and Denom. by 187
we get $\frac{561}{748} = \frac{3}{4}$

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15. (C) Let the numbers be $8x$ and $8y$, where x and y are prime to each other,

then $8x \times 8y = 4928$

or $64xy = 4928$

$\therefore xy = 77, \therefore x = 1$ or 7 and $y = 77$ or 11

$\therefore$ These two pairs of required numbers will be (8, 77 × 8) or (8 × 7, 8 × 11) that is (8, 616) or (56, 88).

16. (A) The number of children required must be a common factor of 429 and 715. Now the H. C. F. of 429 and 715 is 143.

$\therefore$ The number of children required must be 143 or a factor of 143, but $143 = 13 \times 11$

$\therefore$ The number of children required is 143, 13 or 11.

17. (A) Since the last but one remainder is 383 and the last figure to be affixed to it is 7, the last partial product is 3837 – 1 = 3836.

Similarly, the other partial products will be 2740 and 548

```
548) 86037 (157
     548
     ----
     3123
     2740
     ----
     3837
     3836
     ----
        1
```

The H. C. F. of these three partial products = 548

$\therefore$ The divisor = 548 or a factor of 548. But the divisor must be greater than each of the partial remainders 312, 383 and 1.

$\therefore$ The divisor is 548. Hence the quotient is 157.

18. (A) The least common multiple of 38 and 57 is 114 and the multiple which is between 900 and 1000 is 912.

Now, 912 + 23 *i.e.*; 935 lies between 900 and 1000 and when divided by 38 and 57 leaves in each case 23 as the remainder. Therefore, 935 is number required.

19. (C) From the question we see that the second number is a common factor of the two products and since the numbers are prime to one another. It is their H. C. F. and is, therefore, 19.

$\therefore$ The first number = 437 ÷ 19 = 23

and the third number = 551 ÷ 19 = 29

Hence, the numbers are 23, 19 and 29

$\therefore$ Sum = 23 + 19 + 29

= 71.

20. (A) Let the two numbers be $9a$ and $9b$ where a and b are two numbers prime to each other. The L.C.M. of $9a$ and $9b$ is $9ab$.

$\therefore 9ab = 1188$

$\therefore ab = 132$

Now, the possible pairs of factors of 132 are 1×132, 2×66, 3×44, 6×22, 11×12 of these pairs (2, 66) and (6, 22) are not prime to each other and, therefore, not admissible.

Hence the admissible pairs are

1, 132, 3, 44 : 4, 33, 11, 12

$\therefore a = 1, b = 132$; $a = 3, b = 44$, $a = 4, b = 33$,

$a = 11, b = 12$

Hence, the required numbers are $9, 9 \times 132$; 9×3, 9×44; 9×4, 9×33; 9×11, 9×12

or, 9, 1188, 27, 396, 36, 297, 99, 108.

21. (C) The L. C. M. of 9, 10, 15 = 90

On dividing 1936 by 90, the remainder = 46

But a part of this remainder = 7

Hence, the two numbers = 46 – 7 = 39.

22. (B) The largest possible number of persons in a class is given by the H.C.F. of 391 and 323 *i.e.* 17

$\therefore$ No. of classes of boys $= \frac{391}{17} = 23$

and No. of classes of girls $= \frac{323}{17} = 19$.

23. (D) Find the H.C.F. of 84 and 180, which is 12 and this is the required answer.

24. (A) $\because$ The last divisor = 49 and quotient = 2

$\therefore$ dividend = $49 \times 2 = 98$

```
343) 5929 (17
      98) 343 (3
          49) 98 (2
              ×
```

Now, divisor = 98, quotient = 98 × 3 + 49 = 343

Again divisor = 343, quotient = 17

and remainder = 98

$\therefore$ dividend = $343 \times 17 + 98 = 5929$

Hence, the required numbers are 343, 5929.

25. (A) On subtracting the remainders 246, 222, 542 from the numbers giving rise to them, the successive partial products will be found to be 5049, 2244, 1683.

```
   ) 529565 (
     2466
     ----
     2225
     ----
      542
```

Hence, the divisor must be a common factor of these three partial product.

Now, 561 is their H.C.F. and no smaller factor (for example 51) will serve the purpose, since 5049 ÷ 51 = 99 a two-digit number which is absurd.

$\therefore$ The divisor = 561 and the quotient = 943.

26. (A) Let the numbers be $16a$ and $16b$, where a and b are two numbers prime to each other.

$\therefore 16a \times 16b = 7168$

$\therefore ab = 28$

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Now, the pairs of numbers whose product is 28, are (28, 1); (14, 2), (7, 4)

14 and 2 which are not prime to each other should be rejected.

Hence, the required numbers are

$28 \times 16, 1 \times 16, 7 \times 16, 4 \times 16$

or 448, 16, 112, 64

Hence, the required answer

$= 448 + 16 + 112 + 64 = 640.$

27. (D) Let the numbers be $81a$ and $81b$ where a and b are two numbers prime to each other.

$\therefore \quad 81a + 81b = 1215$

$\therefore \quad a + b = \frac{1215}{81} = 15$

Now, find two numbers, whose sum is 15, the possible pairs are (14, 1), (13, 2), (12, 3), (11, 4), (10, 5), (9, 6), (8, 7) of these the only pairs of numbers that are prime to each other are (14, 1), (13, 2), (11, 4) and (8, 7).

Hence, the required numbers are

$(14 \times 81, 1 \times 81); (13 \times 81, 2 \times 81); (11 \times 81, 4 \times 81); (8 \times 81, 7 \times 81)$

or (1134, 81); (1053, 162); (891, 324); (648, 567)

So, there are four such pairs.

28. (B) The required number must be a factor of (11284 – 7655) or 3692.

Now, $3692 = 19 \times 191$

$$\begin{array}{r} 191)\ 7655\ (40 \\ \underline{764} \\ 15 \end{array}$$

$\therefore$ 191 is the required number and 15 is the remainder.

29. (B) H.C.F. of 21, 42, 56 = 7

Number of rows of mango trees, apple trees and orange trees are $\frac{21}{7} = 3, \frac{42}{7} = 6$ and $\frac{56}{7} = 8$

$\therefore$ Required number of rows = (3 + 6 + 8) = 17

30. (C) L.C.M. of 6, 7, 8, 9, 12 is 504

So, the bells will toll together after 504 sec.

In hour, they will toll together

$= \left(\frac{60 \times 60}{504}\right)$ times

$= 7$ times

31. (D)

3	3, 4, 5, 6, 8
2	1, 4, 5, 2, 8
2	1, 2, 5, 1, 4
	1, 1, 5, – 1, – 2

L.C.M. of 3, 4, 5, 6, 8

$= 3 \times 2 \times 2 \times 5 \times 2 = 120$

Required number

$= (3 \times 3 \times 2 \times 2 \times 5 \times 5 \times 2 \times 2)$

$= 3600$

32. (C) Required length

= (H. C. F. of 700, 385, 1295) cm

= 35 cm.

33. (C) Biggest measure

= (H. C. F. of 403, 434 and 465) kg

= 31 kg

34. (A) Greatest possible length of each plank

= (H. C. F. of 42, 49, 63) m = 7 m

35. (C) The largest number is the H. C. F. of 210, 315, 147 and 168, which is 21.

36. (C) Let the numbers be $27a$ and $27b$

Then, $27a + 27b = 216$

or $27(a + b) = 216$

or $a + b = \frac{216}{27} = 8$

$\therefore$ Values of co-primes (with sum 8) are (1, 7) and (3, 5)

So, the numbers are $(27 \times 1, 27 \times 7)$ *i.e.*, (27, 189)

37. (D) The difference of requisite numbers must be 12 and each one must be divisible by 12, so the numbers are 84, 96.

38. (B) Let the numbers be $12a$ and $12b$

Then, $12a \times 12b = 2160$

or $ab = 15$

$\therefore$ Values of co-primes a and b are (1, 15); (3, 5)

So, the two digit numbers are 12×3 and 12×5 *i.e.*, 36 and 60.

39. (B) 40. (A) 41. (A) 42. (D) 43. (C)

44. (C) 45. (B) 46. (B) 47. (D)

48. (C) Side of each tile

= (H. C. F. of 1517 and 902) cm

= 41 cm

$\therefore$ Required number of tiles

$= \frac{1517 \times 902}{41 \times 41} = 814$

49. (D) Required number is the H. C. F. of (147 – 77), (252 – 147) and (252 – 77) *i.e.*, H. C. F. of 70, 105 and 175. This is 35.

50. (A) 51. (C)

52. (A) Time taken by A, B, C to cover 12 km is 4 hours, $\frac{12}{7}$ hours and $\frac{12}{13}$ hours respectively.

L.C.M. of 4, $\frac{12}{7}$ and $\frac{12}{13} = 12$

So, they will meet again after 12 hours.

53. (A) L.C.M. of 6, 8, 12, 18 min. = 72 min.

= 1 hr. 12 min.

So, they will toll together after 1 hr. 12 min.

In 6 hours, they will toll together

$= 1 + \frac{6 \times 60}{72} = 5 + 1 = 6$ times.

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54. (B) Find the H.C.F. of 2400 cm, 2880 cm and 3360 cm, which is 480 cm.

Hence required answer is 4·8 metres.

55. (D) Tiles are least, when size of each is largest. So, H.C.F. of 1500 cm and 900 cm gives each side of a tile, which is 300 cm.

$\therefore$ Number of tiles $= \left(\frac{1500 \times 900}{300 \times 300}\right) = 15$

56. (D) H.C.F. of 403, 527 and 589 is 31

$\therefore$ Required answer = 31.

57. (B) The required distance in metres

$= \text{L.C.M. of } \frac{87}{14} \text{ and } \frac{145}{18}$

$= \frac{\text{L.C.M. of 87 \& 145}}{\text{H.C.F. of 14 \& 18}} = \left(\frac{435}{2}\right)$ m

= 217·5 m.

58. (A) Let the L.C.M. and H.C.F. be h and k respectively.

$\therefore \quad h + k = 592$ and $h - k = 518$

Consequently $h = \frac{592 + 518}{2} = 555$

and $k = \frac{592 - 518}{2} = 37$

i.e. L.C.M. = 555

and H.C.F. = 37

Now, let the numbers be $37a$ and $37b$, where a and b are co-primes

$\therefore \quad 37a + 37b = 296$

or $a + b = 8$

Possible pairs of co-primes, whose sum is 8 are (1, 7) and (3, 5)

$\therefore$ Possible pairs of numbers are

$(37 \times 1, 37 \times 7)$ or (37×259)

and $(37 \times 3, 37 \times 5)$ or (111, 185)

Now, H.C.F. $\times$ L.C.M. $= 555 \times 37 = 20535$

Also, $111 \times 185 = 20535$

while $37 \times 259 \neq 20535$

Hence, the required number are 111 and 185.

59. (A) Here $(20 - 14) = (25 - 19) = (35 - 29)$

$= (40 - 34) = 6$

$\therefore$ Required number = L.C.M. of $(20, 25, 35, 40) - 6$

$= (1400 - 6) = 1394.$

60. (B) Here, $(35 - 18) = 17, (45 - 28) = 17$

and $(55 - 38) = 17$

$\therefore$ Required number = (L.C.M. of 35, 45, 55) – 17

$= (3465 - 17) = 3448$

61. (D) Required number

$= (\text{L.C.M. of } 21, 28, 36, 45) + 3$

$= (1260 + 3) = 1263.$

62. (C) Here $(16 - 3) = 13, (18 - 5)$

$= 13$ and $(21 - 8) = 13$

So, required number = (L.C.M. of 16, 18, 21) – 13

$= (1008 - 13) = 995$

63. (D) L.C.M. of 2, 4, 6, 8, 10 and 12 is 120

So, the bells will toll together after 120 seconds *i.e.* 2 minutes. In 30 min. they will toll together in $\left(\frac{30}{2}\right) + 1$ times, *i.e.* 16 times.

64. (C) Required number is divisible by the L.C.M. of 12, 18, 21, 28 *i.e.* 252.

Now, greatest number of four digits = 9999

On dividing 9999 by 252, the remainder is 171

$\therefore$ Required number = (9999 – 171) = 9828.

65. (D) Let the least multiple of 7 be x, which when divided by 90 leaves the remainder 4. Then, x is of the form $90k + 4$

Now, the minimum value of k for which $90k + 4$ is divisible by 7 is 4

$\therefore \quad x = 90 \times 4 + 4 = 364.$

66. (B) 67. (C)

68. (C) Required length = L.C.M. of (64, 80, 96) cm

$= 960$ cm = 9·60 m.

69. (C) The number of prime factors in the given product

$= (222 + 333 + 555) = 1110.$

70. (C) Since 2, 3, 5, 17 are prime numbers and the given expression is $(2^3)^{20} \times (3 \times 5)^{24} \times (17)^{15}$ *i.e.* $2^{60} \times 3^{24} \times 5^{24} \times 17^{15}$, so the total number of prime factors in the given expression is $(60 + 24 + 24 + 15) = 123$.

71. (B) Since 2, 3, 7, 11 are prime numbers and the given expression is $2^{10} \times 3^{10} \times 7^{17} \times 11^{27}$, so the number of prime factors in the given expression is $(10 + 10 + 17 + 27) = 64$.

72. (B) L. C. M. of 9, 11, 13 is 1287

On dividing 1294 by 1287, the remainder is 7

$\therefore$ 1 must be subtracted from 1294, so that 1293 when divided by 9, 11, 13 leaves in each case the same remainder 6.

73. (C) First number $= 2 \times 44 = 88$

Second number $= \frac{44 \times 264}{88} = 132.$

74. (B) L. C. M. of 5, 6, 7, 8 is 840

So, the number is of the form $840k + 3$

Least value of k for which $(840k + 3)$ is divisible by 9 is $k = 2$

$\therefore$ Required number $= (840 \times 2 + 3) = 1683.$

75. (A) Required number

= (H. C. F. of 1657 – 6) and (2037 – 5)

= H. C. F. of 1651 and 2032 = 127.

76. (A) Interval of change

= (L. C. M. of 48, 72, 108) sec. = 432 sec.

So, the lights will simultaneously change after every 432 seconds *i.e.* 7 min. 12 sec.

So, the next simultaneous change will take place at 8 : 27 : 12 hrs.

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Series

Important Points/Facts

1. Series—The sum of the corresponding terms of the sequence $u_1, u_2, u_3, \ldots\ldots$ *i.e.*

$u_1 + u_2 + u_3 \ldots$ is called a series.

A series is called a finite or infinite according as the corresponding sequence is finite or infinite.

A series $u_1 + u_2 + u_3 + \ldots\ldots$ is called a positive term series if $u_n > 0$, $\forall_n$.

A series $u_1 - u_2 + u_3 \ldots\ldots$ is called an alternating series if $u_n > 0$, $\forall_n$.

The infinite series $u_1 + u_2 + u_3 + \ldots\ldots + u_n + \ldots\ldots$ is denoted by Σu_n and the sum of the first n terms of the series is denoted by S_n.

$\therefore \quad S_n = u_1 + u_2 + u_3 + \ldots + u_n$

2. Nature of the Series

(i) Convergent—The infinite series $u_1 + u_2 + u_3 + \ldots\ldots$is said to be convergent. If $\lim_{n \to \infty} S_n$

$= \lim_{n \to \infty} (u_1 + u_2 + \ldots + u_n)$ is finite.

(ii) Divergent—The infinite series $u_1 + u_2 + u_3 + \ldots$ is said to be divergent. If $\lim_{n \to \infty} S_n$

$= \lim_{n \to \infty} (u_1 + u_2 + \ldots + u_n)$

$= +\infty$ or $-\infty$.

(iii) Oscillatory—The infinite series $u_1 + u_2 + u_3 + \ldots$is said to be an oscillatory series. If,

$\lim_{n \to \infty} S_n = \lim_{n \to \infty} (u_1 + u_2 + \ldots + u_n)$ is not defined or oscillates between two limits.

(iv) Geometric Series Test—The geometric series $a + ar + ar^2 + \ldots$ is—

(a) Convergent when $|r| < 1$.

(b) Divergent when $r \geq 1$

(c) Oscillatory when $r \leq -1$

Exercise

1. The series : $\frac{x}{1 \cdot 2} + \frac{x^2}{3 \cdot 4} + \frac{x^3}{5 \cdot 6} + \frac{x^4}{7 \cdot 8} + \ldots\ldots$, $x > 0$ is :
   (A) Convergent if $x < 1$
   (B) Divergent if $x > 1$
   (C) Convergent if $x = 1$
   (D) All are true

2. Which of the following series is convergent series ?
   (A) $1 + 2 - 3 + 1 + 2 - 3 + \ldots\ldots$
   (B) $\frac{1}{\sqrt{2}-1} - \frac{1}{\sqrt{3}-1} + \frac{1}{\sqrt{4}-1} - \ldots\ldots$
   (C) $\left(1 + \frac{1}{1}\right)^1 + \left(1 + \frac{1}{2}\right)^2 + \ldots$
   (D) $1 + \frac{1}{2^2} + \frac{2^2}{3^3} + \frac{3^3}{4^4} + \ldots$

3. Which one of the following is false ?
   (A) The series $\frac{2}{1} + \frac{3}{4} + \frac{4}{9} + \frac{5}{16} + \ldots + \frac{n+1}{n^2} + \ldots$ is divergent
   (B) The series $\frac{1}{2} + \frac{\sqrt{2}}{5} + \frac{\sqrt{3}}{10} + \ldots + \frac{\sqrt{n}}{n^2+1} + \ldots$ is convergent
   (C) The series whose nth term is $\sqrt{n^3+1} - \sqrt{n^3}$ is convergent
   (D) The series whose nth term is $\sin \frac{1}{n}$ is convergent

4. Which of the following is true ?
   (A) $1 + \frac{1}{2^{1/3}} + \frac{1}{3^{1/3}} + \frac{1}{4^{1/3}} + \ldots$ is convergent
   (B) $1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \ldots$ is convergent
   (C) $1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \ldots$ is convergent
   (D) $\frac{1}{1^k} + \frac{1}{2^k} + \frac{1}{3^k} + \frac{1}{4^k} + \ldots$ is divergent, if $k > 1$

5. The series : $1 - \frac{1}{3} + \frac{1}{9} - \frac{1}{27} + \ldots$ is :
   (A) Convergent
   (B) Divergent
   (C) Oscillatory
   (D) Not Convergent

6. The series : $\frac{1}{1+2^{-1}} + \frac{2}{1+2^{-2}} + \frac{3}{1+2^{-3}} + \ldots$ is—
   (A) Convergent
   (B) Divergent
   (C) Not convergent
   (D) None of these

7. The series $1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \ldots$ is—
   (A) Convergent
   (B) Divergent
   (C) Oscillatory
   (D) None of these

8. Which of the following is not true ?
   (A) The series $1 - \frac{1}{2} + \frac{1}{2^2} - \frac{1}{2^3} + \ldots$ is convergent
   (B) The series $1 + 2 + 3 + \ldots$ is divergent
   (C) The series $1 - 2 + 3 - 4 + 5 - 6 + \ldots$ is oscillatory
   (D) Only two of the above are true.

9. The series : $1p + \left(\frac{1}{2}\right) p + \left(\frac{1 \cdot 3}{2 \cdot 4}\right)^p + \left(\frac{1 \cdot 3 \cdot 5}{2 \cdot 4 \cdot 6}\right)^p + \ldots\ldots$ is—
   (A) Convergent if $p \geq 2$ and divergent, if $p < 2$
   (B) Convergent if $p > 2$ and divergent, if $p \leq 2$
   (C) Convergent, if $p \leq 2$ and divergent, if $p > 2$
   (D) Convergent, if $p < 2$ and divergent, if $p \geq 2$

10. The series $1 + \frac{\alpha}{1.\beta} x + \frac{\alpha(\alpha+1)^2}{1.2\,\beta(\beta+1)} x^2 + \frac{\alpha(\alpha+1)^2(\alpha+2)^2}{1.2.3\,\beta(\beta+1)(\beta+2)} x^3 + \ldots$ is—
    (A) The series is convergent, if $x < 1$
    (B) The series is divergent, if $x > 1$

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(C) The series is convergent, if $x = 1$ and $\beta > 2\alpha$

(D) The series is divergent, if $x = 1$ and $\beta \leq 2\alpha$

(E) All of the above are true.

11. The series

$1 + \frac{1}{2}x + \frac{\lfloor 2}{3^2}x^2 + \frac{\lfloor 3}{4^3}x^3 + \ldots$ $x > 0$ is—

(A) Convergent, if $x \geq e$

(B) Divergent, if $x \leq e$

(C) Divergent, if $x \geq e$

(D) Convergent, if $x \leq e$

12. The series

$x^2 + \frac{2^2}{3 \cdot 4}x^4 + \frac{2^2 . 4^2}{3.4.5.6}x^6 + \frac{2^2 . 4^2 . 6^2}{3.4.5.6.7.8}x^8 + \ldots$ is—

(A) Convergent, if $x^2 > 1$ and divergent, if $x^2 \leq 1$

(B) Convergent, if $x^2 \leq 1$ and divergent, if $x^2 > 1$

(C) Convergent, if $x^2 < 1$ and divergent, if $x^2 \geq 1$

(D) Convergent, if $x^2 \geq 1$ and divergent, if $x^2 < 1$

13. The series

$1 + \frac{3}{\lfloor 2} + \frac{5}{\lfloor 3} + \frac{7}{\lfloor 4} + \ldots\ldots$ is—

(A) Convergent

(B) Divergent

(C) Not convergent

(D) None of these

14. The series

$1 - \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{3}} - \frac{1}{\sqrt{4}} + \ldots$ is

(A) Conditionally convergent

(B) Absolutely convergent

(C) Divergent

(D) Oscillatory

15. The series $1 - \frac{1}{2} + \frac{1}{4} - \frac{1}{8} + \ldots$ is—

(A) Convergent

(B) Semi-convergent

(C) Absolutely convergent

(D) All of the above

16. The series $\Sigma \frac{1}{n\sqrt{n^2 - 1}}$ is—

(A) Convergent

(B) Divergent

(C) Not convergent

(D) Oscillatory

17. The series $\frac{(\log 2)^2}{2^2} + \frac{(\log 3)^2}{3^2} + \frac{(\log 4)^2}{4^2} + \ldots$ is—

(A) Convergent

(B) Divergent

(C) Oscillatory

(D) Not convergent

18. The series $\Sigma \frac{(n + \sqrt{n})^n}{2^n \, n^{n+1}}$ is—

(A) Convergent

(B) Divergent

(C) Not convergent

(D) None of these

19. The series

$\frac{1^2}{2^2} + \frac{1^2 \, 3^2}{2^2 . 4^2} + \frac{1^2 . 3^2 . 5^2}{2^2 . 4^2 . 6^2} + \ldots$ is

(A) Convergent

(B) Divergent

(C) Oscillatory

(D) Non convergent

20. Which of the following infinite series is convergent ?

(A) $\sum_1^\infty \frac{1}{n^2 - n}$

(B) $\sum_1^\infty \frac{1}{n^{1/2} + n}$

(C) $\sum_1^\infty \frac{1}{n - \sqrt{n}}$

(D) $\sum_1^\infty \frac{n^2}{n^3 - n^2 + 1}$

21. The series $x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \ldots$ is convergent for—

(A) All real values of x

(B) $|x| < 1$ only

(C) $|x| \leq 1$

(D) $-1 < x \leq 1$

22. The series $x^2 + \frac{3}{5}x^4 + \frac{8}{10}x^6 + \frac{15}{17}x^8 + \ldots + \frac{n^2 - 1}{n^2 + 1}x^{2n} + \ldots$ is—

(A) Convergent, if $x^2 \geq 1$ and divergent, if $x^2 < 1$

(B) Convergent, if $x^2 \leq 1$ and divergent, if $x^2 > 1$

(C) Convergent, if $x^2 < 1$ and divergent, if $x^2 \geq 1$

(D) Convergent, if $x^2 > 1$ and divergent, if $x^2 \leq 1$

23. The series $\Sigma \frac{x^n}{x^2 + 1}$ is divergent, if—

(A) $x < 1$

(B) $x = 1$

(C) $x > 1$

(D) None of these

24. The series $\sum_{n=1}^\infty \frac{n}{2^n}$ is—

(A) Oscillatory

(B) Divergent

(C) Convergent

(D) None of these

25. The series $\frac{2}{1^p} + \frac{3}{2^p} + \frac{4}{3^p} + \ldots$ is—

(A) Convergent, if $p \geq 2$ and divergent, if $p < 2$

(B) Convergent, if $p > 2$ and divergent, if $p \leq 2$

(C) Convergent, if $p \leq 2$ and divergent, if $p > 2$

(D) Convergent, if $p < 2$ and divergent, if $p \geq 2$

26. The sum of the series

$\sum_{n=1}^\infty \frac{1}{n(n+1)(n+2)}$ is—

(A) $\frac{1}{2}$ (B) $\frac{1}{4}$

(C) $\log 2 - \frac{1}{2}$ (D) $\log 2 + 1$

27. For the geometric series—

$1 - k + k^2 - k^3 + \ldots\ldots$

Which one of the following is false ?

(A) The series is convergent, if $k = -\frac{1}{3}$

(B) The series is divergent, if $k = -3$

(C) The series is oscillatory, if $k = -1$

(D) The series is divergent, if $k = -2$

28. The series $\frac{1}{1.2} + \frac{2}{3.4} + \frac{3}{5.6} + \ldots$ ∞ is—

(A) Divergent

(B) Convergent

(C) Oscillating

(D) None of these

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29. For a positive term series Σa_n, the ratio test states that—
(A) The series converges, if $\lim_{n \to \infty} \frac{a_{n+1}}{a_n} > 1$
(B) The series converges, if $\lim_{n \to \infty} \frac{a_{n+1}}{a_n} < 1$
(C) The series diverges, if $\lim_{n \to \infty} \frac{a_{n+1}}{a_n} = 1$
(D) None of these

30. If $u_n \geq u_{n+1} \geq 0$ for all n, then for convergence of the series $\sum_{n=1}^{\infty} u_n$ the condition $\lim_{n \to \infty} u_n = 0$ is—
(A) Necessary but not sufficient
(B) Sufficient but not necessary
(C) Necessary and sufficient
(D) None of these

31. The series $1 - 2x + 3x^2 - 4x^3 + \ldots$, where $0 < x < 1$, is—
(A) Convergent
(B) Divergent
(C) Oscillatory
(D) Semi-convergent

32. The series $1 - \frac{1}{2} + 1 - \frac{3}{4} + 1 - \frac{7}{8} + \ldots$ is—
(A) Convergent
(B) Conditionally convergent
(C) Absolutely convergent
(D) Oscillatory

33. Which one of the following is false ?
(A) A series is said to converge if the sequece $\{S_n\}$ of its partial sums is converges
(B) The nature of the series is not affected by adding or removing some terms
(C) If $\lim_{n \to \infty} u_n = 0$, then the series Σu_n is convergent
(D) If from and after some fixed terms $u_n \geq u_n \geq \infty$, then Σv_n is divergent, if Σu_n is divergent.

34. The series $\frac{1}{n (\log n)^p}$ is divergent if—
(A) $p > 1$ (B) $p \geq 1$
(C) $p < 1$ (D) $p \leq 1$

35. The series $\Sigma \frac{(-1)^n}{(n+1)^p}$ is—
(A) Conditionally convergent if $0 < p \leq 1$
(B) Absolutely convergent if $p > 1$
(C) Oscillatory if $p \leq 0$
(D) All (A), (B) and (C) are correct

36. Which of the following series is non absolutely convergent ?
(A) $1 - \frac{1}{2} + \frac{1}{2^2} - \frac{1}{2^3} + \ldots\ldots$
(B) $1 - \frac{1}{2^4} + \frac{1}{3^4} - \frac{1}{4^4} + \ldots\ldots$
(C) $\Sigma (-1)^n \sin \frac{1}{n}$
(D) $\Sigma \frac{(-1)^n}{(n+1)^{\frac{3}{2}}}$

37. Which one of the following is false ?
(A) Absolute Converges $\Rightarrow$ Convergence
(B) A conditionally convergent series cannot be absolute convergent
(C) Convergent $\Rightarrow$ absolute convergence
(D) Convergent series may also be conditionally convergent

38. If x is positive, then the series : $\frac{2}{3}x + \left(\frac{3}{4}\right)^2 x^2 + \left(\frac{4}{5}\right)^3 x^3 + \ldots$ is convergent, if—
(A) $x = 1$
(B) $x < 1$
(C) $x > 1$
(D) None of these

39. The series : $x + x^{1+1/2} + x^{1+1/2+1/3} + x^{1+1/2+1/3+1/4} + \ldots$ is—
(A) Convergent, if $x \geq \frac{1}{e}$
(B) Divergent, if $x \geq \frac{1}{e}$
(C) Convergent, if $x > \frac{1}{e}$
(D) Divergent, if $x \leq \frac{1}{e}$

40. The series $\frac{a}{b} + \frac{a(a+1)}{b(b+1)} + \frac{a(a+1)(a+2)}{b(b+1)(b+2)} + \ldots$ is
(A) Convergent if $b - a < 1$ and divergent, if $b - a \geq 1$
(B) Convergent if $b \leq 1 + 9$ and divergent if $b > 1 + a$
(C) Convergent if $b > 1 + a$ and divergent if $b \leq 1 + a$
(D) Convergent, if $b \geq 1 + a$ and divergent if $b < 1 + a$

41. Both D Alembert's ratio test and Raabe's test are particular cases of—
(A) Kummar's test
(B) Gauss's test
(C) Both Kummar's test and Gauss's test
(D) None of these

42. The alternating series $u_1 - u_2 + u_3 - u_4 + \ldots\ldots$ $(0 < u_n < n)$ is convergent, if—
(A) $u_n < u_{n+1}$ and $u_n \to 0$ as $n \to \infty$
(B) $u_n < u_{n+1}$ and $u_n \to \infty$ as $n \to \infty$
(C) $u_n > u_{n+1}$ and $u_n \to 0$ as $n \to \infty$
(D) $u_n > u_{n+1}$ or $u_n \to \infty$ as $n \to \infty$

43. The series $x + \frac{2^2 x^2}{\lfloor 2} + \frac{3^3 x^3}{\lfloor 3} + \frac{4^4 x^4}{\lfloor 4} + \ldots\ldots$ is convergent, if—
(A) $0 < x < \frac{1}{e}$ (B) $x > \frac{1}{e}$
(C) $\frac{2}{e} < x < \frac{3}{e}$ (D) $\frac{3}{e} < x < \frac{4}{e}$

44. The sum of the alternating harmonic series—
$1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \ldots\ldots$ is
(A) Zero
(B) Infinite
(C) log 2
(D) Not defined as the series is not convergent

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45. The series $\frac{x}{1}+\frac{1}{2}\cdot\frac{x^3}{3}+\frac{1.3}{2.4}\cdot\frac{x^5}{5}+\frac{1.3.5}{2.4.6}\cdot\frac{x^7}{7}+\ldots$ is—
(A) Convergent, if $x^2 > 1$ and divergent, if $x^2 \le 1$
(B) Convergent, if $x^2 \ge 1$ and divergent, if $x^2 < 1$
(C) Convergent, if $x^2 < 1$ and divergent, if $x^2 \ge 1$
(D) Convergent, if $x^2 \le 1$ and divergent, if $x^2 > 1$

46. The series $\Sigma\, n^m x^n$ is convergent if—
(A) $x > 1$ and $x = 1$ when $m < -1$
(B) $x > 1$ and $x = 1$ when $m > -1$
(C) $x < 1$ and $x = 1$ when $m < -1$
(D) $x < 1$ and $x = 1$ when $m > -1$

47. Demorgan and Bertrand's Test for testing the convergence or divergence of a series $\Sigma\, u_n$ of positive terms is applied when …… fails.
(A) Comparison ratio test
(B) Cauchy's root test
(C) Raabe's test
(D) Logarithmic test

48. The series $\Sigma\frac{n^{n^2}}{(n+1)^{n^2}}$ is—
(A) Convergent
(B) Divergent
(C) Cannot determined
(D) Not convergent

49. Which of the following series is not convergent ?
(A) $\frac{1}{\sqrt[2]{2}}+\frac{1}{\sqrt[3]{3}}+\frac{1}{\sqrt[4]{4}}+\ldots$ ad inf.
(B) $1\frac{1}{2}-1\frac{1}{3}+1\frac{1}{4}\ldots$ ad inf.
(C) $\frac{1}{2}-\frac{1}{3}+\frac{1}{4}-\frac{1}{5}+\ldots$ ad inf.
(D) $x+x^2+x^3+\ldots$where $|x|<1$

50. Let $\Sigma\, u_n$ be a series of positive terms and let $\Sigma\frac{1}{d^n}$ be a divergent series of positive terms such that $\lim_{n\to\infty}\left(d_n\frac{u_n}{u_{n+1}}-d_{n+1}\right)=k$, then—
(A) The series is convergent if $k > 0$
(B) The series is divergent if $k \ge 0$
(C) The series is divergent if $k < 0$
(D) Only (A) and (C) are true

Answers with Hints

1. (D) Here $u_n = \frac{x^n}{(2n-1)(2n)}$

and $u_{n+1} = \frac{x^{n+1}}{(2n+1)(2n+2)}$

$\Rightarrow \frac{u_n}{u_{n+1}} = \frac{x^n}{(2n-1)(2n)}\times\frac{(2n+1)(2n+2)}{x^{n+1}}$

$= \frac{(2n+1)(2n+2)}{(2n-1)(2n)}\cdot\frac{1}{x}$

$\therefore \lim_{n\to\infty}\frac{u_n}{u_{n+1}} = \lim_{n\to\infty}\frac{(2n+1)(2n+2)}{(2n-1)(2n)}\cdot\frac{1}{x}$

$= \frac{1}{x}$

Hence, if $\frac{1}{x} > 1$ *i.e.* $x < 1$ the series is convergent and if $\frac{1}{x} < 1$ *i.e.* $x > 1$ the series is divergent.

If $x = 1$, D' Alembert's test fails. In this case by comparison test

$u_n = \frac{1}{(2n-1)(2n)}$ take $v_n = \frac{1}{n^2}$

$\therefore \lim_{n\to\infty} = \frac{u_n}{v_n} = \lim_{n\to\infty}\frac{n^2}{(2n-1)(2n)} = \frac{1}{4}$

which is finite and non-zero auxiliary series $\Sigma v_n = \Sigma\frac{1}{n^2}$ is a p-series, where $p = 2 > 1$.

Therefore, $\Sigma\, v_n$ is convergent. Hence $\Sigma\, u_n$ is also convergent.

$\therefore$ When $x = 1$, the series is convergent.

Hence all (A) (B) and (C) are true

$\therefore$ The correct answer is (D)

2. (B)
(A) The given series is

$\Sigma\, u_n = 1+2-3+1+2-3+\ldots\ldots$

$\Rightarrow S_{3n} = (1+2-3)+(1+2-3)+(1+2-3)+\ldots+(1+2-3) = 0$

$\therefore \lim_{n\to\infty} S_{3n} = 0$

$\Rightarrow S_{3n+1} = (1+2-3)+(1+2-3)+\ldots+(1+2-3)+1 = 1$

$\therefore \lim_{n\to\infty} S_{3n+1} = 1$

$\Rightarrow S_{3n+2} = (1+2-3)+(1+2-3)+\ldots+(1+2-3)+1+2 = 3$

$\therefore \lim_{n\to\infty} S_{3n+2} = 3$

The limit does not exist because the sum of infinite terms are 0, 1 and 3. Hence the given series is oscillatory.

$\therefore$ In (A) the series is not convergent.

(B) The given series is

$\Sigma\, u_n = \frac{1}{\sqrt{2}-1}-\frac{1}{\sqrt{3}-1}+\frac{1}{\sqrt{4}-1}-\ldots+\frac{1}{\sqrt{n+1}-1}$

Here we see that

(i) The series is alternating.

(ii) $\frac{1}{\sqrt{2}-1} > \frac{1}{\sqrt{3}-1} > \frac{1}{\sqrt{4}-1} > \ldots\ldots$

(iii) $\lim_{n\to\infty} u_n = \lim_{n\to\infty}\frac{1}{\sqrt{n+1}-1} = 0$

Hence all the three conditions of Leibnitz's test are satisfied. Hence, the series is convergent.

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(C) The given series is

$$\Sigma u_n = \left(1+\frac{1}{1}\right)^1 + \left(1+\frac{1}{2}\right)^2 + \ldots\ldots + \left(1+\frac{1}{n}\right)^n$$

Here $u_n = \left(1+\frac{1}{n}\right)^n$

and $\lim_{n\to\infty} u_n = \lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n = e \neq 0$

Hence the series is divergent

$\therefore$ In (C) the series is not convergent

(D) The given series is :

$$\Sigma u_n = 1 + \frac{1}{2^2} + \frac{2^2}{3^2} + \frac{3^3}{4^4} + \ldots + \frac{n^n}{(n+1)^{n+1}}$$

Here $u_n = \frac{n^n}{(n+1)^{n+1}}$

Take $v_n = \frac{n^n}{n^n+1} = \frac{1}{n}$

$$\lim_{n\to\infty}\frac{u_n}{v_n} = \lim_{n\to\infty}\frac{n^n}{(n+1)^{n+1}}\times\frac{n}{1}$$

$$= \lim_{n\to\infty}\frac{n^{n+1}}{(n+1)^{n+1}}$$

$$= \lim_{n\to\infty}\frac{1}{\left(1+\frac{1}{n}\right)^{n+1}}$$

$$= \lim_{n\to\infty}\frac{1}{\left(1+\frac{1}{n}\right)^n}\times\frac{1}{\left(1+\frac{1}{n}\right)}$$

$$= \frac{1}{e}\times 1$$

$$= \frac{1}{e}$$

which is finite and non-zero

By comparison test Σu_n and Σv_n behave alike.

Now $\Sigma v_n = \Sigma\frac{1}{n}$ is a p–series, where $p = 1$.

Therefore, Σv_n is divergent. Hence Σu_n is also divergent

$\therefore$ In (D) the series is not convergent.

The correct answer is (B).

3. (D)

(A) The given series is

$$\frac{2}{1}+\frac{3}{4}+\frac{4}{9}+\ldots\ldots+\frac{n+1}{n^2}\ldots$$

$\therefore \quad u_n = \frac{n+1}{n^2}$, Take $v_n = \frac{n}{n^2} = \frac{1}{n}$

$$\therefore \lim_{n\to\infty}\frac{u_n}{v_n} = \lim_{n\to\infty}\frac{\left(\frac{n+1}{n^2}\right)}{\frac{1}{n}}$$

$$= \lim_{n\to\infty}\frac{n+1}{n}$$

$$= \lim_{n\to\infty}\left(1+\frac{1}{n}\right)$$

$$= 1,$$ which is finite and non-zero.

By comparison test Σu_n and Σv_n behave alike.

Now $\Sigma v_n = \Sigma\frac{1}{n}$ is a p-series, where $p = 1$

Therefore, Σv_n is divergent. Hence, Σu_n is also divergent.

(B) The given series is

$$\frac{1}{2}+\frac{\sqrt{2}}{5}+\frac{\sqrt{3}}{10}+\ldots\ldots+\frac{\sqrt{n}}{n^2+1}+\ldots\ldots$$

Here, $u_n = \frac{\sqrt{n}}{(n^2+1)}$

Take $v_n = \frac{\sqrt{n}}{n^2} = \frac{1}{n^{3/2}}$

$$\lim_{n\to\infty} = \frac{u_n}{v_n} = \lim_{n\to\infty}\frac{\left(\frac{\sqrt{n}}{n^2+1}\right)}{\frac{1}{n^{3/2}}}$$

$$= \lim_{n\to\infty}\frac{n^2}{n^{2+1}}$$

$$= \lim_{n\to\infty}\frac{1}{1+\left(\frac{1}{n^2}\right)}$$

$$= 1$$ which is finite and non zero.

By comparison test Σu_n and Σv_n behave alike.

Now $\Sigma v_n = \Sigma\frac{1}{n^{3/2}}$ is a p–series, where $p = \frac{3}{2}$

Therefore, Σv_n is convergent. Hence Σu_n is also convergent.

(C) The given series is $\Sigma\left[\sqrt{n^3+1}-\sqrt{n^3}\right]$

Here $u_n = \sqrt{n^3+1}-\sqrt{n^3}$

$$= \frac{\sqrt{n^3+1}-\sqrt{n^3}}{1}\times\frac{\sqrt{n^3+1}+\sqrt{n^3}}{\sqrt{n^3+1}+\sqrt{n^3}}$$

$$= \frac{1}{\sqrt{n^3+1}+\sqrt{n^3}}$$

Take $v_n = \frac{1}{n^{3/2}}$

$$\therefore \lim_{n\to\infty}\frac{u_n}{v_n} = \lim_{n\to\infty}\frac{\left(\frac{1}{\sqrt{n^3+1}+\sqrt{n^3}}\right)}{\frac{1}{n^{3/2}}}$$

$$= \lim_{n\to\infty}\frac{1}{\sqrt{1+\frac{1}{n^3}}+\sqrt{1}}$$

$$= \frac{1}{\sqrt{1}+\sqrt{1}} = \frac{1}{2}$$

which is finite and non-zero.

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By comparison test Σu_n and Σv_n behave alike.

Now $\Sigma v_n = \Sigma \frac{1}{n^{3/2}}$ is a p-series, where $p = \frac{3}{2} > 1$

Therefore, Σv_n is convergent.

Hence Σu_n is also convergent.

(D) Here given series is :

$$u_n = \sin\frac{1}{n}$$

$$= \frac{1}{n} - \frac{1}{\lfloor 3}\left(\frac{1}{n}\right)^3 + \ldots\ldots$$

$$= \frac{1}{n} - \frac{1}{6n^3} + \ldots$$

Take $v_n = \frac{1}{n}$

$$\lim_{n\to\infty}\frac{u_n}{v_n} = \lim_{n\to\infty}\left(\frac{1}{n} - \frac{1}{6n^3} + \ldots\right) \times \frac{n}{1}$$

$$= \lim_{n\to\infty}\left(1 - \frac{1}{6n^2} + \ldots\right)$$

$$= 1, \text{ which is finite and non-zero.}$$

Now, auxiliary series $\Sigma v_n = \Sigma \frac{1}{n}$ is a p-series

where $p = 1$

$\therefore$ Σv_n is divergent. Hence Σu_n is also divergent.

The correct answer of this question is (D).

Note : Comparison test is found useful, when in the given series Σv_n, terms do not contain power of x or involving x or factorials.

4. (C) Comparing the series

(A) $\frac{1}{1} + \frac{1}{2^{1/3}} + \frac{1}{3^{1/3}} + \ldots\ldots$ with p-series test, we get

$$p = \frac{1}{3} < 1$$

$\therefore$ The series is divergent

(B) In the series $1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \ldots$,

$$p = 1$$

$\therefore$ The series is divergent.

(C) In the series $1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \ldots$, $p = 2 > 1$

$\therefore$ The series is convergent.

(D) In the series $\frac{1}{1^k} + \frac{1}{2^k} + \frac{1}{3^k} + \ldots$ $p = k > 1$

$\therefore$ The series is convergent.

The correct answer is (C).

5. (A) The given series

$1 - \frac{1}{3} + \frac{1}{9} - \frac{1}{27} + \ldots\ldots$ is a G.P.

where $a = 1$, $r = \frac{1}{3}$ which lies between – 1 and 1.

$\therefore$ The given series is convergent.

The correct answer is (A).

6. (B) Here $u_n = \frac{n}{1 + 2^{-n}}$

$$\therefore \lim_{n\to\infty} u_n = \lim_{n\to\infty}\frac{n}{1 + 2^{-n}}$$

$$= \lim_{n\to\infty}\frac{n}{1 + \left(\frac{1}{2}\right)^n} = \infty \neq 0$$

Hence the series is divergent.

$\therefore$ The correct answer is (B).

7. (A) Here we see that—

(i) The series is alternating series.

(ii) $1 > \frac{1}{2} > \frac{1}{3} > \frac{1}{4} \ldots\ldots$

(iii) $\lim_{n\to\infty} u_n = \lim_{n\to\infty}\frac{1}{n} = 0$

All the three conditions of Leibnitz Test are satisfied.

Hence the given series is convergent.

The correct answer is (A).

8. (D)

(A) The series $1 - \frac{1}{2} + \frac{1}{2^2} - \frac{1}{2^3} + \ldots$ is a G.P.

$$\therefore S_n = \frac{1\left[1 - \left(-\frac{1}{2}\right)^n\right]}{1 - \left(-\frac{1}{2}\right)}$$

$$= \frac{2}{3}\left[1 - \left(-\frac{1}{2}\right)^n\right]$$

$$\therefore \lim_{n\to\infty} S_n = \lim_{n\to\infty}\frac{2}{3}\left[1 - \left(-\frac{1}{2}\right)^n\right]$$

$$= \frac{2}{3}(1 - 0)$$

$$= \frac{2}{3} \text{ (which is finite)}$$

$\therefore$ The series is convergent.

(B) The series $1 + 2 + 3 + \ldots\ldots$ is an A.P.

$$S_n = \frac{1}{2}n(n+1)$$

$$\lim_{n\to\infty} S_n = \lim_{n\to\infty}\frac{1}{2}n(n+1) = \infty$$

$\therefore$ The series is divergent.

(C) The series $1 - 2 + 3 - 4 + 5 - 6 + \ldots\ldots$is an alternating series.

The series can be written as

$$S_n = (1-2) + (3-4) + (5-6) + \ldots + \{(n-1) - n\}$$

$$= (-1) + (-1) + (-1) + \ldots + (-1)$$

$$= -\frac{1}{2}n$$

$$\lim_{n\to\infty} S_n = \lim_{n\to\infty}\left(-\frac{1}{2}n\right) = -\infty$$

The series can also be written as

$$S_n = 1 - (2-3) - (4-5) - (6-7) \ldots\ldots - \{(n-1) - n\}$$

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$$= 1 + 1 + 1 + 1 + \ldots\ldots + 1$$

$$= \frac{1}{2}(n+1)$$

$$\lim_{n\to\infty} S_n = \lim_{n\to\infty} \frac{1}{2}(n+1) = \infty$$

Since the limit does not exist because the sum of infinite terms of the series is not unique.

Therefore, the series is oscillatory.

(D) Since (A), (B), (C) are all correct. Hence only (D) is incorrect statement. *i.e.*, not true.

9. (B) Neglecting the first term

$$u_n = \left(\frac{1.3.5\ldots\ldots(2n-1)}{2.4.6\ldots\ldots 2n}\right)^p$$

and $$u_n + 1 = \left(\frac{1.3.5\ldots\ldots (2n-1)\,(2n+1)}{2.4.6\ \ldots\ldots\ (2n)\,(2n+2)}\right)^p$$

$$\therefore \quad \frac{u_n}{u_{n+1}} = \left(\frac{2n+2}{2n+1}\right)^p = \frac{\left(1+\frac{1}{n}\right)^p}{\left(1+\frac{1}{2n}\right)^p}$$

$$\Rightarrow \lim_{n\to\infty} \frac{u_n}{u_{n+1}} = \lim_{n\to\infty} \frac{\left(1+\frac{1}{n}\right)^p}{\left(1+\frac{1}{2n}\right)^p} = 1$$

$\therefore$ Ratio test fails

$$\therefore \quad \log \frac{u_n}{u_{n+1}} = \log \left\{\frac{\left(1+\frac{1}{n}\right)^p}{\left(1+\frac{1}{2n}\right)^p}\right\}$$

$$= p \log\left(1+\frac{1}{n}\right) - p\log\left(1+\frac{1}{2n}\right)$$

$$= p\left[\left(\frac{1}{n} - \frac{1}{2n^2} + \frac{1}{3n^3}\ldots\ldots\right) - \left(\frac{1}{2n} - \frac{1}{8n^2} + \frac{1}{24n^3} + \ldots\ldots\right)\right]$$

$$= p\left[\left(\frac{1}{n} - \frac{1}{2n}\right) - \left(\frac{1}{2n^2} - \frac{1}{8n^2}\right) + \left(\frac{1}{3n^3} - \frac{1}{24n^3} + \ldots\right)\right]$$

$$= p\left[\frac{1}{2n} - \frac{3}{8n^2} + \frac{7}{24n^3} + \ldots\right]$$

$$\Rightarrow n \log \frac{u_n}{u_{n+1}} = p\left(\frac{1}{2} - \frac{3}{8n} + \frac{7}{24n^2} + \ldots\right)$$

$$\therefore \lim_{n\to\infty} n \log \frac{u_n}{u_{n+1}}$$

$$= \lim_{n\to\infty} p\left(\frac{1}{2} - \frac{3}{8n} + \frac{7}{24n^2} + \ldots\right)$$

$$= \frac{p}{2}$$

From logarithmic test.

The series is convergent, if $\frac{1}{2}p > 1$ *i.e.* $p > 2$.

The series is divergent, if $\frac{1}{2}p < 1$ *i.e.* $p < 2$.

The test fails, if $\frac{1}{2}p = 1$ *i.e.* $p = 2$.

Now, $$n \log \frac{u_n}{u_{n+1}} = 2\left(\frac{1}{2} - \frac{3}{8n} + \frac{7}{24\,n^2} + \ldots\right)$$

$$\Rightarrow \left\{n \log \frac{u_n}{u_{n+1}} - 1\right\}$$

$$= \left\{\left(1 - \frac{3}{4n} + \frac{7}{12n^2} + \ldots\right) - 1\right\}$$

$$= -\frac{3}{4n} + \frac{7}{12n^2} + \ldots$$

$$\Rightarrow \left\{n \log \frac{u_n}{u_{n+1}} - 1\right\} \log n$$

$$= -\frac{3}{4} \times \frac{\log n}{n} + \frac{7}{12} \times \frac{\log n}{n^2} + \ldots\ldots$$

$$\Rightarrow \lim_{n\to\infty}\left[\left\{n \log \frac{u_n}{u_{n+1}} - 1\right\} \log n\right]$$

$$= \lim_{n\to\infty}\left(-\frac{3}{4} \times \frac{\log n}{n} + \frac{7}{12} \times \frac{\log n}{n^2}\right)$$

$$= 0 < 1$$

Hence by higher logarithmic test the given series is divergent, if $p = 2$.

Hence the given series is convergent when $p > 2$ and divergent when $p \le 2$.

The correct answer is (B).

10. (E) Neglecting the first term

$$u_n = \frac{\alpha\,(\alpha+1)^2\,(\alpha+2)^2\,\ldots\,(\alpha+n-1)^2}{1.2.3\ldots\,n\,\beta\,(\beta+1)\,(\beta+2)\,\ldots\,(\beta+n-1)} x^n$$

$$u_{n+1} = \frac{\alpha\,(\alpha+1)^2\,(\alpha+2)^2\,\ldots\,(\alpha+n-1)^2\,(\alpha+n)^2}{1.2.3\,\ldots\,n\,(n+1)\,\beta\,(\beta+1)\,(\beta+2)\,\ldots\ldots\,(\beta+n-1)\,(\beta+n)} x^{n+1}$$

$$\therefore \frac{u_n}{u_{n+1}} = \frac{(n+1)\,(\beta+n)}{(a+n)^2}\frac{1}{x}$$

$$\therefore \lim_{n\to\infty} \frac{u_n}{u_{n+1}} = \lim_{n\to\infty}\left[\frac{n^2 + (1+\beta)\,n + \beta}{n^2 + 2\,an + a^2}\frac{1}{x}\right] = \frac{1}{x}$$

$\therefore$ From ratio test

The series is convergent, if $\frac{1}{x} > 1$ *i.e.* $x < 1$.

The series is divergent, if $\frac{1}{x} < 1$ *i.e.* $x > 1$.

The test fails if $\frac{1}{x} = 1$ *i.e.* $x = 1$

$$\therefore \quad \frac{u_n}{u_{n+1}} = \frac{n^2 + n(1+\beta) + \beta}{n^2 + 2\alpha n + \alpha^2}$$

$$\Rightarrow n\left(\frac{u_n}{u_{n+1}} - 1\right) = n\left[\frac{n^2 + n\,(1+\beta) + \beta}{n^2 + 2n\alpha + \alpha^2} - 1\right]$$

$$= \frac{n^2(1+\beta-2\alpha) + n(\beta-\alpha^2)}{n^2 + 2n\alpha + \alpha^2}$$

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$$\Rightarrow \lim_{n\to\infty} n\left(\frac{u_n}{u_{n+1}}-1\right)$$

$$= \lim_{n\to\infty}\left[\frac{n^2(1+\beta-2\alpha)+n(\beta-\alpha^2)}{n^2+2n\alpha+\alpha^2}\right]$$

$$= 1+\beta-2\alpha$$

From Raabe's test the series is convergent if $(1+\beta-2a)>1$ *i.e.* $\beta>2\alpha$.

The series is divergent, if $1+\beta-2\alpha<1$, *i.e.* $\beta<2\alpha$.

The Raabe's test fails if $1+\beta-2\alpha=1$, *i.e.* $\beta=2\alpha$.

$$\therefore n\left(\frac{u_n}{u_{n+1}}-1\right)-1 = \frac{-n\alpha^2-\alpha^2}{n^2+2\alpha n+\alpha^2}$$

$$\therefore \lim_{n\to\infty}\left\{\left[n\left(\frac{u_n}{u_{n+1}}-1\right)-1\right]\log n\right\}$$

$$= \lim_{n\to\infty}\left[\frac{-\alpha^2\left(1+\frac{1}{n}\right)}{\left\{1+\frac{2\alpha}{n}+\frac{\alpha^2}{n^2}\right\}}\times\frac{\log n}{n}\right]$$

$= a^2\times 0$

$= 0<1$

$\therefore$ From De Morgan's test, the given series is divergent if $\beta=2\alpha$.

If $x<1$, the given series is convergent (A).

If $x>1$, the given series is divergent (B).

If $x=1$ and $\beta>2\alpha$, the series is convergent (C).

If $x=1$ and $\beta\le 2\alpha$, the series is divergent (D).

Hence all A, B, C and D are correct.

Thus the correct answer is (E).

11. (C) If Σu_n is the given series and neglecting first term

$$u_n = \frac{\lfloor n}{(n+1)^n}x^n$$

and $$u_{n+1} = \frac{\lfloor n+1}{(n+2)^{n+1}}x^{n+1}$$

$$\frac{u_n}{u_{n+1}} = \frac{\lfloor n\ x^n}{(n+1)^n}\times\frac{(n+2)^{n+1}}{\lfloor n+1\ x^{n+1}}$$

$$= \left(\frac{n+2}{n+1}\right)^{n+1}\frac{1}{x}$$

$$= \left[\frac{(n+1)+1}{(n+1)}\right]^{n+1}\frac{1}{x}$$

$$= \left(1+\frac{1}{n+1}\right)^{n+1}\frac{1}{x}$$

$$\lim_{n\to\infty}\frac{u_n}{u_{n+1}} = \lim_{n\to\infty}\left[\left(1+\frac{1}{n+1}\right)^{n+1}\frac{1}{x}\right]=\frac{e}{x}$$

From the ratio test the series is convergent.

If $\frac{e}{x}>1$, *i.e.* $x<e$.

The series is divergent, if $\frac{e}{x}<1$ *i.e.* $x>e$.

The ratio test fails if $\frac{e}{x}=1$ *i.e.* $x=e$

$$\because \frac{u_n}{u_{n+1}} = \left(1+\frac{1}{n+1}\right)^{n+1}\frac{1}{e}$$

$$\therefore \log\frac{u_n}{u_{n+1}} = (n+1)\log\left(1+\frac{1}{n+1}\right)-\log e$$

$$= (n+1)\left[\frac{1}{n+1}-\frac{1}{2(n+1)^2}+\frac{1}{3(n+1)^3}\ldots\ldots\right]-1$$

$$= \left[1-\frac{1}{(2n+1)}+\frac{1}{3(n+1)^2}\ldots\ldots\right]-1$$

$$= -\frac{1}{2(n+1)}+\frac{1}{3(n+1)^2}-\ldots\ldots$$

$$\Rightarrow n\log\frac{u_n}{u_{n+1}}$$

$$= n\left[\frac{-1}{2(n+1)}+\frac{1}{3(n+1)^2}\ldots\ldots\right]$$

$$= -\frac{1}{2}\left(1+\frac{1}{n}\right)^{-1}+\frac{1}{3n}\left(1+\frac{1}{n}\right)^2+\ldots$$

$$= -\frac{1}{2}\left[1-\frac{1}{n}+\frac{1}{n^2}\ldots\ldots\right]$$

$$+\frac{1}{3n}\left[1-\frac{2}{n}+\frac{3}{n^2}\ldots\ldots\right]+\ldots\ldots$$

$$= -\frac{1}{2}+\frac{5}{6n}+\ldots\ldots$$

$$\therefore \lim_{n\to\infty} n\log\frac{u_n}{u_{n+1}}$$

$$= \lim_{n\to\infty}\left(-\frac{1}{2}+\frac{5}{6n}+\ldots\right)$$

$$= -\frac{1}{2}<1$$

$\therefore$ From logarithmic test the given series is divergent, if $x=e$.

Hence the series is convergent, if $x<e$ and divergent, if $x\ge e$.

$\therefore$ The correct answer is (C).

Note : If logarithmic test fails, then it is useful to apply higher logarithmic test.

12. (B) If Σu_n be the given series, then neglecting the first term.

$$\therefore u_n = \frac{2^2.4^2.6^2\ldots\ldots(2n)^2}{3.4.5.6.\ldots\ldots(2n+1)(2n+2)}x^{2n+2}$$

and $$u_{n+1} = \frac{2^2.4^2.6^2\ldots\ldots(2n+2)^2}{3.4.5.6.\ldots\ldots(2n+1)(2n+2)(2n+3)(2n+4)}x^{2n+4}$$

$$\therefore \frac{u_n}{u_{n+1}} = \frac{(2n+3)(2n+4)}{(2n+2)^2}\cdot\frac{1}{x^2}$$

$$\Rightarrow \lim_{n\to\infty}\frac{u_n}{u_{n+1}} = \lim_{n\to\infty}\frac{(2n+3)(2n+4)}{(2n+2)^2}\cdot\frac{1}{x^2}$$

$$= \frac{1}{x^2}$$

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The series is convergent, if $\frac{1}{x^2} > 1$ *i.e.* $x^2 < 1$.

The series is divergent, if $\frac{1}{x^2} < 1$ *i.e.* $x^2 > 1$.

The test fails, if $\frac{1}{x^2} = 1$ *i.e.* $x^2 = 1$

$$\therefore \quad n\left(\frac{u_n}{u_{n+1}} - 1\right) = n\left[\frac{(2n+3)(2n+4)}{(2n+2)^2} - 1\right]$$

$$= \frac{n(6n+8)}{(4n^2+8n+4)}$$

$$\lim_{n\to\infty} n\left(\frac{u_n}{u_{n+1}} - 1\right) = \lim_{n\to\infty} \frac{n(6n+8)}{(4n^2+8n+4)}$$

$$= \frac{3}{2} > 1$$

$\therefore$ By Raabe's test the given series is convergent, if $x^2 = 1$.

Hence the series is convergent when $x^2 \leq 1$ and divergent when $x^2 > 1$.

Hence the correct answer of this question is (B).

13. (A) Here $u_n = \frac{(2n-1)}{\lfloor n}$

and $u_{n+1} = \frac{(2n+1)}{\lfloor n+1}$

$$\therefore \quad \frac{u_n}{u_{n+1}} = \frac{(2n-1)}{\lfloor n} \times \frac{\lfloor n+1}{(2n+1)}$$

$$= \frac{(2n-1)(n+1)}{(2n+1)}$$

$$\Rightarrow \quad \lim_{n\to\infty} \frac{u_n}{u_{n+1}} = \lim_{n\to\infty} \frac{(2n-1)(n+1)}{(2n+1)}$$

$$= \infty > 1$$

$\therefore$ The series is convergent.

The correct answer is (A).

14. (A) The given series

$$1 - \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{3}} - \frac{1}{\sqrt{4}} + \ldots\ldots$$

is an alternating series. By Leibnitz's test the given series is convergent.

Now $\Sigma |u_n| = 1 + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{3}} + \frac{1}{\sqrt{4}} + \ldots\ldots$

which is a p-series with $p = \frac{1}{2} < 1$. Hence $\Sigma |u_n|$ is divergent. Hence the given series is **conditionally convergent series.**

Hence the correct answer is (A).

15. (C) The given series is :

$$1 - \frac{1}{2} + \frac{1}{4} - \frac{1}{8} + \ldots\ldots$$

By Leibnitz's test this series is convergent.

$$\Sigma |u_n| = 1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \ldots\ldots$$

This is a geometric series with $r = \frac{1}{2} < 1$.

Thus, the series $\Sigma |u_n|$ is convergent, therefore, the given series is absolutely convergent.

Hence the correct answer is (C).

16. (A) Σu_n is the given series

$$\therefore \quad u_n = \frac{1}{n\sqrt{n^2-1}}$$

Let $f(x) = \frac{1}{x\sqrt{x^2-1}}$

$$\Rightarrow \quad f(n) = \frac{1}{n\sqrt{n^2-1}}$$

$$= u_n$$

Also $f(x)$ is a continuous, positive and decreasing function of x for $x > 0$.

Now $\int_1^\infty f(x)\,dx = \int_1^\infty \frac{1}{x\sqrt{x^2-1}}\,dx$

$$= [\sec^{-1} x]_1^\infty$$

$$= \left(\frac{\pi}{2} - 0\right)$$

$$= \frac{\pi}{2}$$

$\therefore \int_1^\infty f(x)\,dx$ is convergent and by Cauchy's integral test $\int_1^\infty f(x)\,dx$ and Σu_n behave alike.

Therefore Σu_n is also convergent.

Hence the correct answer is (A).

17. (A) The given series is Σu_n then

$$u_n = \frac{(\log n)^2}{n^2}$$

also $u_{n+1} < u_n$

$\therefore$ By Cauchy's condensation test

$$\Sigma a^n u_{a^n} = \Sigma a^n \frac{(\log a^n)^2}{(a^n)^2}$$

$$= (\log a)^2 \Sigma \frac{n^2}{(a^n)}$$

Let $\Sigma v_n = \Sigma a^n u_{a^n}$

$$= \Sigma \frac{n^2 (\log a)^2}{a^n}$$

$$v_n = \frac{n^2 (\log a)^2}{a^n}$$

$$v_{n+1} = \frac{(n+1)^2 (\log a)^2}{a^{n+1}}$$

$$\Rightarrow \quad \frac{v_n}{v_{n+1}} = \frac{n^2 (\log a)^2}{a^n} \times \frac{a^{n+1}}{(n+1)^2 (\log a)^2}$$

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$$= \frac{a}{\left[1+\left(\frac{1}{n}\right)\right]^2}$$

$$\therefore \quad \lim_{n\to\infty}\frac{v_n}{v_{n+1}} = \lim_{n\to\infty}\frac{a}{\left[1+\left(\frac{1}{n}\right)\right]^2}$$

Hence from Ratio test Σv_n is convergent *i.e.* $\Sigma a^n u_a{}^n$ is convergent and if $\Sigma a^n u_a{}^n$ is convergent, then from Cauchy's condensation test Σu_n is convergent.

Hence the correct answer is (A).

18. (A) If Σu_n is the given series, then

$$u_n = \frac{(n+\sqrt{n})^n}{2^n\,(n)^{n+1}}$$

$$\Rightarrow \quad (u_n)^{1/n} = \left[\left\{\frac{n+\sqrt{n}}{2n}\right\}^n \cdot \frac{1}{n}\right]^{1/n}$$

$$= \left(\frac{n+\sqrt{n}}{2n}\right)\frac{1}{n^{1/n}}$$

$$\therefore \lim_{n\to\infty}(u_n)^{1/n}$$

$$= \lim_{n\to\infty}\left[\frac{1}{2}\left\{\left(1+\frac{1}{\sqrt{n}}\right)\frac{1}{n^{1/n}}\right\}\right]$$

$$= \frac{1}{2}(1+0).\,1$$

$$= \frac{1}{2} < 1$$

Hence from Cauchy's root test the given series is convergent.

$\therefore$ The correct answer is (A).

19. (B) If Σu_n is the given series, then

$$u_n = \frac{1^2.3^2.5^2 \ldots\ldots (2n-1)^2}{2^2.4^2.6^2 \ldots\ldots (2n)^2}$$

and $$u_{n+1} = \frac{1^2.3^2.5^2 \ldots\ldots (2n-1)^2\,(2n+1)^2}{2^2.4^2.6^2\ldots\ldots(2n)^2\,(2n+2)^2}$$

$$\therefore \quad \frac{u_n}{u_{n+1}} = \frac{(2n+2)^2}{(2n+1)^2}$$

$$\lim_{n\to\infty}\frac{u_n}{u_{n+1}} = \lim_{n\to\infty}\frac{(2n+2)^2}{(2n+1)^2} = 1$$

$\therefore$ Ratio test fails

$\because$ $$\frac{u_n}{u_{n+1}} = \frac{(2n+2)^2}{(2n+1)^2}$$

$$= 1+\frac{4n+3}{(2n+1)^2}$$

$$= 1+\left(\frac{4n+3}{4n^2}\right)\left(1+\frac{1}{2n}\right)^{-2}$$

$$= 1+\left(\frac{4n+3}{4n^2}\right)\left(1-\frac{1}{n}+\frac{3}{4n^2}\ldots\right)$$

$$= 1+\frac{1}{n}-\frac{1}{4n^2}+\ldots\ldots$$

Comparing by Gauss's test $\lambda = 1$. Hence the given series is divergent.

The correct answer is (B).

20. (A) (A) Here $u_n = \frac{1}{n^2-n}$ take $v_n = \frac{1}{n^2}$

$$\therefore \lim_{n\to\infty}\frac{u_n}{v_n} = \lim_{n\to\infty}\frac{1}{n^2-n}\times\frac{n^2}{1} = 1$$ which is finite and non-zero.

$\therefore$ By p-series test $\Sigma v_n = \Sigma\frac{1}{n^2}$ is convergent because $p = 2 > 1$

This by comparison test Σu_n is also convergent.

(B) Here $u_n = \frac{1}{n^{1/2}+n}$, take $v_n = \frac{1}{n}$

$$\therefore \lim_{n\to\infty}\frac{u_n}{v_n} = \lim_{n\to\infty}\frac{1}{n^{1/2}+n}\times\frac{n}{1} = 1$$

which is finite and non-zero.

By p-series test $\Sigma v_n = \Sigma\frac{1}{n}$ is divergent because $p = 1$.

Therefore, by comparison test Σu_n is also divergent.

(C) Here $u_n = \frac{1}{n-\sqrt{n}}$, take $v_n = \frac{1}{n}$

$$\lim_{n\to\infty}\frac{u_n}{v_n} = \lim_{n\to\infty}\frac{1}{n-\sqrt{n}}\times\frac{n}{1} = 1$$

By p-series test $\Sigma v_n = \Sigma\frac{1}{n}$ is divergent.

Therefore, by comparison test Σu_n is also divergent.

(D) Here $u_n = \frac{n^2}{n^3-n^2+1}$

take $v_n = \frac{n^2}{n^3} = \frac{1}{n}$

$$\lim_{n\to\infty}\frac{u_n}{v_n} = \lim_{n\to\infty}\frac{n^2}{n^3-n^2+1}\times\frac{n}{1}$$

By p-series test $\Sigma u_n = \Sigma\frac{1}{n}$ is divergent because $p = 1$.

Therefore by comparison test Σu_n is also divergent.

21. (D) Here $u_n = \frac{(-1)^{n-1}\,x^n}{n}$

$$\Rightarrow \quad \lim_{n\to\infty}\frac{u_n}{u_{n+1}} = -\left(\frac{n+1}{n}\right)\frac{1}{x}$$

$$\therefore \quad \left|\frac{u_n}{u_{n+1}}\right| = \left|\frac{n+1}{nx}\right|$$

$$\therefore \lim_{n\to\infty}\left|\frac{u_n}{u_{n+1}}\right| = \frac{1}{|x|}$$

$\therefore$ By ratio test, we find that the series $\Sigma\,|\,u_n\,|$ is convergent, if $\frac{1}{|x|} > 1$, *i.e.* $|x| < 1$.

If $x = 1$, then $\Sigma u_n = 1-\frac{1}{2}+\frac{1}{3}\ldots\ldots$

$$= \log 2$$

So, Σu_n is convergent.

If $x = -1$ we have

$$\Sigma u_n = -\left(1+\frac{1}{2}+\frac{1}{3}+\ldots\ldots\right)$$

$$= -\Sigma\frac{1}{n}$$

which is divergent, because $p = 1$.

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If $x > 1$; u_n does not tend to zero as $n \to \infty$, So Σu_n is not convergent, when $x > 1$.

$\therefore$ Σu_n is convergent, if $-1 < x \leq 1$.

22. (C) Leaving the first term,

$$u_n = \frac{n^2-1}{n^2+1}x^{2n}$$

$$u_{n+1} = \frac{(n+1)^2-1}{(n+1)^2+1}x^{2n+2}$$

$$= \frac{(n^2+2n)}{n^2+2n+2}x^{2n+2}$$

$$\therefore \quad \frac{u_n}{u_{n+1}} = \frac{n^2-1}{n^2+1}x^{2n} \times \frac{n^2+2n+2}{(n^2+2n)} \cdot \frac{1}{x^{2n+2}}$$

$$= \frac{(n^2-1)(n^2+2n+2)}{(n^2+1)(n^2+2n)}\frac{1}{x^2}$$

$$\lim_{n\to\infty}\frac{u_n}{u_{n+1}} = \lim_{n\to\infty}\frac{(n^2-1)(n^2+2n+2)}{(n^2+1)(n^2+2n)}\frac{1}{x^2}$$

$$= \frac{1}{x^2}$$

By ratio test Σu_n is convergent, if $\frac{1}{x^2} > 1$, *i.e.* $x^2 < 1$

and the series Σu_n is divergent, if $\frac{1}{x^2} < 1$ *i.e.* $x^2 > 1$

The ratio test fails, if $\frac{1}{x^2} = 1$ *i.e.* $x^2 = 1$

But in this case

$$\lim_{n\to\infty} u_n = \lim_{n\to\infty}\frac{n^2-1}{n^2+1} = 1 \neq 0$$

Hence the series is divergent when $x^2 = 1$

Hence the series is convergent if $x^2 < 1$ and divergent if $x^2 \geq 1$.

23. (C) Here $\lim_{n\to\infty}\frac{u_n}{u_{n+1}} = \lim_{n\to\infty}\frac{1}{x}$

The series is divergent, if $\frac{1}{x} < 1 \Rightarrow x > 1$.

24. (C) Here $\because \quad u_n = \frac{n}{2^n}$

$$\therefore \quad \lim_{n\to\infty}\frac{u_n}{u_{n+1}} = \lim_{n\to\infty}\frac{n}{2^n} \times \frac{2^{n+1}}{n+1}$$

$$= \lim_{n\to\infty} 2.\frac{1}{\left(1+\frac{1}{n}\right)}$$

$$= 2 > 1.$$

$\therefore$ By ratio test Σu_n is convergent.

25. (B) The given series is

$$\Sigma u_n = \frac{2}{1^p} + \frac{3}{2^p} + \frac{4}{3^p} + \ldots\ldots + \frac{n+1}{n^p} + \ldots\ldots$$

Here $u_n = \frac{(n+1)}{n^p}$

and $v_n = \frac{n}{n^p}$

$$= \frac{1}{n^{p-1}}$$

$$\therefore \quad \frac{u_n}{v_n} = \frac{n+1}{n^p} \times \frac{n^{p-1}}{1}$$

$$= \frac{n+1}{n} = 1 + \frac{1}{n}$$

$$\lim_{n\to\infty}\frac{u_n}{v_n} = \lim_{n\to\infty}\left(1+\frac{1}{n}\right) = 1$$ which is finite and non-zero.

By p-series test, $\Sigma v_n = \Sigma\frac{1}{n^{p-1}}$ is convergent.

If $p - 1 > 1$, *i.e.* $p > 2$ and divergent if

$p - 1 \leq 1$ *i.e.* $p \leq 2$

Hence by comparison test Σu_n is convergent if $p > 2$ and divergent if $p \leq 2$.

26. (B) Here $T_n = \frac{1}{n(n+1)(n+2)}$

$$= \frac{1}{2n} - \frac{1}{(n+1)} + \frac{1}{2(n+2)}$$

Put $n = 1, 2, 3$

$$S = T_1 + T_2 + \ldots\ldots +$$

$$= \frac{1}{2}\left(\frac{1}{1}+\frac{1}{2}+\frac{1}{3}+\ldots\ldots\right)$$

$$-\left(\frac{1}{2}+\frac{1}{3}+\ldots\ldots\right)+\frac{1}{2}\left(\frac{1}{3}+\frac{1}{4}\ldots\ldots\right)$$

$$= \frac{1}{2} - \frac{1}{4} = \frac{1}{4}$$

27. (C) Note that sum of this geometric series is $\frac{1}{1+k}$, if the value of k is numerically less than '1'. Clearly if $k = -1$. Series cannot be oscillatory, for $k = -1$ series is

$1 + 1 + 1 + 1 + 1 + \ldots\ldots$

whose sum is ∞. (Hence option C is false).

28. (A) Here $u_n = \frac{n}{(2n-1)2n}$

$$= \frac{1}{2(2n-1)}$$

and $v_n = \frac{1}{n}$

Here $\lim_{n\to\infty}\frac{u_n}{v_n} = \frac{1}{4}$

which is non-zero and finite.

By p-series test $\Sigma\frac{1}{n}$ is divergent because $p = 1$.

Hence by comparison test Σu_n is also divergent.

29. (B)

30. (A)

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31. (A) The given series is : $1 - 2x + 3x^2 - 4x^3 + \ldots\ldots$

$$S_\infty = 1 - 2x + 3x^2 - 4x^3 + \ldots\ldots$$
$$-x\,S_\infty = -x + 2x^2 - 3x^3 + \ldots\ldots$$
$$(1+x)\,S_\infty = 1 - x + x^2 - x^3 + \ldots\ldots$$
$$(1+x)\,S_\infty = \frac{1}{1+x}$$
$$\Rightarrow S_\infty = \frac{1}{(1+x)^2} = \text{finite because } 0 < x < 1$$

Hence the given series is convergent.

32. (D) Given series is $1 - \frac{1}{2} + 1 - \frac{3}{4} + 1 - \frac{7}{8} + \ldots\ldots$

$$S_{2n} = \left(1 - \frac{1}{2}\right) + \left(1 - \frac{3}{4}\right) + \left(1 - \frac{7}{8}\right) + \ldots\ldots + \left(1 - \frac{2n-1}{2^n}\right)$$
$$= \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \ldots\ldots + \frac{1}{2^n}$$
$$= \frac{\frac{1}{2}\left[1 - \left(\frac{1}{2}\right)^n\right]}{1 - \frac{1}{2}}$$
$$= \left[1 - \left(\frac{1}{2}\right)^n\right]$$
$$\lim_{n\to\infty} S_{2n} = \lim_{n\to\infty}\left[1 - \left(\frac{1}{2}\right)^n\right] = 1$$
$$S_{2n+1} = \left(1 - \frac{1}{2}\right) + \left(1 - \frac{3}{4}\right) + \left(1 - \frac{7}{8}\right) + \ldots\ldots + \left(1 - \frac{2n-1}{2^n}\right) + 1$$
$$= \left(\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \ldots\ldots + \frac{1}{2^n}\right) + 1$$
$$= \frac{\frac{1}{2}\left[1 - \left(\frac{1}{2}\right)^n\right]}{1 - \frac{1}{2}} + 1$$
$$= \left[1 - \left(\frac{1}{2}\right)^n\right] + 1$$
$$= 2 - \left(\frac{1}{2}\right)^n$$
$$\lim_{n\to\infty} S_{2n+1} = \lim_{n\to\infty} 2 - \left(\frac{1}{2}\right)^n = 2$$

Since the sum of the infinite series oscillate between 1 and 2. Hence the given series is oscillatory.

33. (C) The necessary condition for convergence of a series Σu_n is $\lim_{n\to\infty} u_n = 0$ but if $\lim_{n\to\infty} u_n = 0$, then we cannot say that the series is always convergent. For example

$1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \ldots\ldots + \frac{1}{n} + \ldots$ is divergent but

$$\lim_{n\to\infty} u_n = \lim_{n\to\infty} \frac{1}{n} = 0.$$

Hence, this condition is necessary but not sufficient.

34. (D) Let $u_n = \frac{1}{n\,(\log n)^p}$

Here $u_2 \geq u_3 \geq u_4 \geq \ldots\ldots\ldots \geq u_n \geq \ldots\ldots\ldots$

Therefore, the sequence $< u_2, u_3, u_4 \ldots\ldots u_n \ldots\ldots >$

Satisfied the conditions of Cauchy's condensation test hence the series

$\sum_2^\infty u_n$ and $\sum_2^\infty a^n\, u_{a^n}$, $(a > 1)$

will converge or diverge together.

Now $\sum_2^n a^n\, u_{a^n} = \sum_2^\infty a^n \frac{1}{a^n\,(\log a^n)^p}$

$$= \sum_2^\infty \frac{1}{(n \log a)^p}$$
$$= \frac{1}{(\log a)^p} \sum_2^\infty \frac{1}{n^p}$$
$$= \frac{1}{(\log a)^p}\left(\frac{1}{2^p} + \frac{1}{3^p} + \ldots\ldots + \frac{1}{n^p} + \ldots\right)$$

Here $\frac{1}{2^p} + \frac{1}{3^p} + \frac{1}{4^p} + \ldots\ldots + \frac{1}{n^p} + \ldots\ldots$ is a p-series.

This series is convergent, if $p > 1$ and divergent if $p \leq 1$.

$\therefore$ The series $\sum_2^\infty a^n\, u_{a^n}$ is convergent if $p > 1$ and divergent if $p \leq 1$.

$\therefore$ The given series is convergent, if $p > 1$ and divergent if $p \leq 1$.

35. (D) The series is $\Sigma \frac{(-1)^n}{(n+1)^p}$

which is an alternating series.

Case I : $p \leq 0$

Let $p = -q$

The given series becomes

$$\Sigma (-1)^n (n+1)^q = -2^q + 3^q - 4^q + 5^q - \ldots\ldots$$

This is an oscillatory series.

Case II : $0 < p \leq 1$. The series is

$$\Sigma u_n = -\frac{1}{2^p} + \frac{1}{3^p} - \frac{1}{4^p} + \frac{1}{5^p} \ldots\ldots$$

but Leibnitz's test, this series is convergent.

also $|\Sigma u_n| = \frac{1}{2^p} + \frac{1}{3^p} + \frac{1}{4^p} + \ldots\ldots$

This is a p-series and $p \leq 1$, so it is divergent.

$\therefore$ The given series is conditionally convergent.

Case III : $p > 1$. The series is

$$\Sigma u_n = -\frac{1}{2^p} + \frac{1}{3^p} - \frac{1}{4^p} + \frac{1}{5^p} \ldots\ldots$$

By Leibnitz's test this series is convergent.

also $|\Sigma u_n| = \frac{1}{2^p} + \frac{1}{3^p} + \frac{1}{4^p} + \ldots\ldots$

This is a p-series and $p > 1$, so it is convergent.

$\therefore$ The given series is absolutely convergent.

$\therefore$ All (A) (B) and (C) are correct.

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36. (C) In case of (A), $\Sigma \mid u_n \mid$ is geometric series with common ratio $\frac{1}{2}$ hence convergent. Similarly (B) and (D) are also absolutely convergent. In case of (C) $\Sigma \mid u_n \mid = \Sigma \sin \frac{1}{n}$.

Comparing with auxiliary series $\Sigma \frac{1}{n}$, we see that $\Sigma \mid u_n \mid$ is divergent, hence Σu_n is non absolutely convergent.

37. (C) Convergence $\Rightarrow$ absolute convergence is false.

38. (B) Here $u_n = \left(\frac{n+1}{n+2}\right)^n x^n$

$$\therefore \lim_{n\to\infty} (u_n)^{1/n} = \lim_{n\to\infty} \left\{\left(\frac{n+1}{n+2}\right)^n x^n\right\}^{1/n}$$

$$= \lim_{n\to\infty} \left(\frac{n+1}{n+2}\right) x = x$$

$\therefore$ By Cauchy's root test this series is convergent if $x < 1$.

The series is divergent if $x > 1$.

The Cauchy's root test fails if $x = 1$, but in this case

$$u_n = \left(\frac{n+1}{n+2}\right)^n$$

$$= \left(\frac{n+1}{n}\right)^n \left(\frac{n}{n+2}\right)^n$$

$$= \left(1+\frac{1}{n}\right)^n \frac{1}{\left(1+\frac{2}{n}\right)^n}$$

$$\therefore \lim_{n\to\infty} u_n = \lim_{n\to\infty} \frac{\left(1+\frac{1}{n}\right)^n}{\left(1+\frac{2}{n}\right)^n}$$

$$= \frac{e}{e^2} = \frac{1}{e} \neq 0$$

Hence the series is divergent.

Thus, the series is convergent if $x < 1$ and divergent if $x \geq 1$.

39. (B) Here $\frac{u_n}{u_{n+1}} = \frac{x^{1\ +\ 1/2\ +\ 1/3\ +\ \ldots\ +\ 1/n}}{x^{1\ +\ 1/2\ +\ 1/3\ +\ \ldots\ +\ 1/n\ +\ 1/(n+1)}}$

$$= \frac{1}{x^{1/(n+1)}}$$

$$\therefore \lim_{n\to\infty} \frac{u_n}{u_{n+1}} = \lim_{n\to\infty} \frac{1}{x^{1/(n+1)}}$$

$$= \frac{1}{x^0} = 1$$

$\therefore$ D' Alembert's ratio test fails.

$$\therefore n \log \frac{u_n}{u_{n+1}} = n \log \frac{1}{x^{1/(n+1)}}$$

$$= n \log \left(\frac{1}{x}\right)^{1/(n+1)}$$

$$= \frac{n}{n+1} \log \frac{1}{x}$$

$$\Rightarrow \lim_{n\to\infty} \left(n \log \frac{u_n}{u_{n+1}}\right)$$

$$= \lim_{n\to\infty} \frac{n}{n+1} \log \frac{1}{x}$$

$$= \log \frac{1}{x}$$

$\therefore$ By Logarithmic test the series is convergent if $\log \frac{1}{x} > 1 \Rightarrow \frac{1}{x} > e \Rightarrow x < \frac{1}{e}$.

The series is divergent if $\log \frac{1}{x} < 1$,

$\Rightarrow \frac{1}{x} < e, \Rightarrow x > \frac{1}{e}$.

The test fails if, $\log \frac{1}{x} = 1, \Rightarrow \frac{1}{x} = e$,

$\Rightarrow x = \frac{1}{e}$. But in this case

$$\because n \log \frac{u_n}{u_{n+1}} - 1 = \frac{n}{n+1} \log e - 1$$

$$= \frac{n}{n+1} - 1$$

$$= \frac{-1}{(n+1)}$$

$$\therefore \lim_{n\to\infty} \left(n \log \frac{u_n}{u_{n+1}} - 1\right) \log_n$$

$$= \lim_{n\to\infty} \frac{(-1)}{(n+1)} \log n$$

$$= \lim_{n\to\infty} \frac{(-1)}{\left(1+\frac{1}{n}\right)} \frac{\log n}{n}$$

$$= (-1) \times 0 = 0 < 1$$

By Higher Logarithmic test the series is divergent.

Hence the series is convergent, if $x < \frac{1}{e}$ and divergent. If $x \geq \frac{1}{e}$.

40. (C) In the given series

$$\because \frac{u_n}{u_{n+1}} = \frac{b+n}{a+n}$$

$$\Rightarrow \lim_{n\to\infty} \frac{u_n}{u_{n+1}} = \lim_{n\to\infty} \frac{b+n}{a+n}$$

$$= 1$$

$\therefore$ The ratio test fails.

$$\therefore \lim_{n\to\infty} n\left(\frac{u_n}{u_{n+1}} - 1\right) = \lim_{n\to\infty} \frac{(b-a)\,n}{(a+n)}$$

$$= b - a$$

$\therefore$ By Raabe's test, the series is convergent, if $b - a > 1$ *i.e.* $b > 1 + a$.

The series is divergent, if $b - a < 1$, *i.e.* $b < 1 + a$.

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The Raabe's test fails if $b - a = 1$, *i.e.* $b = 1 + a$.

But in this case,

$$\because \quad n\left(\frac{u_n}{u_{n+1}} - 1\right) = \frac{n}{a+n}$$

$$\therefore \lim_{n\to\infty}\left\{n\left(\frac{u_n}{u_{n+1}} - 1\right) - 1\right\}.\log n$$

$$= \lim_{n\to\infty}\left(\frac{-a}{a+n}\right).\log n$$

$$= \lim_{n\to\infty}\left(\frac{-a}{\frac{a}{n}+1}\right)\times\frac{\log n}{n}$$

$$= 0 < 1$$

$\therefore$ By Logarithmic test the given series is divergent if $b = 1 + a$.

Hence, the series is convergent, if $b > (1 + a)$ and divergent, if $b \le (1 + a)$.

41. (A) 42. (C) 43. (A)

44. (C) Since $\log(1 + x) = x - \frac{1}{2}x + \frac{1}{3}x^3 - \frac{1}{4}x^4 + \ldots\ldots$

put $x = 1$ in both sides, we get

$$\log 2 = 1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \ldots\ldots$$

45. (C) Neglecting first term,

$$u_n = \frac{1.3.5.\ldots\ldots(2n-1)}{2.4.6.\ldots\ldots 2n}x^{2n+1}$$

$$u_{n+1} = \frac{1.3.5.\ldots\ldots(2n-1)(2n+1)}{2.4.6.\ldots\ldots 2n(2n+2)}x^{2n+3}$$

$$\Rightarrow \quad \frac{u_n}{u_{n+1}} = \frac{1.3.5.\ldots\ldots(2n-1)}{2.4.6.\ldots\ldots 2n}x^{2n+1}$$

$$\times\frac{2.4.6.\ldots\ldots 2n(2n+2)}{1.3.5.\ldots\ldots(2n-1)(2n+1)}.\frac{1}{x^{2n+3}}$$

$$= \frac{(2n+2)}{(2n+1)}.\frac{1}{x^2}$$

$$\Rightarrow \lim_{n\to\infty}\frac{u_n}{u_{n+1}} = \lim_{n\to\infty}\frac{2n+2}{2n+1}.\frac{1}{x^2}$$

$$= \frac{1}{x^2}$$

$\therefore$ The series is convergent, if $\frac{1}{x^2} > 1$, *i.e.* $x^2 < 1$

The series is divergent, if $\frac{1}{x^2} < 1$, *i.e.* $x^2 > 1$

The ratio test fails, if $\frac{1}{x^2} = 1$, *i.e.*, $x^2 = 1$. But in this case,

$$\because \quad \frac{u_n}{u_{n+1}} = \frac{2n+2}{2n+1}.$$

$$\Rightarrow \quad n\left(\frac{u_n}{u_{n+1}} - 1\right) = \frac{n}{(2n+1)}$$

$$\therefore \lim_{n\to\infty} n\left(\frac{u_n}{u_{n+1}} - 1\right) = \lim_{n\to\infty}\frac{n}{2n+1}$$

$$= \frac{1}{2} < 1$$

Hence by Raabe's test the series is divergent. Hence the series is convergent, if $x^2 < 1$ and divergent, if $x^2 \ge 1$. Hence the correct answer is (C).

46. (C) The given series is $\Sigma u_n = \Sigma n^m x^n$

$$\lim_{n\to\infty}(u_n)^{1/n} = \lim_{n\to\infty}(n^m x^n)^{1/n}$$

$$= \lim_{n\to\infty} n^{m/n}x$$

$$= x$$

$\therefore$ By Cauchy's root test Σu_n is convergent if $x < 1$.

The Cauchy's test fails if $x = 1$.

When $x = 1$, then

$$\Sigma u_n = \Sigma n^m = \Sigma\frac{1}{n^{-m}} = \frac{1}{1^{-m}} + \frac{1}{2^{-m}} + \ldots\ldots$$

$\therefore$ This series is P-series and it is convergent if $-m > 1$, *i.e.*, $m < -1$.

$\therefore$ The series is convergent if $x = 1$ and also convergent if $x = 1$, $m < -1$.

47. (C)

48. (A) The given series is $\Sigma u_n = \Sigma\frac{n^{n^2}}{(n+1)^{n^2}}$

By Cauchy's root test.

$$\therefore \quad \lim_{n\to\infty}(u_n)^{1/n} = \lim_{n\to\infty}\left(\frac{n^{n^2}}{(n+1)^{n^2}}\right)^{1/n}$$

$$= \lim_{n\to\infty}\left(\frac{n}{n+1}\right)^n$$

$$= \lim_{n\to\infty}\frac{1}{\left(1+\frac{1}{n}\right)^n}$$

$$= \frac{1}{e} < 1$$

$\therefore$ The given series is convergent.

49. (B) In (A), the series is *p*-series.

where $p = 3/2 > 1$, so it is convergent

In (B) $\lim_{n\to\infty} u_n = \lim_{n\to\infty}\frac{n+1}{n} = 1 \ne 0$

So it is not convergent.

In (C) the series is alternating and $u_{n+1} < u_n$ and $\lim_{n\to\infty} u_n = \lim_{n\to\infty}\frac{1}{n+1} = 0$.

$\therefore$ The series is convergent (Leibnitz's test).

In (D) The series is geometric and $|x| \le |$, so it is also convergent.

$\therefore$ The required answer is (B).

50. (D)

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Permutation & Combination

Some Important Notations and Formulae

From the examination point of view, the following few result are useful. Without going into details you should simply remember the results.

1. Factorial Notations—The product of n consecutive positive integers beginning with 1 is denoted by $n!$ or $\lfloor n$ and read as factorial n.

Thus, according to the definition of $\lfloor n$

$$\lfloor n = 1 \times 2 \times 3 \times \ldots \times (n-1) \times n$$
$$= n \times (n-1) \times (n-2) \times \ldots \times 3 \times 2 \times 1$$

For example

$$\lfloor 6 = 1 \times 2 \times 3 \times 4 \times 5 \times 6 = 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$$

2. According to the definition of $\lfloor n$

1. $$\lfloor n = n \times (n-1) \times (n-2) \times \ldots \times 3 \times 2 \times 1$$
$$= n\{(n-1) \times (n-2) \times \ldots \times 3 \times 2 \times 1\}$$
$$= n(n-1)\{(n-2) \times \ldots \times 3 \times 2 \times 1\}$$ and so on.

$$\therefore \quad \lfloor n = n \lfloor n-1 = n(n-1) \lfloor n-2$$
$$= n(n-1)(n-2) \lfloor n-3$$

2. If r and n are positive integers and $r < n$, then

$$\frac{n!}{r!} = \frac{n \times (n-1) \times (n-2) \times \ldots \times (r+1) \times r \times (r-1) \times \ldots \times 3 \times 2 \times 1}{r \times (r-1) \times (r-2) \times \ldots \times 3 \times 2 \times 1}$$
$$= n(n-1)(n-2) \ldots (r+1)$$

$$\frac{n!}{(n-r)} = n(n-1)(n-2) \ldots (n-r+1)$$

Caution – $\frac{n!}{r!} \neq \left(\frac{n}{r}\right)!$

For example

$$\frac{8!}{4!} = 8 \times 7 \times 6 \times 5$$
$$= 1680 \neq \left(\frac{8}{4}\right)! = 2! = 2$$

3. $${}^{n}p_r = \frac{n!}{(n-r)}$$

where ${}^{n}p_r$ = number of permutations or arrangements of n different things taken r at a time.

4. $${}^{n}C_r = \frac{n!}{r!\,(n-r)}$$

where ${}^{n}C_r$ = number of selections, or groups of n different things taken r at a time.

5. From (3) and (4), we have
${}^{n}p_r = r! \times {}^{n}C_r$
Total number of arrangements = total no. of group or selections $\times\, r!$

6. If ${}^{n}C_x = {}^{n}C_y$ then either $x = y$ or $x + y = n$

7. Number of permutations of n things out of which P are alike and are of one type, q are alike and are of the other type, r are alike and are of another type and remaining $[n - (p + q + r)]$ all are different $= \frac{n!}{p!\,q!\,r!}$.

8. Number of selections of r things ($r \leq n$) out of n identical things is 1.

9. Total number of selections of zero or more things from n identical things $= n + 1$.

10. Total number of selection of zero or more things from n different things
$$= {}^{n}C_0 + {}^{n}C_1 + {}^{n}C_2 + \ldots + {}^{n}C_n = 2^n.$$

11. Number of ways to distribute (or divide) n identical things among r persons where any persons may get any no. of things $= {}^{n+r-1}C_{r-1}$

12. (a) ${}^{n}P_n = n!$

(b) $0! = 1$

(c) ${}^{n}C_r = {}^{n}C_{n-r} = \frac{n!}{r!\,(n-r)}$

(d) ${}^{n}C_n = {}^{n}C_0 = 1$

Examples

Q. 1. If ${}^{n}P_4 = 360$, find n.

Solution : Given ${}^{n}P_4 = 360$

$$\therefore \quad \frac{n!}{(n-4)} = 360$$
$$\Rightarrow \quad n(n-1)(n-2)(n-3) = 360$$
$$= 6 \times 5 \times 4 \times 3$$
$$\therefore \quad n = 6$$

[Here L.H.S. is the product of 4 consecutive integers, therefore, R.H.S. *i.e.* 360 is to be expressed as the product of 4 consecutive integers.]

$360 = 2 \times 2 \times 2 \times 3 \times 3 \times 5$, greatest of these factors is 5, therefore, try with 5.

Integers just before and after 5 are 4 and 6. Both 4 and 6 are factors of 360. Thus we get four consecutive integers 6, 5, 4 and 3 whose product is 360.

If 5 does not suit, then try with 2×5 *i.e.* 10 etc.

Q. 2. If ${}^{10}P_r = 720$, find r.

Solution : Given ${}^{10}P_r = 720$

$$\therefore \quad \frac{10!}{(10-r)!} = 720$$
$$\therefore \quad 10 \times 9 \times 8 \times \ldots\ldots \text{ to } r \text{ factors} = 720 = 10 \times 9 \times 8$$
$$\therefore \quad r = 3$$

Q. 3. How many numbers of four digits can be formed with the digits 1, 2, 3, 4 and 5 ? (If repetition of digits is not allowed).

Solution :

Here n = number of digits = 5

and r = number of places to be filled up = 4

$$\therefore \text{ Required number} = {}^{5}P_4 = \frac{5!}{1!}$$
$$= 5 \times 4 \times 3 \times 2 = 120$$

Q. 4. In a class of 10 students, there are 3 girls. In how many different ways can they be arranged in a row such that no two of the three girls are consecutive ?

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Solution :

No. of girls = 3, number of boys = 7. Since there is no restriction on boys, therefore, first of all fix the positions of the 7 boys.

Now, 7 boys can be arranged in a row in 7 ! ways.

$\times B \times B \times B \times B \times B \times B \times B \times$

If the positions of girls are fixed at places (including the two ends) indicated by crosses, no two of three girls will be consecutive.

Now, there are 8 places for 3 girls.

$\therefore$ 3 girls can be arranged in ${}^8P_3$ ways

$\therefore$ Required number of ways = ${}^8P_3 \times 7! = \frac{8!}{5!} \times 7!$

Short Method : Applying the above theorem, we have required answer = ${}^{7+1}P_3 \times 7! = \frac{8!}{5!} \times 7!$.

Q. 5. In how many ways can 10 examination papers be arranged so that the best and the worst papers never come together ?

Solution : The number of permutations of 10 papers when there is no restriction = ${}^{10}P_{10} = 10$!.

When the best and the worst papers come together regarding the two as one paper. We have only 9 papers.

These 9 papers can be arranged in ${}^9P_9 = 9!$ ways.

But these two papers can be arranged among themselves in 2! ways.

$\therefore$ Number of arrangements when the best and the worst papers do not come together

$$= 10! - 9! \times 2! = 9!$$
$$(10 - 2) = 8 \times 9!$$

Short Method : Applying the above theorem, we have the required number of ways = $(10 - 2) \times (10 - 1)! = 8 \times 9! = 8 \times 9!$

The number of ways in which 'n' books may be arranged on a shelf so that two particular books shall not be together is $(n - 2) \times (n - 1)!$]

Q. 6. There are 5 boys and 3 girls. In how many ways can they be seated in a row so that all the three girls do not sit together.

Solution : Total number of persons = 5 + 3 = 8. When there is no restriction they can be seated in a row in 8! ways.

But when all the three girls sit together, regarding the three girls as one person, we have only 5 + 1 = 6 persons.

These 6 persons can be arranged in a row in 6! ways. But the three girls can be arranged among themselves in 3! ways.

$\therefore$ Number of ways when three girls are together

$$= 6! \times 3!$$

$\therefore$ Required number of ways in which all the three girls do not sit together

$$= 8! - 6! \times 3! = 6! (8 \times 7 - 6)$$
$$= 50 \times 6! = 36000$$

Short Method : Applying the above theorem, we have the required no. of ways

$$= (5 + 3)! - (5 + 1)! \times 3!$$
$$= 8! - 6! \times 3! = 50 \times 6!$$
$$= 36000$$

There are 'm' boys and 'n' girls. The no. of ways in which they can be seated in row so that all the boys do not sit together are given by $[(m + n)! - (n + 1)! \times m!]$ ways.

Q. 7. In how many ways 4 boys and 4 girls can be seated in a row so that boys and girls are alternate ?

Solution : When a boy sits at the first place possible arrangement will be of the form

B	G	B	G	B	G	B	G

Now there are four places namely 1st, 3rd, 5th and 7th for four boys, therefore, four boys can be seated in 4! ways. Again there are four places namely 2nd, 4th, 6th and 8th for four girls.

$\therefore$ Four girls can be seated in 4! ways.

$\therefore$ Number of ways in this case = $4! \times 4!$.

Short Method : Applying the above theorem, we have the required answer = $2\ (4! \times 4!) = 1152$.

Q. 8. In how many ways 4 boys and 3 girls can be seated in a row so that they are alternate ?

Solution : Possible arrangement will be of the form

B	G	B	G	B	G	B

There are four places namely 1st, 3rd, 5th and 7th for four boys.

$\therefore$ Four boys can be seated in 4! ways. Again there are three places namely 2nd, 4th and 6th for three girls.

$\therefore$ Three girls can be seated in 3! ways.

$\therefore$ Required number = 4! 3! = 144.

Short Method : Applying the above theorem, we have the required answer = 4! 3! = 144.

Exercise

1. How many number between 400 and 1000 can be made with the digits 2, 3, 4, 5, 6 and 0 ?
   (A) 60 (B) 70
   (C) 40 (D) 120
2. Find the number of numbers between 300 and 3000 that can be formed with the digits 0, 1, 2, 3, 4 and 5 no digits being repeated in any number.
   (A) 90 (B) 120
   (C) 160 (D) 180
3. How many even numbers of four digits can be formed with the digits 0, 1, 2, 3, 4, 5 and 6, no digit being used more than once?
   (A) 300 (B) 140
   (C) 120 (D) 420
4. How many numbers of four digits greater than 2300 can be formed with digits 0, 1, 2, 3, 4, 5 and 6 no digit being repeated in any number ?
   (A) 480 (B) 560
   (C) 660 (D) 580
5. How many positive numbers can be formed by using any number of the digits 0, 1, 2, 3 and 4, no digit being repeated in any numbers ?
   (A) 360 (B) 260
   (C) 620 (D) 280

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6. In how many ways can the letters of the word 'civilization' be arranged ?

(A) $\frac{12!}{4!}$

(B) $\frac{12!}{4!} - 1$

(C) $\frac{13!}{5!} - 1$

(D) None of these

7. In how many ways can the letters of the word 'Director' be arranged so that the three vowels are never together ?

(A) 1800 (B) 18000

(C) 16000 (D) 1600

8. Find the number of rearrangements of the letters of the word 'Benevolent'. How many of them end in l ?

(A) 302400, 30239

(B) 302399, 30239

(C) 302399, 30240

(D) None of these

9. How many words can be formed with the letters of the word 'Pataliputra' without changing the relative order of the vowels and consonants ?

(A) 3600 (B) 6300

(C) 3900 (D) 4600

10. How many different words can be formed with the letters of the word 'Pencil' when vowels occupy even places ?

(A) 140

(B) 147

(C) 144

(D) Can't be determined

11. How many different words can be formed with five given letters of which three are vowels and two are consonants no two vowels being together in any word ?

(A) 12 (B) 16

(C) 18 (D) 10

12. Letters of the word DIRECTOR are arranged in such a way that all the vowels come together. Find out the total no. of ways for making such arrangement.

(A) 4320 (B) 2720

(C) 2160 (D) 1120

13. How many different letter arrangements can be made from the letters of the word RECOVER ?

(A) 1210 (B) 5040

(C) 1260 (D) 1200

14. There are 20 books of which 4 are single volume and the other are books of 8, 5 and 3 volumes respectively. In how many ways can all these books be arranged on a self so that volumes of the same book are not separated ?

(A) 7! 8! 5! 3!

(B) 7! 8! 4! 3!

(C) 7! 6! 5! 3!

(D) None of these

15. A library has two books each having three copies and three other books each having two copies. In how many ways can all these books be arranged in a shelf so that copies of the same book are not separated ?

(A) 120 (B) 180

(C) 160 (D) 140

16. 4 boys and 2 girls are to be seated in a row in such a way that two girls are always together. In how many different ways can they be seated ?

(A) 120 (B) 720

(C) 148 (D) 240

17. In how many different ways can the letters of word JUDGE be arranged so that the vowels always come together ?

(A) 48 (B) 24

(C) 120 (D) 60

18. How many groups of 6 persons can be formed from 8 men and 7 women ?

(A) 5000

(B) 5005

(C) 5050

(D) None of these

19. There are 10 oranges in a basket. Find the no. of ways in which 3 oranges are chosen from the basket ?

(A) 125 (B) 140

(C) 110 (D) 120

20. There are 25 students in a class. Find the number of ways in which a committee of 3 students is to be formed.

(A) 2200 (B) 2300

(C) 2400 (D) 3200

21. 8 men entered a lounge simultaneously. If each person shook hands with the other, then find the total no. of hand shakes.

(A) 16 (B) 36

(C) 56 (D) 28

22. From 4 officers and 8 Jawans in how many ways can be 6 chosen to include at least one officer.

(A) 896 (B) 986

(C) 886 (D) 996

23. From a group of 6 men and 4 women a committee of 4 persons is to be formed :

(i) In how many different ways can it be done so that the committee has at least one woman ?

(A) 210 (B) 225

(C) 195 (D) 185

(ii) In how many different ways can it be done so that the committee has at least 2 men ?

(A) 210 (B) 225

(C) 195 (D) 185

24. The number of straight lines can be formed out of 10 points of which 7 are collinear ?

(A) 26

(B) 21

(C) 25

(D) None of these

25. Which of the following is incorrect ?

(A) ${}^nC_r = {}^nC_{n-r}$

(B) ${}^nC_r = {}^{n-1}C_r + {}^nC_{n-r}$

(C) ${}^nC_r = {}^{n-1}C_r + {}^{n-1}C_{r-1}$

(D) $r!\ {}^nC_r = P_r$

26. The total number of words, which can be formed out of the letters a, b, c, d, e, f taken 3 together, such that each word contains at least one vowel is—

(A) 72

(B) 48

(C) 96

(D) None of these

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27. The number of different permutations of the word 'BANANA' is—
(A) 270 (B) 60
(C) 120 (D) 360

28. A polygon has 44 diagonals the number of its sides is—
(A) 9 (B) 10
(C) 11 (D) 12

29. If 7 points out of 12 are in the same straight line, then the number of triangles formed is—
(A) 19 (B) 158
(C) 185 (D) 201

30. If ${}^{n+2}C_8 : {}^{n-2}P_4 = 57 : 16$ then the value of n is—
(A) 20 (B) 19
(C) 18 (D) 17

31. Everybody in a room shakes hands with everybody else. The total number of hand shakes is 66. The total number of persons in the room is—
(A) 11 (B) 12
(C) 13 (D) 14

32. If ${}^{56}P_{r+6} : {}^{54}P_{r+3} = 30800 : 1$ then the value of r is—
(A) 40
(B) 41
(C) 42
(D) None of these

33. If ${}^nC_{r-1} = 36$, ${}^nC_r = 84$ and ${}^nC_{r+1} = 126$ then—
(A) $n = 8, r = 4$
(B) $n = 9, r = 3$
(C) $n = 7, r = 5$
(D) None of these

34. If ${}^{35}C_{n+7} = {}^{35}C_{4n-2}$, then all the values of n are given by—
(A) 28 (B) 3, 6
(C) 3 (D) 6

35. If ${}^{2n+1}P_{n-1} : {}^{2n-1}P_n = 3 : 5$, then n is equal to—
(A) 4 (B) 6
(C) 3 (D) 8

36. The value of $\sum_{r=1}^{n} \frac{{}^nP_r}{r!}$ is—
(A) 2^n (B) $2^n - 1$
(C) 2^{n-1} (D) $2^n + 1$

37. If ${}^nP_r = 720\ {}^nC_r$ than the value r is—
(A) 6 (B) 5
(C) 4 (D) 7

38. If S = {2, 3, 4, 5, 7, 9}, then the number of different three-digit numbers (with all distinct digits) less than 400 that can be formed from S is—
(A) 20 (B) 40
(C) 80 (D) 120

39. The number of triangles that can be formed by choosing the vertices from a set of 12 points, seven of which lie on the same straight line, is—
(A) 185 (B) 175
(C) 115 (D) 105

40. The middle term of $\left(2x - \frac{1}{3x}\right)^{10}$ is—
(A) ${}^{10}C_4 \frac{2^4}{3^4}$ (B) $-{}^{10}C_5 \frac{2^5}{3^5}$
(C) $-{}^{10}C_4 \frac{2^4}{3^5}$ (D) ${}^{10}C_5 \frac{2^5}{3^5}$

41. The number of ways in which 5 boys and 5 girls can sit in a ring are—
(A) 10! (B) 9!
(C) 5! (D) 6!

42. How many words of 4 consonants and 3 vowels can be made from 12 consonants and 4 vowels. If all the letters are different ?
(A) 251820 (B) 258120
(C) 281520 (D) 285120

43. If ${}^nP_r = 120\ {}^nC_r$ then r is equal to—
(A) 4 (B) 5
(C) 6 (D) 7

44. 12 persons are to be arranged to a round table. If two particular persons among them are not to be side by side, the total number of arrangements is—
(A) 9 (10!) (B) 2 (10!)
(C) 45 (8!) (D) 10!

45. Seven women and seven men are to sit round a circular table such that there is a man on either side of every woman the number of seating arrangements is—
(A) $(7!)^2$ (B) $(6!)^2$
(C) $\lfloor 6 \times \lfloor 7$ (D) 7!

46. The total number of permutations of 4 letters that can be made out of the letters of the word EXAMINATION is—
(A) 2454
(B) 2436
(C) 2545
(D) None of these

47. The total number of selections of fruit which can be made from 3 bananas, 4 apples and 2 oranges is—
(A) 39
(B) 315
(C) 512
(D) None of these

48. The total number of arrangements of the letters in the expression $a^3b^2c^4$ when written at full length is—
(A) 1260
(B) 2520
(C) 610
(D) None of these

49. A library has a copies of one book, b copies of each of two book, c copies of each of three books and single copy of d book. The total number of ways in which these books can be distributed is—
(A) $\frac{(a+b+c+d)!}{a!\ b!\ c!}$
(B) $\frac{(a+2b+3c+d)!}{a!\ (b!)^2\ (c!)^3}$
(C) $\frac{(a+2b+3c+d)!}{a!\ b!\ c!}$
(D) None of these

50. In how many different ways can the letters of the word 'PADDLED' be arranged ?
(A) 910 (B) 2520
(C) 5040 (D) 840

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Answers with Hints

1. (A) [Here nothing has been given about repetition of digits, therefore, we will assume that repetition of digit is not allowed.]
Any number between 400 and 1000 must be of three digits only.

4 or 5 or 6		
↓	↓	
3 ways	$^5P_2$ ways	

Since the number should be greater than 400, therefore, hundreds place can be filled up by anyone of the three digits 4, 5 and 6 in 3 ways.
Remaining two places can be filled up by remaining five digits $^5P_2$ ways.

$\therefore$ Required number $= 3 \times {}^5P_2 = 3 \times \frac{5!}{3!} = 60$

2. (D) Any number between 300 and 3000 must be of 3 or 4 digits.
Case I. When number is of 3 digits.

3 or 4 or 5		
↓	↓	
3 ways	$^5P_2$ ways	

Hundreds place can be filled up by anyone of the three digits 3, 4 and 5 in 3 ways.
Remaining two places can be filled up by remaining five digits in $^5P_2$ ways.
$\therefore$ Number of numbers formed in this case $= 3 \times {}^5P_2$
$= 3 \times \frac{5!}{3!} = 60$.

Case II. When number is of 4 digits

1 or 2		
↓	↓	
2 ways	$^5P_3$ ways	

Thousands place can be filled up by anyone of the two digits 1 and 2 in 2 ways and remaining three places can be filled up by remaining five digits in $^5P_3$ ways.
$\therefore$ Number of numbers formed in this case
$= 2 \times {}^5P_3 = 2 \times \frac{5!}{2!} = 120$
$\therefore$ Required number = 60 + 120 = 180

3. (D) Each even number must have 0, 2, 4 or 6 in its units, place.
Here total number of digits = 7

			0 or 2 or 4 or 6

[When 0 occurs at units place there is no restriction on other places and when 2 or 4 or 6 occurs at units place there is restriction, on thousands place as 0 cannot be put at thousands' place.]
Case I. When 0 occurs at units place

			0
↓	↓	↓	↓
$^6P_3$ ways			1 way

Units place can be filled up by 0 in 1 way and remaining three places can be filled up by remaining 6 digits in $^6P_3$ ways.
$\therefore$ Number of numbers formed in this case
$= 1 \times {}^6P_3 = \frac{6!}{3!}$
$= 120$

Case II. When 0 does not occur at units place.

Anyone of remaining six except zero			2 or 4 or 6
↓	↓		↓
5 ways	$^5P_2$ ways		3 ways

Units place can be filled up by anyone of the three digits 2, 4 and 6 in 3 ways.
Thousand place can be filled up by any one of the remaining six digits except zero in 5 ways.
Remaining two places can be filled up by remaining five digits in $^5P_2$ ways.
$\therefore$ Number of numbers formed in this case.
$= 5 \times 3 \times {}^5P_2 = 15 \times \frac{5!}{3!} = 300$
$\therefore$ Required number = 120 + 300 = 420.

4. (B) [Since number must be of four digits and greater than 2300, therefore anyone of the five digits 2, 3, 4, 5 and 6 will occur at thousands, place. When anyone of 4, 5, 6 occurs at thousands, place the number will be definitely greater than 2300 but when 2 occurs at thousands, place there will be also restriction on hundreads, place to make the number greater than 2300.]
When 2 occurs at thousands, place.
Case I.

2	3 or 4 or 5 or 6		
↓	↓	↓	
1 way	4 way	$^5P_2$ ways	

Thousand's place can be filled up by 2 in 1 way and hundred's place can be filled up by any one of the four digits 3, 4, 5 and 6 in 4 ways.
Remaining two places can be filled up by remaining five digits in $^5P_2$ ways.
$\therefore$ Number of numbers formed in this case
$= 1 \times 4 \times {}^5P_2 = 4 \times \frac{5!}{3!} = 80$

Case II.
When anyone of 3, 4, 5 and 6 occurs at thousand's place.

3 or 4 or 5 or 6			
↓	↓		
4 ways	$^6P_3$ ways		

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Thousand's place can be filled up by anyone of the four digits 3, 4, 5 and 6 in 4 ways and remaining three places can be filled up by remaining six digits in ${}^6P_3$ ways.

∴ Number of numbers formed in this case

$$= 4 \times {}^6P_3 = 4 \times \frac{6!}{3!} = 480$$

∴ Required number = 80 + 480 = 560.

5. (B) When number is of five digits

Case I.

1 or 2 or 3 or 4				
↓		↓		
4 ways		${}^4P_4$ ways		

Ten thousand's place can be filled up by anyone of the four digits 1, 2, 3 and 4 in 4 ways and the remaining four places can be filled up by the remaining four digits in ${}^4P_4$ ways.

∴ Number of numbers formed in this case = $4 \times {}^4P_4$.

Case II : When number is of four digits

1 or 2 or 3 or 4			
↓		↓	
4 ways		${}^4P_3$ ways	

Number of numbers formed in this case = $4 \times {}^4P_3$.

Case III : When number is of three digits.

1 or 2 or 3 or 4		
↓	↓	
4 ways	${}^4P_2$ ways	

∴ Number of numbers formed in this case

$$= 4 \times {}^4P_2$$

Case IV : When number is of two digits.

1 or 2 or 3 or 4		
↓	↓	
4 ways	${}^4P_1$ ways	

∴ Number of numbers formed in this case = $4 \times {}^4P_1$.

Case V : When number is of one digit.

Number of positive numbers formed in this case = 4

∴ Required number

$$= 4 \times {}^4P_4 + 4 \times {}^4P_3 + 4 \times {}^4P_2 + 4 \times {}^4P_1 + 4$$
$$= 96 + 96 + 48 + 16 + 4 = 260$$

6. (B) There are 12 letters in the word 'civilization' of which four are i's and other are different letters.

∴ Total number of permutations = $\frac{12!}{4!}$

But one word is civilization itself.

∴ Required number of rearrangements = $\frac{12!}{4!} - 1$

7. (B) Total number of letters = 8.

number of vowels = 3 and *r* occurs twice.

Total number of arrangements when there is no restriction

$$= \frac{8!}{2!}$$

When three vowels are together, regarding them as one letter, we have only 5 + 1 = 6 letters.

These six letters can be arranged in $\frac{6!}{2!}$ ways, since *r* occurs twice.

But the three vowels can be arranged among themselves in 3! ways.

Hence number of arrangements when the three vowels are together = $\frac{6!}{2!} \times 3!$

∴ Required number

$$= \frac{8!}{2!} - \frac{6!}{2!} \times 3! = \frac{6!}{2!}(8 \cdot 7 - 6) = 18{,}000$$

8. (C) There are ten letters in the word 'Benevolent' of which three are e's and two are n's.

∴ Total number of arrangements

$$= \frac{10!}{3! \times 2!} = 302400$$

But one word is Benevolent itself.

∴ Number of re-arrangements = $\frac{10!}{3!\,2!} - 1 = 302399$

When l is put in the end, number of remaining letters is 9 of which three are e's and two are n's

∴ Number of words ending in l = $\frac{9!}{3!\,2!} = 30240$

9. (A) There are eleven letters in the word 'Pataliputra' and there are two p's, two t's three a's and four other different letters.

Number of consonants = 6, number of vowels = 5

Since relative order of the vowels and consonants remains unchanged, therefore, vowels will occupy only vowel's place and consonants will occupy only consonants place.

Now 6 consonants can be arranged among themselves in $\frac{6!}{2!\,2!}$ ways. [∵ There are two P's and two t's]

and five vowels can be arranged among themselves in $\frac{5!}{3!}$ ways, since 'a' occurs thrice.

∴ Required numbers = $\frac{6!}{2!\,2!} \times \frac{5!}{3!}$

= 3600

10. (C) There are 6 letters in the word 'pencil' and no letter is repeated. There are two vowels e and i .

Places are :

1st	2nd	3rd	4th	5th	6th

Even places are : 2nd, 4th and 6th.

Now there are three even places for two vowels.

∴ 2 vowels can be arranged in ${}^3P_2 = 3! = 6$ ways.

Four consonants can be arranged in remaining four places in 4! = 24 ways.

∴ Required number = 6 × 24 = 144.

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11. (A) Since there is no resriction on consonants, therefore, first of all we arrange the two consonants. Two consonants can be arranged in 2! ways.

Now if the vowels are put at the places (including the two ends) indicated by the '×' then no two vowels will come together

×	Consonant	×	Consonant	×

There are three places for three vowels and hence the three vowels can be arranged in these three places in

$${}^3P_3 = 3! \text{ ways}$$

Hence, the required number of words, when no two vowels are together

$$2!\,3! = 12$$

12. (C) Taping all vowels (IEO) as a single letter (since they come together) there are six letters with two 'R's

Hence no. of arrangements $= \frac{6!}{2!} \times 3! = 2160$

[3 vowels can be arranged in 3! ways among themselves, hence multiplied with 3!.]

13. (C) Possible arrangements are $\frac{7!}{2!\,2!} = 1260$

[Division by 2 times 2! is because of the repetition of E and R.]

14. (A) [Volumes of the same book are not to be separated *i.e.* all volumes of the same book are to be kept together]. Regarding all volumes of the same book as one book, we have only 4 + 1 + 1 + 1 = 7 books.

These seven books can be arranged in 7! ways. Volumes of the book having 8 volumes can be arranged among themselves in 8! ways, volumes of the book having 5 volumes can be arranged among themselves in 5! ways.

And Volumes of the book having 3 volumes can be arranged among themselves in 3! ways.

∴ Required number = 7! 8! 5! 3!

15. (A) Regarding all copies of the same book as one book, we have only 5 books.

These 5 books can be arranged in 5! ways. But all copies of the same book being identical can be arranged in only one way.

∴ Required number $= 5! \times 1 \times 1 \times 1 \times 1 = 120$

16. (D) Assume the 2 girl students to be together *i.e.* (one). Now there are 5 students.

Possible ways of arranging them are 5! = 120.

Now they (two girls) can arrange themselves in 2! ways.

Hence, total ways = 120 × 2 = 240.

17. (A) Required number = 4! 2! = 48.

18. (B) Total no. of persons = 8 + 7 = 15

$$\text{No. of groups} = {}^{15}C_6 = \frac{15!}{6!\,(15-6)!} = \frac{15!}{6!\,9!}$$

$$= \frac{15 \times 14 \times 13 \times 12 \times 11 \times 10}{6 \times 5 \times 4 \times 3 \times 2 \times 1}$$

$$= 5005$$

19. (D) Required number of ways = ${}^{10}C_3$

$$= \frac{10!}{3!\,(10-3)!} = \frac{10!}{3!\,7!} = \frac{10 \times 9 \times 8}{3 \times 2} = 120$$

20. (B) Required number of ways

$$= {}^{25}C_3 = \frac{25 \times 24 \times 23}{1 \times 2 \times 3} = 2300$$

21. (D) Applying the given rule, we have

$$\text{required no. of hand shakes} = \frac{8\,(8-1)}{2} = 28$$

22. (A)

	No. of Officers	No. of Jawans	No. of Ways
Case I	1	5	${}^4C_1 \times {}^8C_5 = 224$
Case II	2	4	${}^4C_2 \times {}^8C_4 = 420$
Case III	3	3	${}^4C_3 \times {}^8C_3 = 224$
Case IV	4	2	${}^4C_4 \times {}^8C_2 = 28$

∴ Required number = 224 + 420 + 224 + 28 = 896.

Short Method : Applying the above theorem, we have, $x = 4$, $y = 8$ and $n = 6$.

The value of

$${}^xC_x \times {}^yC_{n-x} = {}^4C_4 \times {}^8C_{6-4} = {}^4C_4 \times {}^8C_2$$

Now, from the above theorem,

Required answer

$= {}^4C_1 \times {}^8C_5 + {}^4C_2 \times {}^8C_4 + {}^4C_3 \times {}^8C_3 + {}^4C_4 \times {}^8C_2$

$= 224 + 420 + 224 + 28 = 896.$

23. (i) (C) Required no. of ways

$= {}^4C_1 \times {}^6C_3 + {}^4C_2 \times {}^6C_2 + {}^4C_3 \times {}^6C_1 + {}^4C_4$

$= 4 \times \frac{6 \times 5 \times 4}{1 \times 2 \times 3} + \frac{4 \times 3}{1 \times 2} \times \frac{6 \times 5}{1 \times 2} + \frac{4 \times 3 \times 2}{1 \times 2 \times 3} \times 6 + 1$

$= 80 + 90 + 24 + 1 = 195.$

(ii) (D) Required no. of ways

$= {}^6C_2 \times {}^4C_2 + {}^6C_3 \times {}^4C_1 + {}^6C_4$

$= \frac{6 \times 5}{1 \times 2} \times \frac{4 \times 3}{1 \times 2} + \frac{6 \times 5 \times 4}{1 \times 2 \times 3} \times 4 + \frac{6 \times 5 \times 4 \times 3}{1 \times 2 \times 3 \times 4}$

$= 90 + 80 + 15 = 185$

24. (C) If there were no three points collinear. We should have ${}^{10}C_2$ lines but since 7 points are collinear we must subtract ${}^7C_2$ lines and add the one corresponding to the line of collinearity of the seven points.

Thus, the required number of straight lines.

$$= {}^{10}C_2 - {}^7C_2 + 1 = 25$$

25. (B)

26. (C) The required number of words is :

$$({}^2C_1 \times {}^4C_2 + {}^2C_2 \times {}^4C_1)\,3! = 96$$

27. (B) There are 3A's 2N's and one B. We have to find the total number of arrangements of 6 letters out of which 3 are alike of one kind, 2 are alike of second kind, thus the total number of words

$$= \frac{6!}{3!\,2!} = 60$$

28. (C) Let there be n sides of the polygon. Then it has n vertices. The total number of straight lines obtained by joining n vertices by taking 2 at a time is ${}^nC_2$.

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These ${}^nC_2$ lines also include n sides of polygon. Therefore, the number of diagonals formed is ${}^nC_2 - n$.

Thus $\quad {}^nC_2 - n = 44$

$\Rightarrow \quad \frac{n(n-1)}{2} - n = 44$

$\Rightarrow \quad \frac{n^2 - 3n}{2} = 44$

$\Rightarrow \quad n^2 - 3n = 88$

$\Rightarrow \quad n^2 - 3n - 88 = 0$

$\Rightarrow \quad (n - 11)(n + 8) = 0$

$\therefore \quad n = 11$

29. (C) The number of ways of selecting 3 points out of 12 points is ${}^{12}C_3$. The number of ways of selecting 3 points out of 7 points, on the same straight line is ${}^7C_3$. Hence, the number of triangle formed will be ${}^{12}C_3 - {}^7C_3 = 210 - 35 = 185$.

30. (B) $\because \quad {}^{n+2}C_8 : {}^{n-2}P_4 = 57 : 16$

$\Rightarrow \quad \frac{(n+2)!\,(n-6)!}{(n-6)!\,(n-2)!\,8!} = \frac{57}{16}$

$\Rightarrow \quad (n+2)(n+1)\,n\,(n-1) = 143640$

$\Rightarrow \quad (n^2 + n - 2)(n^2 + n) = 143640$

$\Rightarrow \quad (n^2 + n)^2 - 2(n^2 + n) + 1 = 143641$

$\Rightarrow \quad (n^2 + n - 1)^2 = (379)^2$

$[\because n^2 + n - 1 > 0]$

$\Rightarrow \quad n^2 + n - 1 = 379$

$\Rightarrow \quad n^2 + n - 380 = 0$

$\Rightarrow \quad (n + 20)(n - 19) = 0$

$n = 19$

$(\because n$ is not negative)

31. (B) Let there be n persons in the room. The total number of hand shakes is same as the number of ways of selecting 2 out of n.

$\because \quad {}^nC_2 = 66$

$\Rightarrow \quad \frac{n(n-1)}{2!} = 66$

$\Rightarrow \quad n^2 - n - 132 = 0$

$\Rightarrow \quad (n - 12)(n + 11) = 0$

$\therefore \quad n = 12$

32. (B) $\because \quad {}^{56}P_{r+6} : {}^{54}P_{r+3} = 30800 : 1$

$\Rightarrow \quad \frac{56!}{(50-r)!} = 30800\left(\frac{54!}{51-r!}\right)$

$\Rightarrow \quad 56 \times 55 = \frac{30800}{(51-r)}$

$\Rightarrow \quad 51 - r = 10$

$\therefore \quad r = 41$

33. (B) ${}^nC_{r-1} = 36$, ${}^nC_r = 84$, ${}^nC_{r+1} = 126$

$\Rightarrow \quad \frac{{}^nC_r}{{}^nC_{r-1}} = \frac{84}{36} \quad \ldots(1)$

and $\quad \frac{{}^nC_{r+1}}{{}^nC_r} = \frac{126}{84} \quad \ldots(2)$

$\Rightarrow \quad \frac{n-r+1}{r} = \frac{7}{3} \quad \ldots(1)$

and $\quad \frac{n-r}{r+1} = \frac{3}{2} \quad \ldots(2)$

$\Rightarrow \quad 3n - 10r + 3 = 0 \quad \ldots(1)$

and $\quad 2n - 5r - 3 = 0 \quad \ldots(2)$

$\Rightarrow \quad r = 3, n = 9$

34. (B) ${}^{35}C_{n+7} = {}^{35}C_{4n-2}$

[We know that ${}^nC_x = {}^nC_y$, $x = y$ or $x + y = n$]

$\Rightarrow \quad$ If $n + 7 + 4n - 2 = 35$

$\Rightarrow \quad 5n + 5 = 35$

$\Rightarrow \quad 5n = 30 \therefore n \Rightarrow 6$

$\Rightarrow \quad$ If $n + 7 = 4n - 2$

$\Rightarrow \quad 4n - n = 2 + 7$

$\Rightarrow \quad 3n = 9$

$\therefore \quad n = 3$

35. (A) We have $\frac{{}^{2n+1}P_{n-1}}{{}^{2n-1}P_n} = \frac{3}{5}$

$\Rightarrow \quad 5\,{}^{2n+1}P_{n-1} = 3\,{}^{2n-1}P_n$

$\Rightarrow \quad \frac{5(2n+1)!}{(n+2)!} = \frac{3(2n-1)!}{(n-1)!}$

$\Rightarrow \quad \frac{5(2n+1)(2n)(2n-1)!}{(n+2)(n+1)\,n\,(n-1)!} = \frac{3.(2n-1)!}{(n-1)!}$

$\Rightarrow \quad 10(2n+1) = 3(n+2)(n+1)$

$\Rightarrow \quad 3n^2 - 11n - 4 = 0 \therefore n = 4$

$\Rightarrow \quad (3n+1)(n-4) = 0$

36. (B) $\because \quad {}^nP_r = {}^nC_r\, r!$

$\Rightarrow \quad \frac{{}^nP_r}{r!} = {}^nC_r$

$\therefore \quad \sum_{r=1}^{n} \frac{{}^nP_r}{r!} = \sum_{r=1}^{n} C_r$

$= {}^nC_1 + {}^nC_2 + {}^nC_3 + \ldots\ldots {}^nC_n$

$= 2^n - 1$

37. (A) We have ${}^nP_r = {}^nC_r\, r!$

$\because \quad {}^nP_r = 720\,{}^nC_r$

$\Rightarrow \quad {}^nC_r.\, r! = 720\,{}^nC_r$

$\Rightarrow \quad r! = 720$

$\therefore \quad r = 6$

38. (A) The hundreds place will be reserved for 3 or 2, 5 digits are free to fill rest two places *i.e.*, of tens and unit. Number of required 3 digit numbers $= 2 \times {}^5C_2 = 20$.

39. (A) Required no. of triangles $= {}^{12}C_3 - {}^7C_3 = 185$

40. (B) Middle term $= \left(\frac{n}{2} + 1\right)^{\text{th}}$ term

$= \left(\frac{10}{2} + 1\right)^{\text{th}}$ term

$=$ 6th term

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$$= {}^{10}C_5 (2x)^5 \left(-\frac{1}{3x}\right)^5$$

$$= -{}^{10}C_5 \frac{2^5}{3^5}$$

41. (B) Here $n = 5 + 5 = 10$

$\therefore$ Total no. of circular permutations

$$= \lfloor n-1$$

$$= \lfloor 10-1$$

$$= \lfloor 9$$

42. (D) Required no. of words

$$= {}^{12}P_4 \times {}^4P_3$$

$$= 12 \times 11 \times 10 \times 9 \times 4 \times 3 \times 2$$

$$= 120\,(100-1) \times 24$$

$$= 288000 - 2880 = 285120$$

43. (B) $\because$ ${}^nP_r = 120\ {}^nC_r$

$$\Rightarrow \frac{\lfloor n}{\lfloor n-r} = 120 \times \frac{\lfloor n}{\lfloor n-r \,.\, \lfloor r}$$

$$\Rightarrow \lfloor r = 120 = 5 \times 4 \times 3 \times 2 \times 1$$

$$\therefore \quad r = 5$$

44. (A) 12 persons can be seated around a round table in 11! ways. The total number of ways in which 2 particular persons sit side by side = 10! × 2!. Hence, the required number of arrangements

$$= 11! - 10! \times 2! = 9 \times (10!)$$

45. (C) 7 women can sit on a round table in $(7-1)! = \lfloor 6$ ways. Now seven places are created which can be filled by 7 men in 7! ways. Hence required number of ways = 6! × 7!.

46. (A) We have 11 letters *viz.* A; A; I; I; N; N; E; X M, T, O

For groups of 4 we may arrange these as follows :

(i) Two alike, two others alike

(ii) Two alike, two different

(iii) All four different

(i) gives rise to ${}^3C_2$ selections (ii) gives rise $3 \times {}^7C_2$ selections and (iii) gives rise to ${}^8C_4$ selections.

So, number of permutations

$$= {}^3C_2 \times \frac{\lfloor 4}{\lfloor 2 \times \lfloor 2} + {}^3C_1 \times {}^7C_2 \times \frac{\lfloor 4}{\lfloor 2} + {}^8C_4 \times \lfloor 4$$

$$= \left(\frac{3}{4} + \frac{63}{2} + 70\right) \times \lfloor 4$$

$$= \left(\frac{3 + 126 + 280}{4}\right) \times 24$$

$$= 409 \times 6$$

$$= 2454$$

47. (D) Required number of ways

$$= (2+1)(3+1)(4+1) - 1$$

$$= 59$$

48. (A) We have 9 letters 3 *a*'s, 2 *b*'s and 4 *c*'s. These 9 letters can be arranged in $\frac{9!}{3!\,2!\,4!} = 1260$ ways.

49. (B) Total number of books = $a + 2b + 3c + d$. Since there are b copies of each of two books, c copies of each of three books and single copy of d book.

Therefore, the total number of arrangements is

$$\frac{(a + 2b + 3c + d)!}{a!\,(b!)^2\,(c!)^3}$$

50. (D) Reqd. ways $= \frac{\lfloor 7}{\lfloor 3} = 840.$

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Simple Interest

Important Points/Facts

1. If any person borrowed some money from the other for a fixed period, then he has to pay some extra money to him for the use of money lent. This extra money paid for using other's money is called interest.

Interest is the money paid by the borrower to the lender for the use of money lent. The money borrowed is called Principal or Sum.

2. The sum of the principal and interest is called the amount.

$\therefore$ Amount = Principal + Interest

or Interest = Amount – Principal

3. Interest is usually calculated at the rate of so many rupees for every Rs. 100 of the money lent for a year. This is called the rate per cent per annum.

''Per annum'' means for a year. The words per annum are sometimes omitted. Thus 6 P.C. means Rs. 6 is interest on Rs. 100 in one year.

4. The interest is usually paid yearly, half yearly or quarterly as agreed upon between money lender and the borrower.

5. If the interest on a certain sum for a certain period is reckoned uniformly. It is called simple interest, abbreviated as S.I. when interest is calculated on the original principal for any length of time. It is called Simple interest.

This may be remembered in the symbolic form—

$$\text{S.I.} = \frac{P \times t \times r}{100}$$

where, P = Principal,

t = Number of years

r = Rate% per annum.

6. When simple interest is to be calculated between the two dates, the day/date on which the money is paid back should be included but not the day on which it is borrowed, *i.e.*, in counting, the first day is omitted.

Example : To reckon the period between 20th April to 20th September, the 20th April shall be omitted and the required time will be counted from 21st April to 20th September.

7. When the time is given in months and days, 12 months are reckoned to a year and 30 days to the month. But when the time is given in days or in years and days, 365 days are reckoned to a year.

8. If a sum of money is deposited for n months in a recurring deposit, then

$$\text{Time} = \frac{n(n+1)}{2} \text{ months}$$

$$= \frac{n(n+1)}{2 \times 12} \text{ year}$$

Examples

Q. 1. A sum of money doubles itself in 20 years. In how many years will it become four times ?

Solution : Let Rs. P become 2 times in 20 years at the rate of r% per annum and will become 4 times in T years.

$$\because \quad 2 \times P = P + \frac{P \times r \times 20}{100} \quad \ldots(i)$$

$$\text{and} \quad 4 \times P = P + \frac{P \times r \times T}{100} \quad \ldots(ii)$$

$$2 \times P = P\left(1 + \frac{r \times 20}{100}\right)$$

$$\Rightarrow \quad 2 = \frac{100 + r \times 20}{100}$$

$$\Rightarrow r \times 20 = 200 - 100$$

$$\Rightarrow \quad r = \frac{100}{20} = 5\%$$

Substituting the value of r in equation (ii)

$$\Rightarrow \quad 4P = \frac{P(100 + 5 \times T)}{100}$$

$$4 = \frac{100 + 5 \times T}{100}$$

$$5 \times T = 400 - 100$$

$$= 300$$

$$T = \frac{300}{5} = 60 \text{ years}$$

Hence, Required time = 60 years

Short Method

$$\text{Required time} = \frac{(n-1)t}{m-1}$$

$$= \frac{(4-1) \times 20}{(2-1)}$$

$$= 3 \times 20$$

$$= 60 \text{ years}$$

Q. 2. What is the rate of simple interest at which a sum of money doubles itself in 5 years ?

Solution : Let Rs. P doubles in 5 years at the rate of simple interest r% per annum.

$$\therefore \quad P \times 2 = P + \frac{P \times r \times 5}{100}$$

$$\Rightarrow P \times 2 = P\left(\frac{100 + r \times 5}{100}\right)$$

$$\Rightarrow \quad 2 = \frac{100 + r \times 5}{100}$$

$$\Rightarrow \quad r \times 5 = 200 - 100$$

$$\therefore \quad r = \frac{100}{5} = 20\%$$

Short Method

$$\text{Required rate} = \frac{(n-1) \times 100}{t}$$

$$= \frac{(2-1) \times 100}{5}$$

$$= 20\%$$

Q. 3. A deposits a sum of money in a Bank, who pay 10% simple interest. At the end of 5 years, he receives Rs. 30000, then what sum he had deposited in the Bank ?

Solution : Let that sum of money be Rs. P

$$\because \quad \text{S.I.} = \frac{P \times 10 \times 5}{100}$$

$$= \frac{50P}{100}$$

From the question,

$$\because \quad 30000 = P + \frac{50P}{100}$$

$$\Rightarrow \quad 30000 = P\left(1 + \frac{50}{100}\right)$$

$$\Rightarrow \quad P = \frac{30000 \times 100}{150}$$

$$= \text{Rs. } 20000$$

$\therefore$ Amount deposited in Bank

= Rs. 20000

Short Method

$$\text{Required sum} = \frac{100A}{100 + r \times t}$$

$$= \frac{100 \times 30000}{100 + 10 \times 5}$$

$$= \frac{100 \times 30000}{150}$$

$$= \text{Rs. } 20000$$

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Q. 4. A man lent a sum of money at the rate of simple interest 4%. If the interest for 8 years is Rs. 340 less than the principal, then what was the principal ?

Solution : Let the principal be Rs. P

$$\text{S.I.} = \frac{P \times 4 \times 8}{100} = \frac{32P}{100}$$

From the question,

$$\because \quad P - \frac{32P}{100} = 340$$

$$\Rightarrow \quad \frac{68P}{100} = 340$$

$$\Rightarrow \quad P = \frac{340 \times 100}{68}$$

$$= 500$$

Hence Principal = Rs. 500

Short Method

$$\text{Principal} = \frac{100 \times d}{100 - r \times t}$$

$$= \frac{100 \times 340}{100 - 4 \times 8}$$

$$= \frac{100 \times 340}{68}$$

$$= \text{Rs. } 500$$

Q. 5. A sum was put at S.I. at a certain rate for 3 years. Had it been put at 4% higher rate of interest, it would have fetched Rs. 120 more. Find the sum.

Solution : Let the required sum be Rs. P and original rate is R%.

$\therefore$ New rate of interest

$$= (R + 4)\%$$

From the question,

$$\because \quad \frac{P \times (R+4) \times 3}{100} - \frac{P \times R \times 3}{100}$$

$$= 120$$

$$\Rightarrow \frac{P \times R \times 3}{100} + \frac{P \times 4 \times 3}{100}$$

$$- \frac{P \times R \times 3}{100} = 120$$

$$\Rightarrow \quad \frac{P \times 4 \times 3}{100} = 120$$

$$\Rightarrow \quad P = \frac{120 \times 100}{4 \times 3}$$

$$\therefore \quad P = \text{Rs. } 1000$$

Hence, Required sum

$$= \text{Rs. } 1000$$

Short Method

$$\text{Required sum} = \frac{D \times 100}{r \times t}$$

$$= \frac{120 \times 100}{4 \times 3}$$

$$= \text{Rs. } 1000$$

Q. 6. At a certain rate of simple interest Rs. 800 amounted to Rs. 920 in 3 years. If the rate of interest be increased by 3%. What will be the amount after 3 years ?

Solution : Let the original rate of interest is R%.

$$\because \quad 920 = 800 + \frac{800 \times 3 \times R}{100}$$

$$\Rightarrow \quad 120 = \frac{800 \times 3 \times R}{100}$$

$$\therefore \quad R = \frac{120 \times 100}{800 \times 3} = 5\%$$

At the rate of interest increased by 3%.

$$\text{New rate} = (5 + 3)\% = 8\%$$

$$\therefore \quad \text{Interest} = \frac{800 \times 8 \times 3}{100}$$

$$= \text{Rs. } 192$$

$$\therefore \quad \text{Amount} = 800 + 192$$

$$= 992$$

$\therefore$ Hence, Required amount

$$= \text{Rs. } 992$$

Short Method

$\therefore$ Required amount

$$= A \pm \frac{P \times t \times r}{100}$$

$$= 920 + \frac{800 \times 3 \times 3}{100}$$

$$= 920 + 72$$

$$= \text{Rs. } 992$$

Q. 7. The amount of interest for a certain sum at 5·5% annual rate of interest for one year is Rs. 676·5. How much the interest will be less on the same sum at 5% annual rate of interest for one year ?

Solution : Let the certain sum be Rs. P

$$\because \quad 676{\cdot}5 = \frac{P \times 5{\cdot}5 \times 1}{100}$$

and second interest $= \dfrac{P \times 5 \times 1}{100}$

$\therefore$ Required sum

= 676·5 – Second interest

$$= \frac{P \times 5{\cdot}5 \times 1}{100} - \frac{P \times 5 \times 1}{100}$$

$$= \frac{P\,(5{\cdot}5 - 5)}{100}$$

$$= \frac{P \times 0{\cdot}5}{100}$$

$$= \frac{676{\cdot}5 \times 100 \times 0{\cdot}5}{5{\cdot}5 \times 1 \times 100}$$

$$\left[\because P = \frac{676 \times 100}{5{\cdot}5 \times 1}\right]$$

$$= 61{\cdot}5$$

Hence, Required sum = Rs. 61·5

Short Method

Required sum

$$= \frac{R \times r}{R} \times 1$$

$$= \frac{5{\cdot}5 - 5}{5{\cdot}5} \times 676{\cdot}5$$

$$= \frac{0{\cdot}5 \times 676{\cdot}5}{5{\cdot}5}$$

$$= \text{Rs. } 61{\cdot}5$$

Q. 8. A sum of Rs. 810 is divided in two parts in such a way that the interest on first part at 4% for 3 years is equal to that on second part at 5% for 3 years. Find the two parts of sum.

Solution : Let the first part of the sum be Rs. x

$\therefore$ Second part of sum

$$= \text{Rs. } (810 - x)$$

$\therefore$ Interest on the first part

$$= \frac{x \times 4 \times 3}{100}$$

and interest on the second part

$$= \frac{(810 - x) \times 5 \times 3}{100}$$

From the question,

$$\because \quad \frac{x \times 4 \times 3}{100}$$

$$= \frac{(810 - x) \times 5 \times 3}{100}$$

$$\Rightarrow \quad 4x = (810 - x) \times 5$$

$$\Rightarrow \quad 4x = 4050 - 5x$$

$$\Rightarrow \quad 9x = 4050$$

$$\therefore \quad x = \frac{4050}{9} = \text{Rs. } 450$$

$\therefore$ Second part

$$= 810 - 450$$

$$= \text{Rs. } 360$$

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Exercise

1. The simple interest on a certain sum for 3 years at 14% per annum is Rs. 235·20. The sum is—
   (A) Rs. 480 (B) Rs. 560
   (C) Rs. 650 (D) Rs. 720
2. A sum of money amounts to Rs. 702 in 2 years and Rs. 783 in 3 years. The rate per cent is—
   (A) 12% per annum
   (B) 13% per annum
   (C) 14% per annum
   (D) 15% per annum
3. If Rs. 64 amount to Rs. 83·20 in 2 years. What will Rs. 86 amount to in 4 years at the same rate per cent per annum ?
   (A) Rs. 137·60
   (B) Rs. 124·70
   (C) Rs. 114·80
   (D) Rs. 127·40
4. A sum of money amounts to Rs. 850 in 3 years and Rs. 925 in 4 years. The sum is—
   (A) Rs. 600
   (B) Rs. 575
   (C) Rs. 625
   (D) Data inadequate
5. The simple interest on a sum of money is $\frac{1}{9}$ of the principal and the number of years is equal to the rate per cent per annum. The rate per cent per annum is—
   (A) 3 (B) $\frac{1}{3}$
   (C) $3\frac{1}{3}$ (D) $\frac{3}{10}$
6. A moneylender finds that due to a fall in the rate of interest from 13% to $12\frac{1}{2}$% his yearly income diminishes by Rs. 104. His capital is—
   (A) Rs. 21400
   (B) Rs. 20800
   (C) Rs. 22300
   (D) Rs. 24000
7. A sum of money will double itself in 16 years at simple interest with yearly rate of—
   (A) 10% (B) $6\frac{1}{4}$%
   (C) 8% (D) 16%
8. If the amount of Rs. 360 in 3 years is Rs. 511·20. What will be the amount of Rs. 700 in 5 years ?
   (A) Rs. 1190 (B) Rs. 1230
   (C) Rs. 1060 (D) Rs. 1225
9. A sum of Rs. 2600 is lent out in two part in such a way that the interest on one part at 10% for 5 years is equal to that on another part at 9% for 6 years. The sum lent out at 10% is—
   (A) Rs. 1150 (B) Rs. 1250
   (C) Rs. 1350 (D) Rs. 1450
10. Simple interest on a certain sum at a certain rate is $\frac{9}{16}$ of the sum. If the number representing rate per cent and time in years be equal, then the time is—
    (A) $5\frac{1}{2}$ years (B) $6\frac{1}{2}$ years
    (C) $6\frac{1}{4}$ years (D) $7\frac{1}{2}$ years
11. A sum of Rs. 2540 is lent out into two parts. One at 12% and another one at $12\frac{1}{2}$%. If the total annual income is Rs. 311·60, the money lent at 12% is—
    (A) Rs. 1180 (B) Rs. 1360
    (C) Rs. 1240 (D) Rs. 1340
12. A man invested $\frac{1}{3}$ of his capital at 7%, $\frac{1}{4}$ at 8% and remainder at 10%. If his annual income is Rs. 561, the capital is—
    (A) Rs. 5400 (B) Rs. 6000
    (C) Rs. 6600 (D) Rs. 7200
13. A certain sum of money at simple interest amounts to Rs. 1260 in 2 years and to Rs. 1350 in 5 years. The rate per cent per annum is—
    (A) 2·5% (B) 3·75%
    (C) 5% (D) 7·5%
14. A sum of money put at simple interest trebles itself in 15 years. The rate per cent per annum is—
    (A) $13\frac{1}{3}$% (B) $16\frac{2}{3}$%
    (C) $12\frac{2}{3}$% (D) 20%
15. A lent Rs. 600 to B for 2 years and Rs. 150 to C for 4 years and received altogether from both Rs. 90 as simple interest. The rate of interest is—
    (A) 4% (B) 5%
    (C) 10% (D) 12%
16. At the certain rate of simple interest, a certain sum doubles itself in 10 years. It will treble itself in—
    (A) 15 years (B) 20 years
    (C) 30 years (D) 12 years
17. A sum of money at simple interest amounts to Rs. 2240 in 2 years and Rs. 2600 in 5 years. The sum is—
    (A) Rs. 1880
    (B) Rs. 2000
    (C) Rs. 2120
    (D) Data inadequate
18. Rs. 800 amounts to Rs. 920 in 3 years at simple interest. If the interest rate is increased by 3%. It would amount to how much ?
    (A) Rs. 1056 (B) Rs. 1112
    (C) Rs. 1182 (D) Rs. 992
19. The simple interest on a sum of money at 8% per annum for 6 years is half the sum. The sum is—
    (A) Rs. 4800
    (B) Rs. 6000
    (C) Rs. 8000
    (D) Data inadequate
20. If the interest on Rs. 1200 be more than the interest on Rs. 1000 by Rs. 50 in 3 years, the rate per cent is—
    (A) $10\frac{1}{3}$% (B) $6\frac{2}{3}$%
    (C) $8\frac{1}{3}$% (D) $9\frac{2}{3}$%
21. The simple interest on a sum of money will be Rs. 600 after 10 years. If the principal is trebled after 5 years, what will be the total interest at the end of the tenth year ?
    (A) Rs. 600
    (B) Rs. 900
    (C) Rs. 1200
    (D) Data inadequate
22. A man lends Rs. 10000 in four parts. If he gets 8% on Rs. 2000, $7\frac{1}{2}$% on Rs. 4000 and $8\frac{1}{2}$% on

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Rs. 1400. What per cent must he get for the remainder if the average interest is 8·13% ?

(A) 7% (B) 9%

(C) $9\frac{1}{4}\%$ (D) $10\frac{1}{2}\%$

23. In how many years will a sum of money double itself at 12% per annum ?

(A) 6 years 9 months

(B) 8 years 4 months

(C) 7 years 6 months

(D) 8 years 6 months

24. A sum was put at simple interest at a certain rate for 2 years. Had it been put at 1% higher rate, it would have fetched Rs. 24 more. The sum is—

(A) Rs. 600 (B) Rs. 800

(C) Rs. 1200 (D) Rs. 480

25. The simple interest at x% for x years will be Rs. x on a sum of—

(A) Rs. x

(B) Rs. $100x$

(C) Rs. $\left(\frac{100}{x}\right)$

(D) Rs. $\left(\frac{100}{x^2}\right)$

26. A sum of money becomes (8/5) of itself in 5 years at a certain rate of interest. The rate per cent per annum is—

(A) 5% (B) 8%

(C) 10% (D) 12%

27. The rate of interest on a sum of money is 4% per annum for the first 2 years, 6% per annum for the next 4 years and 8% per annum for the period beyond 6 years. If the simple interest accrued by the sum for a total period of 9 years is Rs. 1120. What is the sum ?

(A) Rs. 1500 (B) Rs. 2000

(C) Rs. 2500 (D) Rs. 4000

28. The difference between the interests received from two different banks on Rs. 500 for 2 years is Rs. 2·50. The difference between their rates is—

(A) 1% (B) 0·5%

(C) 2·5% (D) 0·25%

29. At simple interest, a sum doubles after 20 years. The rate of interest per annum is—

(A) 5%

(B) 10%

(C) 12%

(D) Data inadequate

30. What annual payment will discharge a debt of Rs. 580 due in 5 years, the rate being 8% per annum ?

(A) Rs. 166·40

(B) Rs. 65·60

(C) Rs. 100

(D) Rs. 120

31. A certain sum of money at simple interest amounts to Rs. 1012 in $2\frac{1}{2}$ years and to Rs. 1067·20 in 4 years. The rate of interest per annum is—

(A) 2·5% (B) 3%

(C) 4% (D) 5%

32. Two equal amounts of money are deposited in two banks, each at 15% per annum for $3\frac{1}{2}$ years and 5 years. If the difference between their interests is Rs. 144, each sum is—

(A) Rs. 460 (B) Rs. 500

(C) Rs. 640 (D) Rs. 720

33. If x is the simple interest on y and y is the simple interest on z, the rate % and the time being the same in both cases, what is the relation between x, y and z ?

(A) $x^2 = yz$ (B) $y^2 = xz$

(C) $z^2 = xy$ (D) $xyz = 1$

34. If the rate of interest rises from $6\frac{1}{2}$ to 8% a man's annual income increases by Rs. 4050. Find the capital.

(A) Rs. 270000

(B) Rs. 370000

(C) Rs. 300000

(D) None of these

35. A man derives his income from the investment of Rs. 4150 at a certain rate of interest and Rs. 3500 at 1 per cent higher. This whole income for 4 years is Rs. 1211. Find the rates of interest—

(A) $3\frac{1}{2}\%, 4\frac{1}{2}\%$

(B) $2\frac{1}{2}\%, 3\frac{1}{2}\%$

(C) $4\frac{1}{2}\%, 5\frac{1}{2}\%$

(D) None of these

36. If Rs. 5600 amount to Rs. 6678 in $3\frac{1}{2}$ years. What will Rs. 9400 amount to in $5\frac{1}{4}$ years at the same rate per cent per annum simple interest ?

(A) Rs. 9400

(B) Rs. 12114·25

(C) Rs. 12115

(D) None of these

37. The simple interest on a sum of money will be Rs. 600 after 10 years. If the principal is trebled after 5 years the total interest at the end of 10 years will be—

(A) Rs. 600

(B) Rs. 900

(C) Rs. 1200

(D) Data inadequate

38. Ashok took a loan of Rs. 15000 for 3 years at simple interest. If the total interest paid is Rs. 2700. What is the rate of interest per annum ?

(A) 18 (B) 5·4

(C) 9 (D) 6

39. Pratap borrowed some money from Arun at simple interest. The rate of interest for the first 3 years was 12% for the next 5 years was 16% and beyond this it was 20%. If the simple interest for 11 years was more than the money borrowed by Rs. 6080. What was the money borrowed ?

(A) Rs. 7550 (B) Rs. 8500

(C) Rs. 8000 (D) Rs. 9000

40. Yogesh borrowed Rs. 12000 at simple interest for 5 years. If he paid Rs. 3600 as simple interest after 5 years. What is the rate of interest per cent per annum ?

(A) 5 (B) 8

(C) 10 (D) 6

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41. The rate of interest for the first 2 years is 5% for the next 3 years is 8% and beyond this. It is 10% per annum. If the simple interest for 8 years is Rs. 1280. What is the principal ?
(A) Rs. 2500
(B) Rs. 2000
(C) Rs. 3200
(D) Rs. 2440

42. If a sum of money double itself in 20 years. What is the rate of simple interest per cent per year ?
(A) 4% (B) 8%
(C) 5% (D) 10%

43. Mr. Patel borrowed Rs. 8000 from Mr. Chobey at simple interest. After 2 years he paid Rs. 800 more than what be borrowed and thus cleared the loan. What was the rate of interest ?
(A) 6
(B) 8
(C) 5
(D) None of these

44. Anil borrowed some money at simple interest. The rate of interest for the first 3 years was 5% for the next 2 years was 8% and for the next 4 years it was 10%. Beyond this it was 12% per annum. If he paid Rs. 8560, as interest for 12 years. How much money did he borrow ?
(A) Rs. 8000 (B) Rs. 6000
(C) Rs. 5000 (D) Rs. 7000

45. Dayanand borrowed some money at simple interest at 16% per annum. He repaid Rs. 10080 in all after 5 years. What did he borrow ?
(A) Rs. 4600
(B) Rs. 4000
(C) Rs. 5000
(D) None of these

46. Prabhat borrowed some money from a bank at 8% p.a. simple interest and lended it to Ashish at 12% p.a. simple interest. If his profit in 2 years is Rs. 320. What sum of money did he borrow ?
(A) Rs. 2000 (B) Rs. 4000
(C) Rs. 6000 (D) Rs. 3000

47. Rs. 4200 amounts to Rs. 5712 in 4 years.If the rate of interest is increased by 3%. What will be the amount ?
(A) Rs. 6372 (B) Rs. 4000
(C) Rs. 6216 (D) Rs. 3000

Answers with Hints

1. (B) Required sum = Rs. $\frac{100 \times 235{\cdot}20}{3 \times 14}$ = Rs. 560

2. (D) S.I. for 1 year = Rs. (783 – 702) = Rs. 81
S.I. for 2 years = Rs. (81 × 2) = Rs. 162
∴ Sum = Rs. (702 – 162) = Rs. 540
∴ Required rate = $\left(\frac{100 \times 162}{540 \times 2}\right)\%$ = 15%

3. (A) S.I. on Rs. 64 for 2 years = Rs. 19·20
∴ Rate = $\left(\frac{100 \times 19{\cdot}20}{64 \times 2}\right)$
= 15%
∴ S.I. on Rs. 86 for 4 years = Rs. $\left(\frac{86 \times 4 \times 15}{100}\right)$
= Rs. 51·60
∴ Amount of Rs. 86 = Rs. (86 + 51·60)
= Rs. 137·60

4. (C) S.I. for 1 year = Rs. (925 – 850) = Rs. 75
S.I. for 3 years = Rs. (75 × 3) = Rs. 225
∴ Sum = Rs. (850 – 225) = Rs. 625

5. (C) Let principal = Rs. P
Then S.I. = $\frac{P}{9}$
Let Rate = R% per annum
and time = R years
Then, $\frac{P}{9} = \frac{P \times R \times R}{100}$
⇒ $R^2 = \frac{100}{9}$
∴ $R = \frac{10}{3} = 3\frac{1}{3}$ % per annum

6. (B) Let capital = Rs. x
Then, $\left(\frac{x \times 13 \times 1}{100}\right) - \left(x \times \frac{25}{2} \times \frac{1}{100}\right) = 104$
⇒ $\frac{13x}{100} - \frac{x}{8} = 104$
⇒ $26x - 25x = (104 \times 200)$
⇒ $x = 20800$
∴ Capital = Rs. 20800

7. (B) Let principal = Rs. P then S.I. = Rs. P
Then, Rate = $\frac{100 \times P}{P \times 16} = \frac{100}{16} = 6\frac{1}{4}\%$

8. (A) S.I. for 3 years = Rs. (511·20 – 360)
= Rs. 151·20
∴ Rate = $\frac{100 \times 151{\cdot}20}{360 \times 3}$ = 14%
∴ S.I. on Rs. 700 for 5 years
= Rs. $\left(\frac{700 \times 5 \times 14}{100}\right)$
= Rs. 490
∴ Required amount = Rs. (700 + 490) = Rs. 1190

9. (C) Let the money at 10% be Rs. x. Then the money at 9% is Rs. $(2600 - x)$
∴ $\frac{x \times 10 \times 5}{100} = \frac{(2600 - x) \times 9 \times 6}{100}$
or $104x = 2600 \times 54$
or $x = \frac{2600 \times 54}{104}$ = Rs. 1350

10. (D) Let principal = P, then S.I. = $\frac{9}{16}$ P.
Let rate = R% per annum and Time = R years

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Then, $\frac{9}{16}P = \frac{P \times R \times R}{100}$

$\Rightarrow R^2 = \frac{900}{16}$

$\therefore R = \frac{30}{4} = 7\frac{1}{2}$ years

11. (A) Let money lent at 12% = Rs. x

Then, money lent at $12\frac{1}{2}\%$ = Rs. $(2540 - x)$

$\because \frac{x \times 12 \times 1}{100} + (2540 - x) \times \frac{25}{2} \times \frac{1}{100} = 311{\cdot}60$

$\Rightarrow \frac{3x}{25} + \frac{2540 - x}{8} = 311{\cdot}60$

$\Rightarrow 24x + 25(2540 - x) = 200 \times 311{\cdot}60$

$\therefore x = 63500 - 62320$

$= 1180$

12. (C) Let the capital be Rs. x, then

$\frac{x}{3} \times \frac{7}{100} + \frac{x}{4} \times \frac{8}{100} + \left[x - \left(\frac{x}{3} + \frac{x}{4}\right)\right] \times \frac{10}{100} = 561$

$\Rightarrow \frac{7x}{300} + \frac{x}{50} + \frac{x}{24} = 561$

$\Rightarrow 42x + 36x + 75x = 1009800$

$\therefore x = \frac{1009800}{153} = 6600$

13. (A) S.I. for 3 years = Rs. $(1350 - 1260)$ = Rs. 90

S.I. for 2 years = Rs. $\left(\frac{90}{3} \times 2\right)$ = Rs. 60

$\therefore$ Sum = Rs. $(1260 - 60)$ = Rs. 1200

$\therefore$ Rate = $\frac{100 \times 60}{1200 \times 2} = 2{\cdot}5\%$

14. (A) Let principal = P.

Then S.I. = 2P

Also Time = 15 years

$\therefore$ Required rate = $\frac{100 \times 2P}{P \times 15} = \frac{200}{15}$

$= 13\frac{1}{3}\%$ per annum

15. (B) Let rate = $x\%$ per annum.

Then $\frac{600 \times x \times 2}{100} + \frac{150 \times x \times 4}{100} = 90$

$\Rightarrow 18x = 90$

$\therefore x = 5\%$

16. (B) Let principal = P. Then, S. I. = P. and Time = 10 years

$\therefore$ Required time = $\frac{(n-1) \times t}{(m-1)}$

$= \frac{(3-1) \times 10}{(2-1)}$

$= 20$ years

17. (B) S.I. for 3 years = Rs. $(2600 - 2240)$ = Rs. 360

S.I. for 2 years = Rs. $\left(\frac{360}{3} \times 2\right)$ = Rs. 240

$\therefore$ Required sum = Rs. $(2240 - 240)$ = Rs. 2000

18. (D) Principal = Rs. 800

S.I. = Rs. $(920 - 800)$ = Rs. 120

and Time = 3 years

$\therefore$ Original rate = $\frac{100 \times 120}{800 \times 3} = 5\%$

New rate = 8%

Now, S.I. = Rs. $\left(\frac{800 \times 8 \times 3}{100}\right)$ = Rs. 192

$\therefore$ Amount = Rs. $(800 + 192)$ = Rs. 992

19. (D) Let, Sum = P

Then, S.I. = $\frac{1}{2}$P

Rate = 8%

and Time = 6 years

But $\frac{P}{2} = \frac{P \times 8 \times 6}{100}$ (Not possible)

Thus, data is inadequate.

20. (C) Let rate = $x\%$ per annum. Then,

$\frac{1200 \times x \times 3}{100} - \frac{1000 \times x \times 3}{100} = 50$

$\Rightarrow 6x = 50$

$\Rightarrow x = 8\frac{1}{3}$

$\therefore$ Rate = $8\frac{1}{3}\%$ per annum

21. (B) Let, sum = Rs. x. Then, S.I. = Rs. 600, Time = 10 years.

$\therefore$ Rate = $\left(\frac{100 \times 600}{x \times 10}\right)$

$= \left(\frac{6000}{x}\right)\%$ per annum

S.I. on Rs. x for 1st five years

= Rs. $\left(x \times \frac{6000}{x} \times 5 \times \frac{1}{100}\right)$ = Rs. 300

S.I. on Rs. $3x$ for next 5 years

= Rs. $\left(3x \times \frac{6000}{x} \times 5 \times \frac{1}{100}\right)$

= Rs. 900

22. (B) $\because \frac{2000 \times 8 \times 1}{100} + \left(4000 \times \frac{15}{2} \times \frac{1}{100}\right)$

$+ \left(1400 \times \frac{17}{2} \times \frac{1}{100}\right) + \left(\frac{2600 \times x \times 1}{100}\right)$

$= \left(\frac{10000 \times 8{\cdot}13 \times 1}{100}\right)$

$\Rightarrow 160 + 300 + 119 + 26x = 813$

$\Rightarrow 26x = 234$

$\Rightarrow x = 9\%$

23. (B) Let principal = Rs. P. Then, S.I. = Rs. P, Rate = 12%

Time = $\left(\frac{100 \times P}{P \times 12}\right)$ years

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$= \frac{25}{3}$ years

$= 8$ years 4 months

24. (C) Let sum = Rs. x

and original rate = $y\%$ per annum

Then, $\frac{x \times (y+1) \times 2}{100} - \frac{x \times y \times 2}{100} = 24$

$\Rightarrow \quad x = 1200$

25. (C) $\text{Sum} = \left(\frac{100 \times x}{x \times x}\right) = \text{Rs.}\left(\frac{100}{x}\right)$

26. (D) Let sum = Rs. x

Then amount = Rs. $\left(\frac{8x}{5}\right)$

$\therefore$ S.I. = Rs. $\left(\frac{8x}{5} - x\right) = \text{Rs.}\left(\frac{3x}{5}\right)$

$\therefore$ Required rate $= \left(\frac{100 \times \frac{3x}{5}}{x \times 5}\right)\% = 12\%$

27. (B) Let sum = Rs. x

Then, $\frac{x \times 4 \times 2}{100} + \frac{x \times 6 \times 4}{100} + \frac{x \times 8 \times 3}{100} = 1120$

$\Rightarrow \quad 56x = 112000$

$\therefore \quad x = \frac{112000}{56} = \text{Rs. } 2000$

28. (D) Let the rates be $x\%$ and $y\%$. Then,

$\frac{500 \times x \times 2}{100} \sim \frac{500 \times y \times 2}{100} = 2{\cdot}5$

$\Rightarrow \quad 10\,(x \sim y) = 2{\cdot}5$

$\therefore$ Req. difference $x \sim y = 0{\cdot}25\%$

29. (A) Let sum = P, then S.I. = P and Time = 20 years

$\therefore$ Required rate $= \frac{100 \times \text{P}}{\text{P} \times 20} = 5\%$ per annum

30. (C) Let the annual instalment be Rs. x

Then, $\left[x + \left(\frac{x \times 4 \times 8}{100}\right)\right] + \left[x + \left(\frac{x \times 3 \times 8}{100}\right)\right]$

$+ \left[x + \left(\frac{x \times 2 \times 8}{100}\right)\right] + \left[x + \left(\frac{x \times 1 \times 8}{100}\right)\right] + x = 580$

$\Rightarrow \quad \frac{33x}{25} + \frac{31x}{25} + \frac{29x}{25} + \frac{27x}{25} + x = 580$

$\Rightarrow \quad (120 + 25)\,x = 580 \times 25$

$\therefore \quad x = 100$

31. (C) $\because$ S.I. for $\frac{3}{2}$ years

$= \text{Rs. } (1067{\cdot}20 - 1012)$

$= \text{Rs. } 55{\cdot}20$

$\Rightarrow$ S.I. for $\frac{5}{2}$ years $= \text{Rs.}\left(55{\cdot}20 \times \frac{2}{3} \times \frac{5}{2}\right) = 92$

$\therefore \quad \text{Sum} = \text{Rs. } (1012 - 92) = \text{Rs. } 920$

Hence, $\text{Rate} = \left(\frac{100 \times 92 \times 2}{920 \times 5}\right) = 4\%$

32. (C) Let each sum be Rs. P. Then,

$\because \quad \frac{\text{P} \times 15 \times 5}{100} - \frac{\text{P} \times 15 \times 7}{100 \times 2} = 144$

$\Rightarrow \quad \frac{3}{4}\text{P} - \frac{21}{40}\text{P} = 144$

$\Rightarrow \quad \frac{9\text{P}}{40} = 144$

$\therefore \quad \text{P} = \frac{144 \times 40}{9} = \text{Rs. } 640$

33. (B) $\because \quad x = \frac{y \times r \times t}{100}$

$\Rightarrow \quad y = \frac{z \times r \times t}{100}$

$\Rightarrow \quad \frac{x}{y} = \frac{y}{z}$

$\therefore \quad y^2 = xz$

34. (A) Due to the rise in the rate of interest, annual income increases by Rs. $\left(8 - 6\frac{1}{2}\right) = \text{Rs. } 1\frac{1}{2}$, when the capital is Rs. 100.

Thus, the required capital $= \frac{100 \times 2 \times 4050}{3}$

$= \text{Rs. } 270000$

35. (A) $\because$ Income for 1 year = Rs. $\frac{1211}{4}$

Since the rate of interest for Rs. 3500 is 1% higher therefore, if we subtract 1% on Rs. 3500 from Rs. $\frac{1211}{4}$ the remainder will be 1 year's interest on (Rs. 4150 + Rs. 3500) at the lower rate of interest.

$\because$ Interest on (Rs. 4150 + Rs. 3500)

$= \text{Rs. } \frac{1211}{4} - 1\%$ on Rs. 3500

$\Rightarrow \quad \frac{7650 \times x \times 1}{100} = \frac{1211}{4} - \frac{3500 \times 1}{100}$

$= \frac{1211 - 140}{4} = \frac{1071}{4}$

$\therefore \quad x = \frac{1071 \times 10}{765 \times 4} = \frac{7}{2} = 3\frac{1}{2}\%$

and $(x+1)\% = 4\frac{1}{2}\%$

36. (B) We first find the rate per cent of Interest

Interest on Rs. 5600 = Rs. 6678 – Rs. 5600

$= \text{Rs. } 1078$

$\Rightarrow \quad \text{Rate } \% = \frac{100 \times 1078}{5600 \times 3\frac{1}{2}}$

$= \frac{100 \times 1078 \times 2}{5600 \times 7} = 5\frac{1}{2}\%$

$\Rightarrow$ Interest on Rs. 9400 $= \text{Rs. } \frac{9400 \times 21 \times 11}{100 \times 4 \times 2}$

$= \text{Rs. } \frac{10857}{4}$

$= \text{Rs. } 2714{\cdot}25$

$\therefore$ The required amount = Rs. 9400 + Rs. 2714·25

$= \text{Rs. } 12114{\cdot}25$

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37. (C) Let the sum be Rs. x

$$\text{S.I.} = \text{Rs. } 600,$$
$$\text{Time} = 10 \text{ years}$$
$$\therefore \quad \text{Rate} = \left(\frac{600 \times 100}{x \times 10}\right)\%$$
$$= \left(\frac{6000}{x}\right)\% \text{ per annum}$$
$$\text{S.I. for first 5 years} = \text{Rs.} \left(\frac{x \times 5 \times 6000}{100 \times x}\right)$$
$$= \text{Rs. } 300$$
$$\text{S.I. for last 5 years} = \text{Rs.} \left(\frac{3x \times 5 \times 6000}{100 \times x}\right)$$
$$= \text{Rs. } 900$$

Hence, total interest at the end of 10 years
$$= \text{Rs. } 1200.$$

38. (D) $\because \quad \text{Rate} = \frac{\text{Interest} \times 100}{\text{Principal} \times \text{Time}}\%$

$$\Rightarrow \quad \text{Rate} = \frac{2700 \times 100}{15000 \times 3}\%$$
$$\therefore \quad \text{Rate} = 6\%$$

39. (C)

40. (D) $\text{Rate} = \frac{\text{Interest} \times 100}{\text{Principal} \times \text{Time}}\%$

$$= \frac{3600 \times 100}{12000 \times 5}\%$$
$$= 6\%$$

41. (B) $r_1 = 5\%, \quad t_1 = 2 \text{ years}$
$r_2 = 8\%, \quad t_2 = 3 \text{ years}$
$r_3 = 10\%, \quad t_3 = 8 - (2 + 3)$
$= 3 \text{ years}$

$$\because \quad \text{Principal} = \frac{\text{Interest} \times 100}{r_1t_1 + r_2t_2 + r_3t_3}$$
$$= \frac{1280 \times 100}{5 \times 2 + 8 \times 3 + 10 \times 3}$$
$$= \frac{128000}{10 + 24 + 30} = \frac{128000}{64}$$
$$= \text{Rs. } 2000$$

42. (C) Let the principal $= \text{Rs. } x$

$$\Rightarrow \quad \text{Amount} = \text{Rs. } 2x$$
$$\Rightarrow \quad \text{Interest} = 2x - x = \text{Rs. } x$$
$$\because \quad \text{Rate} = \frac{\text{Interest} \times 100}{\text{Principal} \times 20}$$
$$= \frac{x \times 100}{x \times 20} = 5\%$$

43. (C) $\text{Rate} = \frac{\text{Interest} \times 100}{\text{Principal} \times \text{Time}}$

$$= \frac{800 \times 100}{8000 \times 2} = 5\%$$

44. (A) $r_1 = 5\%, \quad t_1 = 3 \text{ years}$
$r_2 = 8\%, \quad t_2 = 2 \text{ years}$
$r_3 = 10\%, \quad t_3 = 4 \text{ years}$
$r_4 = 12\%, \quad t_4 = 12 - (3 + 2 + 4)$
$= 3 \text{ years}$

$$\because \quad \text{Principal} = \frac{\text{Interest} \times 100}{r_1t_1 + r_2t_2 + r_3t_3 + r_4t_4}$$
$$= \frac{8560 \times 100}{(5 \times 3 + 8 \times 2 + 10 \times 4 + 12 \times 3)}$$
$$= \frac{856000}{107} = \text{Rs. } 8000$$

45. (D) Let the principal be Rs. x

$$\therefore \quad \text{Amount} = \text{Rs. } 10080$$
$$\therefore \quad \text{Simple interest} = \text{Amount} - \text{Principal}$$
$$= 10080 - \text{P}$$
$$\because \quad \text{Simple interest} = \frac{\text{Principal} \times \text{Rate} \times \text{Time}}{100}$$
$$\Rightarrow \quad 10080 - \text{P} = \frac{\text{P} \times 16 \times 5}{100}$$
$$\Rightarrow \quad 10080 - \text{P} = \frac{4\text{P}}{5}$$
$$\Rightarrow \quad 50400 - 5\text{P} = 4\text{P}$$
$$\Rightarrow \quad 50400 = 5\text{P} + 4\text{P}$$
$$\Rightarrow \quad 50400 = 9\text{P}$$
$$\therefore \quad \text{P} = \frac{50400}{9} = \text{Rs. } 5600$$

46. (B) Let principal $= \text{Rs. } 100$

$\therefore$ Interest on Rs. 100 at 8% for 2 years
$$= \frac{100 \times 8 \times 2}{100}$$
$$= \text{Rs. } 16$$

$\therefore$ Interest on Rs. 100 at 12% for 2 years
$$= \frac{100 \times 12 \times 2}{100}$$
$$= \text{Rs. } 24$$
$$\text{Difference} = 24 - 16$$
$$= \text{Rs. } 8$$

When difference is Rs. 8 principal is Rs. 100. When difference is Rs. 320
$$\text{the principal} = \frac{100}{8} \times 320$$
$$= \text{Rs. } 4000$$

47. (C) $\because \quad \text{S.I.} = \frac{\text{Principal} \times \text{Rate} \times \text{Time}}{100}$

$$\therefore \quad \text{Amount} - \text{Principal} = \frac{\text{Principal} \times \text{Rate} \times \text{Time}}{100}$$
$$\Rightarrow \quad 5712 - 4200 = \frac{4200 \times \text{Rate} \times 4}{100}$$
$$\Rightarrow \quad 1512 = 42 \times 4 \times \text{Rate}$$
$$\text{Rate} = \frac{1512}{42 \times 4} = 9\%$$

On increasing 3%, new rate of interest
$$= 9 + 3 = 12\%$$

Simple interest on new rate
$$= \frac{4200 \times 12 \times 4}{100}$$
$$= \text{Rs. } 2016$$
$$\text{Amount} = \text{Principal} + \text{Interest}$$
$$= 4200 + 2016$$
$$= \text{Rs. } 6216$$

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Compound Interest

Important Points/Facts

1. Let Principal = Rs. P,

Time = n years and Rate = R% p.a.

Case I. When interest is compounded annually

$$\text{Amount} = P\left(1+\frac{R}{100}\right)^n$$

Case II. When interest is compounded half yearly

$$\text{Amount} = P\left(1+\frac{\frac{1}{2}R}{100}\right)^{2n}$$

Case III. When interest is compounded quarterly

$$\text{Amount} = P\left(1+\frac{\frac{1}{4}R}{100}\right)^{4n}$$

Case IV. When time is fraction of a year, say $3\frac{1}{5}$ years, then

$$\text{Amount} = P\left(1+\frac{R}{100}\right)^3 \times \left(1+\frac{\frac{1}{5}R}{100}\right)$$

Case V. When rate of interest is $R_1\%$, $R_2\%$ and $R_3\%$ for 1st year, 2nd year and 3rd year respectively, then

$$\text{Amount} = P\left(1+\frac{R_1}{100}\right)\times\left(1+\frac{R_2}{100}\right)\times\left(1+\frac{R_3}{100}\right)$$

2. Present worth of a sum of Rs. x due n years hence is given by—

$$\text{Present worth} = \frac{x}{\left(1+\frac{R}{100}\right)^n}$$

Examples

Q. 1. Find compound interest on Rs. 50000 at 16% per annum for 2 years, compounded annually.

Solution : Amount after 2 years

$= \text{Rs.}\left[50000\times\left(1+\frac{16}{100}\right)^2\right]$

$= \text{Rs.}\left(50000\times\frac{29}{25}\times\frac{29}{25}\right)$

$= \text{Rs. } 67280$

$\therefore$ Compound interest

$= \text{Rs. } (67280 - 50000)$

$= \text{Rs. } 17280$

Q. 2. A certain sum on compound interest amount to Rs. 2809 in 2 years and Rs. 2977·54 in 3 years. Find the sum and rate per cent.

Solution : S.I. on Rs. 2809 for 1 year

$= \text{Rs. } (2977{\cdot}54 - 2809)$

$= \text{Rs. } 168{\cdot}54$

$\because$ S.I. on Rs. 100 for 1 year

$= \text{Rs.}\left(\frac{168{\cdot}54}{2809}\times 100\right)\%$

$= 6\%$

$\therefore$ Rate

$= 6\%$ per annum

Let the sum be Rs. 100

Amount of Rs. 100 for 2 years

$= \text{Rs.}\left[100\times\left(1+\frac{6}{100}\right)^2\right]$

$= \text{Rs.}\left(\frac{2809}{25}\right)$

$\because\ 100 : \frac{2809}{25} = x : 2809$

$\therefore\quad x = \frac{100\times 2809\times 25}{2809}$

$= 2500$

Hence, the sum = Rs. 2500

Q. 3. The difference between compound interest and the simple interest on a certain sum at $12\frac{1}{2}\%$ per annum for 3 years is Rs. 250. Find the sum.

Solution : Let the sum be Rs. x

Then, amount

$= \text{Rs.}\left[x\times\left(1+\frac{25}{2\times 100}\right)^3\right]$

$= \text{Rs.}\left(\frac{9}{8}\times\frac{9}{8}\times\frac{9}{8}\times x\right)$

$= \text{Rs.}\left(\frac{729}{512}\right)x$

$\therefore$ Compound interest

$= \text{Rs.}\left[\frac{729}{512}x - x\right]$

$= \text{Rs.}\left(\frac{217}{512}\right)x$

Simple interest

$= \text{Rs.}\left[x\times\frac{25}{2}\times\frac{3}{100}\right]$

$= \text{Rs.}\ \frac{3x}{8}$

$\because\ \frac{217}{512}x - 3\frac{x}{8} = 250$

$\Rightarrow 217x - 192x = 250\times 512$

$\therefore\quad x = \frac{250\times 512}{25}$

$= \text{Rs. } 5120$

Q. 4. If the compound interest on a certain sum of money for 3 years at 10% per annum be Rs. 993. What would be the simple interest ?

Solution : Let principal = Rs. P, then

$\because\ P\left(1+\frac{10}{100}\right)^3 - P = 993$

$\Rightarrow\left(\frac{11}{10}\times\frac{11}{10}\times\frac{11}{10} - 1\right)P = 993$

$\Rightarrow\ \left(\frac{1331-1000}{1000}\right)P = 993$

$\therefore\ P = \frac{993\times 1000}{331}$

$= 3000$

$\therefore$ Simple interest

$= \text{Rs.}\left(\frac{3000\times 3\times 10}{100}\right)$

$= \text{Rs. } 900$

Q. 5. Find compound interest on Rs. 51200 at 15% per annum for 9 months compounded quarterly.

Solution : Time = 9 months = 3 quarters Rate = 15% per annum $= \left(\frac{15}{4}\right)\%$ quarterly

$\therefore$ Amount

$= \text{Rs.}\left[51200\times\left(1+\frac{15}{4\times 100}\right)^3\right]$

$= \text{Rs.}\left(51200\times\frac{83}{80}\times\frac{83}{80}\times\frac{83}{80}\right)$

$= \text{Rs. } 57178{\cdot}70$

$\therefore$ Compound interest

$= \text{Rs. } (57178{\cdot}70 - 51200)$

$= \text{Rs. } 5978{\cdot}70$

Q. 6. Find compound interest on Rs. 100000 at 20% per annum for 2 years 3 months compounded annually.

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Solution : Here time = $2\frac{1}{4}$ years

$\because$ Amount

$$= \text{Rs.}\left[100000 \times \left(1+\frac{20}{100}\right)^2 \times \left(1+\frac{\frac{1}{4}\times 20}{100}\right)\right]$$

$$= \text{Rs.}\left(100000 \times \frac{6}{5} \times \frac{6}{5} \times \frac{21}{20}\right)$$

= Rs. 151200

$\therefore$ Compound interest

= Rs. (151200 – 100000)

= Rs. 51200

Exercise

1. The difference between the compound interest and the simple interest on a certain sum at 5% per annum for 2 years is Rs. 1·50. The sum is—
   (A) Rs. 600 (B) Rs. 500
   (C) Rs. 400 (D) Rs. 300

2. If the compound interest on a certain sum for 2 years at 12·5% per annum is Rs. 170, the simple interest is—
   (A) Rs. 150 (B) Rs. 152·50
   (C) Rs. 160 (D) Rs. 162·50

3. The simple interest on a certain sum for 2 years at 10% per annum is Rs. 90. The corresponding compound interest is—
   (A) Rs. 99 (B) Rs. 95·60
   (C) Rs. 94·50 (D) Rs. 108

4. What is the principal amount which earns Rs. 132 as compound interest for the second year at 10% per annum ?
   (A) Rs. 1000
   (B) Rs. 1200
   (C) Rs. 1320
   (D) None of these

5. At what rate of compound interest per annum will a sum of Rs. 1200 become Rs. 1348·32 in 2 years ?
   (A) 7% (B) 7·5%
   (C) 6% (D) 6·5%

6. A sum amounts to Rs. 1352 in 2 years at 4% compound interest. The sum is—
   (A) Rs. 1300 (B) Rs. 1250
   (C) Rs. 1260 (D) Rs. 1200

7. The compound interest on Rs. 30000 at 7% per annum for a certain time is Rs. 4347. The time is—
   (A) 2 years (B) $2\frac{1}{2}$ years
   (C) 3 years (D) 4 years

8. Rs. 800 at 5% per annum compound interest will amount to Rs. 882 in—
   (A) 1 year (B) 2 years
   (C) 3 years (D) 4 years

9. Simple interest on a sum at 4% per annum for 2 years is Rs. 80. The compound interest on the same sum for the same period is—
   (A) Rs. 81·60
   (B) Rs. 160
   (C) Rs. 1081·60
   (D) None of these

10. The difference of compound interest on Rs. 800 for 1 year at 20% per annum when compound half yearly and quarterly is—
    (A) Nil (B) Rs. 2·50
    (C) Rs. 4·40 (D) Rs. 6·60

11. The difference between simple interest and the compound interest on Rs. 600 for 1 year at 10% per annum, reckoned half yearly is—
    (A) Nil (B) Rs. 6·60
    (C) Rs. 4·40 (D) Rs. 1·50

12. The compound interest of Rs. 20480 at $6\frac{1}{4}$ % per annum for 2 years 73 days is—
    (A) Rs. 3000 (B) Rs. 3131
    (C) Rs. 2929 (D) Rs. 3636

13. The compound interest on Rs. 2800 for $1\frac{1}{2}$ years at 10% per annum is—
    (A) Rs. 441·35
    (B) Rs. 436·75
    (C) Rs. 434
    (D) Rs. 420

14. If Rs. 7500 are borrowed at compound interest at the rate of 4% per annum, then after 2 years the amount to be paid is—
    (A) Rs. 8082 (B) Rs. 7800
    (C) Rs. 8100 (D) Rs. 8112

15. The compound interest on a sum for 2 years is Rs. 832 and the simple interest on the same sum for the same period is Rs. 800. The difference between the compound and simple interest for 3 years will be—
    (A) Rs. 48
    (B) Rs. 66·56
    (C) Rs. 98·56
    (D) None of these

16. The difference in compound interest and simple interest for 2 years on a sum of money is Rs. 160. If the simple interest for 2 years be Rs. 2880, the rate per cent is—
    (A) $5\frac{5}{9}$ % (B) $12\frac{1}{2}$ %
    (C) $11\frac{1}{9}$ % (D) 9%

17. The value of a machine depreciates every year at the rate of 10% on its value at the beginning of that year. If the present value of the machine is Rs. 729, its worth 3 years ago was—
    (A) Rs. 947·10
    (B) Rs. 800
    (C) Rs. 1000
    (D) Rs. 750·87

18. A tree increases annually by $\frac{1}{8}$ th of its height. By how much will it increase after 2 years, if it stands today 64 cm high ?
    (A) 72 cm (B) 74 cm
    (C) 75 cm (D) 81 cm

19. The least number of complete years in which a sum of money put out at 20% compound interest will be more than doubled is—
    (A) 3 years (B) 4 years
    (C) 5 years (D) 6 years

20. A man borrows Rs. 4000 from a bank at $7\frac{1}{2}$ % compound interest. At the end of every he pays Rs. 1500 as part repayment of loan and interest. How much does he still owe to the bank after three such instalments ?
    (A) Rs. 123·25
    (B) Rs. 125
    (C) Rs. 400
    (D) Rs. 469·18

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21. A sum of Rs. 550 was taken as a loan. This is to be repaid in two equal annual instalments. If the rate of interest be 20% compounded annually then the value of each instalment is—
(A) Rs. 421 (B) Rs. 396
(C) Rs. 360 (D) Rs. 350

22. A loan was repaid in two annual instalments of Rs. 121 each. If the rate of interest be 10% per annum. Compounded annually, the sum borrowed was—
(A) Rs. 200
(B) Rs. 210
(C) Rs. 217·80
(D) Rs. 280

23. A sum amounts to Rs. 2916 in 2 years and to Rs. 3149·29 in 3 years at compound interest. The sum is—
(A) Rs. 1500 (B) Rs. 2000
(C) Rs. 2500 (D) Rs. 3000

24. A sum of money amounts to Rs. 10648 in 3 years and Rs. 9680 in 2 years. The rate of interest is—
(A) 5% (B) 10%
(C) 15% (D) 20%

25. A sum of Rs. 12000 deposited at compound interest becomes doubles after 5 years. After 20 years it will become—
(A) 120000 (B) 192000
(C) 124000 (D) 96000

26. A sum of money placed at compound interest doubles itself in 5 years. It will amount to eight times itself in—
(A) 15 years (B) 20 years
(C) 12 years (D) 10 years

27. A sum is invested at compound interest payable annually. The interest in two successive years was Rs. 500 and Rs. 540. The sum is—
(A) Rs. 3750 (B) Rs. 5000
(C) Rs. 5600 (D) Rs. 6250

28. The difference between simple interest and compound interest at the same rate for Rs. 5000 for 2 years is Rs. 72. The rate of interest is—
(A) 10% (B) 12%
(C) 6% (D) 8%

29. The compound interest on a certain sum of money for 2 years at 10% per annum is Rs. 420. The simple interest on the same sum at the same rate and for the same time will be—
(A) Rs. 350 (B) Rs. 375
(C) Rs. 380 (D) Rs. 400

30. A sum of money becomes Rs. 6690 after three years and Rs. 10035 after six years on compound interest. The sum is—
(A) Rs. 4400 (B) Rs. 4445
(C) Rs. 4460 (D) Rs. 4520

31. Rs. 1600 at 10% per annum compound interest compounded half yearly amount to Rs. 1944·81 in—
(A) 2 years (B) 3 years
(C) $1\frac{1}{2}$ years (D) $2\frac{1}{2}$ years

32. The difference between simple interest and compound interest on a sum for 2 years at 8% when the interest is compounded annually is Rs. 16. If the interest were compounded half yearly the difference in two interests would be nearly—
(A) Rs. 16 (B) Rs. 16·80
(C) Rs. 21·85 (D) Rs. 24·64

33. Divide Rs. 3903 between A and B, so that A's share at the end of 7 years may equal to B's share at the end of 9 years, compound interest being at 4 per cent.
(A) Rs. 2028, Rs. 1875
(B) Rs. 2018, Rs. 1885
(C) Rs. 2008, Rs. 1895
(D) Rs. 2038, Rs. 1865

34. A sum of money put out at compound interest amounts in 2 years to Rs. 578·40 and in 3 years to Rs. 614·55. Find the rate of interest.
(A) 6% (B) $6\frac{1}{4}\%$
(C) $6\frac{1}{2}\%$ (D) $6\frac{3}{4}\%$

35. Find what is that first year in which a sum of money will become more than double in amount if put out at compound interest at the rate of 10% per annum.
(A) 6th year
(B) 7th year
(C) 8th year
(D) Data inadequate

36. What will be the compound interest of Rs. 8000 at 10% p.a. for $1\frac{1}{2}$ years. When compound interest is payable half yearly ?
(A) Rs. 1261 (B) Rs. 1385
(C) Rs. 1480 (D) Rs. 1255

37. If the interest of a certain sum for the first year at 8% p.a. compound interest is Rs. 48. What will be the interest for the second year ?
(A) Rs. 52·55 (B) Rs. 51·84
(C) Rs. 58·60 (D) Rs. 53·04

38. If the simple interest on certain sum of money be Rs. 40 for 2 years and the compound interest on the same sum at the same rate and for the same time be Rs. 45. What is the principal ?
(A) Rs. 70 (B) Rs. 90
(C) Rs. 85 (D) Rs. 80

39. Neeraj saves Rs. 400 at the end of each year and lends this saving at 5% p.a. compound interest. How much will it worth at the end of 3 years ?
(A) Rs. 1312·50
(B) Rs. 1284
(C) Rs. 1315
(D) Rs. 1324·05

40. If the compound interest of a certain sum of money for 2 years at 5% p.a. is Rs. 328. What will be the simple interest on the same sum of money for the same time and at the same rate ?
(A) Rs. 320 (B) Rs. 322
(C) Rs. 325 (D) Rs. 326

41. What will be the approximate compound interest on Rs. 10105 at 10% p.a. for 3 years ?
(A) Rs. 4500 (B) Rs. 3000
(C) Rs. 3300 (D) Rs. 3600

42. If the compound interests of a certain sum of money for two successive years be Rs. 225 and Rs. 238·50. What is the rate of interest per annum ?
(A) 5% (B) 6%
(C) $7\frac{1}{2}\%$ (D) 10%

43. The cash price of a refrigerator is Rs. 7044. A customer paid Rs. 2000 in cash and promised to

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pay the remaining money in 3 yearly equal instalments at the rate of 5% per annum compound interest. What is the value of each instalment ?
(A) Rs. 1865 (B) Rs. 1868·28
(C) Rs. 1752 (D) Rs. 1852·20

44. A moneylender lends Rs. 2000 for 6 months at 20% per annum whereas the interest is compounded quarterly. After the given period he will get the amount of—
(A) Rs. 2205 (B) Rs. 2200
(C) Rs. 2160 (D) Rs. 2040

45. If a sum of money placed at compound interest becomes 3 times of itself in 3 year. In how many years will it be 9 times at the same rate of interest ?
(A) 6 years (B) 9 years
(C) 12 years (D) 5 years

46. In what time will Rs. 6250 amount to Rs. 6632·55 at 4% compound interest payable half yearly ?
(A) 3 years (B) $\frac{3}{2}$ years
(C) 1 year (D) $\frac{5}{2}$ years

47. Find the least number of complete years in which a sum of money put out at 20 per cent compound interest will be more than doubled.
(A) 2 years
(B) 3 years
(C) 4 years
(D) Data inadequate

48. In what time will Rs. 390625 amount to Rs. 456976 at 4 per cent compound interest ?
(A) 2 years (B) 4 years
(C) 3 years (D) 5 years

49. Find the effective annual rate of 4 per cent per annum compound interest paid quarterly.
(A) 4·0604% (B) 4·604%
(C) 5·0605% (D) 5·605%

50. Find the effective annual rate of 5 per cent per annum compound interest paid half yearly.
(A) 1·025%
(B) 6·0625%
(C) 5·062%
(D) None of these

51. A person invested a certain amount at simple interest at the rate of 6 per cent per annum earning Rs. 900 as an interest at the end of three years. Had the interest been compounded every year. How much more interest would he have earned on the same amount with the same interest after three years ?
(A) Rs. 38·13 (B) Rs. 25·33
(C) Rs. 55·08 (D) Rs. 35·30

52. The difference between the simple and the compound interest compounded every six months at the rate of 10 per cent per annum at the end of two years is Rs. 124·05. What is the sum ?
(A) Rs. 10000
(B) Rs. 6000
(C) Rs. 12000
(D) Rs. 8000

53. Vijay obtains a loan of 64000 against his fixed deposits. If the rate of interest be 2·5 paise per rupee per annum. Calculate the compound interest payable after 3 years.
(A) Rs. 4921 (B) Rs. 5020
(C) Rs. 4821 (D) Rs. 4920

Answers with Hints

1. (A) Let the sum be Rs. 100 then,

$$\text{S.I.} = \text{Rs.}\left(\frac{100\times5\times2}{100}\right) = \text{Rs. } 10$$

$$\text{C.I.} = \text{Rs.}\left[\left\{100\times\left(1+\frac{5}{100}\right)^2\right\}-100\right]$$

$$= \text{Rs.}\ \frac{41}{4}$$

$\therefore$ Difference between C.I. and S.I.

$$= \text{Rs.}\left(\frac{41}{4}-10\right)$$

$$= \text{Re. } 0{\cdot}25$$

$\Rightarrow$ 0·25 : 150 : : 100 : x

$\therefore$ $x = \left(\frac{1{\cdot}50\times100}{0{\cdot}25}\right) = \text{Rs. } 600$

2. (C) $\because$ S.I. on Re. 1 $= \text{Rs.}\left(1\times2\times\frac{25}{2}\times\frac{1}{100}\right)$

$$= \text{Re.}\ \frac{1}{4}$$

$\Rightarrow$ C.I. on Re. 1 $= \text{Rs.}\left[1\times\left(1+\frac{25}{2\times100}\right)^2-1\right]$

$$= \text{Re.}\ \frac{17}{64}$$

$\Rightarrow$ $\frac{\text{S.I.}}{\text{C.I.}} = \left(\frac{1}{4}\times\frac{64}{17}\right) = \frac{16}{17}$

$\therefore$ $\text{S.I.} = \frac{16}{17}\times\text{C.I.}$

$$= \text{Rs.}\left(\frac{16}{17}\times170\right)$$

$$= \text{Rs. } 160$$

3. (C) $\text{Sum} = \text{Rs.}\left(\frac{100\times90}{2\times10}\right) = \text{Rs. } 450$

$$\text{C.I.} = \text{Rs.}\left[450\times\left(1+\frac{10}{100}\right)^2-450\right]$$

$$= \text{Rs. } 94{\cdot}50$$

4. (B) Let x be the principal at the end of first year.

Then $\frac{x\times10\times1}{100} = 132$

$\Rightarrow$ $x = 1320$

Let y be the original principal

Then, $y+\frac{y\times10\times1}{100} = 1320$

$\Rightarrow$ $y = 1200$

5. (C) Let the rate be x% per annum. Then,

$$1200\times\left(1+\frac{x}{100}\right)^2 = 1348{\cdot}32$$

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$\Rightarrow \quad \left(1+\frac{x}{100}\right)^2 = \frac{1348{\cdot}32}{1200}$

$= 1{\cdot}1236 = (1{\cdot}06)^2$

$\Rightarrow \quad \left(1+\frac{x}{100}\right) = 1{\cdot}06$

$\Rightarrow \quad \frac{x}{100} = 0{\cdot}06$

$\therefore \quad x = 6\%$

6. (B) Let the sum be P. Then,

$1352 = P\left(1+\frac{4}{100}\right)^2$

$\Rightarrow \quad 1352 = P \times \frac{26}{25} \times \frac{26}{25}$

$\Rightarrow \quad P = \frac{1352 \times 25 \times 25}{26 \times 26} = 1250$

$\therefore$ Principal = Rs. 1250

7. (A) $\because 30000 \times \left(1+\frac{7}{100}\right)^t = 30000 + 4347$

$\Rightarrow \quad \left(\frac{107}{100}\right)^t = \frac{34347}{30000}$

$= \frac{11449}{10000} = \left(\frac{107}{100}\right)^2$

$\therefore$ Time = 2 years

8. (B) Let time be t years

$\because \quad 882 = 800\left(1+\frac{5}{100}\right)^t$

$\Rightarrow \quad \frac{882}{800} = \left(\frac{21}{20}\right)^t$

$\Rightarrow \quad \left(\frac{21}{20}\right)^2 = \left(\frac{21}{20}\right)^t$

$\Rightarrow \quad t = 2$

$\therefore$ Time = 2 years

9. (A) Principal = Rs. $\left(\frac{100 \times 80}{4 \times 2}\right)$ = Rs. 1000

$\therefore$ C.I. = Rs. $\left[\left\{1000 \times \left(1+\frac{4}{100}\right)^2 - 1000\right\}\right]$

= Rs. 81·60

10. (C) C.I. when reckoned half yearly

= Rs. $\left[800 \times \left(1+\frac{10}{100}\right)^2 - 800\right]$

= Rs. 168

C. I. when reckoned quarterly

= Rs. $800\left[\left(1+\frac{5}{100}\right)^4 - 1\right]$

$= 800\left[\frac{194481 - 160000}{160000}\right]$

$= \frac{34481}{200}$

= Rs. 172·40

$\therefore$ Required Difference

= Rs. (172·40 – 168)

= Rs. 4·40

11. (D) S.I. = Rs. $\left(\frac{600 \times 5 \times 2}{100}\right)$ = Rs. 60

C.I. = Rs. $\left[600 \times \left(1+\frac{5}{100}\right)^2 - 600\right]$

= Rs. 61·50

$\therefore$ Required Difference

= Rs. (61·50 – 60)

= Rs. 1·50

12. (C) C.I. = Rs. $\left[\begin{array}{c} 20480 \times \left(1+\frac{25}{4 \times 100}\right)^2 \\ \left(1+\frac{1}{5} \times \frac{25}{4 \times 100}\right) - 20480 \end{array}\right]$

= Rs. $\left[\left(20480 \times \frac{17}{16} \times \frac{17}{16} \times \frac{81}{80}\right) - 20480\right]$

$= 20480\left[\frac{23409 - 20480}{20480}\right]$

= Rs. 2929

13. (C) $\because$ Amount

= Rs. $\left[2800 \times \left(1+\frac{10}{100}\right)\left(1+\frac{5}{100}\right)\right]$

= Rs. $\left[2800 \times \frac{11}{10} \times \frac{21}{20}\right]$

= Rs. 3234

$\therefore$ Required C. I.

= Rs. (3234 – 2800)

= Rs. 434

14. (D) Amount = Rs. $\left[7500\left(1+\frac{4}{100}\right)^2\right]$

= Rs. $\left[7500 \times \frac{26}{25} \times \frac{26}{25}\right]$

= Rs. 8112

15. (C) S.I. for first year = Rs. 400

S.I. on Rs. 400 for 1 year = Rs. 32

$\therefore$ Rate = $\left(\frac{100 \times 32}{400 \times 1}\right) = 8\%$

Hence, the difference for 3rd year is S.I. on Rs. 832

= Rs. $\left(832 \times \frac{8}{100}\right)$

= Rs. 66·56

$\therefore$ Total difference = Rs. (32 + 66·56)

= Rs. 98·56

16. (C) $\because$ S.I. for 1 year = Rs. 1440

$\Rightarrow$ S.I. on Rs. 1440 for 1 year = Rs. 160

Hence, $\therefore$ Rate per cent = $\left(\frac{100 \times 160}{1440 \times 1}\right)\%$

$= \frac{100}{9}\%$

$= 11\frac{1}{9}\%$

17. (C) $\because P\left(1-\frac{10}{100}\right)^3 = 729$

$\therefore \quad P$ = Rs. $\left(\frac{729 \times 10 \times 10 \times 10}{9 \times 9 \times 9}\right)$

= Rs. 1000

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18. (D) Increase% $= \left(\frac{1}{8}\times 100\right)\% = 12{\cdot}5\%$

Height after 2 years $= 64\times\left(1+\frac{25}{2\times 100}\right)^2$

$= \left(64\times\frac{9}{8}\times\frac{9}{8}\right)$

$= 81$ cm

19. (B) $\because \quad x\left(1+\frac{20}{100}\right)^n > 2x$

$\Rightarrow \quad \left(\frac{6}{5}\right)^n > 2$

Now, $\left(\frac{6}{5}\times\frac{6}{5}\times\frac{6}{5}\times\frac{6}{5}\right) > 2$

$\Rightarrow \quad \frac{1296}{615} > 2$

$\therefore \quad n = 4$ years

20. (A) Balance $=$ Rs. $\left[\left\{4000\times\left(1+\frac{15}{2\times 100}\right)^3\right\}\right.$

$-\left\{1500\times\left(1+\frac{15}{2\times 100}\right)^2+1500\right.$

$\left.\left.\times\left(1+\frac{15}{2\times 100}\right)+1500\right\}\right]$

$=$ Rs. 123·25

21. (C) Let the value of each instalment be Rs. x

Then, $\left\{\frac{x}{\left(1+\frac{20}{100}\right)}+\frac{x}{\left(1+\frac{20}{100}\right)^2}\right\} = 550$

$\Rightarrow \quad \frac{5x}{6}+\frac{25x}{36} = 550$

$\Rightarrow \quad \frac{55x}{36} = 550$

$\therefore \quad x = 360$

22. (B) Principal $=$ (P.W. of Rs. 121 due 1 year hence) + (P.W. of Rs. 121 due 2 years hence)

$=$ Rs. $\left[\frac{121}{\left(1+\frac{10}{100}\right)}+\frac{121}{\left(1+\frac{10}{100}\right)^2}\right]$

$=$ Rs. 210

23. (C) Let P be the principal and R% per annum be rate

Then, $P\left(1+\frac{R}{100}\right)^3 = 3149{\cdot}28 \quad \ldots(i)$

and $P\left(1+\frac{R}{100}\right)^2 = 2916 \quad \ldots(ii)$

On dividing (i) and (ii) we get

$\therefore \quad \left(1+\frac{R}{100}\right) = \frac{3149{\cdot}28}{2916}$

$\Rightarrow \quad \frac{R}{100} = \frac{233{\cdot}28}{2916}$

$\Rightarrow \quad R = \frac{233{\cdot}28}{2916}\times 100 = 8\%$

Now, $P\left(1+\frac{8}{100}\right)^2 = 2916$

$\Rightarrow \quad P\times\frac{27}{25}\times\frac{27}{25} = 2916$

$\therefore \quad P = \frac{2916\times 25\times 25}{27\times 27}$

$=$ Rs. 2500

24. (B) Let P be the principal and R% per annum be the rate. Then,

$P\left(1+\frac{R}{100}\right)^3 = 10648 \quad \ldots(i)$

and $P\left(1+\frac{R}{100}\right)^2 = 9680 \quad \ldots(ii)$

On dividing (i) by (ii), we have

$\Rightarrow \quad \left(1+\frac{R}{100}\right) = \frac{10648}{9680}$

$\Rightarrow \quad \frac{R}{100} = \frac{968}{9680} = \frac{1}{10}$

$\therefore \quad R = \frac{1}{10}\times 100 = 10\%$

25. (B) $\because \quad 2P = P\left(1+\frac{r}{100}\right)^5$

$\Rightarrow \quad \left(1+\frac{r}{100}\right)^5 = 2$

$\therefore \quad \left(1+\frac{r}{100}\right)^{20} = 2^4 = 16$

Thus, $P\left(1+\frac{r}{100}\right)^{20} = 16P$

$=$ Rs. (12000×16)

$=$ Rs. 192000

26. (A) Let the principal be P and rate be r%. Then

$2P = P\left(1+\frac{r}{100}\right)^5$

$\Rightarrow \quad \left(1+\frac{r}{100}\right)^5 = 2$

Let it be 8 times in t years, then

$\because \quad 8P = P\left(1+\frac{r}{100}\right)^t$

$\Rightarrow \quad \left(1+\frac{r}{100}\right)^t = 8 \Rightarrow (2)^3 \Rightarrow \left(1+\frac{r}{100}\right)^{15}$

$\therefore \quad t = 15$ years.

27. (D) S.I. on Rs. 500 for 1 year $= 540 - 500$

$=$ Rs. 40

$\therefore \quad$ Rate $= \left(\frac{100\times 40}{500\times 1}\right) = 8\%$

and Sum $=$ Rs. $\left(\frac{100\times 500}{8\times 1}\right)$

$=$ Rs. 6250

28. (B)

$\because \left[5000\times\left(1+\frac{R}{100}\right)^2-5000\right]-\frac{5000\times 2\times R}{100} = 72$

$\Rightarrow \quad 5000\left[\left(1+\frac{R}{100}\right)^2-1-\frac{R}{50}\right] = 72$

$\Rightarrow \quad 1+\frac{R^2}{10000}+\frac{2R}{100}-1-\frac{R}{50} = \frac{72}{5000}$

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$\Rightarrow \quad R^2 = \left(\frac{72}{5000} \times 10000\right) = 144$

$\therefore \quad R = 12\%$

29. (D) Let the principal be P. Then,

$\because \quad P\left(1 + \frac{10}{100}\right)^2 - P = 420$

$\Rightarrow \quad P\left(\frac{121 - 100}{100}\right) = 420$

$\Rightarrow \quad P = \text{Rs. } 2000$

$\therefore \quad \text{Required S.I.} = \text{Rs. } \left(\frac{2000 \times 2 \times 10}{100}\right)$

$= \text{Rs. } 400$

30. (C) Let the principal be P, then

$P\left(1 + \frac{R}{100}\right)^3 = 6690 \quad \ldots(i)$

and $P\left(1 + \frac{R}{100}\right)^6 = 10{,}035 \quad \ldots(ii)$

Now, Dividing (ii) by (i), we get

$\Rightarrow \quad \left(1 + \frac{R}{100}\right)^3 = \frac{10035}{6690} = \frac{3}{2}$

$\Rightarrow \quad P \times \frac{3}{2} = 6690$

$\therefore \quad P = \left(6690 \times \frac{2}{3}\right) = \text{Rs. } 4460$

31. (A) $1600\left(1 + \frac{5}{100}\right)^T = 1944{\cdot}81$

$\Rightarrow \quad \left(\frac{21}{20}\right)^T = \frac{1944{\cdot}81}{1600{\cdot}00}$

$= \frac{194481}{160000}$

$= \left(\frac{441}{400}\right)^2$

$= \left(\frac{21}{20}\right)^4$

$\therefore \quad T = 4 \text{ (Half years)}$

$\Rightarrow \quad \text{Required time} = 2 \text{ years}$

32. (D) For first year, S.I. = C.I.

Thus, Rs. 16 is the S.I. on S.I. for 1 year, which at 8% is thus Rs. 200, *i.e.*, S.I. on the principal for 1 year is Rs. 200

$\therefore \quad \text{Principal} = \text{Rs. } \left(\frac{100 \times 200}{8 \times 1}\right)$

$= \text{Rs. } 2500$

Amount for 2 years, compounded half yearly

$= \text{Rs. } \left[2500 \times \left(1 + \frac{4}{100}\right)^4\right]$

$= \text{Rs. } 2924{\cdot}64$

$\therefore \quad \text{C.I.} = \text{Rs. } 424{\cdot}64$

Also, $\text{S.I.} = \text{Rs. } \left(\frac{2500 \times 8 \times 2}{100}\right)$

$= \text{Rs. } 400$

Hence $[(\text{C.I.}) - (\text{S.I.})] = \text{Rs. } (424{\cdot}64 - 400)$

$\therefore$ Required difference $= \text{Rs. } 24{\cdot}64$

33. (A) We have (A's present share) $\left(1 + \frac{4}{100}\right)^7$

$= \text{(B's present share)} \left(1 + \frac{4}{100}\right)^9$

$\therefore \quad \frac{\text{A's present share}}{\text{B's present share}} = \left(1 + \frac{4}{100}\right)^2$

$= \left(\frac{26}{25}\right)^2 = \frac{676}{625}$

Dividing Rs. 3903 in the ratio of 676 : 625

$\therefore \quad \text{A's present share} = \frac{676}{(676 + 625)} \text{ of Rs. } 3903$

$= \text{Rs. } 2028$

B's present share $= \text{Rs. } 3903 - \text{Rs. } 2028$

$= \text{Rs. } 1875$

34. (B) Clearly the difference between Rs. 578·40 and Rs. 614·55 is the interest on Rs. 578·40 for 1 year.

$\therefore$ Interest on Rs. 578·40 for 1 year

$= \text{Rs. } 614{\cdot}55 - \text{Rs. } 578{\cdot}40$

$= \text{Rs. } 36{\cdot}15$

$\therefore$ Interest on Rs. 100 for 1 year

$= \text{Rs. } 36{\cdot}15 \times \frac{100}{578{\cdot}40}$

$= \text{Rs. } \frac{3615}{57840} \times \frac{100}{1}$

$= 6{\cdot}25$

$= \text{Rs. } 6\frac{1}{4}$

$\therefore$ The required rate is $6\frac{1}{4}$ per cent.

35. (C) Here, $P\left(1 + \frac{10}{100}\right)^t > 2P$

$\Rightarrow \quad \left(\frac{11}{10}\right)^t > 2$

when $t = 8 \rightarrow \left(\frac{11}{10}\right)^8 = 2{\cdot}14358$

$t = 7 \rightarrow \left(\frac{11}{10}\right)^7 = 1{\cdot}9487$

By trial, $\frac{11 \times 11 \times 11 \times 11 \times 11 \times 11 \times 11 \times 11}{10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10} > 2$

Hence, the first year in which sum of money will become more than double in amount is **8th year.**

36. (A) Yearly interest $= 10\%$

Half yearly interest $= 5\%$

$\text{Time} = 1\frac{1}{2} \text{ year}$

$= \frac{3}{2} \times 2 \text{ half yearly}$

$= 3 \text{ half yearly}$

$\text{Amount} = 8000\left(1 + \frac{5}{100}\right)^3$

$= 8000 \times \left(\frac{21}{20}\right)^3$

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$$= 8000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20}$$

$$= \text{Rs. } 9261$$

$$\text{Compound interest} = \text{Amount} - \text{Principal}$$

$$= 9261 - 8000$$

$$= \text{Rs. } 1261$$

37. (B) S.I. or C.I. for first year are always equal

$$\text{Principal} = \frac{\text{S.I.} \times 100}{\text{Rate} \times \text{Time}}$$

$$= \frac{48 \times 100}{8 \times 1} = \text{Rs. } 600$$

Interest for second year

= Amount of second year – Amount of the first year

$$= 600\left(1 + \frac{8}{100}\right)^2 - 600\left(1 + \frac{8}{100}\right)$$

$$= 600\left(\frac{27}{25}\right)^2 - 600\left(\frac{27}{25}\right)$$

$$= 600\left(\frac{27}{25}\right)\left\{\frac{27}{25} - 1\right\}$$

$$= 600\left(\frac{27}{25}\right)\left(\frac{2}{25}\right)$$

$$= \text{Rs. } 51{\cdot}84$$

38. (D) $\because$ S.I. for 2 years = Rs. 40

S.I. for 1 year = Rs. 20

$$\text{Rate} = \frac{\text{C.I. for 2 years} - \text{S.I. for 2 years}}{\text{S.I. for 1 year}} \times 100$$

$$= \frac{(45 - 40)}{20} \times 100 = 25\%$$

$$\therefore \quad \text{Principal} = \frac{\text{S.I.} \times 100}{\text{Rate} \times \text{Time}}$$

$$= \frac{40 \times 100}{25 \times 2}$$

$$= \text{Rs. } 80$$

39. (D) Amount after 3 years

$$= 400\left(1 + \frac{5}{100}\right)^3 + 400\left(1 + \frac{5}{100}\right)^2 + 400\left(1 + \frac{5}{100}\right)$$

$$= 400\left(1 + \frac{5}{100}\right)\left\{\left(1 + \frac{5}{100}\right)^2 + \left(1 + \frac{5}{100}\right) + 1\right\}$$

$$= 400\left(\frac{105}{100}\right)\left\{\left(\frac{105}{100}\right)^2 + \left(\frac{105}{100}\right) + 1\right\}$$

$$= 400\left(\frac{21}{20}\right)\left\{\left(\frac{21}{20}\right)^2 + \frac{21}{20} + 1\right\}$$

$$= 420\left(\frac{441}{400} + \frac{21}{20} + 1\right)$$

$$= 420\left(\frac{441 + 420 + 400}{400}\right)$$

$$= 420\left(\frac{1261}{400}\right)$$

$$= \text{Rs. } 1324{\cdot}05$$

40. (A) $\because$ $328 = \text{Principal}\left\{\left(1 + \frac{5}{100}\right)^2 - 1\right\}$

$$\Rightarrow \quad 328 = \text{Principal}\left(\frac{441}{400} - 1\right)$$

$$\Rightarrow \quad 328 = \text{Principal}\,\frac{41}{400}$$

$$\Rightarrow \quad \text{Principal} = \frac{328 \times 400}{41}$$

$$= \text{Rs. } 3200$$

$$\therefore \text{ Simple interest} = \frac{3200 \times 5 \times 2}{100}$$

$$= \text{Rs. } 320$$

41. (C) $\text{Compound interest} = P\left\{\left(1 + \frac{r}{100}\right)^t - 1\right\}$

$$= 10105\left\{\left(1 + \frac{10}{100}\right)^3 - 1\right\}$$

$$= 10105\left\{\left(\frac{11}{10}\right)^3 - 1\right\}$$

$$= 10105\left\{\frac{1331}{1000} - 1\right\}$$

$$= 10105\left(\frac{331}{1000}\right)$$

$$= 3344{\cdot}755$$

$$\simeq \text{Rs. } 3300 \text{ (app.)}$$

42. (B) $\text{Rate} = \frac{238{\cdot}50 - 225}{225} \times 100\%$

$$= 6\%$$

43. (D) Remaining money = 7044 – 2000

= Rs. 5044

If each instalment is of Rs. x

When the amount is Rs. x at the end of first second and third year at the rate of 5% then principal will be—

$$\frac{x}{\left(1 + \frac{5}{100}\right)}, \frac{x}{\left(1 + \frac{5}{100}\right)^2} \text{ and } \frac{x}{\left(1 + \frac{5}{100}\right)^3}$$

$$\because \frac{x}{\left(1 + \frac{5}{100}\right)} + \frac{x}{\left(1 + \frac{5}{100}\right)^2} + \frac{x}{\left(1 + \frac{5}{100}\right)^3} = 5044$$

$$\Rightarrow \quad x\left(\frac{20}{21}\right) + x\left(\frac{20}{21}\right)^2 + x\left(\frac{20}{21}\right)^3 = 5044$$

$$\Rightarrow \quad x\left(\frac{20}{21}\right)\left\{1 + \left(\frac{20}{21}\right) + \left(\frac{20}{21}\right)^2\right\} = 5044$$

$$\Rightarrow \quad x\left(\frac{20}{21}\right)\left\{1 + \frac{20}{21} + \frac{400}{441}\right\} = 5044$$

$$\Rightarrow \quad x\left(\frac{20}{21}\right)\left\{\frac{441 + 420 + 400}{441}\right\} = 5044$$

$$\Rightarrow \quad x\left(\frac{20}{21}\right)\left(\frac{1261}{441}\right) = 5044$$

$$\therefore \quad x = \frac{5044 \times 21 \times 441}{20 \times 1261}$$

$$= \text{Rs. } 1852{\cdot}20$$

44. (A) For the quarterly interest,

$$\text{Time} = \frac{6}{12} \text{ year} \times 4$$

$$= 2 \text{ quarterly}$$

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Rate = 20 ÷ 4
= 5%

(∵ On quarterly interest time is multiplied by 4 and rate is divided by 4)

Hence, required amount

$$= \text{Principal}\left(1+\frac{\text{Rate}}{100}\right)^{\text{Time}}$$

$$= 2000\left(1+\frac{5}{100}\right)^2$$

$$= 2000\left(\frac{21}{20}\right)^2$$

= Rs. 2205

45. (A) Let the principal be P then Amount be 3P

$$\because \quad 3P = P\left(1+\frac{r}{100}\right)^3$$

$$\Rightarrow \quad 3 = \left(1+\frac{r}{100}\right)^3$$

On squaring on both the sides,

$$\Rightarrow \quad (3)^2 = \left\{\left(1+\frac{r}{100}\right)^3\right\}^2$$

$$\therefore \quad 9 = \left(1+\frac{r}{100}\right)^6$$

Hence, it will become 9 times in 6 years.

46. (B) $\because \quad 6250\left[1+\frac{\frac{4}{2}}{100}\right]^{2t} = 6632{\cdot}55$

$$\Rightarrow \quad \left(1+\frac{2}{100}\right)^{2t} = \frac{663255}{625000}$$

$$= \frac{132651}{125000} = \left(\frac{51}{50}\right)^3$$

$$\Rightarrow \quad \left(\frac{51}{50}\right)^{2t} = \left(\frac{51}{50}\right)^3$$

$$\Rightarrow \quad 2t = 3$$

$$\therefore \quad t = \frac{3}{2} \text{ years}$$

47. (C) Here $P\left(1+\frac{20}{100}\right)^t > 2P$

$$\Rightarrow \quad \left(\frac{6}{5}\right)^t > 2$$

$$\because \quad \left(\frac{6}{5}\right)^3 = 1{\cdot}728$$

and $\left(\frac{6}{5}\right)^4 = 2{\cdot}0736$

By trial $\frac{6}{5}\times\frac{6}{5}\times\frac{6}{5}\times\frac{6}{5} > 2$

∴ The required time is 4 years.

48. (B) $\because \quad P\left(1+\frac{r}{100}\right)^t = A$

$$\Rightarrow \quad 390625\left(1+\frac{4}{100}\right)^t = 456976$$

$$\Rightarrow \quad \left(1+\frac{4}{100}\right)^t = \frac{456976}{390625} = \left(\frac{26}{25}\right)^4$$

$$\Rightarrow \quad \left(\frac{26}{25}\right)^t = \left(\frac{26}{25}\right)^4$$

$$\Rightarrow \quad t = 4$$

∴ The required time is 4 years.

49. (A) Effective annual rate

$$= 100\left(1+\frac{\frac{4}{4}}{100}\right)^4 - 100$$

$$= \left(\frac{101}{100}\right)^4 \times 100 - 100$$

$$= 104{\cdot}0604 - 100$$

$$= 4{\cdot}0604\%$$

50. (C) The amount of Rs. 100 in one year at compound interest at 5% per annum payable half yearly.

$$= \text{Rs. } 100\left(1+\frac{\frac{5}{2}}{100}\right)^2$$

$$= \text{Rs. } 100\left(\frac{102{\cdot}5}{100}\right)^2$$

$$= \text{Rs. } 100\,(1{\cdot}025)^2$$

$$= \text{Rs. } 105{\cdot}0625$$

Thus, the nominal rate of 5% payable half yearly has the same effect as the rate of 5·0625 per cent would have, if payable yearly.

Hence 5·0625 per cent is called the effective annual rate 5% per annum payable half yearly.

51. (C) Certain sum for the person

$$= \frac{900\times 100}{6\times 3} = \text{Rs. } 5000$$

∴ Interest on Rs. 5000 by C.I.

$$= 5000\left(1+\frac{6}{100}\right)^3 - 5000$$

$$= \text{Rs. } 955{\cdot}08$$

∴ More interest = Rs. (955·08 – 900)

= Rs. 55·08

52. (D) Let the sum be Rs. x, then

$$\because \left[x\left(1+\frac{5}{100}\right)^4 - x\right] - \left[\frac{x\times 10\times 2}{100}\right] = 124{\cdot}05$$

Solving the above equation, we get x = Rs. 8000.

53. (A) P = Rs. 64000

r = 2·5 paise per rupee per annum (given)

= 0·025 rupee per rupee per annum

= 0·025 × 100 rupee per hundred rupee per annum

= 0·025 × 100 per cent per annum

= 2·5 per cent per annum

t = 3 years

$$\text{C.I.} = 64000\left[\left(1+\frac{2{\cdot}5}{100}\right)^3 - 1\right]$$

$$= 64000\,[(1{\cdot}025)^3 - 1]$$

$$= 64000\,[1{\cdot}0769 - 1]$$

$$= 64000 \times 0{\cdot}0769$$

$$= 4921{\cdot}6$$

= Rs. 4921

∴ The compound interest payable is Rs. 4921.

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Problems Based on Ages

Essential Points/Facts

1. If the present age of A is x year, then the age of A, n year ago was $(x - n)$ year and the age of A after n year will be $(x + n)$ year.

2. The present age of A and B are x year and y year respectively. If the age of A is 3 times the age of B. Then the linear equation will be as follows—

$$x = 3y$$

or $\quad x - 3y = 0$

3. Three consecutive odd or even numbers are x, $x + 2$ and $x + 4$ or $(x - 2)$, x, $(x + 2)$ where x is an odd or even number.

Examples

Q. 1. Arun is as older than Anil as he is younger than Bhushan. If the sum of the age of Anil and Bhushan is 58 year then what is the age of Arun ?

Solution : From the equation,

Arun – Anil = Bhushan – Arun

$\Rightarrow$ Arun + Arun

= Anil + Bhushan

$$\Rightarrow \text{Arun} = \boxed{\frac{\text{Anil + Bhushan}}{2}}$$

Hence, Age of Arun $= \frac{58}{2}$

$= 29$ year

Short Method

In such questions the given sum total is to be halved

$$\text{Age of Arun} = \frac{58}{2}$$

$= 29$ year

Q. 2. The ratio of two numbers is 3 : 7. If b is added to each number then the ratio becomes 5 : 9. What are these numbers ?

Solution : Let the numbers are $3x$ and $7x$ then,

From the question,

$$\because \quad \frac{3x + 6}{7x + 6} = \frac{5}{9}$$

$$\Rightarrow \quad 27x + 54 = 35x + 30$$

$$\Rightarrow \quad 35x - 27x = 54 - 30$$

$$\Rightarrow \quad 8x = 24$$

$$\therefore \quad x = 3$$

So that numbers are

$$3x = 3 \times 3 = 9$$

and $\quad 7x = 7 \times 3 = 21$

Short Method

Here, $\frac{3x + 6}{7x + 6} = \frac{5}{9}$

$$x = \frac{6(5 - 9)}{27 - 35}$$

$$= \frac{6 \times 4}{8} = 3$$

i.e., numbers are 9 and 21.

Q. 3. 6 years ago the ratio in the ages of Kamal and Suresh was 6 : 5 and after 4 year the ratio in their ages will be 11 : 10. Find the present age of Suresh.

Solution : Let 6 year ago, the ages of Kamal and Suresh were $6x$ and $5x$ respectively.

$\therefore$ After 6 year, the ratio of the ages of Kamal and Suresh

$= (6x + 6) : (5x + 6)$

Again, after 4 year, the ratio of the ages of Kamal and Suresh

$= (6x + 6 + 4) : (5x + 6 + 4)$

Now, from the question,

$$\because \quad \frac{6x + 6 + 4}{5x + 6 + 4} = \frac{11}{10}$$

$$\Rightarrow \quad \frac{6x + 10}{5x + 10} = \frac{11}{10}$$

$$\Rightarrow \quad 60x + 100 = 55x + 110$$

$$\Rightarrow \quad 60x - 55x = 110 - 100$$

$$\Rightarrow \quad 5x = 10$$

$$x = 2$$

$\therefore$ The present age of Suresh

$= 5x + 6$

$= 5 \times 2 + 6$

$= 16$ year

Short Method

$$\because \quad \frac{6x + 6 + 4}{5x + 6 + 4} = \frac{11}{10}$$

Here, $\quad a : b = 6 : 5$

$\quad c : d = 11 : 10$

and $\quad p = 6 + 4 = 10$

$$x = \frac{10(11 - 10)}{60 - 55}$$

$$= \frac{10}{5} = 2$$

$\therefore$ Present age of Suresh

$= 5x + 6$

$= 5 \times 2 + 6$

$= 16$ year

Q. 4. The difference between a number of two digits and the number obtained by interchanging its digits is 18. How much is the difference between both digits of that number ?

Solution : Let the number be

$= (10a + b)$

On interchanging the digits,

Number $= (10b + a)$

$\therefore$ From the question,

$$(10a + b) - (10b + a) = 18$$

$$9a - 9b = 18$$

$$a - b = \frac{18}{9} = 2$$

i.e., difference between both digits = 2

Short Method

$$\text{Required difference} = \frac{x}{9}$$

$$= \frac{18}{9} = 2$$

Q. 5. In a number of two digits, both digits are interchanged. If the sum of the number and the number obtained by interchanging its digits is 44, then what is the sum of its two digits ?

Solution : Let the number is

$= 10a + b$

$\therefore$ Number obtained by interchaning its both digits

$= 10b + a$

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$\therefore$ From the question,

$$10a + b + 10b + a = 44$$

$$11a + 11b = 44$$

$$a + b = \frac{44}{11} = 4$$

Hence, sum of the two digits = 4

Short Method

Sum of the two digits of the number $= \frac{x}{11} = \frac{44}{11}$

$= 4$

Exercise

1. The ratio of the father's age to the son's age is 4 : 1. The product of their ages is 196. The ratio of their ages after 5 years will be—
   (A) 3 : 1 (B) 10 : 3
   (C) 11 : 4 (D) 14 : 5
2. 10 years ago, Chandravati's mother was 4 times older than her daughter. After 10 years, the mother will be twice older than the daughter. The present age of Chandravati is—
   (A) 5 years (B) 10 years
   (C) 20 years (D) 30 years
3. After five years the age of a father will be thrice the age of his son whereas five years ago, he was seven times as old as his son was. What is father's present age ?
   (A) 35 years (B) 40 years
   (C) 45 years (D) 50 years
4. The age of Arvind's father is 4 times of his age. If 5 years ago, father's age was 7 times of the age of his son at that time. What is Arvind's father's present age ?
   (A) 35 years (B) 40 years
   (C) 70 years (D) 84 years
5. Pushpa is twice as old as Rita was two years ago. If the difference between their ages be 2 years, how old is Pushpa today ?
   (A) 6 years (B) 8 years
   (C) 10 years (D) 12 years
6. The difference between the ages of two persons is 10 years. 15 years ago the elder one was twice as old as the younger one. The present age of the elder person is—
   (A) 25 years (B) 35 years
   (C) 45 years (D) 55 years
7. Five years ago Viney's age was one-third of the age of Vikas and now Viney's age is 17 years. What is the present age of Vikas ?
   (A) 9 years (B) 36 years
   (C) 41 years (D) 51 years
8. The age of a man is 4 times that of his son. Five years ago, the man was nine times as old as his son was at that time. The present age of the man is—
   (A) 24 years (B) 32 years
   (C) 40 years (D) 44 years
9. The sum of the ages of a father and son is 45 years. Five years ago the product of their ages was 4 times the father's age at that time. The present ages of the father and son respectively are—
   (A) 25 years, 10 years
   (B) 36 years, 9 years
   (C) 39 years, 6 years
   (D) None of these
10. Rajan's age is 3 times that of Ashok. After 12 years, Rajan's age will be double the age of Ashok. Rajan's present age is—
    (A) 27 years (B) 32 years
    (C) 36 years (D) 40 years
11. After 10 years, A will be twice as old as B was 10 years ago. If A is now 9 years older than B, the present age of B is—
    (A) 19 years (B) 29 years
    (C) 39 years (D) 49 years
12. Mr. Sohanlal is 4 times as old as his son. Four years hence the sum of their ages will be 43 years. The present age of son is—
    (A) 5 years (B) 7 years
    (C) 8 years (D) 10 years
13. The sum of the ages of a son and father is 56 years. After four years, the age of the father will be three times that of the son. Their present ages respectively are—
    (A) 12 years, 44 years
    (B) 16 years, 42 years
    (C) 16 years, 48 years
    (D) 18 years, 36 years
14. The sum of the ages of a mother and a daughter is 50 years. Also, 5 years ago, the mother's age was 7 times of the age of her daughter. The present ages of the mother and the daughter respectively are—
    (A) 35 years, 15 years
    (B) 38 years, 12 years
    (C) 40 years, 10 years
    (D) 42 years, 8 years
15. Ten years ago A was half of B in age. If the ratio of their present ages is 3 : 4. What will be the total of their present ages ?
    (A) 8 years (B) 20 years
    (C) 35 years (D) 45 years
16. The ratio of Vimal's age and Aruna's age is 3 : 5 and sum of their ages is 80 years. The ratio of their ages after 10 years will be—
    (A) 2 : 3 (B) 1 : 2
    (C) 3 : 2 (D) 3 : 5
17. Jayesh is as much younger to Anil as he is older to Prashant. If the sum of the ages of Anil and Prashant is 48 years. What is the age of Jayesh ?
    (A) 20 years
    (B) 24 years
    (C) 30 years
    (D) Cannot be determined
18. Three years ago the average age of A and B was 18 years. With C joining them, now the average becomes 22 years. How old is C now ?
    (A) 24 years (B) 27 years
    (C) 28 years (D) 30 years
19. One year ago the ratio between Samir and Ashok's age was 4 : 3. One year hence the ratio of their age will be 5 : 4. What is the sum of their present ages in years ?
    (A) 12 years
    (B) 15 years
    (C) 16 years
    (D) Cannot be determined
20. The ages of A and B are in the ratio 2 : 5. After 8 years their ages will be in the ratio 1 : 2. The difference of their ages is—
    (A) 20 years (B) 24 years
    (C) 26 years (D) 29 years

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21. The ratio between the ages of A and B at present is 2 : 3. Five years hence the ratio of their ages will be 3 : 4. What is the present age of A ?
(A) 10 years
(B) 15 years
(C) 25 years
(D) Data inadequate

22. The ratio of the ages of father and son at present is 6 : 1. After 5 years the ratio will become 7 : 2. The present age of the son is—
(A) 5 years (B) 6 years
(C) 9 years (D) 10 years

23. Ratio of Ashok's age to Pradeep's age is equal to 4 : 3. Ashok will be 26 years old after 6 years. How old is Pradeep now ?
(A) 12 years
(B) 15 years
(C) $19\frac{1}{2}$ years
(D) 21 years

24. One year ago a father was four times as old as his son. After 6 years his age exceeds than twice of his son's age by 9 years. Ratio of their present ages is—
(A) 13 : 4 (B) 12 : 5
(C) 11 : 3 (D) 9 : 2

25. The age of a father 10 years ago was thrice the age of his son. Ten years hence, the father's age will be twice that of his son. The ratio of their present ages is—
(A) 8 : 5 (B) 7 : 3
(C) 5 : 2 (D) 9 : 5

26. Kamla got married 6 years ago. Today her age is $1\frac{1}{4}$ times her son's age at the time of marriage. Her son's age is (1/10) times of her age. Her son's age is—
(A) 2 years (B) 3 years
(C) 4 years (D) 5 years

27. The ratio of Laxmi's age to the age of her mother is 3 : 11. The difference of their ages is 24 years. The ratio of their ages after 3 years will be—
(A) 1 : 3
(B) 2 : 3
(C) 3 : 5
(D) None of these

28. Sachin was twice as old as Ajay 10 years back. How old is Ajay today if Sachin will be 40 years old 10 years hence ?
(A) 20 years (B) 10 years
(C) 30 years (D) 15 years

29. The ratio of Mona's age to the age of her mother is 5 : 15. The difference of their ages is 24 years. The ratio of their ages after 3 years will be—
(A) 1 : 3
(B) 2 : 3
(C) 3 : 7
(D) None of these

30. Deepak is 4 times as old as his son. Four years hence the sum of their ages will be 43 years. How old is Deepak's son now ?
(A) 5 years (B) 7 years
(C) 8 years (D) 10 years

31. The ages of A, B and C together total 185 years. B is twice as old as A and C is 17 years older than A. Then the respective ages of A, B and C are—
(A) 40, 86 and 59 years
(B) 42, 84 and 59 years
(C) 40, 80 and 65 years
(D) None of these

32. A is 20 years older than B. He is also 6 times as old as B. Then the respective age of A and B are …… and …… years.
(A) 24, 4
(B) 42, 7
(C) 30, 5
(D) None of these

33. Shyam is 3 times as old as his son. After 10 years the sum of their ages will be 76 years. The respective ages of the father and the son are …… and …… years.
(A) 42, 14
(B) 39, 13
(C) 45, 15
(D) None of these

34. If 6 years are subtracted from the present age of Randheer and the remainder is divided by 18 then the present age of his grandson Anup is obtained. If Anup is 2 years younger to Mahesh whose age is 5 years, then what's the age of Randheer ?
(A) 96 years (B) 84 years
(C) 48 years (D) 60 years

35. Ratio of Sujeet's age to Sameer's age is 4 : 3 Sujeet will be 26 years old after 6 years. Then the present age of Sameer is—
(A) 21 years (B) 15 years
(C) 24 years (D) 18 years

36. The ratio of the father's and son's age is 7 : 4. The product of their ages is 1008. The ratio of their ages after 6 years hence will be—
(A) 5 : 3 (B) 8 : 5
(C) 7 : 4 (D) 5 : 8

37. The sum of the ages of the father and son is 45 years. Five years ago, the product of their ages was four times the father's age at that time, then the present ages of the father and son respectively are …… and …… years.
(A) 39, 6 (B) 35, 10
(C) 36, 9 (D) 40, 10

38. The total ages of A, B and C at present is 90 years. Ten years ago the ratio of their ages was 1 : 2 : 3. Then the present age of B is ……
(A) 30 years
(B) 20 years
(C) 40 years
(D) None of these

39. The respective ages of a father and his son are 41 and 16 years. In how many years will the father be twice as old as his son ?
(A) 19 years (B) 9 years
(C) 10 years (D) 15 years

40. A father's age is four times as much as the sum of the ages of his three children but 6 years hence his age will be only double the sum of their ages. Then the age of the father is—
(A) 30 years (B) 40 years
(C) 60 years (D) 45 years

41. A father's age is three times the sum of the ages of his two children but 20 years hence his age will be equal to the sum of their ages. Then the father's age is—
(A) 30 years (B) 40 years
(C) 35 years (D) 45 years

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42. If C's age is twice the average age of A, B and C. A's age is one half the average of A, B and C. If B is 5 years old, the average age of A, B and C is—
(A) 10 years (B) 15 years
(C) 12 years (D) 9 years

43. A is 3 years younger to B. C is two years older than A. Then B's relation to C is—
(A) Two years older
(B) One year younger
(C) One year older
(D) Two years younger

44. Two years ago, a mother was four times as old as her daughter. 8 years hence, mother's age will exceed her daughter's age by 12 years. The ratio of the present ages of mother and daughter is—
(A) 3 : 1 (B) 4 : 1
(C) 3 : 2 (D) 5 : 1

45. Five years ago, the total of the ages of father and son was 60 years. The ratio of their present ages is 4 : 1. Then the present age of the father is—
(A) 48 years (B) 51 years
(C) 56 years (D) 61 years

46. In ten years, A will be twice as old as B was 10 years ago. If A is now 9 years older than B. Find the present age of B.
(A) 39 years (B) 40 years
(C) 36 years (D) 49 years

47. A is twice as old as B was two years ago. If the difference in their ages be 2 years, find A's age.
(A) 14 years (B) 18 years
(C) 8 years (D) 12 years

48. A is as much younger than B as he is older than C. If the sum of B's and C's age is 40 years. Find the age of A.
(A) 20 years (B) 25 years
(C) 30 years (D) 27 years

49. A says to B ''I am twice as old as you were when I was as old as you are.'' The sum of their ages is 63 years. Find the difference of their ages.
(A) 27 years (B) 12 years
(C) 9 years (D) 6 years

50. 15 years hence, A will be twice as old as B but five years ago A was 4 times as old as B. Find the difference of their present ages.
(A) 15 years (B) 45 years
(C) 30 years (D) 25 years

51. 20 years ago my age was $\frac{1}{3}$ of what it is now. What is my present age ?
(A) 30 years (B) 25 years
(C) 35 years (D) 40 years

52. The ratio of the present ages of a son and his father is 1 : 5 and that of his mother and father is 4 : 5. After 2 years the ratio of the age of the son to that of his mother becomes 3 : 10. What is the present age of the father ?
(A) 30 years
(B) 28 years
(C) 37 years
(D) None of these

53. Present age of Rahul is 8 years less than Ritu's present age. If 3 years ago Ritu's age was x, which of the following represents Rahul's present age ?
(A) $x + 3$ (B) $x - 5$
(C) $x - 3 + 8$ (D) $x + 3 + 8$

54. The product of the ages of Harish and Seema is 240. If twice the age of Seema is more than Harish's age by 4 years. What is Seema's age in years ?
(A) 12 years (B) 20 years
(C) 10 years (D) 14 years

55. If the ages of P and R are added to twice the age of Q the total becomes 59. If the ages of Q and R are added to thrice the age of P the total becomes 68. And if the age of P is added to thrice the age of Q and thrice the age of R, the total becomes 108. What is the age of P ?
(A) 15 years (B) 19 years
(C) 17 years (D) 12 years

56. The ratio in the present ages of Ramesh and Jayesh is 3 : 2. Four years ago Ramesh's age was more than Jayesh's age by 6 years. What is the present age of Jayesh ?
(A) 18 years
(B) 12 years
(C) 6 years
(D) Data is inadequate

57. The age of Sushil 6 years ago was three times the age of Snehal. 6 years hence, the age of Sushil would be $\frac{5}{3}$ times that of Snehal. What is the present age of Snehal ?
(A) 14 years
(B) 22 years
(C) 18 years
(D) None of these

58. The age of the father 4 years ago was 5 times the age of his son. If the sum of their present ages is 44 years. What is the present age of his son ?
(A) 6 years (B) 10 years
(C) 4 years (D) 8 years

59. The ratio in the ages of A and B, 1 year ago was 3 : 4. While it will be 5 : 6 after 1 year. What is the present age of B ?
(A) 8 years
(B) 4 years
(C) 6 years
(D) None of these

60. After 6 years Pradhan's age will be $\frac{3}{7}$ times the age of his father. 10 years ago the ratio in the age of Pradhan and his father was 1 : 5. What is the present age of Pradhan's father ?
(A) 40 years
(B) 50 years
(C) 56 years
(D) Data is inadequate

61. The sum of the ages of Yogesh, Prakash and Sameer is 93 years. 10 years ago the ratio of their ages was 2 : 3 : 4. What is the present age of Sameer ?
(A) 32 years
(B) 24 years
(C) 34 years
(D) None of these

62. The total of the present age of P, Q and R together is 88 years. If the difference between the ages of P and R is 12 years. What is Q's age at present ?
(A) 28 years
(B) 22 years

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(C) 24 years
(D) Data is inadequate

63. A man is five times as old as his son. Four years hence the sum of their ages will be 56 years. How old is the son at present ?
(A) 12 years (B) 5 years
(C) 6 years (D) 8 years

64. If a son is younger than his father by 25 years and the father was 45 years old, 4 years ago. What will be the total age of the father and son after 5 years ?
(A) 82 years (B) 88 years
(C) 83 years (D) 78 years

65. The ratio between present age of Kunal and Ganesh is 3 : 5. If 4 years hence Kunal will be younger than Ganesh by 12 years. What is the present age of Kunal ?
(A) 17 years
(B) 19 years
(C) 22 years
(D) None of these

Answers with Hints

1. (C) Let father's age be $4x$ and son's age x years.
$\because$ $4x \times x = 196$
$\Rightarrow$ $x^2 = 49$
$\therefore$ $x = 7$
Father's age after 5 years $= (4x + 5) = 33$ years
Son's age after 5 years $= (x + 5) = 12$ years
$\therefore$ Ratio of their ages after 5 years
$= 33 : 12 = 11 : 4$

2. (C) Let Chandravati's age 10 years ago be x years.
$\therefore$ Mother's age 10 years ago $= (4x)$ years
$\because$ $2(x + 20) = (4x + 20)$
$\Rightarrow$ $x = 10$
$\therefore$ Present age of Chandravati $= (x + 10)$
$= 20$ years

3. (B) Let son's age 5 years hence $= x$ years
Then, father's age after 5 years hence
$= (3x)$ years
$\because$ $7(x - 10) = (3x - 10)$
$\Rightarrow$ $x(7 - 3) = 70 - 10$
$\Rightarrow$ $x = 15$
$\therefore$ Father's present age $= (3x - 5)$
$= 40$ years

4. (B) Let Arvind's present age be x years
Then, his father's present age $= 4x$ years
$\because$ $(4x - 5) = 7(x - 5)$
$\Rightarrow$ $3x = 30$
$\therefore$ $x = 10$
Hence, Arvind's father's age is 40 years.

5. (B) Let Rita's age 2 years ago be x years.
$\therefore$ Pushpa's present age $= (2x)$ years
$\Rightarrow$ $2x - (x + 2) = 2 \Rightarrow x = 4$
$\therefore$ Pushpa's present age $= 8$ years.

6. (B) Let the present age of the elder person be x years.
Then, the present age of the younger person
$= (x - 10)$ years,
$\because$ $(x - 15) = 2(x - 10 - 15)$
$\Rightarrow$ $x = 35$
$\therefore$ The present age of the elder person is 35 years.

7. (C) Let the present age of Vikas be x years. Then,
$$17 - 5 = \frac{1}{3}(x - 5)$$
$\Rightarrow$ $x - 5 = 36$
$\therefore$ $x = 41$ years

8. (B) Let the son's age be x years. Then father's age
$= 4x$ years.
$\therefore$ $(4x - 5) = 9(x - 5)$
$\Rightarrow$ $5x = 40$
$\Rightarrow$ $x = 8$
$\therefore$ Present age of the man $= 32$ years

9. (B) Let the present ages of father and son be x years and $(45 - x)$ years respectively.
Then, $(x - 5)(45 - x - 5) = 4(x - 5)$
$\Rightarrow$ $-x^2 + 41x - 180 = 0$
$\Rightarrow$ $(x - 5)(x - 36) = 0$
$\Rightarrow$ $x = 36$
$\therefore$ The present ages of father and son are 36 years and 9 years respectively.

10. (C) Let Ashok's present age be x years. Then Rajan's present age $= 3x$ years.
$\therefore$ $2(x + 12) = (3x + 12)$
$\Rightarrow$ $x = 12$
Hence, Rajan's present age is 36 years.

11. (C) Let the present ages of B and A be x years and $(x + 9)$ years respectively.
Then, $(x + 9 + 10) = 2(x - 10)$
$\therefore$ $x = 39$

12. (B) Let the son's present age be x years
Then, $(x + 4) + (4x + 4) = 43$
$\Rightarrow$ $5x = 35$
$\therefore$ $x = 7$

13. (A) let the present ages of son and father be x years and $(56 - x)$ years respectively. Then,
$(56 - x + 4) = 3(x + 4)$
$\Rightarrow$ $4x = 48$
$\Rightarrow$ $x = 12$
So, their present ages are 12 years, 44 years respectively.

14. (C) Let the daughter's present age be x years.
Then, mother's present age $= (50 - x)$ years
Now, $7(x - 5) = (50 - x - 5)$

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$\Rightarrow \quad x = 10$

So, the present ages of mother and daughter are 40 years and 10 years respectively.

15. (C) Let A's age 10 years ago $= x$ years

Then, B's age 10 years ago $= 2x$ years

$\because \quad \frac{x+10}{2x+10} = \frac{3}{4}$

$\Rightarrow \quad 4(x+10) = 3(2x+10)$

$\Rightarrow \quad x(6-4) = 40-30$

$\Rightarrow \quad x = 5$

$\therefore$ Total of their present ages $= (x+10+2x+10)$

$= (3x+20)$

$= 35$ years

16. (A) $\because \quad 3x+5x = 80$

$\Rightarrow \quad x = 10$

Ratio of their ages after 10 years

$= (3x+10):(5x+10)$

$= 40:60 = 2:3$

17. (B) Let Anil's age $= x$ years

Then, Prashant's age $= (48-x)$ years

Let the age of Jayesh be p years. Then,

$p-(48-x) = x-p$

$\Rightarrow \quad 2p = 48$

$\therefore \quad p = 24$

18. (A) Sum of ages of A and B, 3 years ago

$= (18 \times 2) = 36$ years

Sum of ages of A, B and C, now

$= (22 \times 3) = 66$ years

Sum of ages of A and B, now

$= (36+6)$ years $= 42$ years

$\therefore$ C's present age $= (66-42)$ years $= 24$ years

19. (C) Let their ages one year ago be $4x$ and $3x$ years.

$\because \quad \frac{4x+2}{3x+2} = \frac{5}{4}$

$\Rightarrow \quad 4(4x+2) = 5(3x+2)$

$\Rightarrow \quad x = 2$

$\therefore$ Sum of their present ages $= (4x+1+3x+1)$

$= 16$ years

20. (B) $\because \quad \frac{2x+8}{5x+8} = \frac{1}{2}$

$\Rightarrow \quad 2(2x+8) = (5x+8)$

$\Rightarrow \quad x = 8$

$\therefore$ Difference of their ages $= (5x-2x)$

$= 3x = 24$ years.

21. (A) Let the ages of A and B be $2x$ and $3x$ years respectively.

$\because \quad \frac{2x+5}{3x+5} = \frac{3}{4}$

$\Rightarrow \quad 4(2x+5) = 3(3x+5)$

$\Rightarrow \quad x = 5$

$\therefore$ A's present age $= 2x = 10$ years

22. (A) $\because \quad \frac{6x+5}{x+5} = \frac{7}{2}$

$\Rightarrow \quad 2(6x+5) = 7(x+5)$

$\Rightarrow \quad (12-7)x = 35-10$

$\Rightarrow \quad x = 5$

$\therefore$ Son's present age $= 5$ years

23. (B) Let Ashok's age $= 4x$ years

and Pradeep's age $= 3x$ years

$\because \quad 4x+6 = 26$

$\Rightarrow \quad x = 5$

$\therefore$ Pradeep's age $= 3x = 15$ years.

24. (C) Let son's age 1 year ago be x years.

$\Rightarrow$ Father's age 1 year ago $= (4x)$ years

$\because \quad 4x+7 = 2(x+7)+9$

$\Rightarrow \quad 2x = 23-7$

$\Rightarrow \quad x = 8$

Ratio of father's and son's present ages

$= (4x+1 : x+1)$

$= 33:9 = 11:3$

25. (B) Let son's age 10 years ago be x years.

$\therefore$ Father's age 10 years ago $= (3x)$ years

$\because \quad 3x+20 = 2(x+20)$

$\Rightarrow \quad x = 20$

$\therefore$ Ratio of their present ages $= (3x+10 : x+10)$

$= 70:30 = 7:3$

26. (B) Let Kamla's age 6 years ago be x years. Then,

Kamla's present age $= (x+6)$ years

$\therefore \quad x+6 = \frac{5}{4}x$

$\Rightarrow \quad 4x+24 = 5x$

$\Rightarrow \quad x = 24$

So, Kamla's present age $= (x+6)$ years

$= 30$ years

$\therefore$ Son's present age $= \left(\frac{1}{10} \times 30\right) = 3$ years

27. (A) $\because \quad 11x-3x = 24$

$\Rightarrow \quad x = 3$

$\therefore$ Ratio of their ages after 3 years.

$= (3x+3 : 11x+3)$

$= 12:36 = 1:3$

28. (A) Let Ajay's age 10 years back be x years.

Then Sachin's age 10 years back $= 2x$ years

$\therefore \quad 2x+20 = 40$

$\Rightarrow \quad x = 10$

$\therefore$ Present age of Ajay $= x+10 = 20$ years

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29. (C) Let the age of Mona and her mother be $5x$ and $13x$ years respectively.

Then, $(13x - 5x) = 24$

$\Rightarrow x = 3$

So, their present ages are 15 years and 39 years

Ratio of their ages after 3 years

$= 18 : 42$

$= 3 : 7$

30. (B) Let the son's present age be x years

Then, $(x + 4) + (4x + 4) = 43$

$\Rightarrow 5x = 35$

$\Rightarrow x = 7$ years

31. (B) Let A's age be x years. B's age be $2x$ years.

C's age $= (x + 17)$ years

According to the question,

$\because x + 2x + (x + 17) = 185$

$\Rightarrow 4x = 185 - 17 = 168$

$\therefore x = 42$

$\therefore$ A's age $= 42$ years

B's age $= 84$ years

C's age $= 42 + 17 = 59$ years

32. (A) Let the age of B be x years

According to the question,

$\because x + 20 = 6x$

$\therefore x = 4$ years

$\therefore$ A's age $= 4 \times 6 = 24$ years and B's age $= 4$ years.

33. (A) Let son's present age be x years.

$\therefore$ Father's present age $= 3x$ years

Son's age 10 years hence $= (x + 10)$

Father's age 10 years hence $= (3x + 10)$

As per the condition,

$\because (x + 10) + (3x + 10) = 76$

$\Rightarrow 4x = 56$

$\therefore x = 14$

$\therefore$ Son's present age $= 14$ years

Father's present age $= 42$ years

34. (D) $\because$ Anup's age $= (5 - 2)$ years $= 3$ years

Let Randheer's age be x years. Then,

$$\frac{x - 6}{18} = 3$$

$\Rightarrow x = 54 + 6 = 60$

35. (B) Let the respectively ages of Sujeet and Sameer be $4x$ and $3x$ years.

$\because 4x + 6 = 26$

$\Rightarrow x = 5$

$\therefore$ Sameer's present age $= 3 \times x = 3 \times 5$

$= 15$ years.

36. (B) Let father's and son's age be $7x$ and $4x$ respectively.

$\because 28x^2 = 1008$

$\Rightarrow x^2 = 36$

$\Rightarrow x = 6$

$\therefore$ Father's age $= 7x = 42$ years

Son's age $= 4x = 24$ years

Father's age after 6 years hence $= 48$ years

Son's age 6 years hence $= 30$ years

Required ratio $= 48 : 30 = 8 : 5$

37. (C) Let son's present age be x years and father's age $= (45 - x)$ years.

$\because (x - 5)(45 - x - 5) = 4(45 - x - 5)$

$\Rightarrow (40 - x)(x - 9) = 0$

$\Rightarrow x = 9$ years

$\therefore$ The son's age $= 9$ years

Father's age $= 45 - 9 = 36$ years

38. (A) Let the respective ages of A, B and C ten years ago be x, $2x$ and $3x$ years.

$\because (x + 10) + (2x + 10) + (3x + 10) = 90$

$\Rightarrow 6x = 60$

$\Rightarrow x = 10$

$\therefore$ B's present age $= 2x + 10$

$= 30$ years

39. (B) Suppose x years hence the father will be twice as old as his son.

$\because x + 41 = 2(x + 16)$

$\Rightarrow x = 41 - 32 = 9$ years

40. (C) Let father's age be x years and the sum of ages of children be y years.

$\because x = 4y$ ...(i)

Also $(x + 6) = 2(y + 6 + 6 + 6)$ ...(ii)

[6 is added thrice for three children]

Solving (i) and (ii)

$x = 60$ years

and $y = 15$ years.

41. (A) Let the present age of father be x years and the sum of present ages of 2 sons be y years.

$\because x = 3y$ ...(i)

$\Rightarrow (x + 20) = (y + 20 + 20)$ ...(ii)

[20 will be added twice as for 2 children]

Solving (i) and (ii), we get

$x = 30$ years

42. (A) Let the average age of A, B and C be x years.

$\therefore$ Total age of A, B and C $= 3 \times x = 3x$ years

Now, according to the question,

$\because 3x - \left(2x + \frac{x}{2}\right) = 5$

$\therefore x = 10$ years.

43. (C) Let the age of A be $(x - 3)$ years

$\Rightarrow$ B's age $= x$ years

$\Rightarrow$ C's age $= (x - 3) + 2 = x - 1$

$\therefore$ B's age $-$ C's age $= x - (x - 1) = 1$ year

$\therefore$ B is one year older than C.

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44. (A) Let the mother's age 2 years ago be $4x$ and daughter's age 2 years ago be x.

$\because$ $(4x + 8) - (x + 8) = 12$

$\Rightarrow$ $3x = 12$

$\Rightarrow$ $x = 4$

$\therefore$ Mother's present age $= 4x + 2 = 18$ years

and daughter's present age $= x + 2 = 6$ years

$\therefore$ Required ratio $= 3 : 1$

45. (C) Let the present age of the son be x and that of the father be $4x$ years.

$\because$ $(x - 5) + (4x - 5) = 60$

$\Rightarrow$ $5x = 70$

$\therefore$ $x = 14$ years

$\therefore$ Father's present age $= 56$ years

46. (A) Let B's present age be x years then A's present age be $(x + 9)$ years.

As per the given condition,

$\because$ $(x + 9 + 10) = 2(x - 10)$

$\Rightarrow$ $x = 39$

$\therefore$ The present age of B $= 39$ years

47. (C) Let B's age 2 years ago be x years

$\therefore$ A's present age $= 2x$ years

$\because$ $2x - (x + 2) = 2$

$\Rightarrow$ $x = 4$

$\therefore$ A's age $= 2 \times 4 = 8$ years

48. (A) 49. (C)

50. (C) Let A's age = x years and B's age = y years.

As per the first condition,

$\therefore$ $(x + 15) = 2(y + 15)$

$\Rightarrow$ $x - 2y = 15$ …(i)

As per the second condition,

$\therefore$ $(x - 5) = 4(y - 5)$

$\Rightarrow$ $x - 4y = -15$ …(ii)

Solving (i) and (ii) one gets,

$x = 45, y = 15$

$\therefore$ A's age $= 45$ years

B's age $= 15$ years

$\therefore$ Difference of their ages

$= 45 - 15 = 30$ years

51. (A) Let my present age be x years.

$\because$ $(x - 20) = \frac{x}{3}$

$\Rightarrow$ $(3x - 60) = x$

$\Rightarrow$ $2x = 60$

$\therefore$ My present age $= x$

$= 30$ years

52. (D) $\because$ $\frac{S}{F} = \frac{1}{5}$

$\Rightarrow$ $F = 5S,$ …(i)

$\because$ $\frac{M}{F} = \frac{4}{5}$

$\Rightarrow$ $M = \frac{4}{5}F$ …(ii)

$\because$ $\frac{S + 2}{M + 2} = \frac{3}{10}$

$\Rightarrow$ $10S + 20 = 3M + 6$ …(iii)

$= 3 \times \frac{4}{5} \times 5S + 6 = 12S + 6$

$\Rightarrow$ $(12 - 10)S = 20 - 6$

$\Rightarrow$ $2S = 14$

$\therefore$ $S = 7$ years

$\therefore$ $F = 5S = 5 \times 7$

$= 35$ years.

53. (B) Let the Rahul's present age is 'A' years. Then Ritu's present age is $(A + 8)$

Now, according to the question,

$A + 8 - 3 = x$

$\therefore$ $A = (x - 5)$ years

Hence, (B) is the correct answer.

54. (A) Let the ages of Harish and Seema be x and y respectively.

According to the question,

$xy = 240$ …(i)

$2y - x = 4$ …(ii)

Solving equations (i) and (ii), we get

$y = 12$ years

55. (D) $P + R + 2Q = 59,$ …(i)

$Q + R + 3P = 68$ …(ii)

and $P + 3(Q + R) = 108$ …(iii)

Solving the above three equations, we get

$\Rightarrow$ $P + 3(68 - 3P) = 108$

$\Rightarrow$ $P + 204 - 9P = 108$

$\Rightarrow$ $P = 12$ years

56. (B) Let the present age of Ramesh be $3x$ years and the present age of Jayesh = $2x$ years. According to question,

$\because$ $(3x - 4) = (2x - 4) + 6$

$\Rightarrow$ $3x - 4 = 2x - 4 + 6$

$\Rightarrow$ $3x - 4 = 2x + 2$

$\Rightarrow$ $3x - 2x = 2 + 4$

$\therefore$ $x = 6$

$\therefore$ Present age of Jayesh $= 2x$

$= 2 \times 6 = 12$ years

57. (D)

58. (B) Let the present age of father and son be x and y years respectively.

From 1st condition,

$(x - 4) = 5(y - 4)$

$\Rightarrow$ $x - 4 = 5y - 20$

$\Rightarrow$ $x - 5y = -16$ …(i)

From 2nd condition,

$\Rightarrow$ $x + y = 44$ …(ii)

From equation (i) and (ii)

$-6y = -60$

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$\Rightarrow \quad y = 10$

$\therefore$ Present age of son = 10 years

59. (D) Let the present age of A and B be x and y years respectively.

From 1st condition,

$$\frac{x-1}{y-1} = \frac{3}{4}$$

$\Rightarrow \quad 4x - 4 = 3y - 3$

$\Rightarrow \quad 4x - 3y = 1 \quad \ldots(i)$

From 2nd condition,

$$\frac{x+1}{y+1} = \frac{5}{6}$$

$\Rightarrow \quad 6x + 6 = 5y + 5$

$\Rightarrow \quad 6x - 5y = -1 \quad \ldots(ii)$

Multiplying equation (i) by 3 and equation (ii) by 2 and subtract

$$12x - 9y = 3$$
$$12x - 10y = -2$$
$$- \quad + \quad\quad +$$
$$y = 5$$

$\therefore$ Present age of B = 5 years

60. (B) Let the present age of Pradhan be x years and his father's age = y years.

From 1st condition,

$$(x+6) = (y+6)\frac{3}{7}$$

$\Rightarrow \quad 7x + 42 = 3y + 18$

$\Rightarrow \quad 7x - 3y = -24 \quad \ldots(i)$

From 2nd condition,

$$\frac{(x-10)}{(y-10)} = \frac{1}{5}$$

$\Rightarrow \quad 5x - 50 = y - 10$

$\Rightarrow \quad 5x - y = 40 \quad \ldots(ii)$

Multiplying equation (ii) by 3 and subtracting from (i)

$\Rightarrow \quad 7x - 3y = -24$

$\Rightarrow \quad 15x - 3y = 120$

$- \quad + \quad -$

$\therefore \quad -8x = -144$

$$x = \frac{144}{8} = 18$$

Putting the value of x in equation (i)

$7 \times 18 - 3y = -24$

$\Rightarrow \quad 126 - 3y = -24$

$\Rightarrow \quad 3y = 126 + 24$

$\Rightarrow \quad 3y = 150$

$\Rightarrow \quad y = \frac{150}{3}$

$\therefore \quad y = 50$ years

61. (D) Let the respective ages of Yogesh, Prakash and Sameer 10 years ago be $2x$, $3x$ and $4x$ years.

$\therefore$ Present age of Yogesh = $(2x + 10)$ years

$\therefore$ Present age of Prakash = $(3x + 10)$ years

$\therefore$ Present age of Sameer = $(4x + 10)$ years

According to question,

$(2x + 10) + (3x + 10) + (4x + 10) = 93$

$\Rightarrow \quad 9x + 30 = 93$

$\Rightarrow \quad 9x = 63$

$\therefore \quad x = 7$

$\therefore$ Present age of Sameer = $4x + 10$

$= 4 \times 7 + 10$

$= 28 + 10$

$= 38$ years

62. (D) Data is inadequate. (Two equations only for 3 unknown).

63. (D) Let the present age of man be x years and the age of his son be y years.

From 1st condition, $x = 5y \quad \ldots(i)$

From 2nd condition,

$(x + 4) + (y + 4) = 56$

$\Rightarrow \quad x + y + 8 = 56$

$\Rightarrow \quad x + y = 48 \quad \ldots(ii)$

Putting $x = 5y$ in equation (ii)

$5y + y = 48$

$\Rightarrow \quad 6y = 48$

$\Rightarrow \quad y = 8$

$\therefore$ Age of son = 8 years

64. (C) Let the present age of father be x years. Then the present age of son = $(x - 25)$ years.

According to question,

$x - 4 = 45$

$\Rightarrow \quad x = 45 + 4$

$\Rightarrow \quad x = 49$

$\therefore$ Age of son = $49 - 25$

$= 24$ years

$\therefore$ Age of son after five years = $24 + 5$

$= 29$ years

$\therefore$ Age of father after five years = $49 + 5$

$= 54$ years

Total age of both = $29 + 54$

$= 83$ years

65. (D) Let the present age of Kunal be $3x$ years and the present age of Ganesh = $5x$ years.

According to question,

$(5x + 4) - (3x + 4) = 12$

$\Rightarrow \quad 5x - 3x = 12$

$\Rightarrow \quad 2x = 12$

$\therefore \quad x = 6$

$\therefore$ Present age of Kunal = $3 \times x$

$= 3 \times 6 = 18$ years

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Percentage

Important Points/Facts

1. The term per cent means for every hundred. It can be best defined as—"A fraction whose denominator is 100 is called a percentage, and numerator of the fraction is called the rate per cent."

2. To express a is per cent of b can be written as $\boxed{\frac{a}{b} \times 100}$

Note—The numerator is the term to be expressed while the denominator is the term in which the percentage is to be expressed. The following example illustrate it clearly.

Example : How much per cent 15 is of 60 ? Of what per cent of 60 is 15 ? Here 15 is to be expressed in percentage of 60, therefore, we will take 15 as numerator, while 60 as denominator, *i.e.*,

$$\frac{15}{60} \times 100\% = 25\%$$

3. Percentages are simply a convenient way of expressing fractions or decimals.

$$b\% \text{ of } a = a \times \frac{b}{100} = \frac{ab}{100}$$

$$\text{and } a\% \text{ of } b = b \times \frac{a}{100} = \frac{ab}{100}$$

$$i.e., \quad \boxed{a\% \text{ of } b = \frac{ab}{100} = b\% \text{ of } a}$$

Percentages are used very frequently in every day life and are misunderstood by a large number of people.

Examples

Q. 1. Express each of the following as a fraction.

(i) 64% **(ii) 6%**

(iii) 0·5%

Solution :

(i) $64\% = \frac{64}{100} = \frac{16}{25}$

(ii) $6\% = \frac{6}{100} = \frac{3}{50}$

(iii) $0{\cdot}5\% = \frac{0{\cdot}5}{100} = \frac{5}{1000} = \frac{1}{200}$

Q. 2. Express each of the following as a decimal.

(i) 36% **(ii) 8%**

(iii) 0·3%

Solution :

(i) $36\% = \frac{36}{100} = 0{\cdot}36$

(ii) $8\% = \frac{8}{100} = 0{\cdot}08$

(iii) $0{\cdot}3\% = \frac{0{\cdot}3}{100} = 0{\cdot}003$

Q. 3. Express each of the following as rate per cent.

(i) $\frac{2}{3}$ **(ii) $\frac{1}{12}$**

(iii) 0·002

Solution :

(i) $\frac{2}{3} = \left(\frac{2}{3} \times 100\right)\% = 66\frac{2}{3}\%$

(ii) $\frac{1}{12} = \left(\frac{1}{12} \times 100\right)\% = 8\frac{1}{3}\%$

(iii) $0{\cdot}002 = \left(\frac{2}{1000} \times 100\right)\% = 0{\cdot}2\%$

Q. 4. Find :

(i) 70% of 70 **(ii) 90% of 9**

(iii) 3% of 6

Solution :

(i) $70\% \text{ of } 70 = \left(\frac{70}{100} \times 70\right) = 49$

(ii) $90\% \text{ of } 9 = \left(\frac{90}{100} \times 9\right) = 8{\cdot}1$

(iii) $3\% \text{ of } 6 = \left(\frac{3}{100} \times 6\right) = 0{\cdot}18$

Q. 5. Fill in the blanks :

(i) (… ? …)% of 64 = 8

(ii) (?)% of 36 = 144

(iii) (?)% of 24 = ·72

Solution :

(i) Let $x\%$ of $64 = 8$

Then, $\frac{x}{100} \times 64 = 8$

$\Rightarrow x = \frac{8 \times 100}{64}$

$= 12{\cdot}5$

(ii) Let $x\%$ of $36 = 144$

Then, $\frac{x}{100} \times 36 = 144$

$\Rightarrow x = \frac{144 \times 100}{36}$

$= 400$

(iii) Let $x\%$ of $24 = {\cdot}72$

Then, $\frac{x}{100} \times 24 = {\cdot}72$

$\Rightarrow x = \frac{{\cdot}72 \times 100}{24}$

$= 3$

Q. 6. (i) What per cent is 120 of 90 ?

(ii) What per cent is 5 gms of 1 kg ?

(iii) What per cent is 150 ml of 3·5 litres ?

Solution :

(i) It is $\left(\frac{120}{90} \times 100\right)\% = 133\frac{1}{3}\%$

(ii) It is $\left(\frac{5}{1000} \times 100\right)\% = 0{\cdot}5\%$

(iii) It is $\left(\frac{150}{3500} \times 100\right)\% = 4\frac{2}{7}\%$

Short-cut Method :

(i) If A's income is $r\%$ more than B's income then B's income is less than A's income by

$$\left[\frac{r}{(100 + r)} \times 100\right]\%.$$

(ii) If A's income is $r\%$ less than B's income, then B's income is more than A's income by

$$\left[\frac{r}{(100 - r)} \times 100\right]\%.$$

Q. 7. If A's salary is 50% more than that of B, then how much per cent is B's salary less than that of A ?

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Solution : B's salary is less than that of A by $\left[\frac{r}{(100+r)} \times 100\right]\%$

$= \left(\frac{50}{150} \times 100\right)\% = 33\frac{1}{3}\%$

Q. 8. If A's salary is 30% less than that of B, then how much per cent is B's salary more than that of A ?

Solution : B's salary more than that of A by $\left[\frac{r}{100-r} \times 100\right]\%$

$= \left(\frac{30}{70} \times 100\right)\% = 42\frac{6}{7}\%$

Exercise

1. $8\frac{1}{3}\%$ expressed as a fraction is—
   (A) $\frac{25}{3}$ (B) $\frac{3}{25}$
   (C) $\frac{1}{12}$ (D) $\frac{1}{4}$
2. ·025 in terms of rate per cent is—
   (A) 25% (B) 2·5%
   (C) 0·25% (D) $37\frac{1}{2}\%$
3. ·02 = (…… ? ……)%
   (A) 20 (B) 2
   (C) ·02 (D) ·2
4. What per cent of $\frac{2}{7}$ is $\frac{1}{35}$?
   (A) 2·5% (B) 10%
   (C) 25% (D) 20%
5. What per cent of 7·2 kg is 18 gms ?
   (A) ·025% (B) ·25%
   (C) 2·5% (D) 25%
6. Out of a total 85 children playing badminton or table tennis or both, total number of girl in the group is 70% of the total number of boys in the group. The number of boys playing only badminton is 50% of the number of boys and the total number of boys playing badminton is 60% of the total number of boys. The number of children playing only table tennis is 40% of the total number of children and a total 12 children play badminton and table tennis both. What is the number of girls playing only badminton ?
   (A) 16
   (B) 14
   (C) 17
   (D) Data inadequate
7. ?% of 130 = 10·4
   (A) 80 (B) 8
   (C) 0·8 (D) 0·08
8. The fraction equivalent to $\frac{2}{5}\%$ is—
   (A) $\frac{1}{40}$ (B) $\frac{1}{125}$
   (C) $\frac{1}{250}$ (D) $\frac{1}{500}$
9. 30% of 140 = ?% of 840
   (A) 5 (B) 15
   (C) 24 (D) 60
10. ?% of 250 + 25% of 68 = 67
    (A) 10 (B) 15
    (C) 20 (D) 25
11. 5% of [50% of Rs. 300] is—
    (A) Rs. 5 (B) Rs. 7·50
    (C) Rs. 8·50 (D) Rs. 10
12. Pradeep spends 40 per cent of his monthly income on food items and 50 per cent of the remaining on cloths and conveyance. He saves one-third of the remaining amount after spending on food, clothes and conveyance. If he saves Rs. 19,200 every year, what is his monthly income ?
    (A) Rs. 24000
    (B) Rs. 12000
    (C) Rs. 16000
    (D) Rs. 20000
13. What is 25% of 25% is equal to ?
    (A) 6·25 (B) ·625
    (C) ·0625 (D) ·00625
14. The number ·05 is how many per cent of 20 ?
    (A) 25 (B) ·025
    (C) ·25 (D) 2·5
15. ? × 15 = 37·5% of 220
    (A) 82·5 (B) 8250
    (C) 11 (D) 5·5
16. $\left(0{\cdot}756 \times \frac{3}{4}\right)$ in terms of rate per cent is equivalent to—
    (A) 18·9% (B) 37·8%
    (C) 56·7% (D) 75%
17. $\frac{30\% \text{ of } 80}{?} = 24$
    (A) $\frac{3}{10}$ (B) $\frac{3}{17}$
    (C) 1 (D) 2
18. Ashok gave 40 per cent of the amount he had to Jayant. Jayant in turn gave one-fourth of what he received from Ashok to Prakash. After paying Rs. 200 to the taxi driver out of the amount he got from Jayant, Prakash now has Rs. 600 left with him. How much amount did Ashok have ?
    (A) 1200
    (B) 4000
    (C) 8000
    (D) Data inadequate
19. 8% of 96 = ? of $\frac{1}{25}$
    (A) 19·2
    (B) 7·68
    (C) 1·92
    (D) None of these
20. If 8% of x = 4% of y, then 20% of x is—
    (A) 10% of y
    (B) 16%
    (C) 80% of y
    (D) None of these
21. If x is 90% of y, then what per cent of x is y ?
    (A) 90 (B) 190
    (C) 101·1 (D) 111·1
22. (x% of y + y% of x) is equal to—
    (A) x% of y (B) y% of x
    (C) 2% of xy (D) xy% of 3
23. If 31% of a number is 46·5, the number is—
    (A) 150 (B) 155
    (C) 160 (D) 165
24. Rajesh solved 80 per cent of the questions in an examination correctly. Out of 41 questions solved by Rajesh 37 questions are correct and of the remaining questions out of 8 questions, 5 questions have been solved by Rajesh correctly then find the total number of questions asked in the examination ?
    (A) 75
    (B) 65

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(C) 60
(D) Can't be determined

25. Which number is 60% less than 80 ?
(A) 48 (B) 42
(C) 32 (D) 12

26. A number exceeds 20% of itself by 40. The number is—
(A) 50 (B) 60
(C) 80 (D) 320

27. If 90% of A = 30% of B and B = x% of A, then the value of x is—
(A) 900 (B) 800
(C) 600 (D) 300

28. Which is greatest $33\frac{1}{3}$%, $\frac{4}{15}$ and 0·35 ?
(A) $33\frac{1}{3}$%
(B) $\frac{4}{15}$
(C) 0·35
(D) Cannot be compared

29. 200 = ?% of 300
(A) $33\frac{1}{3}$ (B) 85
(C) $66\frac{2}{3}$ (D) 150

30. In a class of 60 children 30% children can speak only English, 20% Hindi and English both and the rest of the children can speak only Hindi. How many children can speak Hindi ?
(A) 42 (B) 36
(C) 30 (D) 48

31. 45 × ? = 25% of 900
(A) 16·20 (B) 4
(C) 5 (D) 500

32. If 0·5% of x = 85 paise, then the value of x is—
(A) Rs. 170 (B) Rs. 17
(C) Rs. 1·70 (D) Rs. 4·25

33. What per cent is 3% of 5% ?
(A) 15%
(B) 1·5%
(C) 0·15%
(D) None of these

34. 75% of 480 = (?) × 15
(A) 32
(B) 18
(C) 360
(D) None of these

35. 30 quintals is what per cent of 2 metric tonnes ?
(A) 15% (B) 1·5%
(C) 150% (D) 30%

36. The ratio of males and females in a city is 7 : 8 and the percentage of children among males and females is 25% and 20% respectively. If the number of adult females in the city is 156800, what is the total population ?
(A) 245000 (B) 367500
(C) 196000 (D) 171500

37. x% of y is y% of ?
(A) x (B) $100x$
(C) $\frac{x}{100}$ (D) $\frac{y}{100}$

38. 12·5% of 192 = 50% of ?
(A) 48
(B) 96
(C) 24
(D) None of these

39. If $37\frac{1}{2}$% of a number is 900, then $62\frac{1}{2}$% of the number is—
(A) 1200 (B) 1350
(C) 1500 (D) 540

40. Subtracting 6% of x from x is equivalent to multiplying x by how much ?
(A) 0·94 (B) 9·4
(C) 0·094 (D) 94

41. By how much is 30% of 80 greater than $\frac{4}{5}$th of 25 ?
(A) 2 (B) 4
(C) 10 (D) 15

42. The ratio of the number of student appearing for examination in the year 1998 in the states. A, B and C was 3 : 5 : 6. Next year if the number of students in these states increase by 20% 10% and 20% respectively, the ratio in states A and C would be 1 : 2. What was the number of students who appeared for the examination in the state A in 1999 ?
(A) 7200
(B) 6000
(C) 7500
(D) Data inadequate

43. The price of an article is cut by 10%. To restore it to the former value. The new price must be increased by—
(A) 10% (B) $9\frac{1}{11}$%
(C) $11\frac{1}{9}$% (D) 11%

44. The income of a broker remains unchanged though the rate of commission is increased from 4% to 5%. The percentage of slump in business is—
(A) 8% (B) 1%
(C) 20% (D) 80%

45. One-third of 1206 is what per cent of 134 ?
(A) 3
(B) 30
(C) 300
(D) None of these

46. Rakesh credits 15% of his salary in his fixed deposit account and spend 30% of the remaining amount on groceries. If the cash in hand is Rs. 2380, what is his salary ?
(A) 35000 (B) 4000
(C) 45000 (D) 5000

47. A man donated 5% of his income to a charitable organisation and deposited 20% of the remainder in a bank. If he now has Rs. 1919 left, what is his income ?
(A) Rs. 2558·60
(B) Rs. 2525
(C) Rs. 2500
(D) Rs. 2300

48. The price of coffee is increased by 15% and a house wife reduced her consumption of coffee by 15% and hence her expenditure on coffee—
(A) Remains unchanged
(B) Increase by 1%
(C) Decreases by 4%
(D) Decreases by 2·25%

49. After spending 40% in machinery, 25% in building, 15% in raw material and 5% on furniture. Hari Lal has a balance of Rs. 1305. The money with him was—
(A) Rs. 6500 (B) Rs. 7225
(C) Rs. 8700 (D) Rs. 1390

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50. A number increased to $137\frac{1}{2}\%$ gives 33. The number is—
(A) 22 (B) 24
(C) 25 (D) 27

51. A number decreased to $72\frac{1}{2}\%$ gives 87. The number is—
(A) 58 (B) 110
(C) 120 (D) 135

52. 25% of a number is more than 18% of 650 by 19. The number is—
(A) 380·8
(B) 450
(C) 544
(D) None of these

53. 96% of the population of a village is 23040. The total population of the village is—
(A) 32256 (B) 24000
(C) 24936 (D) 25640

54. After deducting a commission of 5% a T.V. set costs Rs. 9595. Its gross value is—
(A) Rs. 10000
(B) Rs. 10074·75
(C) Rs. 10100
(D) None of these

55. A man spends Rs. 3500 per month and saves $12\frac{1}{2}\%$ of his income. His monthly income is—
(A) Rs. 4400 (B) Rs. 4270
(C) Rs. 4000 (D) Rs. 3937·50

56. If 70% of the students in a school are boys and the number of girls be 504, the number of boys is—
(A) 1176 (B) 1008
(C) 1208 (D) 3024

57. A fruit seller had some apples. He sells 40% and still has 420 apples. Originally, he had—
(A) 588 apples
(B) 600 apples
(C) 672 apples
(D) 700 apples

58. An ore contains 12% copper. How many kg of ore are required to get 69 kg of copper ?
(A) 424 kg (B) 575 kg
(C) 828 kg (D) $1736\frac{2}{3}$ kg

59. $\sqrt{(3{\cdot}6\% \text{ of } 40)}$ is equal to—
(A) 2·8
(B) 1·8
(C) 1·2
(D) None of these

60. In an examination 65% of the total examinees passed if the number of failures is 420 total number of examinees is—
(A) 567 (B) 693
(C) 1000 (D) 1200

61. 75% of a number when added to 75 is equal to the number. The number is—
(A) 150 (B) 200
(C) 225 (D) 300

62. 5% income of A is equal to 15% income of B and 10% income of B is equal to 20% income of C. If income of C is Rs. 2000, then total income of A, B and C is—
(A) Rs. 6000
(B) Rs. 18000
(C) Rs. 20000
(D) Rs. 14000

63. In mathematics exam. a student scored 30% marks in the first paper out of a total of 180. How much should he score in second paper out of a total of 150, if he is to get an overall average of atleast 50% ?
(A) 74% (B) 76%
(C) 70% (D) 80%

64. In a examination it is required to get 36% of maximum marks to pass. A student got 113 marks and declared failed by 85 marks. The maximum marks are—
(A) 500 (B) 550
(C) 640 (D) 1008

65. From the salary of an officer 10% deducted as house rent, 15% of the rest he spends on children's education and 10% of the balance, he spends on clothes. After this expenditure he is left with Rs. 1377. His salary is—
(A) Rs. 2000 (B) Rs. 2040
(C) Rs. 2100 (D) Rs. 2200

66. Two numbers are less than a third number by 30% and 37% respectively. How much per cent is the second number less than the first ?
(A) 3% (B) 4%
(C) 7% (D) 10%

67. In an examination, there were 2000 candidates out of which 900 candidates were boys and rest were girls. If 32% of the boys and 38% of the girls passed, then the total percentage of failed candidates is—
(A) 35·3% (B) 64·7%
(C) 68·5% (D) 70%

68. A student who secure 20% marks in an examination fails by 30 marks. Another student who secures 32% marks gets 42 marks more than those required to pass. The percentage of marks required to pass is—
(A) 20% (B) 25%
(C) 28% (D) 30%

69. In a college election, a candidate secured 62% of the votes and is elected by a majority of 144 votes. The total number of votes polled is—
(A) 600 (B) 800
(C) 925 (D) 1200

70. There were 600 students in a school. Each offered either English or Hindi or both. If 75% offered English and 45% Hindi, how many offered both ?
(A) 48 (B) 60
(C) 80 (D) 120

71. What will be 80 per cent of a number whose 200 per cent is 90 ?
(A) 144
(B) 72
(C) 36
(D) None of these

72. The price of sugar is increased by 20%. If the expenditure is not allowed to increase. Then ratio between the reduction in consumption and the original consumption—
(A) 1 : 3 (B) 1 : 4
(C) 1 : 6 (D) 1 : 5

73. Water tax is increased by 20% but its consumption is decreased by 20%. Then the increase or decrease in the expenditure of the money is—
(A) No change
(B) 5% decrease

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(C) 4% increase

(D) 4% decrease

74. 3 litres of water is added to 15 litres of a mixture of a 20% solution of alcohol in water. The strength of alcohol is now—

(A) $12\frac{1}{2}\%$ (B) $16\frac{2}{3}\%$

(C) 24% (D) 16%

75. On decreasing the price of T. V. sets by 30%. Its sale is increased by 20%. What is the effect on the revenue received by the shopkeeper ?

(A) 10% increase

(B) 10% decrease

(C) 16% increase

(D) 16% decrease

76. In vocational course in a college 15% seats increase annually. If there were 800 students in 1992, how many students will be there in 1994 ?

(A) 920 (B) 1040

(C) 1058 (D) 1178

77. The population of a town is 8000. It increases by 10% during first year and by 20% during the second year. The population after 2 years will be—

(A) 10400

(B) 10560

(C) 10620

(D) None of these

78. A papaya was planted 2 years ago. It increases at the rate of 20% every year. If at present, the height of the tree is 540 cm, what was it when the tree was planted ?

(A) 324 cms (B) 375 cms

(C) 400 cms (D) 432 cms

79. The value of a machine depreciates 10% annually. If its present value is Rs. 4000. Its value 2 years hence will be—

(A) Rs. 3200 (B) Rs. 3240

(C) Rs. 3260 (D) Rs. 3280

80. The current birth rate per thousand is 32 whereas corresponding death rate is 11 per thousand. The net growth rate in terms of population increase in per cent is given by—

(A) 0·021% (B) 0·0021%

(C) 21% (D) 2·1%

81. The population of a town increases 4% annually but is decreased by emigration annually to the extent of $\frac{1}{2}\%$. What will be the increase per cent in three years ?

(A) 9·8 (B) 10

(C) 10·5 (D) 10·8

82. A man's wages were decreased by 50%. Again the reduced wages were increased by 50%. He has a loss of—

(A) 0% (B) 0·25%

(C) 2·5% (D) 25%

83. p is six times as large as q. The per cent that q is less than p, is—

(A) $83\frac{1}{3}$ (B) $16\frac{2}{3}$

(C) 90 (D) 60

84. If A's salary is 30% more than B's then how much per cent is B's salary less than A's ?

(A) 30% (B) 25%

(C) $23\frac{1}{13}\%$ (D) $33\frac{1}{3}\%$

85. A man spends 75% of his income. This income is increased by 20% and he increased his expenditure by 10%. His savings are increased by—

(A) 10% (B) 25%

(C) $37\frac{1}{2}\%$ (D) 50%

86. The price of an article has been reduced by 25%. In order to restore the original price, the new price must be increased by—

(A) $33\frac{1}{3}\%$ (B) $11\frac{1}{9}\%$

(C) $9\frac{1}{11}\%$ (D) $66\frac{2}{3}\%$

87. If the numerator of a fraction is increased by 20% and the denominator be diminished by 10%, the value of the fraction is $\frac{16}{21}$. The original fraction is—

(A) $\frac{3}{5}$ (B) $\frac{4}{7}$

(C) $\frac{2}{3}$ (D) $\frac{5}{7}$

88. A mixture of 40 litres of milk and water contains 10% water. How much water should be added to this so that water may be 20% in the new mixture ?

(A) 4 litres (B) 5 litres

(C) 6·5 litres (D) 7·5 litres

89. The price of rice has increased by 60%. In order to restore to the original price, the new price must be reduced by—

(A) $33\frac{1}{3}\%$ (B) $37\frac{1}{2}\%$

(C) 40% (D) 45%

90. The boys and girls in a college are in ratio 3 : 2. If 20% of the boys and 25% of the girls are adults, the percentage of students who are not adults is—

(A) 58% (B) 67·5%

(C) 78% (D) 82·5%

91. 72% of the students of a certain class took Biology and 44% took Mathematics. If each student took Biology or Mathematics and 40 took both. The total number of students in the class was—

(A) 200 (B) 240

(C) 250 (D) 320

92. In measuring the side of a square an error of 5% in excess is made. The error per cent in the calculated area is—

(A) 10% (B) 10·25%

(C) 10·5% (D) 25%

93. One litre of water is evaporated from 6 litre of a solution containing 5% salt. The percentage of salt is—

(A) $4\frac{4}{9}\%$ (B) $5\frac{5}{7}\%$

(C) 5% (D) 6%

94. If the side of a square is increased by 30%, its area is increased by—

(A) 9% (B) 30%

(C) 60% (D) 69%

95. A reduction of 21% in the price of wheat enables a person to buy 10·5 kg more for Rs. 100. What is the reduced price per kg ?

(A) Rs. 2 (B) Rs. 2·25

(C) Rs. 30 (D) Rs. 2·50

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96. The radius of circle is increased by 1%. What is the increased per cent in its area ?
(A) 1% (B) 1·1%
(C) 2% (D) 2·01%

97. The length and breadth of square are increased by 30% and 20% respectively. The area of the rectangle so formed exceeds the area of the square by—
(A) 20% (B) 36%
(C) 50% (D) 56%

98. For a sphere of radius 10 cms. the numerical value of the surface area is how many per cent of the numerical value of its volume ?
(A) 24% (B) 26·5%
(C) 30% (D) 45%

99. The length of a rectangle is increased by 60%. By what per cent would the width have to be decreased to maintain the same area ?
(A) $37\frac{1}{2}\%$ (B) 60%
(C) 75% (D) None of these

100. The price of cooking oil has increased by 25%. The percentage of reduction that a family should effect in the use of cooking oil so as not to increase the expenditure on this account is—
(A) 15% (B) 20%
(C) 25% (D) 30%

Answers with Hints

1. (C) $8\frac{1}{3}\% = \left(\frac{25}{3}\times\frac{1}{100}\right) = \frac{1}{12}$

2. (B) $\cdot025 = \left(\frac{25}{1000}\times 100\right)\% = 2{\cdot}5\%$

3. (B) $\cdot02 = \left(\frac{2}{100}\times 100\right)\% = 2\%$

4. (B) Required percentage $= \left[\frac{1/35}{2/7}\times 100\right]\%$
$= \left(\frac{1}{35}\times\frac{7}{2}\times 100\right)\%$
$= 10\%$

5. (B) Required percentage $= \left(\frac{18}{7{\cdot}2\times 1000}\times 100\right)\%$
$= 0{\cdot}25\%$

6. (B) Let the number of boys $= x$
then $x + \frac{7x}{10} = 85$
$\Rightarrow x = 50$
$\therefore$ No. of girls $= 85 - 50 = 35$
(i) Number of boys playing only badminton
$= 50\%$ of boys
$= \frac{50}{100}\times 50 = 25$
(ii) Number of children playing only table tennis
$= 40\%$ of total no. of children
$= \frac{40}{100}\times 85 = 34$
(iii) Total no. of children playing both badminton and table tennis $= 12$
Hence, number of girls playing only badminton
$= 85 - (25 + 34 + 12)$
$= 85 - 71 = 14.$

7. (B) Let $x\%$ of $130 = 10{\cdot}4$
$\Rightarrow \frac{x}{100}\times 130 = 10{\cdot}4$
$\therefore x = \frac{10{\cdot}4\times 100}{130} = 8$

8. (C) $\frac{2}{5}\% = \left(\frac{2}{5}\times\frac{1}{100}\right) = \frac{1}{250}$

9. (A) Let $x\%$ of $840 = 30\%$ of 140
$\Rightarrow \frac{x}{100}\times 840 = \frac{30}{100}\times 140$
$\therefore x = \left(\frac{30}{100}\times 140\times\frac{100}{840}\right) = 5$

10. (C) Let $x\%$ of $250 + 25\%$ of $68 = 67$
$\Rightarrow \frac{x}{100}\times 250 + \frac{25}{100}\times 68 = 67$
$\Rightarrow \frac{5x}{2} = 50$
$\therefore x = \left(\frac{50\times 2}{5}\right) = 20$

11. (B) 5% of (50% of Rs. 300) $=$ Rs. $\left(\frac{5}{100}\times 300\right)$
$= 7{\cdot}50$

12. (C) $\because$ Food items $= 40\%$
Clothes + Conveyance $= 50\%$ of $60\% = 30\%$
$\Rightarrow$ Remaining amount $= 30\%$
$\because \frac{1}{3}$ of $30\% = \frac{19200}{12}$
$\Rightarrow 10\% = 1600$
$\therefore 100\% =$ Rs. 16000

13. (C) 25% of 25% $= \frac{25}{100}\times\frac{25}{100} = \frac{625}{10000} = \cdot0625$

14. (C) Let $x\%$ of $20 = \cdot05$
Then, $\frac{x}{100}\times 20 = \cdot05$
$\therefore x = \cdot25$

15. (D) Let $x\times 15 = 37{\cdot}5\%$ of 220
$\Rightarrow 15x = \left(\frac{37{\cdot}5}{100}\times 220\right)$
$\therefore x = \frac{37{\cdot}5\times 220}{100\times 15} = 5{\cdot}5$

16. (C) $\left(0{\cdot}756\times\frac{3}{4}\right) = \left(\frac{756}{1000}\times\frac{3}{4}\times 100\right)\% = 56{\cdot}7\%$

17. (C) Let $\frac{30\% \text{ of } 80}{x} = 24$
$\Rightarrow 24x = \left(\frac{30}{100}\times 80\right)$
$\therefore x = \left(\frac{30\times 80}{24\times 100}\right) = 1$

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18. (C) $\because$ J = 40% of A = $\frac{2}{5}$A

$\Rightarrow$ P = $\frac{1}{4}\times\frac{2}{5}$A = $\frac{1}{10}$A

$\Rightarrow$ $\frac{1}{10}$A – 200 = 600

$\Rightarrow$ $\frac{1}{10}$A = 800

$\therefore$ A = Rs. 8000

19. (D) Let 8% of 96 = x of $\frac{1}{25}$

$\Rightarrow$ $\frac{8}{100}\times 96 = \frac{x}{25}$

$\therefore$ $x = \frac{8}{100}\times 96\times 25 = 192$

20. (A) $\because$ 8% of x = 4% of y

$\Rightarrow$ $\frac{8}{100}x = \frac{4}{100}y$

$\Rightarrow$ $x = \left(\frac{4}{100}\times\frac{100}{8}\right)y = \frac{y}{2}$

$\therefore$ 20% of $x = \left(\frac{20}{100}\times x\right)$

$= \left(\frac{1}{5}\times\frac{y}{2}\right) = \frac{1}{10}y$

$= \left(\frac{1}{10}\times 100\right)$% of y

= 10% of y

21. (D) $\because$ x = 90% of y

$\Rightarrow$ $x = \frac{90}{100}\times y$

Let Z% of x = y

then, $\frac{Z}{100}\times x = y$

$\Rightarrow$ $\frac{Z}{100}\times\frac{90}{100}y = y$

$\therefore$ $Z = \frac{100\times 100}{90} = 111{\cdot}1$

22. (C) x% of y + y% of $x = \left(\frac{x}{100}\times y\right) + \left(\frac{y}{100}\times x\right)$

$= \frac{2}{100}xy$ = 2% of xy

23. (A) Let 31% of x = 46·5

$\Rightarrow$ $\frac{31}{100}x$ = 46·5

$\therefore$ $x = \frac{46{\cdot}5\times 100}{31} = 150$

24. (B) Suppose there are $8x$ questions were asked apart from the 41 questions. Then

$\frac{37+5x}{41+8x} = 80\% = \frac{4}{5}$

$\Rightarrow$ $185 + 25x = 164 + 32x$

$\Rightarrow$ $7x = 21$

$\Rightarrow$ $x = 3$

$\therefore$ Total no. of questions = $41 + 8\times 3 = 65$.

25. (C) Required number = 80 – 60% of 80

$= \left(80 - \frac{60}{100}\times 80\right) = 32$

26. (A) $\because$ x – 20% of x = 40

$\Rightarrow$ $x - \frac{x}{5} = 40$

$\Rightarrow$ $\frac{4x}{5} = 40$

$\therefore$ $x = \frac{5}{4}\times 40$

= 50.

27. (D) $\because$ $\frac{90}{100}$A = $\frac{30}{100}$B = $\frac{30}{100}\times\frac{x}{100}$A

$\therefore$ $x = \left(100\times\frac{100}{30}\times\frac{90}{100}\right) = 300$

28. (C) $33\frac{1}{3}\%$ = $\left(\frac{100}{3}\times\frac{1}{100}\right) = \frac{1}{3} = 0{\cdot}33$;

$\frac{4}{15}$ = 0·26

Clearly 0·35 > 0·33 > 0·26

$\therefore$ 0·35 is greatest

29. (C) Let 200 = x% of 300.

$\Rightarrow$ $\frac{x}{100}\times 300 = 200$

$\therefore$ $x = \frac{200}{3} = 66\frac{2}{3}$

30. (A) Number of students who speak only English

= 30% of 60 = 18

Number of students who speak Hindi and English

= 20% of 60 = 12

$\therefore$ Number of students who speak only Hindi

= (60 – 30) = 30

$\therefore$ Number of students who speak Hindi

= 30 + 12 = 42

31. (C) Let $45\times x = \frac{25}{100}\times 900$

$\therefore$ $x = \frac{25\times 9}{45} = 5$

32. (A) $\because$ $\frac{0{\cdot}5}{100}$ of x = $\frac{85}{100}$

$\therefore$ x = Rs. $\left(\frac{85}{0{\cdot}5}\right)$ = Rs. 170

33. (D) Required per cent = $\left[\frac{3/100}{5/100}\times 100\right]$%

$= \left(\frac{3}{100}\times\frac{100}{5}\times 100\right)$%

= 60%

34. (D) Let 75% of 480 = $x\times 15$.

$\Rightarrow$ $\frac{75}{100}\times 480 = 15x$

$\therefore$ $x = \frac{75\times 480}{100\times 15} = 24$

35. (C) Required per cent = $\left(\frac{30}{2\times 10}\times 100\right)$% = 150%

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36. (B) Number of females $= 156800 \times \frac{100}{80} = 196000$

$\therefore$ Number of males $= \frac{7}{8} \times 196000 = 171500$

Total population $= 196000 + 171500$

$= 367500$

37. (A) Let $x\%$ of $y = y\%$ of z

$\Rightarrow \frac{x}{100} \times y = \frac{y}{100} \times z$

$\therefore z = \left(\frac{xy}{100} \times \frac{100}{y}\right) = x$

38. (A) Let $12{\cdot}5\%$ of $192 = 50\%$ of x, then

$\Rightarrow \frac{12{\cdot}5}{100} \times 192 = \frac{50}{100} \times x$

$\therefore x = \frac{12{\cdot}5 \times 192}{50} = 48$

39. (C) Let $37\frac{1}{2}\%$ of $x = 900$

$\Rightarrow \frac{75 \times x}{2 \times 100} = 900$

$\therefore x = \frac{900 \times 2 \times 100}{75} = 2400$

So, $62\frac{1}{2}\%$ of $x = \left(\frac{125}{2} \times \frac{1}{100} \times 2400\right) = 1500$

40. (A) Let $x - 6\%$ of $x = xz$.

$\Rightarrow \frac{94}{100} x \times \frac{1}{x} = z$

$\therefore z = 0{\cdot}94$

41. (B) It is $\left(\frac{30}{100} \times 80 - \frac{4}{5} \times 25\right) = 24 - 20 = 4$

42. (D) Let the number of students appearing for examination in the year 1998 in the states A, B and C be $3x$, $5x$ and $6x$ respectively.

According to the question $= \frac{3x \times \frac{120}{100}}{6x \times \frac{120}{100}} = \frac{1}{2}$

$\Rightarrow \frac{1}{2} = \frac{1}{2}$

43. (C) Let original price = Rs. 100.

Then, new price = Rs. 90.

$\because$ Increase on Rs. 90 = Rs. 10

Required increase% $= \left(\frac{10}{90} \times 100\right)\% = 11\frac{1}{9}\%$

44. (C) Let the business value changes from x to y. Then

4% of $x = 5\%$ of y

$\Rightarrow \frac{4}{100} \times x = \frac{5}{100} \times y$

$\Rightarrow y = \frac{4}{5} x$

$\therefore$ Change in business $= \left(x - \frac{4}{5} x\right) = \frac{1}{5} x$

Percentage slump in business

$= \left(\frac{1}{5} x \times \frac{1}{x} \times 100\right)\% = 20\%$

45. (C) $\because \frac{1}{3} \times 1206 = \frac{x}{100} \times 134$

$\therefore x = \frac{402 \times 100}{134} = 300$

46. (B) Let salary be Rs. x, then

$x - 15\%$ of $x - 30\%$ of 85% of $x = 2380$

$\Rightarrow x - \frac{15x}{100} - \frac{30 \times 85 \times x}{100 \times 100} = 2380$

$\Rightarrow 200x - 30x - 51x = 2380 \times 200$

$\Rightarrow 119x = 2380 \times 200$

$\therefore x = \frac{2380 \times 200}{119} = 4000$

47. (B) Let his income be Rs. x, then

$x - 5\%$ of $x - 20\%$ of 95% of $x = 1919$

$\Rightarrow x - \frac{x}{20} - \frac{20 \times 95 \times x}{100 \times 100} = 1919$

$\Rightarrow x - \frac{x}{20} - \frac{19x}{100} = 1919$

$\Rightarrow 100x - 5x - 19x = 191900$

$\therefore x = \frac{191900}{76} = 2525$

48. (D) Decreases by $2{\cdot}25\%$.

49. (C) $\because x - [40\%$ of $x + 25\%$ of $x + 15\%$ of $x + 5\%$ of $x]$

$= 1305$

$\Rightarrow x - 85\%$ of $x = 1305$

$\Rightarrow 15\%$ of $x = 1305$

$\therefore x = \frac{1305 \times 100}{15} = 8700$

50. (B) $\because 137\frac{1}{2}\%$ of $x = 33$

$\Rightarrow \frac{275}{2} \times \frac{1}{100} x = 33$

$\therefore x = \frac{33 \times 2 \times 100}{275} = 24$

51. (C) $\because 72\frac{1}{2}\%$ of $x = 87$

$\Rightarrow \frac{145}{2} \times \frac{1}{100} x = 87$

$\therefore x = \frac{87 \times 2 \times 100}{145} = 120$

52. (C) $\because (25\%$ of $x) - (18\%$ of $650) = 19$

$\Rightarrow \frac{x}{4} = \left(19 + \frac{18}{100} \times 650\right)$

$= 136$

$\therefore x = (136 \times 4) = 544$

53. (B) $\because 96\%$ of $x = 23040$

$\therefore x = \frac{23040 \times 100}{96} = 24000$

54. (C) $\because 95\%$ of $x = 9595$

$\therefore x = \frac{9595 \times 100}{95} = 10100$

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55. (C) $\because$ $87\frac{1}{2}\%$ of $x = 3500$

$\Rightarrow \frac{175}{2} \times \frac{1}{100} \times x = 3500$

$\therefore x = \frac{3500 \times 2 \times 100}{175} = 4000$

56. (A) Let total number of students be x

Then 30% of $x = 504$

$\Rightarrow x = \frac{504 \times 100}{30} = 1680$

$\therefore$ Number of boys $= (1680 - 504) = 1176$

57. (D) $\because$ 60% of $x = 420$

$\therefore x = \frac{420 \times 100}{60} = 700$

58. (B) $\because$ 12% of $x = 69$

$\Rightarrow x = \frac{69 \times 100}{12} = 575$ kg

59. (C) $\sqrt{\frac{3{\cdot}6}{100} \times 40} = \sqrt{1{\cdot}44} = 1{\cdot}2$

60. (D) 35% of $x = 420$

$\therefore x = \frac{420 \times 100}{35} = 1200$

61. (D) $\because$ $75 + 75\%$ of $x = x$

$\Rightarrow x - \frac{3}{4}x = 75$

$\Rightarrow \frac{1}{4}x = 75$

$\therefore x = (75 \times 4) = 300$

62. (B) $\because$ 5% A = 15% B and 10% B = 20% C

$\therefore \frac{A}{20} = \frac{3B}{20}$ and $\frac{B}{10} = \frac{C}{5}$

$\Rightarrow B = 2C$

$\Rightarrow \frac{A}{20} = \frac{3}{20} \times 2C = \frac{3}{10}C$

$= \frac{3}{10} \times 2000 = 600$

$\therefore A = (600 \times 20) = 12000,$

$B = (2 \times 2000) = 4000$

$\therefore A + B + C = (12000 + 4000 + 2000) = 18000$

63. (A) $\because$ 30% of 180 + x% of 150

$= 50\%$ of $(180 + 150)$

$\Rightarrow 54 + \frac{x}{100} \times 150 = 165$

$\Rightarrow \frac{3x}{2} = 111$

$\therefore x = \frac{111 \times 2}{3} = 74$

64. (B) $\because$ 36% of $x = (113 + 85)$

$\therefore x = \frac{100 \times 198}{36} = 550$

65. (A) Suppose that his salary = Rs. 100

House Rent = Rs. 10

So Balance = Rs. 90

Expenditure on education = Rs. $\left(\frac{15}{100} \times 90\right)$

= Rs. 13·50

Balance = Rs. 76·50

Expenditure on clothes = Rs. $\left(\frac{10}{100} \times 76{\cdot}50\right)$

= Rs. 7·65

Balance now = Rs. 68·85

If balance is Rs. 68·85, Salary = Rs. 100

If balance is Rs. 1377, Salary = Rs. $\left(\frac{100}{68{\cdot}85} \times 1377\right)$

= Rs. 2000

66. (D) Let third number be x

Then, first number = 70% of $x = \frac{7x}{10}$

and, second number = 63% of $x = \frac{63x}{100}$

Difference = $\frac{7x}{10} - \frac{63x}{100} = \frac{7x}{100}$

$\therefore$ Required percentage = $\left(\frac{7x}{100} \times \frac{10}{7x} \times 100\right)\%$

= 10%

67. (B) Boys = 900,

Girls = 1100

Passed = (32% of 900) + (38% of 1100)

= (288 + 418) = 706

Failed = (2000 – 706) = 1294

Failed % = $\left(\frac{1294}{2000} \times 100\right)\% = 64{\cdot}7\%$

68. (B) $\because$ 20% of $x + 30 = 32\%$ of $x - 42$

$\Rightarrow$ 12% of $x = 72$

So $x = \frac{72 \times 100}{12} = 600$

Pass marks = 20% of 600 + 30 = 150

Pass percentage = $\left(\frac{150}{600} \times 100\right)\% = 25\%$

69. (A) $\because$ (62% of x – 38% of x) = 144

$\Rightarrow$ 24% of $x = 144$

$\therefore x = \frac{144 \times 100}{24} = 600$

70. (D) $n(A) = 75\%$ of $600 = 450$

$n(B) = 45\%$ of $600 = 270$ and $n(A \cup B) = 600$

$\because$ $n(A \cap B) = n(A) + n(B) - n(A \cup B)$

$= (450 + 270 - 600) = 120$

71. (C) $\because$ 200% of $x = 90$

$\Rightarrow x = \frac{90 \times 100}{200} = 45$

$\therefore$ 80% of $x = \left(\frac{80}{100} \times 45\right) = 36$

72. (C) Reduction in consumption = $\left(\frac{20}{120} \times 100\right)\%$

$= \frac{50}{3}\%$

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$\therefore \quad \frac{\text{Reduction in consumption}}{\text{Original consumption}} = \left(\frac{50}{3} \times \frac{1}{100}\right) = \frac{1}{6}$

$= 1 : 6$

73. (D) Let tax = Rs. 100 and consumption = 100 units

Original expenditure = Rs. (100×100)

= Rs. 10000

New expenditure = Rs. (120×80)

= Rs. 9600

$\therefore$ Decrease in expenditure = $\left(\frac{400}{10000} \times 100\right)\%$

= 4%

74. (B) Alcohol in 15 litres = $\left(\frac{20}{100} \times 15\right)$ litres

= 3 litres

Now, alcohol in 18 litres = 3 litres

$\therefore$ Strength of alcohol = $\left(\frac{3}{18} \times 100\right)\% = 16\frac{2}{3}\%$

75. (D) Let price = Rs. 100,

Sale = 100

Then sale value = Rs. (100×100) = Rs. 10000

New sale value = Rs. (70×120) = Rs. 8400

Decrease% = $\left(\frac{1600}{10000} \times 100\right)\% = 16\%$

76. (C) Required number = $800 \times \left(1 + \frac{15}{100}\right)^2$

$= \left(800 \times \frac{23}{20} \times \frac{23}{20}\right)$

= 1058

77. (B) Population after 2 years

$= 8000 \left(1 + \frac{10}{100}\right)\left(1 + \frac{20}{100}\right)$

$= \left(8000 \times \frac{11}{10} \times \frac{6}{5}\right) = 10560$

78. (B) $\because \quad 540 = x\left(1 + \frac{20}{100}\right)^2$

$\therefore \quad x = \left(540 \times \frac{5}{6} \times \frac{5}{6}\right) = 375$ cm

79. (B) Value of machine 2 years hence

$= \text{Rs.} \left[4000 \times \left(1 - \frac{10}{100}\right)^2\right]$

$= \text{Rs.} \left(4000 \times \frac{9}{10} \times \frac{9}{10}\right)$

= Rs. 3240

80. (D) Net growth on 1000 = 21

Net growth on 100 = $\left(\frac{21}{1000} \times 100\right) = 2{\cdot}1\%$

81. (D) Increase in 3 years over 100

$= 100 \times \left(1 + \frac{7}{2 \times 100}\right)^3$

$= \left(100 \times \frac{207}{200} \times \frac{207}{200} \times \frac{207}{200}\right)$

$= \frac{(200 + 7)^3}{80000}$

$= \frac{8869743}{80000} = 110{\cdot}8718$

Required increase %

$= (110{\cdot}8 - 100)\%$

$= 10{\cdot}8\%$.

82. (D) Let original wages = Rs. 100

Reduced wages = Rs. 50

Increased wages = 150% of Rs. 50

$= \left(\frac{150}{100} \times 50\right) = \text{Rs. } 75$

$\therefore$ Loss = 25%

83. (A) $p = 6q$. Thus q is less than p by $5q$

$\therefore \quad q$ is less than p by = $\frac{6q - q}{6q} \times 100\%$

$= \left(\frac{5q}{6q} \times 100\right)\% = 83\frac{1}{3}\%$

84. (C) B's salary is less than A's by $\left(\frac{30}{130} \times 100\right)\%$

$= 23\frac{1}{13}\%$.

85. (D) Let income = Rs. 100

Then expenditure = Rs. 75 and saving = Rs. 25

New income = Rs. 120

New expenditure = 110% of Rs. 75 = Rs. $\frac{165}{2}$

New saving = Rs. $\left(120 - \frac{165}{2}\right) = \text{Rs. } \frac{75}{2}$

Increase in saving = Rs. $\left(\frac{75}{2} - 25\right) = \text{Rs. } \frac{25}{2}$

$\therefore \quad$ Increase% = $\left(\frac{25}{2} \times \frac{1}{25} \times 100\right)\% = 50\%$

86. (A) Let original price = Rs. 100

Reduced price = Rs. 75

Increase on Rs. 75 = Rs. 25

Increase on Rs. 100 = $\left(\frac{25}{75} \times 100\right)\% = 33\frac{1}{3}\%$

87. (B) Let the original fraction be $\frac{x}{y}$

Now, $\frac{120\% \text{ of } x}{90\% \text{ of } y} = \frac{16}{21}$

$\Rightarrow \quad \frac{4}{3} \times \frac{x}{y} = \frac{16}{21}$

$\therefore \quad \frac{x}{y} = \left(\frac{16}{21} \times \frac{3}{4}\right) = \frac{4}{7}$

88. (B) $\because$ Milk = 90% of 40 = 36 litres and water = 4 litres

$\Rightarrow \quad \frac{4 + x}{(40 + x)} \times 100 = 20$

$\Rightarrow \quad 20\,(40 + x) = 100\,(4 + x)$

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$\Rightarrow \quad 80x = 400$

$\therefore \quad x = 5$ litres.

89. (B) Let original price = Rs. 100

$\Rightarrow$ Increased price = Rs. 160

$\Rightarrow$ Decrease on Rs. 160 = Rs. 60

$\therefore$ Decrease on Rs. 100 $= \left(\frac{60}{160} \times 100\right)\%$

$= 37\frac{1}{2}\%$

90. (C) Suppose boys $= 3x$ and girls $= 2x$

Not adults = (80% of $3x$) + (75% of $2x$)

$= \left(\frac{12x}{5} + \frac{3x}{2}\right) = \frac{39x}{10}$

$\therefore$ Required percentage $= \left(\frac{39x}{10} \times \frac{1}{5x} \times 100\right)\%$

$= 78\%$

91. (C) Let the total number of students be 100

Then, $n(A \cap B) = n(A) + n(B) - n(A \cup B)$

$= (72 + 44 - 100)\% = 16\%$

Now, $\because$ 16% of $x = 40$

$\Rightarrow \quad \frac{16}{100} \times x = 40$

$\therefore \quad x = \frac{100 \times 40}{16} = 250$

92. (B) Let actual side = 100 cm

$\Rightarrow$ Measured length = 105 cm

$\Rightarrow$ Error in area $= (105)^2 - (100)^2$

$= (105 + 100)(105 - 100)$

$= 1025$

Error% $= \left(\frac{1025}{10000} \times 100\right)\% = 10{\cdot}25\%$

93. (D) Salt in 6 litre = 5% of 6 = 0·30

Salt in new solution $= \left(\frac{0{\cdot}30}{5} \times 100\right)\% = 6\%$

94. (D) Let side of square

= 100 cm

Area $= (100 \times 100)\ \text{cm}^2 = 10000\ \text{cm}^2$

New area $= (130 \times 130)\ \text{cm}^2 = 16900\ \text{cm}^2$

Increase in area $= \left(\frac{6900}{10000} \times 100\right)\% = 69\%$

95. (A) Let original rate = Rs. x per kg

New rate = 79% of Rs. x per kg

$= \text{Rs.} \left(\frac{79x}{100}\right)$ per kg

$\because \quad \frac{100}{\frac{79x}{100}} - \frac{100}{x} = 10{\cdot}5$

$\Rightarrow \quad \frac{10000}{79x} - \frac{100}{x} = 10{\cdot}5$

$\Rightarrow \quad 10000 - 7900 = 10{\cdot}5 \times 79x$

$\therefore \quad x = \frac{2100}{10{\cdot}5 \times 79}$

Reduced rate $= \text{Rs.} \left(\frac{79}{100} \times \frac{2100}{10{\cdot}5 \times 79}\right)$ per kg

= Rs. 2 per kg.

96. (D) Let radius of circle

= 100 m

New radius = 101 m

Original area $= [\pi \times (100)^2]\text{m}^2$

New area $= [\pi \times (101)^2]\text{m}^2$

Increase% $= \left[\frac{\pi \times \{(101)^2 - (100)^2\}}{\pi \times 100 \times 100} \times 100\right]\%$

$= \frac{201}{100}\% = 2{\cdot}01\%$

97. (D) Let length of square

= 100 m and breadth of square

= 100 m

Area $= (100 \times 100)\text{m}^2 = 10000\ \text{m}^2$

New length = 130 m

And New breadth = 120 m

New area of rectangle

$= (130 \times 120)\text{m}^2 = 15600\ \text{m}^2$

Increase% $= \left(\frac{5600}{10000} \times 100\right)\%$

$= 56\%$

98. (C) Surface area sphere $= 4\pi \times (10)^2 = (400\pi)\ \text{cm}^2$

Volume sphere $= \frac{4}{3}\pi \times (10)^3$

$= \left(\frac{4000\ \pi}{3}\right)\ \text{cm}^3$

$\therefore$ Required percentage $= \left(400\pi \times \frac{3}{4000\pi} \times 100\right)\%$

$= 30\%$

99. (A) Let length of a rectangle

= 100 m,

Breadth = 100 m

New length = 160 m,

New breadth = x metres

Then, $160 \times x = 100 \times 100$

$\Rightarrow \quad x = \frac{100 \times 100}{160} = \frac{125}{2}$

Decrease in breadth $= \left(100 - \frac{125}{2}\right)\%$

$= 37\frac{1}{2}\%$

100. (B) Reduction in consumption

$= \left(\frac{m}{(100 + m)} \times 100\right)\%$

$= \left(\frac{25}{125} \times 100\right)\%$

$= 20\%$.

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Profit and Loss

Important Points/Facts

1. **Cost price (C.P.)**—It is that price at which a particular article or item is bought.

2. **Selling price (S. P.)**—It is that price at which a particular article or item is sold.

3. **Profit or gain**—If the selling price of an article is more than its cost price, then there is profit or gain.

Example—If an article is bought for Rs. 1000, and sold for Rs. 1200, then

$$\text{Profit} = \text{Rs. } (1200 - 1000) = \text{Rs. } 200$$

Hence, Profit = S. P. – C.P.

4. **Loss**—If the cost price of an article is more than its selling price, then there is loss.

Example—If an article is bought for Rs. 1000 and sold for Rs. 800

$$\therefore \quad \text{Loss} = \text{Rs. } (1000 - 800) = \text{Rs. } 200$$

Hence Loss = C.P. – S.P.

Examples

Q. 1. Mohan buys a chair for Rs. 150 and sells it for Rs. 160. Find his profit or loss per cent.

Solution :

Here C.P. of chair = Rs. 150

and S.P. of chair = Rs. 160

$$\text{Profit} = \text{Rs. } (160 - 150) = \text{Rs. } 10$$

$$\text{Profit per cent} = \frac{\text{Profit} \times 100}{\text{Cost Price}} = \frac{10 \times 100}{150} = \frac{20}{3} = 6\frac{2}{3}\%$$

Q. 2. A sold a cycle to B for 20% gain and B sold to C for 25% gain. If C paid Rs. 1500 for that then how much amount was paid by A for that cycle ?

Solution : Let A bought the cycle for Rs. P.

For 20% gain, selling price of the cycle for A

$$= \text{Cost price}\left(1 + \frac{\text{Gain}}{100}\right) = \text{Rs. P}\left(1 + \frac{20}{100}\right) = \text{Rs. P}\left(\frac{120}{100}\right)$$

Since a sale to B for Rs. P $\left(\frac{120}{100}\right)$ therefore cost price for B is

Rs. P $\left(\frac{120}{100}\right)$.

Now for 25% gain, selling price of the cycle

$$\text{For B} = \text{P}\left(\frac{120}{100}\right)\left[1 + \frac{25}{100}\right]$$

i.e., cost price of the cycle for C

$$= \text{P}\left(\frac{120}{100}\right)\left(\frac{125}{100}\right)$$

But according to the question, cost price of the cycle for

C = Rs. 1500

$$\therefore \text{P}\left(\frac{120}{100}\right)\left(\frac{125}{100}\right) = 1500$$

$$\text{P} = \frac{1500 \times 100 \times 100}{120 \times 125}$$

P = Rs. 1000

Hence cost price of cycle paid by A = Rs. 1000

Short Method

Required amount

$$= \frac{x}{A' B'} = \frac{1500}{\left(\frac{100 + 20}{100}\right)\left(\frac{100 + 25}{100}\right)} = \frac{1500 \times 100 \times 100}{120 \times 125} = \text{Rs. } 1000$$

Q. 3. A trader goes from Delhi to Lucknow to purchase an article whose price at Lucknow is 10% less than in Delhi. The transport expense is Rs. 150 and he earns gain of Rs. 240, on selling that article at Delhi. Then how much that article cost at Delhi ?

Solution : Let value of article at Delhi = Rs. x

$\therefore$ Value (C.P.) at Lucknow

$$= x\left(1 - \frac{10}{100}\right) = \text{Rs. } \frac{90}{100}x$$

$\because$ Transport expenses (overhead) = Rs. 150

$\therefore$ Cost price of that article on reaching Delhi

$$= \text{Rs. } \left(\frac{90}{100}x + 150\right)$$

But he earns gain of Rs. 240 on selling that article of Delhi.

$$\therefore x - \left(\frac{90}{100}x + 150\right) = 240$$

$$x - \frac{90}{100x} = 240 + 150$$

$$\frac{10}{100x} = 390$$

$$x = \text{Rs. } 3900$$

Q. 4. When a man sells an article to other man for A% gain or loss. The other person sells the same article to third man for B% gain or loss. If third man gets that article for Rs. x, then the cost price of that article for the first man

$$= \frac{100 \times 100x}{(100 \pm A)(100 \pm B)}$$

Solution : For memory

$$\text{C. P.} = \boxed{\frac{x}{A' \cdot B'}}$$

where $A' = \frac{100 \pm A}{100}$

and $B' = \frac{100 \pm B}{100}$

Q. 5. A retailer purchases goods from a wholeseller for Rs. 1000. The retailer bears additional expense of Rs. 200 on carriage of goods by his servant and he sold the goods to the consumer for Rs. 1500. Find the per cent gain.

Solution : Here Rs. 200 will be added as overhead expenses in the cost price of goods

$$\therefore \text{C.P. of goods} = 1000 + 200 = \text{Rs. } 1200$$

$$\therefore \quad \text{Gain} = 1500 - 1200 = \text{Rs. } 300$$

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∴ Per cent of gain

$$= \frac{\text{Gain} \times 100}{\text{C.P.}}$$

$$= \frac{300 \times 100}{1200}$$

$$= 25\%$$

Q. 6. A sells a manufactured table to a wholeseller at a profit of 10% the wholeseller sells that table to a retailer at a profit of 15% and retailer sells it to a customer at a profit of 25% for Rs. 1265. What is the cost of production of the table for manufacturer ?

Solution :

$$\text{Cost of table} = \frac{x}{A^- B^- C^-}$$

$$= \frac{1265 \times 100 \times 100 \times 100}{110 \times 115 \times 125}$$

$$= \text{Rs. } 800$$

Q. 7. A bought a horse for Rs. 9000. He sold this horse to B at 10% loss of cost price. Again B sold the horse to A at 10% profit. How much gain or loss happen to A in total transaction ?

Solution :

Profit or loss to

$$A = 9000 \times \frac{90}{100}\left(1 - \frac{110}{100}\right)$$

$$= 90 \times 90 \times \frac{-10}{100}$$

$$= \text{Rs. } (-810)$$

∵ Result is negative (– ve)

∴ Loss to A = Rs. 810

Q. 8. Find gain or loss per cent when :

(a) C.P. = Rs. 9·50
and S.P. = Rs. 11·40
(b) C.P. = Rs. 10·20
and S.P. = Rs. 8·50

Solution : (a) C.P. = Rs. 9·50,

S. P. = Rs. 11·40

∴ Gain = Rs. (11·40 – 9·50)

= Rs. 1·90

Hence,

$$\text{Gain\%} = \left(\frac{1{\cdot}90}{9{\cdot}50} \times 100\right)\%$$

$$= 20\%$$

(b) C. P. = Rs. 10·20,

S.P. = Rs. 8·50

∴ Loss = (Rs. 10·20 – 8·50)

= Rs. 1·70

Hence,

$$\text{Loss\%} = \left(\frac{1{\cdot}70}{10{\cdot}20} \times 100\right)\%$$

$$= 16\frac{2}{3}\%$$

Exercise

1. By selling an article for Rs. 100, one gains Rs. 10. Then the gain per cent is—
   (A) 9%
   (B) 10%
   (C) $11\frac{1}{9}\%$
   (D) None of these
2. There would be 10% loss if a toy is sold at Rs. 10·80 per piece. At what price should it be sold to earn a profit of 20% ?
   (A) Rs. 12
   (B) Rs. 12·96
   (C) Rs. 14·40
   (D) None of these
3. By selling an article for Rs. 247·50 we get a profit of $12\frac{1}{2}$ %. The cost of the article is—
   (A) Rs. 210 (B) Rs. 220
   (C) Rs. 224 (D) Rs. 225
4. The selling price of 12 articles is equal to the cost price of 15 articles. The gain per cent is—
   (A) $6\frac{2}{3}\%$ (B) 20%
   (C) 25% (D) 80%
5. If the cost price of 15 tables be equal to the selling price of 20 tables, the loss per cent is—
   (A) 20% (B) 30%
   (C) 25% (D) 37·5%
6. An article when sold for Rs. 200 fetches 25 per cent profit. What would be the percentage profit/ loss if 6 such articles are sold for Rs. 1056 ?
   (A) 10 per cent loss
   (B) 10 per cent profit
   (C) 5 per cent loss
   (D) 5 per cent profit
7. Two chairs and three tables cost Rs. 1025 and three chairs and two tables cost Rs. 1100. What is the difference between the cost of one table and that of one chair ?
   (A) Rs. 75
   (B) Rs. 35
   (C) Cannot be determined
   (D) 125
8. Profit after selling a commodity for Rs. 425 is same as loss after selling it for Rs. 355. The cost of the commodity is—
   (A) Rs. 385 (B) Rs. 390
   (C) Rs. 395 (D) Rs. 400
9. By selling an article for Rs. 100 one loses Rs. 10. Then, the loss per cent is—
   (A) $11\frac{1}{9}\%$
   (B) $9\frac{1}{11}\%$
   (C) 10%
   (D) None of these
10. A man buys 10 articles for Rs. 8 and sells them at the rate of Rs. 1·25 per article. His gain is—
    (A) 20% (B) 50%
    (C) $19\frac{1}{2}\%$ (D) $56\frac{1}{4}\%$
11. A man sold a radio for Rs. 1980 and gained 10%. The radio was bought for—
    (A) Rs. 1782
    (B) Rs. 1800
    (C) Rs. 2178
    (D) None of these
12. What per cent of selling price would be 34% of cost price if gross profit is 26% of the selling price ?
    (A) 17·16 (B) 74·00
    (C) 25·16 (D) 88·40
13. Alok bought 25 kg of rice at the rate of Rs. 6·00 per kg and 35 kg of rice at the rate of Rs. 7·00 per kg. He mixed the two and sold the mixture at the rate of Rs. 6·75 per kg. What was his gain or loss in this transaction ?
    (A) Rs. 16·00 gain
    (B) Rs. 16·00 loss
    (C) Rs. 20·00 gain
    (D) None of these
14. An item costing Rs. 200 is being sold at 10% loss. If the price is

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further reduced by 5%, the selling price will be—
(A) Rs. 179 (B) Rs. 175
(C) Rs. 171 (D) Rs. 170

15. A buys oranges at Rs. 2 for 3 oranges and sells them at a rupee each. To make a profit of Rs. 10, he must sell—
(A) 10 oranges
(B) 20 oranges
(C) 30 oranges
(D) 40 oranges

16. The cost of 2 T.V. sets and a radio is Rs. 7000, while 2 radios and one T.V. set together cost Rs. 4250. The cost of a T.V. set is—
(A) Rs. 3000
(B) Rs. 3160
(C) Rs. 3240
(D) None of these

17. If books bought at prices ranging from Rs. 200 to Rs. 350 are sold at prices ranging from Rs. 300 to Rs. 425, what is the greatest possible profit that might be made in selling 8 books ?
(A) Rs. 400
(B) Rs. 600
(C) Cannot be determined
(D) None of these

18. A man purchased a watch for Rs. 400 and sold it at a gain of 20% of the selling price. The selling price of the watch is—
(A) Rs. 300 (B) Rs. 320
(C) Rs. 440 (D) Rs. 500

19. By selling 8 dozen of pencils, a shopkeeper gains the selling price of 1 dozen pencils. His gain per cent is—
(A) 12·5%
(B) 87·5%
(C) $14\frac{2}{7}\%$
(D) None of these

20. By selling 36 oranges, a vender loses the selling price of 4 oranges. His loss per cent is—
(A) $12\frac{1}{2}\%$
(B) $11\frac{1}{9}\%$
(C) 10%
(D) None of these

21. While selling a watch a shopkeeper gives a discount of 5%. If he gives a discount of 7%, he earns Rs. 15 less as profit. What is the marked price of the watch ?
(A) Rs. 697·50
(B) Rs. 712·50
(C) Rs. 787·50
(D) None of these

22. A sells a horse to B for Rs. 4860, thereby losing 19 per cent, B sells it to C at a price which would have given A, 17 per cent profit. Find B's gain—
(A) Rs. 2160 (B) Rs. 2610
(C) Rs. 1260 (D) Rs. 2260

23. The cost price of an article, which on being sold at a gain of 12% yields Rs. 6 more than when it is sold at a loss of 12% is—
(A) Rs. 30 (B) Rs. 25
(C) Rs. 20 (D) Rs. 24

24. When the price of pressure cooker was increased by 15%, its sale fell down by 15%. The effect on the money receipt was—
(A) No effect
(B) 15% decrease
(C) 7·5% increase
(D) 2·25% decrease

25. Subhash purchased a tape-recorder at $\frac{9}{10}$ th of its selling price and sold it at 8% more than its selling price. His gain is—
(A) 9% (B) 10%
(C) 18% (D) 20%

26. By selling 100 bananas, fruit seller gains the selling price of 20 bananas. His gain per cent is—
(A) 10% (B) 15%
(C) 20% (D) 25%

27. A fruitseller buys lemons at 2 for a rupee and sells them at five for three rupees. His gain per cent is—
(A) 10%
(B) 15%
(C) 20%
(D) None of these

28. By selling a book for Rs. 10, the publisher loses (1/11) of what it costs him. His cost price is—
(A) Rs. 9 (B) Rs. 10
(C) Rs. 11 (D) Rs. 12

29. If I purchased 11 books for Rs. 10 and sold all the books at the rate of 10 books for Rs. 11, the profit per cent is—
(A) 10% (B) 11%
(C) 21% (D) 100%

30. By selling an article for Rs. 144, a man loses $\frac{1}{7}$ of his outlay. By selling it for Rs. 168, his gain or loss per cent is—
(A) 20% loss
(B) 20% gain
(C) $4\frac{1}{6}\%$ gain
(D) None of these

31. A shopkeeper bought 150 calculators at the rate of Rs. 250 per calculator. He spent Rs. 2500 on transportation and packing. If the marked price of calculator is Rs. 320 per calculator and the shopkeeper gives a discount of 5% on the marked price then what will be the percentage profit gained by the shopkeeper ?
(A) 20% (B) 14%
(C) 15% (D) 16%

32. The loss incurred on selling an article for Rs. 270 is as much as the profit made after selling it at 10% profit. The C.P. of the article is—
(A) Rs. 90 (B) Rs. 110
(C) Rs. 363 (D) Rs. 300

33. There would be 10% loss if rice is sold at Rs. 5·40 per kg. At what price per kg should it be sold to earn a profit of 20% ?
(A) Rs. 7·20 (B) Rs. 7·02
(C) Rs. 6·48 (D) Rs. 6

34. A retailer purchases a sewing machine at discount of 15% and sells it for Rs. 1955. In the bargain he makes a profit of 15%. How much is the discount which he got from the wholesale ?
(A) Rs. 270
(B) Rs. 290
(C) Rs. 300
(D) None of these

35. A shopkeeper earns a profit of 12% after selling a book at 10% discount on the printed price. The ratio of the cost price and printed price of the book is—
(A) 45 : 56
(B) 50 : 61

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(C) 99 : 125
(D) None of these

36. A discount series of 10%, 20% and 40% is equal to a single discount of—
(A) 50% (B) 56·80%
(C) 70% (D) 70·28%

37. By selling 12 oranges for one rupee, a man loses 20%. How many for a rupee should he sell to get a gain of 20% ?
(A) 5 (B) 8
(C) 10 (D) 15

38. A dishonest dealer professes to sell his goods at cost price. But he uses a false weight and thus gains $6\frac{18}{47}$ % . For a kg, he uses a weight of—
(A) 953 gms (B) 940 gms
(C) 960 gms (D) 947 gms

39. The C.P. of an article is 40% of the S.P. The per cent that the S.P. is of C.P. is—
(A) 40 (B) 60
(C) 240 (D) 250

40. Toffees are bought at the rate of 8 for a rupee. To gain 60% they must be sold at—
(A) 6 for a rupee
(B) 5 for a rupee
(C) 9 for Rs. 2
(D) 24 for Rs. 5

41. Tarun bought a T.V. with 20% discount on the labelled price had he bought it with 25% discount he would have saved Rs. 500. At what price did he buy the T.V. ?
(A) Rs. 5000
(B) Rs. 10000
(C) Rs. 12000
(D) None of these

42. Jimmy bought paper sheets for Rs. 7200 and spent Rs. 200 on transport paying Rs. 600 he had 330 boxes made, which he sold at Rs. 28 each. What is his profit percentage ?
(A) 15·5
(B) 40
(C) 60
(D) None of these

43. A sold a watch at a gain of 5% to B and B sold it to C at a gain of 4%. If C paid Rs. 91 for it, then the price paid by A is—
(A) Rs. 82·81
(B) Rs. 83
(C) Rs. 83·33
(D) None of these

44. When the price of a toy was increased by 20%, the number of toys sold was decreased by 15%. What was the effect on the sales of the shop ?
(A) 4% increase
(B) 4% decrease
(C) 2% increase
(D) 2% decrease

45. Ram bought 4 dozen apples at Rs. 12 per dozen and 2 dozen apples at Rs. 16 per dozen. He sold all of them to earn 20%. At what price per dozen did he sell the apples ?
(A) Rs. 14·40 (B) Rs. 16·00
(C) Rs. 16·80 (D) Rs. 19·20

46. A owns a house worth Rs. 10000. He sells it to B at a profit of 10% based on the worth of the house B sells the house back to A at a loss of 10%. In this transaction A gets—
(A) No profit no loss
(B) Profit of Rs. 1000
(C) Profit of Rs. 1100
(D) Profit of Rs. 2000

47. A dealer professing to sell at cost price uses a 900 gms weight for a kilogram. His gain per cent is—
(A) 9 (B) 10
(C) 11 (D) $11\frac{1}{9}$

48. When the price of fans was reduced by 20%, the number of fans sold increased by 40% what was the effect on the sales in rupees ?
(A) 12% increase
(B) 12% decrease
(C) 30% increase
(D) 40% increase

49. A dealer sold two T.V. sets for Rs. 3700 each. On one he gained 10% and on the other he lost 10%. The dealer's loss or gain per cent is—
(A) 0% (B) 0·1%
(C) 1% gain (D) 1% loss

50. An article is sold at a certain price. By selling it at $\frac{2}{3}$ of that price, one loses 10%. The gain per cent at original price is—
(A) 20% (B) $33\frac{1}{3}$ %
(C) 35% (D) 40%

51. A man sold two houses for Rs. 7·81 lakhs each. On one he gained 5% and on the other he lost 5%. What per cent is the effect of the sale on the whole ?
(A) 0·25% loss
(B) 0·25% gain
(C) 25% loss
(D) 25% gain

52. Profit after selling commodity for Rs. 425 is same as loss after selling it for Rs. 355. The cost of the commodity is—
(A) Rs. 385 (B) Rs. 390
(C) Rs. 395 (D) Rs. 400

53. A merchant sold his goods for Rs. 75 at a profit per cent equal to C.P. The C.P. was—
(A) Rs. 40 (B) Rs. 50
(C) Rs. 60 (D) Rs. 70

54. A horse and a cow were sold for Rs. 12000 each. The horse was sold at a loss of 20% and the cow at a gain of 20%. The entire transaction resulted in—
(A) No loss or gain
(B) Loss of Rs. 1000
(C) Gain of Rs. 1000
(D) Gain of Rs. 2000

55. By selling an article for Rs. 144, a man gained such that the percentage gain equals the cost price. The C.P. of the article is—
(A) Rs. 60 (B) Rs. 64
(C) Rs. 72 (D) Rs. 80

56. By selling 45 oranges for Rs. 40, a man loss 20%. How many should he sell for Rs. 24 so as to gain 20% in the transaction ?
(A) 16 (B) 18
(C) 20 (D) 22

57. A man sells a car to his friend at 10% loss. If the friend sells it for Rs. 54000 and gains 20%, the original C.P. of the car was—
(A) Rs. 25000
(B) Rs. 37500

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(C) Rs. 50000
(D) Rs. 60000

58. If two mixers and one T.V. cost Rs. 7000, while two T.V.s and one mixer cost Rs. 9800. The value of one T.V. is—
(A) Rs. 2800 (B) Rs. 2100
(C) Rs. 4200 (D) Rs. 8400

59. A man purchased sugar worth of Rs. 400. He sold (3/4)th at a loss of 10% and the remainder at a gain of 10%. On the whole, he gets—
(A) A loss of 5%
(B) A gain of $5\frac{1}{2}\%$
(C) A loss of $5\frac{1}{19}\%$
(D) A loss of $5\frac{5}{19}\%$

60. Bhajan Singh purchased 120 reams of paper at Rs. 80 per ream. He spent Rs. 280 on transportation paid octroi at the rate of 40 paise per ream and paid Rs. 72 to the coolie. If he wants to have a gain of 8%. What must be the selling price per ream ?
(A) Rs. 86 (B) Rs. 87·48
(C) Rs. 89 (D) Rs. 90

61. The cost price of an article, which on being sold at a gain of 10% yields Rs. 6 more than when it is sold at a loss of 10% is—
(A) Rs. 30 (B) Rs. 25
(C) Rs. 24 (D) Rs. 20

62. A shopkeeper sells (3/4)th of its articles at a gain of 20% and the remaining at C.P. His real gain in the transaction is—
(A) 10% (B) 15%
(C) 20% (D) 25%

63. A man gains 10% by selling an article for a certain price. If he sells it at double the price, the profit made is—
(A) 20% (B) 60%
(C) 100% (D) 120%

64. If an article is sold at a gain of 6% instead of at a loss of 6% then the seller gets Rs. 6 more. The C.P. of the article is—
(A) Rs. 50 (B) Rs. 94
(C) Rs. 100 (D) Rs. 106

65. A person bought an article and sold it at a loss of 10%. If he had bought it for 20% less and sold it for Rs. 55 more. He would have had a profit of 40%. The C.P. of the article is—
(A) Rs. 200
(B) Rs. 225
(C) Rs. 250
(D) None of these

66. A dealer sells a radio at a gain of 10%. If he had bought it at 10% less and sold it for Rs. 132 less, he would have still gained 10%. The C.P. of the radio is—
(A) Rs. 1188
(B) Rs. 1200
(C) Rs. 1320
(D) None of these

67. A man sold an article for Rs. 75 and lost something. Had he sold it for Rs. 96, his gain would have been double the former loss. The C.P. of the article is—
(A) Rs. 81 (B) Rs. 82
(C) Rs. 83 (D) Rs. 85·5

68. Due to an increase of 30% in the price of eggs, 3 eggs less are available for Rs. 7·80. The present rate of eggs per dozen is—
(A) Rs. 8·64
(B) Rs. 8·88
(C) Rs. 9·36
(D) None of these

69. A man sells two horses for Rs. 4000 each, neither losing nor gaining in the deal. If he sold one horse at a gain of 25% the other horse is sold at a loss of—
(A) $16\frac{2}{3}\%$
(B) $18\frac{2}{9}\%$
(C) 25%
(D) None of these

70. A grocer sells rice at a profit of 10% and uses weights which are 20% less than the market weight. The total gain earned by him will be—
(A) 30%
(B) 35%
(C) 37·5%
(D) None of these

71. A bicycle is sold at a gain of 16%. If it had been sold for Rs. 20 more, 20% would have been gained. The C.P. of the bicycle is—
(A) Rs. 350 (B) Rs. 400
(C) Rs. 500 (D) Rs. 600

72. A radio dealer sold radio at a loss of 2·5%. Had he sold it for Rs. 100 more, he would have gained $7\frac{1}{2}\%$. In order to gain $12\frac{1}{2}\%$ he should sell it for—
(A) Rs. 850 (B) Rs. 925
(C) Rs. 1080 (D) Rs. 1125

73. A man sells an article at a gain of 15%. If he had bought it at 10% less and sold it for Rs. 4 less, he would have gained 25%. The C.P. of the article is—
(A) Rs. 140 (B) Rs. 150
(C) Rs. 160 (D) Rs. 180

74. 6% more is gained by selling a radio for Rs. 475 than by selling for Rs. 451. The C.P. of the radio is—
(A) Rs. 400
(B) Rs. 434
(C) Rs. 440·50
(D) None of these

75. Rahim sells a chair at a gain of $7\frac{1}{2}\%$. If he had bought it at $12\frac{1}{2}\%$ less and sold it for Rs. 5 more. He would have gained 30%. The C.P. of the chair is—
(A) Rs. 72 (B) Rs. 80
(C) Rs. 88 (D) Rs. 96

76. At what price must Kantilal sell a mixture of 80 kg sugar at Rs. 6·75 per kg with 120 kg at Rs. 8 per kg to gain 20% ?
(A) Rs. 7·50 per kg
(B) Rs. 8·20 per kg
(C) Rs. 8·85 per kg
(D) Rs. 8·76 per kg

77. The per cent profit when an article is sold for Rs. 78 is twice as when it is sold for Rs. 69. The C.P. of the article is—
(A) Rs. 49 (B) Rs. 51
(C) Rs. 57 (D) Rs. 60

78. A trader by means of a false balance defrauds to the extent of 8% in buying goods and also

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defrauds to 8% in selling. His gain per cent is—

(A) 15·48%

(B) 16%

(C) 16·64%

(D) None of these

79. Kabir buys an article with 25% discount on its marked price. He makes a profit of 10% by selling it at Rs. 660. The marked price is—

(A) Rs. 600 (B) Rs. 700

(C) Rs. 800 (D) Rs. 685

80. A discount series of 10%, 20% and 40% is equal to a single discount of—

(A) 50% (B) 56·8%

(C) 60% (D) 70·28%

81. An umbrella marked at Rs. 80 is sold for Rs. 68. The rate of discount is—

(A) 15% (B) 12%

(C) $17\frac{11}{17}\%$ (D) 20%

82. The price of an article was increased by P%. Later the new price was decreased by P%. If the latest price was Re. 1, the original price was—

(A) Re. 1

(B) Rs. $\left(\frac{1-P^2}{100}\right)$

(C) Rs. $\left(\frac{10000}{10000-P^2}\right)$

(D) Rs. $\left(\frac{\sqrt{1-P^2}}{100}\right)$

83. A dealer marks his goods 20% above cost price. He then allows some discount on it and makes a profit of 8%. The rate of discount is—

(A) 12% (B) 10%

(C) 6% (D) 4%

84. The marked price of an article is Rs. 480. The shopkeeper allows a discount of 10% and gains 8%. If no discount is allowed, his gain per cent would be—

(A) 18% (B) 20%

(C) 18·5% (D) 20·5%

85. The ratio of the prices of three different types of cars is 4 : 5 : 7. If the difference between the costliest and the cheapest cars is Rs. 60000 the price of the car of modest price is—

(A) Rs. 80,000

(B) Rs. 1,00,000

(C) Rs. 1,40,000

(D) Rs. 1,20,000

86. A tradesman marks his goods 30% more than the cost price. If he allows a discount of $6\frac{1}{4}\%$ then his gain per cent is—

(A) $23\frac{3}{4}\%$

(B) 22%

(C) $21\frac{7}{8}\%$

(D) None of these

87. A man purchases an electric heater whose printed price is Rs. 160. If he received two successive discounts of 20% and 10% he paid—

(A) Rs. 112

(B) Rs. 129·60

(C) Rs. 119·60

(D) Rs. 115·20

88. A trader lists his articles 20% above C.P. and allows a discount of 10% on cash payment. His gain per cent is—

(A) 10% (B) 8%

(C) 6% (D) 5%

89. The difference between a discount of 40% on Rs. 500 and two successive discounts of 36% and 4% on the same amount is—

(A) 0 (B) Rs. 2

(C) Rs. 1·93 (D) Rs. 7·20

90. The marked price is 10% higher than the cost price. A discount of 10% is given on the marked price. In this kind of sale, the seller—

(A) Bears no loss, no gain

(B) Gains

(C) Losses 1%

(D) None of these

Answers with Hints

1. (C) S.P. = Rs. 100, gain = Rs. 10

$\therefore$ C.P. = (S.P.) – gain = Rs. 90

$\therefore$ Gain% = $\left(\frac{10}{90}\times 100\right)\% = 11\frac{1}{9}\%$

2. (C) 90 : 10·80 : : 120 : x

$\therefore$ $x = \frac{10\cdot 80\times 120}{90} = 14\cdot 40$

3. (B) S.P. = Rs. 247·50

Gain = $\frac{25}{2}\%$

$\therefore$ C.P. = Rs. $\left\{\frac{100}{\left(100+\frac{25}{2}\right)}\times 247\cdot 50\right\}$

= Rs. $\left(\frac{100\times 2}{225}\times 247\cdot 50\right)$

= 220

4. (C) Let C.P. of each article = Re. 1

Then, C.P. of 12 articles = Rs. 12

S.P. of 12 articles = C.P. of 15 articles

= Rs. 15

$\therefore$ Gain % = $\left(\frac{3}{12}\times 100\right)\%$

= 25%

5. (C) Let C.P. of each table = Re. 1

C.P. of 20 tables = Rs. 20

S.P. of 20 tables = C.P. of 15 tables = Rs. 15

$\therefore$ Loss = $\left(\frac{5}{20}\times 100\right)\% = 25\%$

6. (B) $\because$ C.P. of 1 article = $\frac{200}{125}\times 100 = \text{Rs. } 160$

$\Rightarrow$ C.P. of 6 articles = $6\times 160 = 960$

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$\therefore$ Profit = $1056 - 960 = 96$

Percentage profit = $\frac{96}{960} \times 100 = 10\%$

7. (A) Let the cost of each table and chair be Rs. x and Rs. y respectively

$\because$ $2y + 3x = 1025$

and $3y + 2x = 1100$

Solving the above two equations, we get

x = Rs. 175 and y = Rs. 250

$\therefore$ Difference between the cost of one table and one chair = Rs. (250 – 175) = Rs. 75

8. (B) Let C.P. = Rs. x

$\because$ $425 - x = x - 355$

$\Rightarrow$ $2x = 780$

$\therefore$ $x = 390$

9. (B) S.P. = Rs. 100,

Loss = Rs. 10

$\therefore$ C.P. = (S.P.) + (Loss) = Rs. 110

$\therefore$ Loss% = $\left(\frac{10}{110} \times 100\right)\% = 9\frac{1}{11}\%$

10. (D) C.P. of 10 articles = Rs. 8

S.P. of 10 articles = Rs. $(1{\cdot}25 \times 10)$

= Rs. 12·50

$\therefore$ Gain = $\left(\frac{4{\cdot}5}{8} \times 100\right)\% = 56\frac{1}{4}\%$

11. (B) S.P. = Rs. 1980

Gain = 10%

$\therefore$ C.P. = Rs. $\left(\frac{100}{110} \times 1980\right)$ = Rs. 1800

12. (C) Let the selling price of the article = Rs. 100

$\therefore$ Profit = Rs. 26

$\therefore$ Cost price of the article = 100 – 26 = Rs. 74

$\therefore$ Required % = $\frac{34 \times 74}{100} = 25{\cdot}16\%$

13. (D) C.P. of 60 kg mix = Rs. $(25 \times 6 + 35 \times 7)$

= Rs. 395

S.P. of 60 kg mix = Rs. $(60 \times 6{\cdot}75)$ = Rs. 405

Gain = Rs. (405 – 395) = Rs. 10

14. (C) S.P. = 90% of Rs. 200 = Rs. 180

Required S.P. = (95% of Rs. 180) = Rs. 171

15. (C) Suppose he sells x oranges

Then, C.P. of x oranges = Rs. $\frac{2}{3}x$

S.P. of x oranges = Rs. x

Profit on x oranges = Rs. $\left(x - \frac{2}{3}x\right)$ = Rs. $\frac{x}{3}$

$\because$ $\frac{x}{3} = 10 \Rightarrow x = 30$

16. (D) $2x + y = 7000$ …(i)

$x + 2y = 4250$ …(ii)

Solving (i) and (ii) we get,

$x = 3250$

$\therefore$ Cost of a T.V. set is Rs. 3250.

17. (D) $\because$ Profit is maximum when C.P. is minimum and S.P. is maximum

Thus, C.P. = Rs. (200×8) = Rs. 1600

S.P. = Rs. (425×8) = Rs. 3400

$\therefore$ Gain = Rs. 1800

18. (D) Let S.P. = Rs. x

$\because$ $400 + 20\%$ of $x = x$

$\Rightarrow$ $400 + \frac{x}{5} = x$

$\Rightarrow$ $\frac{4x}{5} = 400$

$\therefore$ $x = \frac{400 \times 5}{4} = 500$

19. (C) $\because$ Gain = (S.P. of 8 dozen) – (C.P. of 8 dozen)

$\Rightarrow$ (S.P. of 1 dozen) = (S.P. of 8 dozen) – (C.P. of 8 dozen)

$\therefore$ (C.P. of 8 dozen) = (S.P. of 7 dozen)

Let C.P. of each dozen be Re. 1

$\Rightarrow$ C.P. of 7 dozen = Rs. 7

$\Rightarrow$ S.P. of 7 dozen = Rs. 8

$\therefore$ Gain % = $\left(\frac{1}{7} \times 100\right)\% = 14\frac{2}{7}\%$

20. (C) $\because$ Loss = (C.P. of 36 oranges) – (S.P. of 36 oranges)

$\Rightarrow$ (S.P. of 4) = (C.P. of 36) – (S.P. of 36)

$\therefore$ (S.P. of 40) = (C.P. of 36)

Let C.P. of each orange

= Re. 1

$\Rightarrow$ C.P. of 40 = Rs. 40

$\Rightarrow$ S.P. of 40 = Rs. 36

$\therefore$ Loss = $\left(\frac{4}{40} \times 100\right)\% = 10\%$

21. (D) Let the marked price be Rs. x

Then, $(7\% \text{ of } x) - 15 = 5\% \text{ of } x$

$\Rightarrow$ $\frac{7x}{100} - \frac{5x}{100} = 15$

$\therefore$ $x = 750$

22. (A) Cost of the horse paid by

A = $4860 \times \frac{100}{81} = \text{Rs. } 6000$

Cost of the horse paid by

C = $6000 \times \frac{117}{100} = \text{Rs. } 7020$

Gain of B = Rs. 7020 – Rs. 4860

= Rs. 2160

23. (B) Let the C.P. be Rs. x

Then, S.P. when gain is 12% = $\left(\frac{12x}{100} + x\right) = \frac{112x}{100}$

$\because$ $\frac{112x}{100} - \frac{88x}{100} = 6$

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$\Rightarrow \quad \frac{24x}{100} = 6$

$\Rightarrow \quad x = \frac{600}{24} = \text{Rs. } 25$

24. (D) Let the original cost of each cooker be Re. 1 and let the number sold originally be 100.

Total sale proceeds = Rs. (100×1) = Rs. 100

New rate = (115% of Re. 1) = Rs. 1·15

Number sold now = 85

$\therefore$ Sale proceeds now = Rs. $(1{\cdot}15 \times 85)$

= Rs. 97·75

So, there is a decrease of 2·25% in the money receipt.

25. (D) Let the S.P. be Rs. x

Then, C.P. paid by Subhash = Rs. $\frac{9x}{10}$

S.P. received by Subhash = (108% of Rs. x)

= Rs. $\frac{27x}{25}$

$\therefore$ Gain = Rs. $\left(\frac{27x}{25} - \frac{9x}{10}\right)$

= Rs. $\left(\frac{9x}{50}\right)$

Hence, Gain% = $\left(\frac{9x}{50} \times \frac{10}{9x} \times 100\right)\%$

= 20%

26. (D) $\because$ Gain = (S.P. of 100 bananas) – (C.P. of 100 bananas)

$\Rightarrow$ (S.P. of 20) = (S.P. of 100) – (C.P. of 100)

$\Rightarrow$ S.P. of 80 = C.P. of 100

Let C.P. of each banana = Re. 1

C.P. of 80 banana = Rs. 80

S.P. of 80 banana = Rs. 100

$\therefore$ Gain % = $\left(\frac{20}{8} \times 100\right)\% = 25\%$

27. (C) Suppose he buys 10 lemons

$\because$ C.P. = Rs. $\left(\frac{10}{2}\right)$ = Rs. 5,

$\Rightarrow$ S.P. = Rs. $\left(\frac{3}{5} \times 10\right)$ = Rs. 6

$\therefore$ Gain % = $\left(\frac{1}{5} \times 100\right)\% = 20\%$

28. (C) Let C.P. = Rs. x

Then $\because \quad x - \frac{x}{11} = 10$

$\Rightarrow \quad \frac{10x}{11} = 10$

$\Rightarrow \quad x = 11$

$\therefore$ C.P. = Rs. 11

29. (C) Suppose 1 purchased 110 books

$\because$ C.P. = Rs. $\left(\frac{10}{11} \times 110\right)$ = Rs. 100

$\Rightarrow$ S.P. = Rs. $\left(\frac{11}{10} \times 110\right)$ = Rs. 121

$\therefore$ Gain % = 21%

30. (D) Let C.P. = Rs. x

Then loss = Rs. $\left(\frac{x}{7}\right)$

S.P. = (C.P.) – (Loss)

= $\left(x - \frac{x}{7}\right)$ = Rs. $\frac{6x}{7}$

$\because \quad \frac{6x}{7} = 144$

$\therefore \quad x = \frac{144 \times 7}{6} = \text{Rs. } 168$

Hence, no loss and no gain.

31. (B) C.P. of 150 calculators

= 150×250 = Rs. 37500

$\therefore$ Total C.P. = 37500 + 2500 = Rs. 40000

Marked price of 150 calculators

= 150×320 = Rs. 48000

Selling price after discount

= $48000 \times \frac{95}{100}$ = Rs. 45600

$\therefore$ Percentage profit = $\frac{45600 - 40000}{40000} \times 100$

= 14%

32. (D) Let C.P. be Rs. x then,

$x - 270 = 10\%$ of $x = \frac{x}{10}$

$\therefore \quad x = 300$

33. (A) Let C.P. per kg be Rs. x then,

$x - 10\%$ of $x = 5{\cdot}40$

$\Rightarrow \quad x = 6$

$\therefore$ Required S.P. = Rs. [6 + 20% of 6] = Rs. 7·20

34. (C) Let the marked price be Rs. x

Discount availed by the retailer = 15% of Rs. x

$\because$ C.P. of the machine by the retailer

= (x – 15% of x) = Rs. $\frac{17x}{20}$

So, 15% of $\frac{17x}{20} = 1955 - \frac{17x}{20}$

$\Rightarrow \quad \frac{51x}{400} + \frac{17x}{20} = 1955$

or $\quad x = 2000$

Discount received by retailer

= (15% of 2000) = Rs. 300

35. (A) Let the printed price of the book be Rs. 100. After a discount of 10%,

S.P. = Rs. 90

Profit earned = 12%

$\therefore$ C.P. of the book = Rs. $\left(\frac{100}{112} \times 90\right)$

= Rs. $\frac{1125}{14}$

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Hence, (C.P.) : (Printed price) = $\frac{1125}{14} : 100$

$\therefore$ $= 45 : 56$

36. (B) Let original price = Rs. 100

Price after 1st discount = Rs. 90

Price after 2nd discount = Rs. $\left(\frac{80}{100} \times 90\right)$

= Rs. 72

Price after 3rd discount = Rs. $\frac{60}{100} \times 72$

= Rs. 43·20

$\therefore$ Single equivalent discount

= (100 – 43·20) = 56·8%

37. (B) Suppose he buys 12 oranges. Then S.P. = Re. 1

Now, $80 : 1 :: 120 : x$

$\therefore$ $x = \frac{1 \times 120}{80} = \frac{3}{2}$

$\therefore$ For Rs. $\frac{3}{2}$, oranges sold = 12

For Re. 1 oranges sold = $\left(12 \times \frac{2}{3}\right) = 8$

So, he must sell them at 8 for a rupee.

38. (B) Let the error be x gms. Then,

$\frac{x}{(1000 - x)} \times 100 = \frac{300}{47}$

$\Rightarrow$ $\frac{x}{1000 - x} = \frac{3}{47}$

$47x = 3000 - 3x$

$\Rightarrow$ $x = 60$

So, he uses a weight = (100 – 60) gm

= 940 gms for 1 kg.

39. (D) Let S.P. = Rs. 100

Then C.P. = Rs. 40

$\therefore$ Required per cent = $\left(\frac{100}{40} \times 100\right)\% = 250\%$

40. (B) Suppose he buys 8 toffees

Then, C.P. = Re. 1

Gain = 60%

$\therefore$ S.P. = Rs. $\left(\frac{160}{100} \times 1\right) = \text{Rs. } \frac{8}{5}$

For Rs. $\frac{8}{5}$, toffees sold = 8

For Re. 1 toffees sold = $\left(8 \times \frac{5}{8}\right) = 5$

So, he must sell them at 5 for a rupee.

41. (D) Let S.P. of T.V. (by trader) = Rs. 100

If S.P. is Rs. 80, then M.P. = Rs. 100

If S.P. is Rs. 100, M.P. = Rs. $\left(\frac{100}{80} \times 100\right)$

= Rs. 125

Now, if discount is 25% then, S.P.

= (75% of Rs. 125)

= Rs. $\frac{375}{4}$

Difference between two S.P.

= Rs. $\left(100 - \frac{375}{4}\right)$

= Rs. $\frac{25}{4}$

If difference is Rs. $\frac{25}{4}$, S.P. = Rs. 100

If difference is Rs. 500, S.P. = Rs. $\left(100 \times \frac{4}{25} \times 500\right)$

= Rs. 8000

42. (A) C.P. of 330 boxes = Rs. (7200 + 200 + 600)

= Rs. 8000

S.P. of 330 boxes = Rs. (330 × 28)

= Rs. 9240

$\therefore$ Gain% = $\left(\frac{1240}{8000} \times 100\right)\%$

= 15·5%

43. (C) Let A's C.P. = Rs. 100

B's C.P. = Rs. 105

C's C.P. = 104% of Rs. 105 = Rs. 109·20

$\because$ 109·20 : 91 = 100 : x

$\therefore$ $x = \frac{91 \times 100}{109 \cdot 20} = \text{Rs. } 83 \cdot 33$

44. (C) Let original cost of each toy be Rs. 100 and number originally sold be 100.

$\therefore$ Original sale proceeds = Rs. (100 × 100)

= Rs. 10000

New sale proceeds = Rs. (120 × 85)

= Rs. 10200

$\therefore$ Increase% = $\left(\frac{200 \times 100}{10000}\right)\% = 2\%$

45. (B) C.P. of 6 dozen apples = Rs. (12 × 4 + 16 × 2)

= Rs. 80

Gain = 20%

$\therefore$ S.P. = Rs. $\left(\frac{120}{100} \times 80\right)$

= Rs. 96

S.P. per dozen = Rs. $\left(\frac{96}{6}\right) = \text{Rs. } 16$

46. (C) C.P. of B = 110% of Rs. 10000 = Rs. 11000

Loss of B = 10%

S.P. of B = 90% of Rs. 11000 = Rs. 9900

Thus, C.P. of A = Rs. 9900

So, A gets [(10% of Rs. 10000) + (10000 – 9900)]

= Rs. 1100

47. (D) Gain% = $\left\{\frac{\text{Error}}{(\text{True value}) - \text{Error}} \times 100\right\}\%$

= $\left(\frac{100}{900} \times 100\right)\% = 11\frac{1}{9}\%$

48. (A) Let original cost of each be Rs. 100 and number originally sold be 100.

Original sale proceeds = Rs. (100 × 100)

= Rs. 10000

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New sale proceeds = Rs. (80×140)

= Rs. 11200

$\therefore$ Increase% = $\left(\frac{1200}{10000} \times 100\right)\%$

= 12%

49. (D) Loss% = $\left(\frac{\text{Common gain or loss\%}}{10}\right)^2$

= $\left(\frac{10}{10}\right)^2 = 1\%$

50. (C) Let C.P. = Rs. 100

S.P. at 10% loss = Rs. 90

$\because$ $\frac{2}{3}$ of actual S.P. = Rs. 90

So, Actual S.P. = Rs. $\left(90 \times \frac{3}{2}\right)$ = Rs. 135

$\therefore$ Gain = 35%

51. (A) Loss% $\left(\frac{\text{Common gain or loss \%}}{10}\right)^2$

= $\left(\frac{5}{10}\right)^2 = \frac{1}{4}\% = 0{\cdot}25\%$

52. (B) Let C.P. = Rs. x then,

$425 - x = x - 355$

$\Rightarrow$ $2x = 780$

$\therefore$ $x = 390$

53. (B) Let C.P. = Rs. x

$\because$ $x + x\%$ of $x = 75$

$\Rightarrow$ $x + \frac{x^2}{100} = 75$

$\Rightarrow$ $x^2 + 100x - 7500 = 0$

$\Rightarrow$ $(x + 150)(x - 50) = 0$

$\therefore$ $x = 50$

54. (B) $\because$ Loss% = $\left(\frac{20}{10}\right)^2 = (2)^2 = 4\%$

$\Rightarrow$ Total S.P. = Rs. 24000

$\Rightarrow$ Total C.P. = Rs. $\left(\frac{100}{96} \times 24000\right)$

= Rs. 25000

$\therefore$ Loss = Rs. 1000

55. (D) 56. (B)

57. (C) $\because$ S.P. = Rs. 54000

Gain earned = 20%

$\therefore$ C.P. = Rs. $\left(\frac{100}{120} \times 54000\right)$ = Rs. 45000

Now, S.P. = Rs. 45000

And Loss = 10%

$\therefore$ Original C.P. = Rs. $\left(\frac{100}{90} \times 45000\right)$ = Rs. 50000

58. (C) $2x + y = 7000$ …(i)

$x + 2y = 9800$ …(ii)

Solving (i) and (ii), we get,

$y = 4200$

59. (A) S.P. = 90% of $\left(\frac{3}{4}\text{ of Rs. } 400\right)$

+ 110% of $\left(\frac{1}{4}\text{ of Rs. } 400\right)$

= Rs. $\left(\frac{90}{100} \times \frac{3}{4} \times 400\right)$

+ Rs. $\left(\frac{110}{100} \times \frac{1}{4} \times 400\right)$

= Rs. (270 + 110) = Rs. 380

$\therefore$ Loss% = $\left(\frac{20}{400} \times 100\right)\%$ = 5%

60. (D) $\because$ C.P. of 120 reams = Rs. $(120 \times 80 + 280$

$+ 72 + 120 \times 0{\cdot}40)$

= (9600 + 280 + 72 + 48)

= Rs. 10000

$\Rightarrow$ C.P. of 1 ream = $\left(\frac{10000}{120}\right)$ = Rs. $\left(\frac{250}{3}\right)$

$\therefore$ S.P. of 1 ream = Rs. $\left(\frac{108}{100} \times \frac{250}{3}\right)$ = Rs. 90

61. (A) Let C.P. = Rs. x

Then $\frac{110}{100}x - \frac{90}{100}x = 6$

$\Rightarrow$ $20x = 600$

$\Rightarrow$ $x = \frac{600}{20} = 30$

$\therefore$ C.P. = Rs. 30

62. (B) Let total C.P. of all the articles = Rs. 100

$\therefore$ C.P. of $\frac{3}{4}$ th part = Rs. $\left(\frac{3}{4} \times 100\right)$

= Rs. 75

$\Rightarrow$ S.P. of $\frac{3}{4}$ th part = Rs. $\left(\frac{120}{100} \times 75\right)$

= Rs. 90

$\Rightarrow$ S.P. of $\frac{1}{4}$ th part = Rs. $\left(\frac{1}{4} \times 100\right)$

= Rs. 25

Total S.P. = Rs. (90 + 25)

= Rs. 115

$\therefore$ Gain = 15%

63. (D) Let C.P. = Rs. x

$\because$ First S.P. = 110% of x = Rs. $\left(\frac{11}{10}x\right)$

$\Rightarrow$ Second S.P. = $\frac{22}{10}x$

$\Rightarrow$ New gain = $\left(\frac{22}{10}x - x\right) = \frac{12x}{10}$

$\therefore$ New gain% = $\left(\frac{12x}{10 \times x} \times 100\right)\%$ = 120%

64. (A) $\because$ 6% of C.P. + 6% of C.P. = Rs. 6

$\Rightarrow$ 12% of C.P. = Rs. 6

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$\Rightarrow \quad \frac{12}{100} \times x = 6$

$\Rightarrow \quad x = \frac{100 \times 6}{12} = 50$

$\therefore$ C.P. = Rs. 50

65. (C) Let C.P. = Rs. x

Then S.P. = Rs. $\left(\frac{90}{100} \times x\right)$ = Rs. $\left(\frac{9}{10}x\right)$

New C.P. = Rs. $\left(\frac{80}{100} \times x\right)$ = Rs. $\left(\frac{4x}{5}\right)$

Now, Gain = 40%

$\therefore$ New S.P. = Rs. $\left(\frac{140}{100} \times \frac{4x}{5}\right)$ = Rs. $\left(\frac{28}{25}x\right)$

$\because \quad \frac{28}{25}x - \frac{9}{10}x = 55$

$\therefore$ C. P. = x = Rs. 250

66. (B) Let C.P. = Rs. x

Then S.P. = Rs. $\left(\frac{110}{100} \times x\right)$ = Rs. $\frac{11x}{10}$

New C.P. = Rs. $\left(\frac{90}{100} \times x\right)$ = Rs. $\frac{9x}{10}$

New S.P. = $\left(\frac{110}{100} \times \frac{9x}{10}\right)$ = Rs. $\frac{99x}{100}$

$\because \quad \frac{11x}{10} - \frac{99x}{100} = 132$

$\Rightarrow \quad x = 1200$

$\therefore$ C.P. = Rs. 1200

67. (B) Let the loss be Rs. x

Then $75 = \text{C.P.} - x$

and $96 = \text{C.P.} + 2x$

On subtracting we get,

$3x = 21$

$\Rightarrow \quad x = 7$

$\therefore$ C.P. = $75 + x$ = Rs. 82

68. (C) Let the original rate be x paise per egg.

Number of eggs bought for Rs. 7·80 = $(780/x)$

New rate = (130% of x) paise per egg

= $\frac{13x}{10}$ paise per egg

Number of eggs bought for

Rs. 7·80 = $\frac{780 \times 10}{13x} = \frac{600}{x}$

$\because \quad \frac{780}{x} - \frac{600}{x} = 3$

$\Rightarrow \quad 3x = 180$

$\Rightarrow \quad x = 60$

So, Present rate = $\left(\frac{13 \times 60}{10}\right)$ paise per egg

= 78 paise per egg

= Rs. 9·36 per dozen

69. (A) C.P. of two horses = Rs. 8000

S.P. of one horse = Rs. 4000

Gain = 25%

$\therefore$ C.P. of this horse = Rs. $\left(\frac{100}{125} \times 4000\right)$

= Rs. 3200

C.P. of another horse = Rs. (8000 – 3200)

= Rs. 4800

S.P. of this horse = Rs. 4000

$\therefore \quad \text{Loss\%} = \left(\frac{800}{4800} \times 100\right)\% = 16\frac{2}{3}\%$

70. (C) Let us consider a packet of rice marked 1 kg

Then its actual weight = (80% of 1 kg) = 0·8 kg

Let C.P. of 1 kg be Rs. x

Then C.P. of 0·8 kg = Rs. $0{\cdot}8x$

Now, S.P. of 1 kg = 110% of C.P. of 1 kg

= $\left(\frac{110}{100} \times x\right)$ = Rs. $1{\cdot}1x$

$\Rightarrow$ Gain = $(1{\cdot}1 - 0{\cdot}8)x = 0{\cdot}3x$

$\Rightarrow \quad \text{Required gain\%} = \left(\frac{0{\cdot}3x}{0{\cdot}8x} \times 100\right)\%$

= 37·5%

71. (C) $\because$ (20% of C.P.) – (16% of C.P.) = Rs. 20

$\Rightarrow$ 4% of C.P. = 20

$\Rightarrow \quad \left(\frac{4}{100} \times \text{C.P.}\right) = 20$

$\Rightarrow \quad \text{C.P.} = \text{Rs.} \left(\frac{100 \times 20}{4}\right)$

$\therefore$ C. P. of the bicycle = Rs. 500

72. (D) It is clear that

$\because$ (2·5% of C.P. + 7·5% of C.P.) = 100

$\therefore$ C.P. = Rs. 1000

Now, gain = $12\frac{1}{2}\%$

So, Required S.P. = $112\frac{1}{2}\%$ of C.P.

= Rs. $\left(\frac{225}{200} \times 1000\right)$

= Rs. 1125

73. (C) $\because$ (115% of C.P.) – (125% of 90% of C.P.) = 4

$\Rightarrow \quad \frac{115}{100}x - \frac{125}{100} \times \frac{90}{100}x = 4$

$\Rightarrow \quad \frac{23x}{20} - \frac{9x}{8} = 4$

$\Rightarrow \quad x = 160$

$\therefore$ C.P. = Rs. 160

74. (A) Difference between two selling prices

= 475 – 451 = Rs. 24

$\because$ 6% of C.P. = Rs. 24

Hence, C.P. = Rs. $\left(\frac{24 \times 100}{6}\right)$ = Rs. 400

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75. (B)

76. (D) Total C.P. of 200 kg of sugar
$= \text{Rs. } (80 \times 6{\cdot}75 + 120 \times 8)$
$= \text{Rs. } (500 + 960)$
$= \text{Rs. } 1460$
C.P. of 1 kg $= \text{Rs. } \frac{1460}{200} = \text{Rs. } 7{\cdot}30$
Gain required $= 20\%$
$\therefore$ S.P. of 1 kg $= (120\% \text{ of Rs. } 7{\cdot}30)$
$= \text{Rs. } \left(\frac{120}{100} \times 7{\cdot}30\right)$
$= \text{Rs. } 8{\cdot}76 \text{ per kg}$

77. (D) Let the C.P. be Rs. x
Then $\frac{2(69 - x)}{100} = \frac{78 - x}{100}$
$\Rightarrow 138 - 2x = 78 - x$
$\Rightarrow x = 60$
$\therefore$ C.P. $= \text{Rs. } 60$

78. (C) In such questions we adopt the rule
Required gain %
$= \left[\frac{(100 + \text{common gain}\%)^2}{100} - 100\right]\%$
$= \left\{\frac{(108)^2}{100} - 100\right\}\% = 16{\cdot}64\%$

79. (C) Let the marked price be Rs. x
$\because$ C.P. $= (x - 25\% \text{ of } x) = \frac{3x}{4}$
$\Rightarrow$ S.P. $= \left(\frac{3x}{4} + 10\% \text{ of } \frac{3x}{4}\right) = \frac{33x}{40}$
But, $\frac{33x}{40} = 660$
$\therefore x = 800$

80. (B) Let original price $= \text{Rs. } 100$
Price after first discount $= \text{Rs. } 90$
Price after second discount $= \text{Rs. } \left(\frac{80}{100} \times 90\right)$
$= \text{Rs. } 72$
Price after third discount $= \text{Rs. } \left(\frac{60}{100} \times 72\right)$
$= \text{Rs. } 43{\cdot}20$
$\therefore$ Single equivalent discount $= (100 - 43{\cdot}20)$
$= 56{\cdot}8\%$

81. (A) Rate of discount $= \left(\frac{12}{80} \times 100\right)\% = 15\%$

82. (C) Let original price be Rs. x
Price after P% increase
$= (100 + \text{P})\% \text{ of } x = \frac{(100 + \text{P})x}{100}$
New price after P% decrease
$= (100 - \text{P})\% \text{ of } \frac{(100 + \text{P})x}{100}$
$= \frac{(100 - \text{P})}{100} \times \frac{(100 + \text{P})}{100} \times x$
$\because \frac{(100 - \text{P})(100 + \text{P})}{100 \times 100} \times x = 1$
$\therefore x = \frac{100 \times 100}{(100 - \text{P})(100 + \text{P})}$
$= \frac{10000}{(10000 - \text{P}^2)}$

83. (B) Let C.P. $= \text{Rs. } 100$
$\Rightarrow$ Marked price $= \text{Rs. } 120,$
$\Rightarrow$ S.P. $= \text{Rs. } 108$
$\therefore$ Rate of discount $= \left(\frac{12}{120} \times 100\right)\% = 10\%$

84. (B) $\because$ S.P. $= (90\% \text{ of Rs. } 480)$
$= \text{Rs. } \left(\frac{90}{100} \times 480\right) = \text{Rs. } 432$
Gain earned on it $= 8\%$
$\therefore$ C.P. $= \text{Rs. } \left(\frac{100}{108} \times 432\right) = \text{Rs. } 400$
If no discount is allowed, S.P. = Rs. 480
$\therefore$ Required gain% $= \left(\frac{80}{400} \times 100\right)\% = 20\%$

85. (B) Let the prices be $4x$, $5x$ and $7x$ rupees.
Then, $7x - 4x = \text{Rs. } 60000$
$\Rightarrow x = 20000$
$\therefore$ Required modest price $= 5x = \text{Rs. } 100000$

86. (C) Let the C.P. be Rs. 100
Then, Marked price $= \text{Rs. } 130$
$\Rightarrow$ S.P. $= \left(93\frac{3}{4}\% \text{ of Rs. } 130\right)$
$= \text{Rs. } \left(\frac{375}{4 \times 100} \times 130\right)$
$= \text{Rs. } \frac{975}{8}$
$= \text{Rs. } 121\frac{7}{8}$
$\therefore$ Required gain% $= 21\frac{7}{8}\%$

87. (D) Price after 1st discount = 80% of Rs. 160
$= \text{Rs. } 128$
Price after 2nd discount
$= 90\% \text{ of Rs. } 128$
$= \text{Rs. } 115{\cdot}20$

88. (B) Let C.P. $= \text{Rs. } 100$
Then marked price $= \text{Rs. } 120$
S.P. $= 90\% \text{ of Rs. } 120 = \text{Rs. } 108$
$\therefore$ Required gain% $= \left(\frac{108 - 100}{100}\right) \times 100\%$
$= 8\%$

89. (D) Sale after 40% discount $= 60\% \text{ of Rs. } 500$
$= \text{Rs. } 300$
Price after 36% discount $= 64\% \text{ of Rs. } 500$
$= \text{Rs. } 320$
Price after next 4% discount $= 96\% \text{ of Rs. } 320$
$= \text{Rs. } 307{\cdot}20$
$\therefore$ Required difference in two prices
$= (307{\cdot}20 - 300)$
$= \text{Rs. } 7{\cdot}20$

90. (C)

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Time and Work

Important Points/Facts

1. If a man can do piece of work in x days, he will do $\frac{1}{x}$ of the work in 1 day. And conversely, if a man can do $\frac{1}{x}$ of the work in 1 day. He will do the work in x days.

2. If A is x times as good a workman as B, then A will take $\frac{1}{x}$ of the time that B takes to do a certain work, *i.e.*,

Time taken by A to do a work

$= \frac{1}{x} \times$ Time taken by B to do the same work

3. The multiple ratio of the capacity of doing work by A and B is inverse of the multiple ratio of their efficiency of doing work, *e.g.*,—(namely)—If the work done by 3 men is equal to the work done by 4 women, then what will be the ratio of the work done by a man and a woman ?

Here, work done by 3 men = Work done by 4 women

$\Rightarrow \frac{\text{Work of a man}}{\text{Work of a woman}} = \frac{4}{3}$

$\therefore$ Required ratio = 4 : 3

In other words, we can say that ''Efficiency is indirectly proportional to the number of days taken to complete a work.''

4. If x can do a work in a days and y can do it in b days, then x and y working together will do the same work in $\frac{ab}{a+b}$ days.

Examples

Q. 1. Dinesh and Ram can do a work in 80 minutes and 120 minutes respectively. In how much time this work will be completed if they work altogether ?

Solution :

$$\text{Required time} = \frac{(80 \times 120)}{(80 + 120)} = \frac{9600}{200} = 48 \text{ minutes}$$

Q. 2. Neelam, Usha, Meena can do a work in 10, 12 and 15 days respectively. If Usha left after 2 days. How long would it take Neelam and Meena to complete the remaining work ?

Solution : The part of work completed by Neelam, Usha and Meena in 2 days

$$= 2 \times \left(\frac{1}{10} + \frac{1}{12} + \frac{1}{15}\right)$$

$$= 2 \times \left(\frac{6+5+4}{60}\right) = \frac{1}{2}$$

$\therefore$ Remaining work $= 1 - \frac{1}{2} = \frac{1}{2}$

$\because$ Work done by (Neelam and Meena) together in 1 day

$$= \frac{1}{10} + \frac{1}{15} = \frac{3+2}{30} = \frac{1}{6} \text{ part}$$

$\because \frac{1}{6}$ th part of work completed by both Neelam and Meena in 1 day

$\therefore \frac{1}{2}$ part of work will be completed in $= \frac{1}{\frac{1}{6}} \times \frac{1}{2} = 3$ days

Q. 3. A can do $\frac{3}{4}$ th part of a work in 10 days and B completed the remaining part of work in 5 days. In how many days A and B working together will finish that work ?

Solution :

Work of A in 1 day $= \frac{3}{4} \times \frac{1}{10} = \frac{3}{40}$

Work of B in 1 day $= \frac{1}{4} \times \frac{1}{5} = \frac{1}{20}$

$\therefore$ Work of (A + B) in one day

$$= \frac{3}{40} + \frac{1}{20} = \frac{3+2}{40} = \frac{1}{8}$$

Hence, A and B working together will finish that work in 8 days.

Q. 4. A can do a work in 12 days. B works 60% more fast than A then in how many days B alone could finish this work ?

Solution :

$\because$ A's work in 1 day $= \frac{1}{12}$

$\therefore$ B's work in 1 day

$$= \frac{1}{12}\left(1 + \frac{60}{100}\right) = \frac{1}{12} \times \frac{160}{100} = \frac{2}{15}$$

$\therefore$ B alone can finish this work in $\frac{15}{2}$ days, *i.e.*, $7\frac{1}{2}$ days.

Q. 5. If 5 men and 2 boys working together can do four times as much work per hour as a man and a boy together. Compare the work of a man with that of a boy.

Solution :

Here (5M + 2B)'s 1 day's work = (1M + 1B)'s 4 days work

$\Rightarrow$ 5M + 2B = 4 (1M + 1B)

[where M = Man, B = Boy]

$\Rightarrow$ 5M + 2B = 4M + 4B

$\Rightarrow$ 1M = 2B

$\Rightarrow \frac{M}{B} = \frac{2}{1}$

$\therefore$ Required ratio = 2 : 1

Q. 6. One man, 2 women and 3 boys working together do a work in 36 days, while 3 men, 2 women and one boy do the same work in 12 days. Then in how many days will 6 men, 6 women and 6 boys will do this work ?

Solution : $\because$ (1 + 3) men (2 + 2) women and (3 + 1) boys work for 1 day $= \frac{1}{36} + \frac{1}{12} = \frac{1+3}{36}$

i.e., 4 men + 4 women + 4 boys work for 1 day $= \frac{1}{9}$

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$\therefore$ (1 man + 1 woman + 1 boy) work for 1 day $= \frac{1}{9} \times \frac{1}{4} = \frac{1}{36}$

$\therefore$ (6 men + 6 women + 6 boys) work for 1 day $= \frac{1}{36} \times 6 = \frac{1}{6}$

$\therefore$ Required time = 6 days

Q. 7. Uday working 4 hours a day completes a work in 10 days, while Subhash working 8 hours a day can complete the same work in 15 days. How many days will it take for both of them working together 10 hours a day to complete the work ?

Solution : It is clear from the question that

$\because$ Uday completes the work in (4×10) hours = 40 hours

and Subhash completes the same work in (8×15) = 120 hours

$\therefore$ Work done in 1 hour, when both working together will be

$$= \frac{1}{40} + \frac{1}{120} = \frac{1}{30}$$

Hence, both working together will complete the work in 30 hours.

$\because$ Both working together 10 hours a day

$\Rightarrow$ Both working together 30 hours in $\frac{1}{10} \times 30 = 3$ days

$\therefore$ Required time = 3 days

Q. 8. A is two times work-efficient than B and three times than C. If C alone can do that work in 11 days then how long will it take for all the three A, B and C to complete the same work ?

Solution : Amount of work, C can do in 1 day $= \frac{1}{11}$

Similarly, Amount of work A can do in 1 day $= \frac{3}{11}$

and amount of work, B can do in 1 day

$$= \frac{3}{2 \times 11} = \frac{3}{22}$$

$\therefore$ Amount of work (C + A + B) together can do in 1 day

$$= \frac{1}{11} + \frac{3}{11} + \frac{3}{22} = \frac{11}{22}$$

$$= \frac{1}{2}$$

Hence, (A + B + C) working together can complete the work in 2 days.

Exercise

1. Twenty-four men can complete a work in sixteen days. Thirty-two women can complete the same work in twenty-four days. Sixteen men and sixteen women started working and worked for twelve days. How many more men are to be added to complete the remaining work in 2 days ?
   (A) 48
   (B) 24
   (C) 36
   (D) None of these

2. A can do a piece of work in 30 days while B can do it in 40 days. In how many days can A and B working together do it ?
   (A) 70 days (B) $42\frac{3}{4}$ days
   (C) $27\frac{1}{7}$ days (D) $17\frac{1}{7}$ days

3. 25 men and 15 women can complete a piece of work in 12 days. All of them start working together and after working for 8 days the women stopped working. 25 men completed the remaining work in 6 days. How many days will it take for completing the entire job if only 15 women are put on the job ?
   (A) 60 days
   (B) 88 days
   (C) 94 days
   (D) None of these

4. A and B can together do a piece of work in 15 days. B alone can do it in 20 days. In how many days can A alone do it ?
   (A) 30 days (B) 40 days
   (C) 45 days (D) 60 days

5. 10 men and 15 women finish a work in 6 days. One man alone finishes that work in 100 days. In how many days will one woman can finish the work ?
   (A) 125 days (B) 150 days
   (C) 90 days (D) 225 days

6. A and B can do a piece of work in 6 days and A alone can do it in 9 days. The time taken by B alone to do the same work is—
   (A) 18 days (B) 15 days
   (C) 12 days (D) $7\frac{1}{2}$ days

7. A can do a piece of work in 12 days, B can do the same work in 8 days and C can do the same job in $\frac{4}{5}$ th time required by both A and B. A and B work together for 3 days, then C completes the job. How many complete days did C work ?
   (A) 8
   (B) 6
   (C) 3
   (D) None of these

8. A can do (1/3) of a work in 5 days and B can do (2/5) of the work in 10 days. In how many days both A and B together can do the work ?
   (A) $7\frac{3}{4}$ (B) $8\frac{4}{5}$
   (C) $9\frac{3}{8}$ (D) 10

9. A completes a work in 15 days. B completes the same work in 20 days. A started working alone after 1 day B joined him. How many days will they now take together to complete the remaining work ?
   (A) 8 days
   (B) 7 days
   (C) 6 days
   (D) None of these

10. A and B can do a piece of work in 18 days; B and C in 24 days, A and C in 36 days. In what time can they do it all working together ?
    (A) 12 days (B) 13 days
    (C) 16 days (D) 26 days

11. A can do a piece of work in 10 days and B can do the same piece of work in 20 days. They start the work together but after 5 days A leaves off. B will do the remaining piece of work in—
    (A) 5 days (B) 6 days
    (C) 8 days (D) 10 days

12. Twelve men can complete a work in 8 days. Three days after they started the work, 3 more men

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joined them. In how many days will all of them together complete the remaining work ?

(A) 2 (B) 4

(C) 5 (D) 6

13. A and B can do a piece of work in 12 days. B and C in 15 days. C and A in 20 days. A alone can do the work in—

(A) $15\frac{2}{3}$ days (B) 24 days

(C) 30 days (D) 40 days

14. A can complete a job in 9 days, B in 10 days and C in 15 days. B and C start the work and are forced to leave after 2 days. The time taken to complete the remaining work is—

(A) 6 days (B) 9 days

(C) 10 days (D) 13 days

15. A, B and C contract a work for Rs. 550. Together A and B are to do $\frac{7}{11}$ of the work. The share of C should be—

(A) Rs. $183\frac{1}{3}$ (B) Rs. 200

(C) Rs. 300 (D) Rs. 400

16. Sunil completes a work in 4 days whereas Dinesh completes the work in 6 days. Ramesh works $1\frac{1}{2}$ times as fast as Sunil. How many days it will take for the three together to complete the work ?

(A) $\frac{7}{12}$

(B) $1\frac{5}{12}$

(C) $1\frac{5}{7}$

(D) None of these

17. A can do a piece of work in 20 days which B can do in 12 days. B worked at it for 9 days. A can finish the remaining work in—

(A) 3 days (B) 5 days

(C) 7 days (D) 11 days

18. Mahesh and Umesh can complete a work in 10 days and 15 days respectively. Umesh starts the work and after 5 days Mahesh also joins him. In all the work would be completed in—

(A) 7 days

(B) 9 days

(C) 11 days

(D) None of these

19. A can do a piece of work in 80 days. He works at it for 10 days and then B alone finishes the work in 42 days. The two together could complete the work in—

(A) 24 days (B) 25 days

(C) 30 days (D) 35 days

20. A can do a certain job in 25 days which B alone can do in 20 days. A started the work and was joined by B after 10 days. The work lasted for—

(A) $12\frac{1}{2}$ days (B) $14\frac{2}{9}$ days

(C) 15 days (D) $16\frac{2}{3}$ days

21. If 5 men and 3 boys can reap 23 hectares in 4 days and if 3 men and 2 boys can reap 7 hectares in 2 days. How many boys must assist 7 men in order that they may reap 45 hectares in 6 days ?

(A) 2 boys (B) 6 boys

(C) 4 boys (D) 5 boys

22. 12 men can complete a work within 9 days. After 3 days they started the work, 6 men joined them to replace 2 men. How many days will they take to complete the remaining work ?

(A) 2 (B) 3

(C) 4 (D) $4\frac{1}{2}$

23. A piece of work was to be completed in 40 days a number of men employed upon it did only half the work in 24 days, 16 more men were then set on, and the work was completed in the specified time, how many men were employed at first ?

(A) 16 men (B) 32 men

(C) 24 men (D) 48 men

24. 25 men reap a field in 20 days. When should 15 men leave the work, if the whole field is to be reaped in $37\frac{1}{2}$ days after they leave the work ?

(A) 6 days

(B) 4 days

(C) 5 days

(D) None of these

25. A can do a piece of work in 12 days. B is 60% more efficient than A. The number of days, it take B to do the same piece of work is—

(A) $7\frac{1}{2}$ (B) $6\frac{1}{4}$

(C) 8 (D) 6

26. 15 men would finish a piece of work in 210 days. But at the end of every 10 days. 15 additional men are employed. In how many days will it be finished ?

(A) 30 days (B) 70 days

(C) 35 days (D) 60 days

27. Ramesh can finish a job in 20 days. He worked for 10 days alone and completed the remaining job working with Dinesh, in 2 days. How many days would both Dinesh and Ramesh together take to complete the entire job ?

(A) 4 (B) 5

(C) 10 (D) 12

28. A can copy 75 pages in 25 hours. A and B together can copy 135 pages in 27 hours. In what time can B copy 42 pages ?

(A) 21 hours

(B) 5 hours, 36 seconds

(C) 18 hours

(D) 24 hours

29. A can do a piece of work in 5 hours, B in 9 hours and C in 15 hours. If C could work with them for 1 hour only the time taken by A and B together to complete the work is—

(A) 2 hours (B) 3 hours

(C) $3\frac{1}{2}$ hours (D) 4 hours

30. Mohan can move his lawn in x hours after 2 hour it begins to rain. The unmoved part of the lawn is—

(A) $\frac{2}{x}$ (B) $\frac{2-x}{2}$

(C) $\frac{x}{2}$ (D) $\frac{x-2}{x}$

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31. A can do a piece of work in 24 days while B alone can do it in 16 days. But with the help of C, they finish the work in 8 days. C alone can do the work in—
(A) 32 days (B) 36 days
(C) 40 days (D) 48 days

32. The rates of working of A and B are in the ratio 3 : 4. The number of days taken by them to finish the work are in the ratio—
(A) 3 : 4
(B) 9 : 16
(C) 4 : 3
(D) None of these

33. A and B can together finish a work in 30 days. They worked for it for 20 days and then B left. The remaining work was done by A alone in 20 more days. A alone can finish the work in—
(A) 48 days (B) 50 days
(C) 54 days (D) 60 days

34. A can do a certain job in 10 days. B is 60% more efficient than A. The number of days, it takes B to do the same piece of work is—
(A) 6 (B) $6\frac{1}{4}$
(C) $6\frac{2}{3}$ (D) 8

35. A, B and C together earn Rs. 150 per day while A and C together earn Rs. 94 and B and C together earn Rs. 76. The daily earning of C is—
(A) Rs. 75 (B) Rs. 56
(C) Rs. 34 (D) Rs. 20

36. A alone can finish a work in 10 days and B alone can do it in 15 days. If they work together and finish it, then out of a total wages of Rs. 75, A will get—
(A) Rs. 30 (B) Rs. 37·50
(C) Rs. 45 (D) Rs. 50

37. A alone can do a piece of work in 6 days and B alone can do it in 8 days. A and B undertook to do it for Rs. 320 with the help of C, they finished it in 3 days. How much is paid to C ?
(A) Rs. 37·50 (B) Rs. 40
(C) Rs. 60 (D) Rs. 80

38. A can do a piece of work in 14 days which B can do in 21 days. They begin together but 3 days before the completion of the work. A leaves off. The total number of days to complete the work is—
(A) $6\frac{3}{5}$ days (B) $8\frac{1}{2}$ days
(C) $10\frac{1}{5}$ days (D) $13\frac{1}{2}$ days

39. A does half as much work as B in three-fourth of the time. If together they take 18 days to complete a work, how much time shall B take to do it ?
(A) 30 days
(B) 35 days
(C) 40 days
(D) None of these

40. A and B working separately can do a piece of work in 9 and 12 days respectively. If they work for a day alternately. A beginning in how many days the work will be completed ?
(A) $10\frac{1}{2}$ days (B) $10\frac{1}{4}$ days
(C) $10\frac{2}{3}$ days (D) $10\frac{1}{3}$ days

41. If factory A turns out x cars an hour and factory B turns out y cars every 2 hours, the number of cars which both factories turn out in 8 hours is—
(A) $8(x + y)$ (B) $8x + \frac{y}{2}$
(C) $16(x + y)$ (D) $(2x + y)4$

42. A does half as much work as B in three-fourth of the time. If together they take 18 days to complete a work. How much time shall B take to do it ?
(A) 40 days
(B) 35 days
(C) 30 days
(D) None of these

43. Two workers A and B working together completed a job in 5 days. If A worked twice as efficiently as he actually did and B worked $\frac{1}{3}$ as efficiently as he actually did the work, then they would have completed the work in 3 days. Find the time for A to complete the job alone.
(A) $6\frac{1}{2}$ days (B) $6\frac{1}{4}$ days
(C) $6\frac{3}{4}$ days (D) $12\frac{1}{2}$ days

44. A is twice as good a workman as B and together they finish a piece of work in 14 days. A alone can finish the work in—
(A) 11 days (B) 21 days
(C) 28 days (D) 42 days

45. A is thrice as good a workman as B and takes 10 days less to do a piece of work than B takes. B can do the work in—
(A) 12 days (B) 15 days
(C) 20 days (D) 30 days

46. A sum of money is sufficiently to pay A's wages for 21 days or B's wages for 28 days. The money is sufficient to pay the wages of both for—
(A) 12 days
(B) $12\frac{1}{4}$ days
(C) 14 days
(D) None of these

47. If 3 men or 4 women can construct a wall in 43 days. Then the number of days that 7 men and 5 women take to construct it is—
(A) 12 (B) 18
(C) 24 (D) 30

48. 12 men or 18 women can reap a field in 14 days. The number of days that 8 men and 16 women will take to reap it is—
(A) 5 (B) 7
(C) 8 (D) 9

49. A and B can do a piece of work in 45 and 40 days respectively. They began the work together, but A leaves after some days and B finished the remaining work in 23 days. After how many days did A leaves ?
(A) 6 days (B) 8 days
(C) 9 days (D) 12 days

50. 10 men can finish a piece of work in 10 days, whereas it takes 12 women to finish it in 10 days. If 15 men and 6 women undertake to complete the work, how many

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days will they take to complete it ?

(A) 2 (B) 4
(C) 5 (D) 11

51. A certain number of men complete a piece of work in 60 days. If there were 8 men more, the work could be finished in 10 days less. How many men were originally there ?

(A) 30 (B) 40
(C) 32 (D) 36

52. If 5 men or 9 women can finish a piece of work in 19 days 3 men and 6 women will do the same work in—

(A) 10 days (B) 12 days
(C) 13 days (D) 15 days

53. 4 men and 6 women finish a job in 8 days. While 3 men and 7 women finish it in 10 days. 10 women working together will finish it in—

(A) 24 days (B) 32 days
(C) 36 days (D) 40 days

54. 8 children and 12 men complete a certain piece of work in 9 days. If each child takes twice the time taken by a man to finish the work, in how many days will 12 men finish the same work ?

(A) 8 (B) 15
(C) 9 (D) 12

55. 3 men and 4 boys do a piece of work in 8 days, while 4 men and 4 boys finish it in 6 days. 2 men and 4 boys will finish it in—

(A) 9 days (B) 10 days
(C) 12 days (D) 14 days

56. 8 men can dig a pit in 20 days. If a man works half as much again as a boy, then 4 men and 9 boys can dig a similar pit in—

(A) 10 days (B) 12 days
(C) 15 days (D) 16 days

57. If 1 man or 2 women or 3 boys can do a piece of work in 44 days then the same piece of work will be done by 1 man, 1 woman and 1 boy in—

(A) 21 days (B) 24 days
(C) 26 days (D) 33 days

58. 2 men and 3 women can finish a piece of work in 10 days, while 4 men can do it in 10 days. In how many days will 3 men and 3 women finish it ?

(A) 6 days (B) $5\frac{2}{3}$ days
(C) 8 days (D) $8\frac{1}{3}$ days

59. Two men undertake to do a piece of work for Rs. 400. One alone can do it in 6 days. The other in 8 days with the help of a boy they finish it in 3 days. The boy's share is—

(A) Rs. 40 (B) Rs. 50
(C) Rs. 60 (D) Rs. 80

60. 16 men and 12 women together complete a work in 20 days. If 18 women complete the same work in 40 days. Then how many days will be taken by 12 men and 27 women together to complete the same work ?

(A) 18 days (B) 15 days
(C) 14 days (D) 16 days

61. A report of 100 pages is to be typed by three typists. Typist A can type 100 pages in 10 hours. Typist B can type the same pages in 20 hours and typist C in 25 hours. All the three typist started typing at 09·00 a.m. At 01·00 p.m. typist A stopped typing. The other two typists finished the job, approximately at what time the report was typed ?

(A) 2·40 p.m. (B) 5·00 p.m.
(C) 6·00 p.m. (D) 3·40 p.m.

62. 14 workers can make 1400 toys in 5 days. One day after they started the work 14 more workers joined them. How many days will they take to complete the remaining work ?

(A) 2 days (B) 3 days
(C) 4 days (D) $3\frac{1}{2}$ days

63. 24 boys can complete a work in 12 days while 16 men can complete the same work in 9 days. In how many days will 12 boys and 12 men together complete the same work ?

(A) 6 days (B) 8 days
(C) 7 days (D) 10 days

64. 15 men can complete a work in 10 days while 20 boys can complete the same work in 15 days. How many days will 10 men and 10 boys together take to complete the same work ?

(A) 10 days (B) 8 days
(C) 12 days (D) 9 days

65. 14 men can complete a work in 12 days. 4 days after they started the work, 2 more men joined them. How many days will they take to complete the remaining work ?

(A) 9 days (B) 5 days
(C) 6 days (D) 7 days

66. 14 persons can complete a work in 16 days. 8 persons started the work 12 days after they started the work 8 more persons joined them. How many days will they take to complete the remaining work ?

(A) 12 days
(B) 7 days
(C) 9 days
(D) None of these

67. Rohan and Sunil separately can complete a work in 8 hours and 4 hours respectively. How much time will they take when working together ?

(A) $2\frac{2}{3}$ hours (B) $1\frac{1}{3}$ hours
(C) 3 hours (D) 2 hours

68. Typist A can type a report in 16 hours. Typist B can type the same report in 20 hours and the typist C in 24 hours. All the three typists started typing at 9·00 a.m. at 1·00 p.m. the typist A stopped typing. The other two typists finished the job. Approximately at what time the report was typed ?

(A) 04 : 10 p.m.
(B) 05 : 11 p.m.
(C) 05 : 45 p.m.
(D) 06 : 15 p.m.

69. A and B together can do a work in 8 days. If A alone can do it in 12 days, then in how many days can B alone do it ?

(A) 12 days (B) 20 days
(C) 24 days (D) 28 days

70. 24 men can do a work in 16 days while 36 women can do the same

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work in 24 days. In how many days will 8 men and 6 women together complete the same work ?

(A) 36 days (B) 28 days

(C) 32 days (D) 24 days

71. A and B together can do a work in 24 days. B alone does its $\frac{1}{3}$ part in 12 days. How long will A alone take to do the remaining work ?

(A) 48 days

(B) 36 days

(C) 24 days

(D) 72 days

72. Ganesh, Ram and Sohan together can do a work in 16 days. If Ganesh and Ram together can do the same work in 24 days then, how long will take Sohan alone to do the same work ?

(A) 42 days (B) 24 days

(C) 36 days (D) 48 days

73. A and B separately can complete a work in 6 days and 3 days respectively. If they work together, then in how many days will they complete the work ?

(A) 4 days (B) 3 days

(C) 2 days (D) 5 days

74. Ram, Dilip and Shekhar can complete a work in 20 days. If Ram and Dilip together can complete the same work in 30 days, then how long will Shekhar take to complete it ?

(A) 60 days (B) 62 days

(C) 40 days (D) 56 days

Answers with Hints

1. (B) 24 men complete the work in 16 days

$\Rightarrow$ 16 men complete $\left(\frac{16}{24}\times\frac{12}{16}\right) = \frac{1}{2}$ part of work in 12 days.

32 women complete the work in 24 days

$\therefore$ 16 women complete $\frac{16}{32}\times\frac{14}{24} = \frac{7}{24}$ part of work in (12 + 2) = 14 days

So, the remaining part of the work which is done by (sixteen men + sixteen women) and required additional no. of men in 2 days

$$= 1-\left(\frac{1}{2}+\frac{7}{24}\right) = \frac{1}{2}-\frac{7}{24} = \frac{5}{24}\text{ (Part)}$$

Now, in 2 days $\frac{5}{24}$ part of the work is done by

$$24\times\frac{16}{2}\times\frac{5}{24} = 40\text{ men}$$

$\therefore$ Required additional no. of men

$$= 40 - 16 = 24.$$

2. (D) (A + B)'s 1 day's work = $\left(\frac{1}{30}+\frac{1}{40}\right) = \frac{7}{120}$

$\therefore$ Time taken by both to finish the work

$$= \frac{120}{7}\text{ days} = 17\frac{1}{7}\text{ days}$$

3. (D) 25 men and 15 women can complete, a piece of work in 12 days.

$\therefore$ Work done by them in 8 days $= \frac{8}{12} = \frac{2}{3}$

Remaining work is completed by 25 men in 6 days

$\therefore$ Time taken by 25 men to complete the whole work

$$= \frac{3\times 6}{1} = 18\text{ days}$$

From the question,

Time taken by 15 women to complete the whole work $= \frac{1}{\left(\frac{1}{12}-\frac{1}{18}\right)} = \frac{1}{\left(\frac{3-2}{36}\right)} = \frac{36}{(3-2)} = 36$ days

[$\because \frac{1}{12}-\frac{1}{18} = \frac{1}{36}$ work is completed by 15 women in one day.]

4. (D) A's 1 day's work $= \left(\frac{1}{15}-\frac{1}{20}\right) = \frac{1}{60}$

$\therefore$ A alone can finish it in 60 days.

5. (D) $\because$ One man alone finishes the work in 100 days.

$\Rightarrow$ 10 men can finish the work in 10 days

From the question,

$\Rightarrow$ 15 women can finish work in one day

$$= \frac{1}{6}-\frac{1}{10} = \frac{1}{15}\text{ work}$$

$\Rightarrow$ 15 women finish the whole work in 15 days

$\therefore$ 1 woman finishes the whole work in

$$= 15\times 15 = 225\text{ days.}$$

6. (A) B's one day's work $= \left(\frac{1}{6}-\frac{1}{9}\right) = \frac{1}{18}$

$\therefore$ B alone can finish it in 18 days.

7. (D) As per question,

Work of A for 1 day $= \frac{1}{12}$

Work of B for 1 day $= \frac{1}{8}$

$\therefore$ Work of (A + B) together for 1 day

$$= \frac{1}{12}+\frac{1}{8} = \frac{2+3}{24} = \frac{5}{24}$$

$\Rightarrow$ Work of (A + B) together for 3 days

$$= 3\times\frac{5}{24} = \frac{5}{8}$$

$\Rightarrow$ Remaining work after 3 days

$$= 1-\frac{5}{8} = \frac{3}{8}$$

$\because$ C can do the same work in

$$= \frac{4}{5}\text{th time required by (A + B)}$$

$$= \frac{4}{5}\times\frac{24}{5} = \frac{96}{25}\text{ days}$$

$\Rightarrow$ Work of C for 1 day

$$= \frac{25}{96}\text{ part}$$

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$\Rightarrow \frac{25}{96}$ part work can be done by C in 1 day

$\Rightarrow \frac{3}{8}$ part work can be done by C in

$= \frac{96}{25} \times \frac{3}{8}$ days

$= \frac{36}{25}$ day $= 1\frac{11}{25}$ days

$\therefore$ The complete day C did the work

$= 1$ day.

8. (C) $\because \frac{1}{3}$ of work is done by A in 5 days.

$\therefore$ Whole work will be done by A in 15 days.

$\because \frac{2}{3}$ of work is done by B in 10 days.

Whole work will be done by B in $\left(10 \times \frac{5}{2}\right)$

i.e., 25 days

$\therefore$ (A + B)'s 1 day's work

$= \left(\frac{1}{15} + \frac{1}{25}\right) = \frac{8}{75}$

So, both together can finish it in $\frac{75}{8}$ days,

i.e., $9\frac{3}{8}$ days.

9. (A) Work of A for 1 day $= \frac{1}{15}$

Work of B for 1 day $= \frac{1}{20}$

Work of (A + B) together for 1 day

$= \frac{1}{15} + \frac{1}{20} = \frac{4+3}{60} = \frac{7}{60}$

Remaining work after A alone does for 1 day

$= 1 - \frac{1}{15} = \frac{14}{15}$

$\because \frac{7}{60}$ part-work can be completed by (A + B) in 1 day

$\therefore \frac{14}{15}$ part-work can be completed by (A + B) in

$= \frac{60}{7} \times \frac{14}{15} = 8$ days.

10. (C) (A + B)'s 1 day's work $= \frac{1}{18}$

(B + C)'s 1 day's work $= \frac{1}{24}$

(A + C)'s 1 day's work $= \frac{1}{36}$

Adding 2 (A + B + C)'s 1 day's work

$= \left(\frac{1}{18} + \frac{1}{24} + \frac{1}{36}\right) = \frac{1}{8}$

$\therefore$ (A + B + C)'s 1 day's work

$= \frac{1}{16}$

Hence, all working together can finish it in 16 days.

11. (A) (A + B)'s 5 day's work $= 5\left(\frac{1}{10} + \frac{1}{20}\right) = \frac{3}{4}$

Remaining work $= \left(1 - \frac{3}{4}\right) = \frac{1}{4}$

$\frac{1}{20}$ work is done by B in $= 1$ day

$\therefore \frac{1}{4}$ work is done by B in $= \left(20 \times \frac{1}{4}\right)$ *i.e.*, 5 days.

12. (B) 1 man's one day's work $= \frac{1}{96}$

12 men's 3 day's work $= \left(3 \times \frac{1}{8}\right) = \frac{3}{8}$

Remaining work $= \left(1 - \frac{3}{8}\right) = \frac{5}{8}$

15 men's 1 day's work $= \frac{15}{96}$

Now, $\frac{15}{96}$ work is done by them in 1 day

$\therefore \frac{5}{8}$ work will be done by them in $= \left(\frac{96}{15} \times \frac{5}{8}\right)$ *i.e.*,

$= 4$ days

13. (C) $\because$ [(A + B) + (B + C) + (C + A)]'s 1 day's work

$= \left(\frac{1}{12} + \frac{1}{15} + \frac{1}{20}\right) = \frac{1}{5}$

$\Rightarrow$ 2 (A + B + C)'s 1 day's work $= \frac{1}{5}$

$\Rightarrow$ (A + B + C)'s 1 day's work $= \frac{1}{10}$

$\Rightarrow$ A's 1 day's work $= \left(\frac{1}{10} - \frac{1}{15}\right) = \frac{1}{30}$

$\therefore$ A alone can finish it in 30 days.

14. (A) (B + C)'s 2 day's work $= 2\left(\frac{1}{10} + \frac{1}{15}\right) = \frac{1}{3}$

Remaining work $= \left(1 - \frac{1}{3}\right) = \frac{2}{3}$

$\because \frac{1}{9}$ work is done by A in 1 day

$\therefore \frac{2}{3}$ work is done by A in $\left(9 \times \frac{2}{3}\right) = 6$ days

15. (B) Work to be done by C $= \left(1 - \frac{7}{11}\right) = \frac{4}{11}$

$\therefore$ (A + B) : C $= \frac{7}{11} : \frac{4}{11} = 7 : 4$

$\therefore$ C's share $=$ Rs. $\left(550 \times \frac{4}{11}\right)$

$=$ Rs. 200

16. (D) Time taken by Ramesh alone $= \left(\frac{2}{3} \times 4\right)$

$= \frac{8}{3}$ days

$\therefore$ Their 1 day's work $= \left(\frac{1}{4} + \frac{1}{6} + \frac{3}{8}\right)$

$= \frac{19}{24}$

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So, together they can finish the work in $\frac{24}{19}$ days, *i.e.*, $1\frac{5}{19}$ days.

17. (B) B's 9 day's work $= 9 \times \frac{1}{12} = \frac{3}{4}$

Remaining work $= \left(1 - \frac{3}{4}\right) = \frac{1}{4}$

$\frac{1}{4}$ work is done by A in $= 20 \times \frac{1}{4}$

$= 5$ days.

18. (B) Umesh's 5 day's work $= 5 \times \frac{1}{15} = \frac{1}{3}$

Remaining work $= \left(1 - \frac{1}{3}\right) = \frac{2}{3}$

$\left(\frac{1}{10} + \frac{1}{15}\right)$ work is done by both in 1 day

$\therefore \frac{2}{3}$ work is done by both in $\left(6 \times \frac{2}{3}\right) = 4$ days

Hence, the work was completed in 4 + 5 = 9 days.

19. (C) A's 10 day's work $= \left(10 \times \frac{1}{80}\right) = \frac{1}{8}$

Remaining work $= \left(1 - \frac{1}{8}\right) = \frac{7}{8}$

$\because \frac{7}{8}$ work is done by B in 42 days

$\Rightarrow$ Whole work will be done by B in $\left(42 \times \frac{8}{7}\right)$

$=$ *i.e.*, 48 days.

$\therefore$ (A + B)'s 1 day's work $= \left(\frac{1}{80} + \frac{1}{48}\right)$

$= \frac{8}{240} = \frac{1}{30}$

Hence, A and B together can finish it in 30 days.

20. (D) A's 10 day's work $= \left(10 \times \frac{1}{25}\right) = \frac{2}{5}$

Remaining work $= \left(1 - \frac{2}{5}\right) = \frac{3}{5}$

$\left(\frac{1}{25} + \frac{1}{20}\right) = \frac{9}{100}$ work was done by (A + B) in 1 day

$\therefore \frac{3}{5}$ work was done by (A + B) in $\left(\frac{100}{9} \times \frac{3}{5}\right)$

$= \frac{20}{3}$ days

Hence, the work lasted for $\left(10 + 6\frac{2}{3}\right)$

$= 16\frac{2}{3}$ days.

21. (A) $\because$ (5 men + 3 boys) can reap 23 hectares in 4 days …(i)

(3 men + 2 boys) can reap 7 hectares in 2 days. …(ii)

$\therefore$ From (i),

$\Rightarrow$ 14 (5 men + 3 boys) can reap 23 × 14 hectares in 4 days …(iii)

Now, from (ii)

$\Rightarrow$ 23 (3 men + 2 boys) can reap 7 × 2 × 23 hectares in 4 days …(iv)

$\because$ 14 (5 men + 3 boys) = 23 (3 men + 2 boys)

$\Rightarrow$ 70 men + 42 boys = 69 men + 46 boys

$\therefore$ 1 man = 4 boys

Now, 5 men + 3 boys = 23 boys

$\Rightarrow$ 23 boys can reap 23 hectares in 4 days

$\Rightarrow$ 1 boy can reap 1 hectare in 4 days

$\Rightarrow$ 4 boys can reap 1 hectare in 1 day

$\Rightarrow 4 \times 45$ boys can reap 45 hectares in 1 day

$\Rightarrow \frac{4 \times 45}{6}$ boys can reap 45 hectares in 6 days

$\therefore$ 30 boys can reap 45 hectares in 6 days

But 30 boys = 28 boys + 2 boys

= 7 men + 2 boys

Hence, 2 boys can assist 7 men for the work.

22. (D) 12 men can complete $\frac{1}{3}$ of the work in 3 days and the remaining $\frac{2}{3}$ of the work in 6 days.

1 man can complete $\frac{2}{3}$ of the work in (12×6)

$= 72$ days

$\therefore$ (12 – 2 + 6) = 16 men can complete $\frac{2}{3}$ of the work in $\frac{72}{16} = 4\frac{1}{2}$ days

23. (B) Let x men were employed at first

$\because$ x men do $\frac{1}{2}$ of the work in 24 days

$\therefore$ 1 man do the whole work in $24 \times 2 \times x$

$= 48x$ days

Now, from the question,

$(x + 16)$ men do the remaining work $\left(1 - \frac{1}{2} = \frac{1}{2}\right)$ in

(40 – 24 = 16) days

$\therefore$ 1 man do the whole work in $16 \times 2\ (x + 16)$ days

$\therefore$ $48x = 32\ (x + 16)$

$\therefore$ $x = 32$ men

24. (C) 25 men reap the field in 20 days

$\therefore$ 10 men can reap the field in $\frac{20 \times 25}{10} = 50$ days.

When 15 men leave the work, 10 men remain and they can reap in $37\frac{1}{2}$ days $= \frac{37\frac{1}{2}}{50} = \frac{3}{4}$ of the field.

Hence, all men must work till $\left(1 - \frac{3}{4}\right) = \frac{1}{4}$ of the field is reaped in $\frac{1}{4} \times 20 = 5$ days.

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25. (A) A's 1 day's work $= \frac{1}{12}$

B's 1 day's work $= \frac{1}{12} + 60\%$ of $\frac{1}{12}$

$= \frac{1}{12} \times \frac{160}{100} = \frac{2}{15}$

$\therefore$ B can do the work in $\frac{15}{2} = 7\frac{1}{2}$ days.

26. (D) 10 day's work by 15 men $= \frac{10}{210} = \frac{1}{21}$

At the end of every 10 days 15 additional men are employed *i.e.*, for the next 10 days we have

$15 + 15 = 30$ men

$\therefore$ Next 10 day's work by 30 men $= \frac{2}{21}$

Hence in 20 days only $\left(\frac{1}{21} + \frac{2}{21} = \frac{3}{21}\right)$ work is completed.

To complete the whole work we have to reach the value of $\left(\frac{21}{21}\right)$ work.

Now, $\left(\frac{1}{21} + \frac{2}{21} + \frac{3}{21} + \ldots\ldots \frac{6}{21}\right) = \frac{21}{21} = 1$

Hence total time to complete the whole work

$= 10 + 10 + 10 + 10 + 10 + 10$

$= 60$ days

27. (A) Ramesh alone finished $\frac{1}{2}$ of the work in 10 days.

Remaining $\frac{1}{2}$ of the job was finished by Ramesh and Dinesh together in 2 days.

Therefore, they both together can finish the complete job in 4 days.

28. (A) In 25 hours A can copy 75 pages

In 1 hour A can copy $\frac{75}{25} = 3$ pages

In 25 hours (A and B) can copy 135 pages

In 1 hour (A and B) can copy $= \frac{135}{27} = 5$ pages

$\therefore$ In 1 hour B can copy $(5 - 3 = 2)$ pages

$\therefore$ B can copy 42 pages in 21 hours.

29. (A) $\because \left(\frac{1}{5} + \frac{1}{9} + \frac{1}{15}\right) = \frac{17}{45}$ work is finished in 1 hour.

$\therefore$ Remaining work $= 1 - \frac{17}{45} = \frac{28}{45}$

$\Rightarrow$ (A + B)'s 1 hour's work $= \frac{1}{5} + \frac{1}{9} = \frac{14}{45}$

$\frac{14}{45}$ work is done by (A and B) in 1 hour

$\frac{28}{45}$ work will be done by A and B in $\left(\frac{45}{14} \times \frac{28}{45}\right)$

$= 2$ hours

30. (D) $\because$ Mohan moves the whole lawn in x hours.

$\Rightarrow$ Mohan moves in 2 hours $= \frac{2}{x}$ part of the lawn.

$\therefore$ Unmoved part $= 1 - \frac{2}{x} = \frac{x-2}{x}$ part

31. (D) $\because$ C's 1 day's work

= [(A + B + C)'s 1 day's work]

$-$ [(A + B)'s 1 day's work]

$= \left[\frac{1}{8} - \left(\frac{1}{24} + \frac{1}{16}\right)\right] = \left(\frac{1}{8} - \frac{5}{48}\right) = \frac{1}{48}$

$\therefore$ C alone can do it in 48 days.

32. (C) Ratio of times taken $= \frac{1}{3} : \frac{1}{4} = 4 : 3$

33. (D) (A + B)'s 20 day's work $= \left(20 \times \frac{1}{30}\right) = \frac{2}{3}$

Remaining work $= \left(1 - \frac{2}{3}\right) = \frac{1}{3}$

$\frac{1}{3}$ work is done by A in 20 days

Whole work can be done by A in (3×20) days

$= 60$ days.

34. (C)

35. (D) $\because$ B's daily earning $=$ Rs. $(150 - 94) =$ Rs. 56

$\Rightarrow$ A's daily earning $=$ Rs. $(150 - 76) =$ Rs. 74

$\therefore$ C's daily earning $=$ Rs. $[(150 - (56 + 74)]$

$=$ Rs. 20

36. (C) 37. (B) 38. (C) 39. (A) 40. (B)

41. (D) $\because$ Factory A turns out x cars in one hour. Factory B turns out $\frac{y}{2}$ cars in one hour.

$\Rightarrow$ In one hour both the factories A and B can turn out $\left(x + \frac{y}{2}\right)$ cars

$\therefore$ In 8 hours both factories turn out

$= 8\left(x + \frac{y}{2}\right)$ cars $= 4(2x + y)$ cars.

42. (C) Let B takes x days to do the work.

$\therefore$ A takes $\left(2 \times \frac{3}{4}x\right) = \frac{3x}{2}$ days to do it.

$\because$ (A + B)'s 1 day's work $= \frac{1}{18}$

$\Rightarrow \frac{1}{x} + \frac{2}{3x} = \frac{1}{18}$

$\therefore x = 30$

43. (B) Efficiency is proportional to work done per day. Work done per day $\times$ number of days worked = Amount of work done. Considering efficiency of A and B initially as 1.

Let A alone can do the work in x days and B alone can do the same work in y days.

Then, $\frac{5}{x} + \frac{5}{y} =$ Total work done $= 1$

Since efficiency of A and B are 2 and $\frac{1}{3}$ respectively

$\because \frac{1}{x} \times 2 \times 3 + \frac{1}{y} \times \frac{1}{3} \times 3 = 1$

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$\Rightarrow \quad \frac{6}{x}+\frac{1}{y} = 1 \quad \ldots(i)$

and $\quad \frac{1}{x}+\frac{1}{y} = \frac{1}{5} \quad \ldots(ii)$

Now, subtracting equation (ii) from equation (i), we have

$$x = \frac{25}{4} = 6\frac{1}{4} \text{ days.}$$

44. (B) (A's 1 day's work) : (B's 1 day's work) = 2 : 1

Now, $\because$ (A + B)'s 1 day's work $= \frac{1}{14}$

$\Rightarrow$ A's 1 day's work $= \left(\frac{1}{14}\times\frac{2}{3}\right) = \frac{1}{21}$

$\therefore$ A alone can finish the work in 21 days.

$\left[\text{Dividing } \frac{1}{14} \text{ in the ratio } 2:1\right]$

45. (B) 46. (A) 47. (A) 48. (D) 49. (C) 50. (C) 51. (B)
52. (D) 53. (D) 54. (D) 55. (C) 56. (D) 57. (B) 58. (C)
59. (B)
60. (D) $\because$ In 20 days the work is completed by

$= 16 \text{ men} + 12 \text{ women}$

$\therefore$ In 1 day the work is completed by

$= 20 \times (16 \text{ men} + 12 \text{ women})$

$= 320 \text{ men} + 240 \text{ women}$

In 40 days the work is completed by 18 women

$\therefore$ 1 day the work is completed by

$= 18 \times 40$

$= 720 \text{ women}$

$\because \quad 720 \text{ women} = 320 \text{ men} + 240 \text{ women}$

$\Rightarrow \quad (720 - 240) \text{ women} = 320 \text{ men}$

$\Rightarrow \quad 480 \text{ women} = 320 \text{ men}$

$\therefore \quad 1 \text{ man} = \frac{480}{320}$

$= \frac{3}{2} \text{ women}$

$\therefore \quad 12 \text{ men} + 27 \text{ women} = 12 \times \frac{3}{2} + 27$

$= 45 \text{ women}$

$\because$ 18 women complete 1 work in 40 days

$\therefore \quad 45 \text{ women complete 1 work} = \frac{40 \times 18}{45}$

$= 16 \text{ days}$

61. (D) $\because$ No. of pages typed by the typist A in 4 hours

$= \frac{100 \times 4}{10} = 40$

$\therefore$ No. of remaining pages $= 100 - 40 = 60$

Let B and C worked for x hours

$\because \quad \frac{100 \times x}{20} + \frac{100 \times x}{25} = 60$

$\Rightarrow \quad 5x + 4x = 60$

$\therefore \quad x = \frac{60}{9} = \frac{20}{3} \text{ hours}$

$= 6 \text{ hours } 40 \text{ min}$

$\therefore$ The time at which the report was typed 03·40 p.m.

62. (A) $\because$ In 5 days 14 workers make $= 1400$ toys

$\therefore$ In 1 day 14 workers make toys $= \frac{1400}{5}$

$= 280$ toys

Number of remaining toys $= 1400 - 280$

$= 1120$

and number of total workers $= 14 + 14$

$= 28$

$\because$ 14 workers make 1400 toys in 5 days

$\therefore \quad 28 \text{ workers make } 1120 \text{ toys} = \frac{5 \times 14 \times 1120}{28 \times 1400}$

$= 2 \text{ days}$

63. (B) $\because$ In 12 days the work is done by = 24 boys

$\therefore$ In 1 day the work is done by $= 24 \times 12$

$= 288$ boys

$\because$ In 9 days the work is done by $= 16$ men

$\therefore \quad 1 \text{ day work is done by} = 16 \times 9$

$= 144 \text{ men}$

$\Rightarrow \quad 144 \text{ men} = 288 \text{ boys}$

$\Rightarrow \quad 1 \text{ man} = \frac{288}{144}$

$= 2 \text{ boys}$

$\Rightarrow \quad 12 \text{ men} + 12 \text{ boys} = 12 \times 2 + 12$

$= 36 \text{ boys}$

$\because$ 24 boys complete 1 work in 12 days

$\therefore$ 36 boys complete 1 work in $\frac{12 \times 24}{36} = 8$ days

64. (A) $\because$ In 10 days a work is completed by 15 men

$\therefore$ In 1 day a work is completed by

$= 15 \times 10 = 150 \text{ men}$

$\because$ In 5 days the work is completed by

$= 20$ boys

$\therefore$ 1 day the work is completed

$= 20 \times 15 = 300$ boys

$\Rightarrow \quad 150 \text{ men} = 300 \text{ boys}$

or $\quad 1 \text{ man} = \frac{300}{150} = 2$ boys

$10 \text{ men} = 2 \times 10 = 20$ boys

$10 \text{ men} + 10 \text{ boys} = 20 + 10$

$= 30$ boys

$\because$ 20 boys complete the work in 15 days

$\therefore$ 30 boys complete the work in $\frac{15 \times 20}{30}$

$= 10$ days

65. (D) $\because$ In 12 days work done by 14 men $= 1$

$\therefore \quad$ In 4 days work done by 14 men $= \frac{1 \times 4}{12} = \frac{1}{3}$

$\therefore \quad$ Remaining work $= 1 - \frac{1}{3} = \frac{2}{3}$

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and number of total men = 14 + 2
= 16

If 1 work is done by 14 men in 12 days

$\therefore \frac{2}{3}$ work is done by 16 men in $\frac{12 \times 14}{16} \times \frac{2}{3} = 7$ days

66. (D) $\because$ 14 persons complete in 16 days = 1 work

$\therefore$ 8 persons complete in 12 days = $\frac{1 \times 8}{14} \times \frac{12}{16}$

$= \frac{3}{7}$

$\therefore$ Remaining work = $1 - \frac{3}{7} = \frac{4}{7}$

and total number of persons = 8 + 8 = 16

$\therefore$ 14 persons do 1 work in 16 days

$\therefore$ 16 persons do $\frac{4}{7}$ work in $\frac{16 \times 14}{16} \times \frac{4}{7} = 8$ days

67. (A) Required time taken to complete the work by both together = $\frac{xy}{x+y}$

(Here $x = 8$ and $y = 4$) = $\frac{8 \times 4}{8+4} = \frac{32}{12}$

= $2\frac{2}{3}$ hours

68. (B) Work of (A + B + C) for 1 hour

= $\frac{1}{16} + \frac{1}{20} + \frac{1}{24} = \frac{37}{240}$

$\therefore$ Work of (A + B + C) for 4 hours

= $\frac{37 \times 4}{240} = \frac{37}{60}$

$\therefore$ Remaining work = $1 - \frac{37}{60} = \frac{23}{60}$

$\therefore$ Work of (B + C) for 1 hour

= $\frac{1}{20} + \frac{1}{24} = \frac{11}{120}$

$\because \frac{11}{120}$ work is done by (B + C) in 1 hour

$\therefore \frac{23}{60}$ work is done by (B + C)

= $\frac{120}{11} \times \frac{23}{60}$

= $\frac{46}{11}$ hours

= 4 hours 11 min.

$\therefore$ The type at which the report was typed

= 01 : 00 + 04 : 11

= 05 : 11 p.m.

69. (C) Required time taken by B to complete the work

= $\frac{xy}{x-y}$

[Here $x = 12$ and $y = 8$]

= $\frac{12 \times 8}{(12-8)} = \frac{96}{4}$

= 24 days

70. (A) In 16 days the work is done by 24 men

$\therefore$ In 1 day the work is done by

= (24 × 16) men

In 24 days the work is done by

= 36 women

$\therefore$ In 1 day the work is done by

= (36 × 24) women

$\because$ (16 × 24) men = 36 × 24 women

$\Rightarrow$ 1 man = $\frac{36 \times 24}{16 \times 24}$

$\Rightarrow$ 8 men = $\frac{36 \times 24}{16 \times 24} \times 8$

= 18 women

$\therefore$ 8 men + 6 women = (18 + 6)

= 24 women

$\because$ 36 women do 1 work in 24 days

$\therefore$ 24 women do 1 work in $\frac{24 \times 36}{24} = 36$ days

71. (A) Work done by (A + B) in 1 day = $\frac{1}{24}$

Work done by B alone in 1 day = $\frac{1}{3 \times 12} = \frac{1}{36}$

$\therefore$ Work of A for 1 day = $\frac{1}{24} - \frac{1}{36} = \frac{1}{72}$

After 12 days the remaining work = $1 - \frac{1}{3} = \frac{2}{3}$

$\because \frac{1}{72}$ work is done by A in 1 day

$\therefore \frac{2}{3}$ work is done by A in $1 \times \frac{72}{1} \times \frac{2}{3} = 48$ days

72. (D) $\because$ Work of (Ganesh, Ram and Sohan) for 1 day

= $\frac{1}{16}$

and work of Ganesh and Ram for 1 day

= $\frac{1}{24}$

$\Rightarrow$ Work of Sohan for 1 day = $\frac{1}{16} - \frac{1}{24} = \frac{1}{48}$

$\therefore$ Sohan alone will complete the work in

= $\left(1 \div \frac{1}{48}\right)$ days

= 48 days

73. (C) Required time taken by (A + B) to complete the work = $\frac{xy}{x+y}$

[Here $x = 6$ and $y = 3$]

= $\frac{6 \times 3}{6+3} = 2$ days

74. (A) $\because$ Work of (Ram + Dilip + Shekhar) for 1 day

= $\frac{1}{20}$

and work of (Ram + Dilip) for 1 day

= $\frac{1}{30}$

$\therefore$ Work of Shekhar for 1 day

= $\frac{1}{20} - \frac{1}{30} = \frac{1}{60}$

Hence, Shekhar will complete the work in 60 days.

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Probability

Important Points/Facts

(1) **Probability of the occurrence of at least one of several independent events of a random experiment**—If $A_1, A_2, A_3, \ldots\ldots A_n$ are independent events then $\bar{A}_1 \bar{A}_2 \bar{A}_3 \ldots\ldots\ldots \bar{A}_n$ are also independent events then probability that at least one of the events occurs.

= 1 – probability of none of events occurs

$= 1 - (1 - p_1)(1 - p_2) \ldots (1 - p_n)$

where $p_1\ p_2\ p_3 \ldots\ldots\ldots p_n$ are probabilities of events $A_1, A_2, A_3, \ldots\ldots A_n$.

(2) **Probability of occurrence of exactly one of the two independent events**—$p_1\ q_2 + p_2 q_1$, where E and F are two events with probability p and q respectively.

(3) **Bayer's formula or Bayer's theorem on probability.**

Let $H_1, H_2 \ldots\ldots\ldots H_n$ be a set of mutually exclusive and exhaustive events and E is any other event, then

(i) $P(E) = \sum_{i=1}^{n} P(E \cup H_i)$

(ii) $P(E/H_i).\ P(H_i)$

$= P(H/E_i) \cdot P(E) = P(E \cap H_i)$

(iii) $P(H_i/E) = \dfrac{P(E \cup H_i)}{P(E)}$

$= \dfrac{P(E/H_i)\ P(H_i)}{\sum_{i=1}^{n} P(E/H_i)\ P(H_i)}$

Examples

Q. 1. A dice is thrown. What is the probability that the number shown on the dice is (i) an even no. (ii) an odd no. (iii) a no. divisible 2 (iv) a no. divisible by 3, (v) a no. less than 4. (vi) a no. less than or equal to 4. (vii) a no. greater than 6. (viii) a no. less than or equal to 6.

Solution :

In all the above cases

$S = \{1, 2, 3, 4, 5, 6\}$

$n(S) = 6$

(i) E (an even no.) = {2 4 6},

$n(E) = 3$

$\therefore\ P(E) = \dfrac{n(E)}{n(S)} = \dfrac{3}{6} = \dfrac{1}{2}$

(ii) E (an odd no.) = {1, 3, 5}

$n(E) = 3$

$\therefore\ P(E) = \dfrac{n(E)}{n(S)} = \dfrac{3}{6} = \dfrac{1}{2}$

(iii) E (a no. divisible by 2)

$= \{2, 4, 6\},\ n(E) = 3$

$\therefore\ P(E) = \dfrac{3}{6} = \dfrac{1}{2}$

(iv) E (a no. divisible by 3)

$= \{3, 6\}\ n(E) = 2$

$\therefore\ P(E) = \dfrac{2}{6} = \dfrac{1}{3}$

(v) E (a no. less than 4)

$= \{1, 2, 3\}\ n(E) = 3$

$\therefore\ P(E) = \dfrac{3}{6} = \dfrac{1}{2}$

(vi) E (a no. less than or equal to 4) $= \{1, 2, 3, 4\}$

$n(E) = 4$

$\therefore P(E) = \dfrac{4}{6} = \dfrac{2}{3}$

(vii) E (a no. greater than 6) = { }, *i.e.,* there is no number greater than 6 in the sample space.

$\therefore\ P(E) = \dfrac{0}{6} = 0$

Probability of an impossible event = 0.

(viii) E (a no. less than or equal to 6) $= \{1, 2, 3, 4, 5, 6\}$,

$n(E) = 6$

$\therefore\ P(E) = \dfrac{6}{6} = 1$

$\because$ Probability of a certain event

$= 1$

$0 < P(E) < 1$

Q. 2. (i) What is the chance that a leap year selected randomly will have 53 Sundays ?

(ii) What is the chance, if the year selected is a not a leap year will have 53 Sundays ?

Solution :

(i) A leap year has 366 days so it has 52 complete weeks and 2 more days. The two days can be {Sunday and Monday, Monday and Tuesday, Tuesday and Wednesday, Wednesday and Thursday, Thursday and Friday, Friday and Saturday, Saturday and Sunday} *i.e.* $n(S) = 7$

Out of these 7 cases, cases favourable for one more Sunday are

{Sunday and Monday, Saturday and Sunday}

i.e. $n(E) = 2$

$\therefore\ P(E) = \dfrac{2}{7}$

(ii) When the year is not a leap year. It has 52 complete weeks and 1 more day that can be {Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday} $n(S) = 7$.

Out of these 7 cases, cases favourable for one more Sunday is—

{Sunday}, $n(E) = 1$

$\therefore\ P(E) = \dfrac{1}{7}$

Q. 3. When two dice are thrown, what is the probability that :

(i) Sum of numbers appeared is 6 and 7 ?

(ii) Sum of numbers appeared ≤ 8 ?

(iii) Sum of numbers is an odd no. ?

(iv) Sum of numbers is a multiple of 3 ?

(v) Numbers shown are equal ?

(vi) The difference of the numbers is 2 ?

(vii) Sum of the numbers is at least 5 ?

Solution :

(i) For 6, reqd. probability

$= \dfrac{n(E)}{n(S)} = \dfrac{5}{36}$

For 7, reqd. probability

$= \dfrac{6}{36} = \dfrac{1}{6}$

(ii) Desired sums of the numbers are 2, 3, 4, 5, 6, 7 and 8.

$n(S) = 1 + 2 + 3 + 4 + 5 + 6 + 5$

$= 26$

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∴ Reqd. probability

$$= \frac{26}{36} = \frac{13}{18}$$

(iii) Desired sums of the numbers are 3, 5, 7, 9 and 11

$$n(S) = 2 + 4 + 6 + 4 + 2$$
$$= 18$$

∴ Reqd. probability

$$= \frac{18}{36} = \frac{1}{2}$$

(iv) Desired sums of the numbers are 3, 6, 9 and 12,

$$n(S) = 2 + 5 + 4 + 1$$
$$= 12$$

∴ Reqd. probability

$$= \frac{12}{36} = \frac{1}{3}$$

(v) Events = {1, 1}, {2, 2}, {3, 3}, {4, 4}, {5, 5}, {6, 6}, $n(S) = 6$

$$\therefore \text{ P (E)} = \frac{6}{36} = \frac{1}{6}$$

(vi) Events = {3, 1}, {4, 2}, {5, 3}, {6, 4}, {4, 6}, {3, 5}, {2, 4}, {1, 3}, n (S) = 8

$$\therefore \text{ P (E)} = \frac{8}{36} = \frac{2}{9}$$

(vii) Events; either 2 or 3 or 4 or 5

$$n(E) = 1 + 2 + 3 + 4 = 10$$
$$n(S) = 36$$
$$\therefore \text{ P (E)} = \frac{n(E)}{n(S)} = \frac{10}{36} = \frac{5}{18}$$

Q. 4. A card is drawn from a pack of cards. What is the probability that it is :

(i) a card of black suit ?

(ii) a spade card ?

(iii) an honours card of red suit ?

(iv) an honours card of club ?

(v) a card having the number less than 7 ?

(vi) a card having the number a mutiple of 3 ?

(vii) a king or a queen ?

(viii) a digit card of heart ?

(ix) a jack of black suit ?

Solution :

For all the above cases

$$n(S) = {}^{52}C_1 = 52$$

(i) $\text{P (E)} = \frac{26}{52} = \frac{1}{2}$

$$\left[\text{or } \frac{{}^{26}C_1}{{}^{52}C_1} = \frac{26}{52} \ (\because {}^{n}C_1 = n)\right]$$

(ii) $\text{P (E)} = \frac{13}{52} = \frac{1}{4}$

(iii) $\text{P (E)} = \frac{4 \times 2}{52} = \frac{2}{13}$

(iv) $\text{P (E)} = \frac{4}{52} = \frac{1}{13}$

(v) $\text{P (E)} = \frac{5 \times 4}{52} = \frac{5}{13}$

(vi) $\text{P (E)} = \frac{3 \times 4}{52} = \frac{3}{13}$

(vii) $\text{P (a king)} = \frac{4}{52} = \frac{1}{13}$

$$\text{P (a queen)} = \frac{4}{52} = \frac{1}{13}$$

$$\therefore \text{ P (a king or a queen)} = \frac{1}{13} + \frac{1}{13} = \frac{2}{13}$$

(viii) $\text{P (E)} = \frac{9}{52}$

(ix) $\text{P (E)} = \frac{2}{52} = \frac{1}{26}$

Q. 5. A bag contains 3 red, 5 yellow and 4 green balls. 3 balls are drawn randomly. What is the probability that the balls drawn contain balls of different colours ?

Solution :

Total no. of balls

$$= 3 + 5 + 4 = 12$$
$$n(S) = {}^{12}C_3$$
$$= \frac{12 \times 11 \times 10}{3 \times 2}$$
$$= 220$$

In order to have 3 different coloured balls the selection of one ball of each colour is to be made.

$$n(E) = {}^{3}C_1 \times {}^{5}C_1 \times {}^{4}C_1$$
$$= 3 \times 5 \times 4 = 60$$
$$\therefore \text{ P (E)} = \frac{60}{220} = \frac{3}{11}$$

Short Method : Applying the theorem, we have the required answer

$$= \frac{6 \times 3 \times 5 \times 4}{12 \times 11 \times 10} = \frac{3}{11}.$$

Q. 6. A bag contains 3 red, 5 yellow and 4 green balls. 3 balls are drawn randomly. What is the probability that balls drawn contain exactly two green balls ?

Solution :

Total no. of balls

$$= 3 + 5 + 4$$
$$= 12$$
$$n(S) = {}^{12}C_3$$
$$= \frac{12 \times 11 \times 10}{3 \times 2} = 220$$

2 green balls can be selected from 4 green balls in ${}^4C_2$ ways and the rest one ball can be selected from the remaining (12 – 4) = 8 balls in ${}^8C_1$ ways.

$$n(E) = {}^{4}C_2 \times {}^{8}C_1 = 6 \times 8 = 48$$
$$\therefore \text{P(E)} = \frac{48}{220} = \frac{12}{55}$$

Short Method : Applying the theorem, we have the reqd. answer

$$= \frac{3 \times 4 \times (4-1) \times 8}{12 \times 11 \times 10}$$
$$= \frac{3 \times 4 \times 3 \times 8}{12 \times 11 \times 10} = \frac{12}{55}$$

Q. 7. A bag contains 3 red, 5 yellow and 4 green balls. 3 balls are drawn randomly. What is the probability that the balls drawn contain no yellow ball ?

Solution :

Total no. of balls

$$= 3 + 5 + 4 = 12$$
$$n(S) = {}^{12}C_3$$
$$= \frac{12 \times 11 \times 10}{3 \times 2}$$
$$= 220$$

3 balls can be selected from 3 (red) + 4 (green)

$$= 7 \text{ balls}$$
$$= 7 \text{ balls in } {}^7C_3 \text{ ways}$$
$$n(E) = {}^{7}C_3 = \frac{7 \times 6 \times 5}{3 \times 2} = 35$$
$$\therefore \text{P (E)} = \frac{35}{220} = \frac{7}{44}$$

Short Method : Applying the theorem, we have the reqd. answer

$$= \frac{7 \times 6 \times 5}{12 \times 11 \times 10}$$
$$= \frac{35}{220} = \frac{7}{44}.$$

Q. 8. There are 4 boys and 4 girls. They sit in a row randomly.

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What is the chance that all the girls do not sit together ?

Solution :

Total no. of arrangements $= n(S) = {}^8P_8 = 8!$

Consider all the 4 girls as one, we have 4 boys + 1 girl = 5 persons. Which can be arranged in ${}^5P_5 = 5!$ ways. But the girls can also be arranged in ${}^4P_4 = 4!$ ways among themselves.

So, in $4! \times 5!$ ways can the persons be arranged so that girls are together $= \dfrac{\lfloor 4 \times \lfloor 5}{8!}$

P (girls are togeher)

$$= \frac{4 \times 3 \times 2}{8 \times 7 \times 6} = \frac{1}{14}$$

$\therefore$ P (All girls are not together)

$$= 1 - P$$

(All girls are together)

$$= 1 - \frac{1}{14} = \frac{13}{14}$$

Short Method : Applying the theorem, we have the required answer

$$P(E) = 1 - \frac{5!\,4!}{8!}$$

$$= 1 - \frac{5!\,4!}{8!} = 1 - \frac{1}{14}$$

$$= \frac{13}{14}$$

Q. 9. A box contains 4 black balls, 3 red balls and 5 green balls. 2 balls are drawn from the box at random. What is the probability that both the balls are of the same colour ?

Solution :

Total no. of balls

$$= 4 + 3 + 5 = 12$$

$$n(S) = {}^{12}C_2 = \frac{12 \times 11}{2} = 66$$

$$n(E) = {}^4C_2 + {}^3C_2 + {}^5C_2$$

$$= \frac{4 \times 3}{2} + \frac{3 \times 2}{2} + \frac{5 \times 4}{2}$$

$$= 6 + 3 + 10 = 19$$

$\therefore$ Reqd. probability, P(E)

$$= \frac{n(E)}{n(S)} = \frac{19}{66}$$

Short Method : Applying the theorem,

Reqd. answer

$$= \frac{4(4-1) + 3(3-1) + 5(5-1)}{(4+3+5)(4+3+5-1)}$$

$$= \frac{12 + 6 + 20}{12 \times 11} = \frac{19}{66}$$

Note : The probability that both the balls are not of the same colour is given by (1 – P) (probability of the same colour).

Case II. If $r = 3$, then the formula for required probability is given by

$$\left[\frac{x(x-1)(x-2) + y(y-1)}{(x+y+z)(x+y+z-1)}\right.$$
$$\left.\frac{(y-2) + z(z-1)(z-2)}{(x+y+z-2)}\right]$$

Q. 10. A bag contains 5 red and 8 black balls. Two draws of three balls each are made, the ball being replaced after the first draw. What is the chance that the balls were red in the first draw and black in the second ?

Solution :

Total no. of balls

$$= 5 + 8 = 13$$

$$n(S) = {}^{13}C_3 = \frac{11 \times 12 \times 13}{1 \times 2 \times 3}$$

$$= 286$$

Chance that the balls were red in first draw $= \dfrac{{}^5C_3}{{}^{13}C_3}$

Chance that the balls were black in the second draw $= \dfrac{{}^8C_3}{{}^{13}C_3}$

[$\because$ balls are replaced after first draw]

Required probability

$$= \frac{{}^5C_3}{{}^{13}C_3} \times \frac{{}^8C_3}{{}^{13}C_3} = \frac{140}{20449}$$

In the above example the two events are independent and can occur simultaneously. So, we used multiplication.

Short Method : Applying theorem, we have the required probability

$$= \frac{(5 \times 4 \times 3) \times (8 \times 7 \times 6)}{(13 \times 12 \times 11)^2}$$

$$= \frac{20160}{2944656} = \frac{140}{20449}$$

Q. 11. A bag contains 5 black and 7 white balls. A ball is drawn out-of it and replaced in the bag. Then a ball is drawn again. What is the probability that (i) both the balls drawn were black (ii) both were white (iii) the first ball was white and the second black (iv) the first ball was black and the second white ?

Solution :

The events are independent and capable of simultaneous occurrence. The rule of multiplication would be applied.

The probability that

(i) Both the balls were black

$$= \frac{5}{12} \times \frac{5}{12} = \frac{25}{144}$$

(ii) Both the balls were white

$$= \frac{7}{12} \times \frac{7}{12} = \frac{49}{144}$$

(iii) The first was white and the second black

$$= \frac{7}{12} \times \frac{5}{12} = \frac{35}{144}$$

(iv) The first was black and the second white

$$= \frac{5}{12} \times \frac{7}{12} = \frac{35}{144}$$

From the above example we can see that how the quicker methods for such questions have been derived.

Q. 12. A bag contains 6 red and 3 white balls. Four balls are drawn out one by one and not replaced. What is the probability that they are alternatively of different colours ?

Solution :

Balls can be drawn alternately in the following order. Red, White, Red, White, or White, Red, White, Red.

If red ball is drawn first, the probability of drawing the balls alternatively

$$= \frac{6}{9} \times \frac{3}{8} \times \frac{5}{7} \times \frac{2}{6} \quad \ldots(i)$$

If white ball is drawn first the probability of drawing the balls alternately

$$= \frac{3}{9} \times \frac{6}{8} \times \frac{2}{7} \times \frac{5}{6} \quad \ldots(ii)$$

Required probability (i) + (ii)

$\ldots$ (*)

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$$= \frac{6}{9} \times \frac{3}{8} \times \frac{5}{7} \times \frac{2}{6} + \frac{3}{9} \times \frac{6}{8} \times \frac{2}{7} \times \frac{5}{6}$$

$$= \frac{5}{84} + \frac{5}{84} = \frac{5}{42}$$

Short Method : Applying the theorem, we have the required probability

$$= \left[\frac{6 \times 3 \times (6-1) \times (3-1)}{(6+3)(6+3-1)(6+3-2)(6+3+3)}\right] \times 2$$

$$= \left[\frac{6 \times 3 \times 5 \times 2}{9 \times 8 \times 7 \times 6}\right] \times 2 = \frac{5}{42}$$

Note : Wherever we find the word **AND** between two events, we use multiplication. Mark that both also means first and second. On the other hand, if the two events are joined with **OR** we use addition as in the above example.

Q. 13. A bag contains 4 white and 6 red balls. Two draws of one ball each are made without replacement. What is the probability that one is red and other white ?

Solution :

Such problems can be very easily solved with the help of the rules of permutation and combination.

Two balls can be drawn out of 10 balls in ${}^{10}C_2 = \frac{10!}{2!\,8!} = \frac{10 \times 9}{2} = 45$ ways.

One white ball can be drawn out of 4 white balls in

$${}^4C_1 = \frac{4!}{1!\,3!} = 4 \text{ ways}$$

One red ball can be drawn out of 6 red balls in ${}^6C_1 = 6$ ways. The total number of ways of drawing a white and a red ball are ${}^4C_1 \times {}^6C_1 = 4 \times 6 = 24$

The required probability would be

$$= \frac{\text{No. of cases favourable to the event}}{\text{Total no. of ways in which the event can happen}}$$

$$= \frac{24}{45} = \frac{8}{15}$$

Short Method : Applying the theorem, we have the required probability

$$= \frac{2 \times 6 \times 4}{10 \times 9} = \frac{8}{15}$$

The above theorem may be put as given below :

"A bag contains 'x' white and 'y' red balls. If two balls are drawn in succession at random, then the probability that one of them is white and the other red is given by

$$\left[\frac{2xy}{(x+y)(x+y-1)}\right]$$

Q. 14. A basket contains 3 white and 9 black balls. There is another basket which contains 6 white and 8 black balls. One ball is to be drawn from either of the two baskets. What is the probability of drawing a white ball ?

Soultion :

Since there are two baskets, each equally likely to be chosen the probability of choosing either basket is $\frac{1}{2}$.

If the first basket is chosen, the probability of drawing a white ball

$$= \frac{1}{2} \times \frac{{}^3C_1}{{}^{12}C_1} = \frac{1}{2} \times \frac{3}{12} = \frac{1}{8}$$

Similarly, if the second basket be chosen, the probability of drawing a white ball $= \frac{1}{2} \times \frac{{}^6C_1}{{}^{14}C_1} = \frac{1}{2} \times \frac{6}{14} = \frac{3}{14}$

Since, the two events are mutually exclusive, we use addition, therefore, the probability of drawing a white ball from either basket is

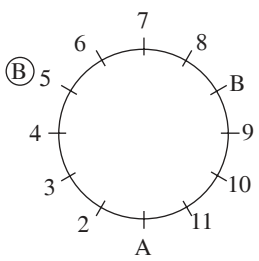
$$P(E) = \frac{1}{8} + \frac{3}{14} = \frac{7+12}{56}$$

$$= \frac{19}{56}$$

Short Method : Applying the theorem we have the required probability $= \frac{1}{2}\left[\frac{3}{12} + \frac{6}{14}\right] = \frac{19}{56}$.

Q. 15. A and B stand in a ring with 10 other persons. If the arrangement of the 12 persons is at random. What is probability that there are exactly 3 persons between A and B ?

Solution :



Let A stand on some point of the ring.

Then n (S) = the number of points on which B can stand = 11.

If there be exactly 3 persons between A and B, then corresponding to any position occupied. B can take up only two position the 4th place and the 8th place as counted from A.

Thus n (E) = 2

$$\therefore \quad P(E) = \frac{n(E)}{n(S)} = \frac{2}{11}$$

Short Method : Applying the theorem we have the required probability $= \frac{2}{(10+1)} = \frac{2}{11}$

Q. 16. 10 persons are seated at a round table. What is the probability that two particular persons sit together ?

Solution :

n (S) = no. of ways of sitting 10 persons at round table = (10 – 1) ! = 9 since 2 particular persons will be always together. Then the no. of persons = 8 + 1 = 9.

$\therefore$ 9 persons will be seated in (9 – 1) ! = 8 ! ways at round table and 2 particular persons will be seated themselves in 2 ! ways

$\therefore$ The number of ways in which two persons always sit together at round table = 8! 2! = n (E)

$$\therefore \quad P(E) = \frac{n(E)}{n(S)} = \frac{8! \times 2!}{9!}$$

$$= \frac{8! \times 2}{9 \times 8!} = \frac{2}{9}$$

Short Method : Applying the theorem we have the required probability $= \frac{(10-2)!\,2!}{(10-1)!} = \frac{8!\,2!}{9!} = \frac{2}{9}$.

Q. 17. An unbiased coin is tossed 7 times, find the chance that exactly 5 times head will apear.

Solution :

Here, $n = 7$, $r = 5$

p = Probability of happening $= \frac{1}{2}$

q = Probability of not happening

$$= \frac{1}{2}$$

$\therefore$ Required probability

$$= {}^7C_5 \times \left(\frac{1}{2}\right)^5 \times \left(\frac{1}{2}\right)^{7-5}$$

$$= \frac{21}{128}$$

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Exercise

1. Ticket numbered 1 to 20 are mixed up and then a ticket is drawn at random. What is the probability that the ticket drawn bears a number which is a multiple of 3 or 7 ?

(A) $\frac{1}{15}$ (B) $\frac{1}{2}$

(C) $\frac{2}{5}$ (D) $\frac{7}{20}$

2. Ticket numbered 1 to 20 are mixed up and then a ticket is drawn at random. What is the probability that the ticket drawn bears a number which is a multiple of 3 ?

(A) $\frac{3}{20}$ (B) $\frac{3}{10}$

(C) $\frac{2}{5}$ (D) $\frac{1}{2}$

3. What is the probability that a number selected from the numbers 1, 2, 3, 4, 5 …… 16 is a prime number ?

(A) $\frac{1}{16}$ (B) $\frac{5}{8}$

(C) $\frac{3}{8}$ (D) $\frac{7}{16}$

4. An urn contains 9 red, 7 white and 4 black balls. A ball is drawn at random. What is the probability that the ball drawn is not red ?

(A) $\frac{1}{11}$ (B) $\frac{9}{20}$

(C) $\frac{2}{11}$ (D) $\frac{11}{20}$

5. In a lottery there are 20 prizes and 15 blanks. What is the probability of getting prize ?

(A) $\frac{1}{10}$ (B) $\frac{2}{5}$

(C) $\frac{4}{7}$ (D) $\frac{2}{7}$

6. The odds against the occurrence of an event are 5 : 4. The probability of its occurrence is—

(A) $\frac{4}{5}$ (B) $\frac{4}{9}$

(C) $\frac{1}{5}$ (D) $\frac{1}{4}$

7. The odds in favour of an event are 3 : 5. The probability of occurrence of the event is—

(A) $\frac{3}{5}$ (B) $\frac{3}{8}$

(C) $\frac{1}{3}$ (D) $\frac{1}{5}$

8. A bag contains 5 blue and 4 black balls. Three balls are drawn at random. What is the probability that 2 are blue and 1 is black ?

(A) $\frac{1}{3}$

(B) $\frac{2}{5}$

(C) $\frac{1}{6}$

(D) None of these

9. A bag contains 8 red and 5 white balls. 2 balls are drawn at random. What is the probability that both are white ?

(A) $\frac{5}{16}$ (B) $\frac{2}{13}$

(C) $\frac{3}{26}$ (D) $\frac{5}{39}$

10. A bag contains 6 black balls and 8 white balls. One ball is drawn at random. What is the probability that the ball drawn is white ?

(A) $\frac{4}{7}$ (B) $\frac{3}{4}$

(C) $\frac{4}{5}$ (D) $\frac{1}{8}$

11. A fair coin is tossed 100 times. The probability of getting head an odd number of times is—

(A) $\frac{1}{4}$ (B) $\frac{2}{3}$

(C) $\frac{1}{2}$ (D) $\frac{3}{4}$

12. Three unbiased coins are tossed. What is the probability of getting at most 2 heads ?

(A) $\frac{1}{4}$ (B) $\frac{3}{8}$

(C) $\frac{7}{8}$ (D) $\frac{1}{2}$

13. Three unbaised coins are tossed, what is the probability of getting exactly two heads ?

(A) $\frac{1}{3}$ (B) $\frac{3}{4}$

(C) $\frac{2}{3}$ (D) $\frac{3}{8}$

14. In a simultaneous throw of two coins, the probability of getting at least one head is—

(A) $\frac{1}{2}$ (B) $\frac{2}{3}$

(C) $\frac{3}{4}$ (D) $\frac{1}{3}$

15. In a throw of a coin, the probability of getting a head is—

(A) $\frac{1}{2}$

(B) $\frac{1}{4}$

(C) 1

(D) None of these

16. The probability that a teacher will give one surprise test during any class meeting in a week is $\frac{1}{5}$. If a student is absent twice. What is the probability that he will miss at least one test ?

(A) $\frac{4}{15}$ (B) $\frac{1}{15}$

(C) $\frac{91}{25}$ (D) $\frac{16}{125}$

17. Out of 15 students studying in a class 7 are from Maharastra, 5 are from Karnataka and 3 are from Goa. Four students are to be selected at random. What are the chances that at least one is from Karnataka ?

(A) $\frac{12}{13}$ (B) $\frac{11}{13}$

(C) $\frac{10}{15}$ (D) $\frac{1}{15}$

18. In a box carrying one dozen of oranges, one third have become bad. If 3 oranges are taken out from the box at random, what is the probability that at least one orange out of the three oranges picked up is good ?

(A) $\frac{1}{55}$ (B) $\frac{54}{55}$

(C) $\frac{45}{55}$ (D) $\frac{3}{55}$

19. A coin is successively tossed two times. Find the probability of getting :

(1) exactly one head

(2) at least one head

(A) $\frac{1}{2}, \frac{3}{4}$ (B) $\frac{2}{3}, \frac{1}{4}$

(C) $\frac{1}{4}, \frac{4}{5}$ (D) $\frac{1}{2}, \frac{2}{3}$

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20. In a simultaneous throw of two dice find the probability of getting a total of 8.

(A) $\frac{2}{9}$

(B) $\frac{5}{36}$

(C) $\frac{1}{6}$

(D) Data inadequate

21. What is the probability that a leap year selected randomly will have 53 Mondays ?

(A) $\frac{2}{7}$

(B) $\frac{5}{7}$

(C) $\frac{1}{7}$

(D) Data inadequate

22. What is the probability that an ordinary year has 53 Sundays ?

(A) $\frac{53}{365}$ (B) $\frac{1}{7}$

(C) $\frac{2}{7}$ (D) $\frac{48}{53}$

23. One card is drawn at random from a pack of 52 cards. What is the probability that the card drawn is a face card ?

(A) $\frac{4}{13}$ (B) $\frac{1}{4}$

(C) $\frac{9}{52}$ (D) $\frac{1}{13}$

24. One card is drawn at random from a pack of 52 cards. What is the probability that the card drawn is either a red card or a king ?

(A) $\frac{6}{13}$ (B) $\frac{1}{2}$

(C) $\frac{7}{13}$ (D) $\frac{27}{52}$

25. Two cards are drawn at random from a pack of 52 cards. What is the probability that the drawn cards are both aces ?

(A) $\frac{1}{221}$

(B) $\frac{2}{13}$

(C) $\frac{2}{26}$

(D) None of these

26. What is the probability of getting a king or a queen in a single drawn from a pack of 52 cards ?

(A) $\frac{1}{26}$

(B) $\frac{1}{13}$

(C) $\frac{2}{13}$

(D) None of these

27. A card is drawn from a pack of 52 cards. A card is drawn at random. What is the probability that it is neither a heart nor a king ?

(A) $\frac{4}{13}$ (B) $\frac{9}{13}$

(C) $\frac{2}{13}$ (D) $\frac{4}{13}$

28. A card is drawn at random from a pack of 52 cards. What is the probability that the card drawn is a spade or a king ?

(A) $\frac{4}{13}$ (B) $\frac{3}{13}$

(C) $\frac{2}{13}$ (D) $\frac{1}{13}$

29. A basket contains 3 blue. 5 black and 3 red balls. If two balls are drawn at random what is the probability that none of them is blue ?

(A) $\frac{21}{55}$ (B) $\frac{3}{55}$

(C) $\frac{28}{55}$ (D) $\frac{9}{11}$

30. If 2 balls are drawn at random what is the probability that one is black and one is red ?

(A) $\frac{2}{11}$ (B) $\frac{8}{11}$

(C) $\frac{9}{11}$ (D) $\frac{3}{11}$

31. If 3 balls are drawn at random what is the probability that all are black ?

(A) $\frac{2}{23}$ (B) $\frac{1}{11}$

(C) $\frac{3}{11}$ (D) $\frac{8}{33}$

32. The probabilities that 9 students pass in Mathematics, Physics and Chemistry are m. p and c respectively, of these subjects, the students has a 75% chance of passing in atleast one subject 50% chance of passing in atleast two subject and 40% chance of passing in exactly two. Which of the following relation are true ?

(A) $p + m + c = \frac{19}{20}$

(B) $p + m + c = \frac{17}{20}$

(C) $pmc = \frac{1}{10}$

(D) $pmc = \frac{1}{4}$

33. If the integers m and n are chosen at random between 1 and 100, then the probability that a number of the form $7^m + 7^n$ is divisible by 5 equals ?

(A) $\frac{1}{4}$ (B) $\frac{1}{7}$

(C) $\frac{1}{8}$ (D) $\frac{1}{49}$

34. There are four machines and it is known that exactly two of them are faulty. They are tested. One by one in a random order till both the faulty machines are identified. Then the probability that only two tests are needed is—

(A) $\frac{1}{3}$ (B) $\frac{1}{6}$

(C) $\frac{1}{2}$ (D) $\frac{1}{4}$

35. If from each of the three boxes containing 3 white and 1 black, 2 white and 2 black and 1 white and 3 black balls, one ball is drawn at random, then the probability that 2 white and 1 black ball will be drawn is—

(A) $\frac{13}{32}$ (B) $\frac{1}{4}$

(C) $\frac{1}{32}$ (D) $\frac{3}{16}$

36. Seven white balls and three black balls are randomly placed in a row. The probability that no two black balls are placed adjacently equals.

(A) $\frac{1}{2}$ (B) $\frac{7}{15}$

(C) $\frac{2}{15}$ (D) $\frac{1}{3}$

37. A box contains 3 white and 2 red balls. If we draw one ball and

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without replacing the first ball. The probability of drawing red ball in the second draw is—

(A) $\frac{8}{25}$ (B) $\frac{2}{5}$

(C) $\frac{3}{5}$ (D) $\frac{21}{25}$

38. A rifleman is firing at a distant target and has only 10% chance of hitting it. The number of least rounds, he must fire in order to have more than 50% chance of hitting it atleast once is—

(A) 5 (B) 7

(C) 9 (D) 11

39. A six-faced dice is so biased that is twice as likely to show an even number as an odd number when throw. It is thrown twice. The probability that the sum of two numbers thrown is even is—

(A) $\frac{1}{12}$ (B) $\frac{1}{6}$

(C) $\frac{1}{3}$ (D) $\frac{5}{9}$

40. The chance of throwing a total of 3 or 5 or 11 with two dice is—

(A) $\frac{5}{36}$ (B) $\frac{1}{9}$

(C) $\frac{2}{9}$ (D) $\frac{19}{36}$

41. If the probability for A to fail in an examination is 0.2 and that for B is 0.3, then the probability that either A or B fails is—

(A) 0·38 (B) 0·44

(C) 0·50 (D) 0·94

42. The probability of occurrence of an event A is $\frac{5}{9}$. The probability of non-occurrence of the event B is $\frac{5}{11}$. The probability that atleast one of them will occur.

(A) $\frac{6}{11}$ (B) $\frac{5}{9}$

(C) $\frac{4}{9}$ (D) 0·8

43. The probability that a man lives after 10 years is $\frac{1}{4}$ and that his wife is alive after 10 years is $\frac{1}{3}$. The probability that neither of them is alive after 10 years is—

(A) $\frac{1}{2}$ (B) $\frac{1}{12}$

(C) $\frac{7}{12}$ (D) $\frac{3}{4}$

44. A fair coin is tossed 100 times. The probability of getting tails an odd number of times is—

(A) $\frac{1}{2}$

(B) $\frac{1}{8}$

(C) $\frac{3}{8}$

(D) None of these

45. The probability that a person will hit a target in shooting practice is 0.3. If he shoots 10 times. Then the probability of his shooting the target is—

(A) 1 (B) $1-(0{\cdot}7)^{10}$

(C) $(0{\cdot}7)^{10}$ (D) $(0{\cdot}3)^{10}$

46. A and B are two independent events. The probability that both A and B occurs is $\frac{1}{6}$ and the probability that neither of them occurs is $\frac{1}{3}$. Then the probability of the two events are respectively.

(A) $\frac{1}{2}$ and $\frac{1}{3}$ (B) $\frac{1}{5}$ and $\frac{1}{6}$

(C) $\frac{1}{2}$ and $\frac{1}{6}$ (D) $\frac{2}{3}$ and $\frac{1}{4}$

47. The probability that *a* marksman will hit a target is given as $\frac{1}{5}$. Then his probability of atleast one hit in 10 shots, is—

(A) $1-\left(\frac{4}{5}\right)^{10}$ (B) $\frac{1}{5^{10}}$

(C) $1-\frac{1}{5^{10}}$ (D) $\left(\frac{4}{5}\right)^{10}$

48. A natural number is selected at random from the set $x = \{x : 1 \le x \le 100\}$. The probability that the number satisfies the inequality $x^2 - 13x \le 30$ is—

(A) $\frac{5}{9}$ (B) $\frac{9}{50}$

(C) $\frac{3}{20}$ (D) $\frac{7}{9}$

49. The number of tosses that have to be made in order that there is 99% probability of getting at least one head is—

(A) 5 (B) 7

(C) 6 (D) 8

50. If an integer is selected at random from 1 to 100. The probability that it is relatively prime to 100 is—

(A) $\frac{2}{5}$ (B) $\frac{61}{100}$

(C) $\frac{17}{100}$ (D) $\frac{19}{100}$

51. *n* books are to be arranged on a self. These include *m* volumes of a science book ($m < n$). The probability that in any arrangement, the volumes of science books are in ascending order is—

(A) $\frac{1}{\lfloor n}$ (B) $\frac{1}{\lfloor n-m}$

(C) $\frac{1}{\lfloor m}$ (D) $\frac{\lfloor m}{\lfloor n}$

52. If P (A) = 0·3, P(B) = 0·4,
P (C) = 0·8
P (AB) = 0·08, P (AC) = 0·28
P (BC) = P, P (ABC) = 0·09
P (A + B + C) ≥ 0·75
then—

(A) $0{\cdot}23 \le P \le 0{\cdot}48$

(B) $0{\cdot}32 \le P \le 0{\cdot}72$

(C) $0{\cdot}25 \le P \le 0{\cdot}71$

(D) None of these

53. The probability that a man aged *x* years will die in a year is *p*. The probability that out of *n* men $M_1, M_2, M_3, \ldots\ldots M_n$ each aged *n* years. M_k will die and be the first to die is—

(A) $\frac{1}{n^2}$

(B) $1-(1-p)^n$

(C) $\frac{1}{n^2\,[1-(1-p)^n}$

(D) $\frac{1}{n}[1-(1-p)^n]$

54. If the probability of machine failing during a day is 0·95 the probability of its working for four consecutive days without failing is—

(A) 0·00000625

(B) 0·0625

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(C) 0·16548375
(D) 0·000625

55. Seven white balls and three black balls are randomly placed in a row. The probability that no two black balls are placed adjacently equals—
(A) 1/2 (B) $\frac{7}{15}$
(C) $\frac{2}{15}$ (D) $\frac{1}{3}$

56. The probability of occurrence of a multiple of 2 on a dice and multiple of 3 on the other dice. If both are thrown together is—
(A) $\frac{7}{26}$ (B) $\frac{1}{3}$
(C) $\frac{71}{36}$ (D) $\frac{1}{4}$

57. If P (B) $=\frac{3}{4}$, P (A $\cap$ B $\cap$ $\bar{C}$) $= \frac{1}{3}$ and P ($\bar{A}$ $\cap$ B $\cap$ $\bar{C}$) $= \frac{1}{3}$, then P (B $\cap$ C) is—
(A) 1/12 (B) 1/6
(C) 1/15 (D) 1/9

58. Two numbers are selected randomly from the set S = {1, 2, 3, 4, 5, 6} without replacement one by one. The probability that minimum of the number is less than 4 is—
(A) 1/15 (B) 14/15
(C) 1/5 (D) 4/5

59. Four whole number taken at random are multiplied together. The chance that the last digit in the product is 1, 3, 7 or 9 is—
(A) $\frac{16}{625}$ (B) $\frac{1}{210}$
(C) $\frac{8}{125}$ (D) $\frac{4}{25}$

60. If n integers taken at random are multiplied together then the probability that the last digit of the product is 2, 4, 6, 8 is—
(A) $\frac{2^n}{5^n}$ (B) $\frac{4^n - 2^n}{5^n}$
(C) $\frac{4^n}{5^n}$ (D) $\frac{8^n - 4^n}{5^n}$

61. Two dice and two coins are tossed. The probability that both the coins show heads and the sum of the numbers found on the two dice is a prime number is—
(A) $\frac{5}{72}$ (B) $\frac{1}{12}$
(C) $\frac{13}{144}$ (D) $\frac{5}{48}$

62. When two dice are thrown, the probability that the difference of the number on the dice is 2 or 3 is—
(A) $\frac{7}{18}$ (B) $\frac{3}{11}$
(C) $\frac{5}{18}$ (D) $\frac{1}{2}$

63. From a set of 17 cards numbered 1, 2, 3…… 17 one is drawn at random. The probability that the number is divisible by 3 or 7 is—
(A) 2/17 (B) 1/7
(C) 7/17 (D) 10/17

64. The probability of getting heads in both trials when a balanced coin is tossed twice will be—
(A) 1/4 (B) 1/2
(C) 1 (D) 3/4

65. A number is chosen at random among the first 120 natural numbers. The probability of the number chosen being a multiple of 5 or 15 is—
(A) 1/5
(B) 1/8
(C) 1/6
(D) None of these

66. A bag contains 7 white and 9 red balls. The probability of drawing a white ball is—
(A) $\frac{1}{16}$ (B) $\frac{1}{52}$
(C) $\frac{7}{52}$ (D) $\frac{7}{16}$

67. A card is drawn at random from a pack of 100 cards numbered 1 to 100. The probability drawing a number which is a square is—
(A) 1/5
(B) 2/5
(C) 1/10
(D) None of these

68. In suffling a pack of card 3 are accidentally dropped then the chance that missing card should be of different suit is—
(A) 169/425
(B) 261/425
(C) 104/425
(D) None of these

69. A card is drawn from a well shuffled pack of cards. The probability of getting a queen of club or king of heart is—
(A) 1/52
(B) 1/26
(C) 1/13
(D) None of these

70. The probability that a card drawn from a pack of 52 cards will be a diamond or king being to—
(A) 4/52 (B) 4/13
(C) 1/52 (D) 2/13

Answers with Hints

1. (C) Clearly, n (S) = 20 and E = {3, 6, 9, 12, 15, 18, 7, 14} *i.e.,* n (E) = 8.

$\therefore$ P (E) $= \frac{n(E)}{n(S)} = \frac{8}{20} = \frac{2}{5}$

2. (B) S = {1, 2, 3, …… 20}
and E = {3, 6, 9, 12, 15, 18}

$\therefore$ P (E) $= \frac{n(E)}{n(S)} = \frac{6}{20} = \frac{3}{10}$

3. (C) S = {1, 2, 3, ……, 16}
and E = {2, 3, 5, 7, 11, 13}

$\therefore$ P (E) $= \frac{n(E)}{n(S)} = \frac{6}{16} = \frac{3}{8}$

4. (D) P (red) $= \frac{9}{9+7+4} = \frac{9}{20}$

$\therefore$ P (not-red) $= \left(1 - \frac{9}{20}\right) = \frac{11}{20}$

5. (C) P (getting a prize) $= \frac{20}{(20+15)} = \frac{20}{35} = \frac{4}{7}$

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6. (B) Number of cases favourable to E = 4
Total number of cases = (5 + 4) = 9
$\therefore \quad P(E) = \frac{4}{9}$

7. (B) Number of cases favourable to E = 3
Total number of cases = (3 + 5) = 8
$\therefore \quad P(E) = \frac{3}{8}$

8. (C) Let S be the sample space and E be the event of drawing 3 balls out of which 2 are blue and 1 is black. Then, $n(S)$ = Number of ways of drawing 3 balls out of 9 = ${}^9C_3 = \frac{9 \times 8 \times 7}{3 \times 2 \times 1} = 84$ and $n(E)$ = Number of ways of drawing 2 balls out of 5 and 1 ball out of 4.

$$= {}^5C_2 + {}^4C_1 = \left(\frac{5 \times 4}{2 \times 1} + 4\right) = 14$$

$\therefore \quad P(E) = \frac{n(E)}{n(S)} = \frac{14}{84} = \frac{1}{6}$

9. (D) $n(S)$ = Number of ways of drawing 2 balls out of 13

$$= {}^{13}C_2 = \frac{13 \times 12}{2} = 78$$

$n(E)$ = No. of ways of drawing 2 balls out of 5

$$= {}^5C_2 = \frac{5 \times 4}{2} = 10$$

$\therefore \quad P(E) = \frac{n(E)}{n(S)} = \frac{10}{78} = \frac{5}{39}$

10. (A) Total no. of balls = (6 + 8) = 14
No. of white balls = 8
$\therefore \quad P(\text{drawing a white ball}) = \frac{8}{14} = \frac{4}{7}$

11. (C) $n(S) = 2^{100}$

$n(E)$ = No. of favourable ways

$$= {}^{100}C_1 + {}^{100}C_3 + \ldots\ldots + {}^{100}C_{99}$$

$$= 2^{100-1} = 2^{99}$$

$$[\because {}^nC_1 + {}^nC_3 + {}^nC_5 + \ldots\ldots = 2^{n-1}]$$

$\therefore \quad P(E) = \frac{n(E)}{n(S)} = \frac{2^{99}}{2^{100}} = \frac{1}{2}$

Note : The given case can be generalised as **"If a unbiased coin is tossed 'n' times, then the chance that the head will present itself an odd number of times is $\frac{1}{2}$."**

12. (C) $\because \quad n(S) = (2)^3 = 8$
E = Event of getting 0, or 1 or 2 heads
= {TTT, TTH, THT, HTT, HHT, HTH, THH}
$\Rightarrow \quad n(E) = 7$
$\therefore \quad P(E) = \frac{n(E)}{n(S)} = \frac{7}{8}$

13. (D) S = {HHH, HHT, HTH, THH, TTH, THT, HTT, TTT} and
E = Event of getting exactly two heads
= [HHT, HTH, THH}
$\therefore \quad P(E) = \frac{n(E)}{n(S)} = \frac{3}{8}$

14. (C) S = {HH, HT, TT, TH}
and E = {HH, HT, TH}
$\therefore \quad P(E) = \frac{n(E)}{n(S)} = \frac{3}{4}$

15. (A) Here S = {H, T}
and E = {H}
$\therefore \quad P(E) = \frac{n(E)}{n(S)} = \frac{1}{2}$

16. (B) The probability of absenting of the student in the class = $\frac{2}{6} = \frac{1}{3}$

$\therefore$ The probability of missing his test = $\frac{1}{5} \times \frac{1}{3} = \frac{1}{15}$

17. (B) Total possible ways of selecting 4 students out of 15 students

$$= {}^{15}C_4 = \frac{15 \times 14 \times 13 \times 12}{1 \times 2 \times 3 \times 4} = 1365$$

The no. of ways of selecting 4 students in which no student belongs to karnataka = ${}^{10}C_4$.

$\therefore$ Number of ways of selecting atleast one student from karnataka = ${}^{15}C_4 - {}^{10}C_4 = 1155$.

$\therefore$ Required probability

$$= \frac{1155}{1365} = \frac{77}{91} = \frac{11}{13}$$

18. (B) $n(S) = {}^{12}C_3 = \frac{12 \times 11 \times 10}{3 \times 2}$

$$= 2 \times 11 \times 10 = 220$$

No. of selection of 3 oranges out of the total 12 oranges

$$= {}^{12}C_3 = 2 \times 11 \times 10 = 220$$

No. of selection of 3 bad oranges out of the total 4 bad oranges

$$= {}^4C_3 = 4$$

$\therefore \quad n(E)$ = No. of desired selection of oranges
= 220 – 4 = 216
$\therefore \quad P(E) = \frac{n(E)}{n(S)} = \frac{216}{220} = \frac{54}{55}$

19. (A) In tossing a coin 2 times the sample space is 4 *i.e.* (H, H), (H, T), (T, H), (T, T)

(1) If A_1 denotes exactly one head
then A_1 = {(H, T) (T, H)}
So, $P(A_1) = \frac{2}{4} = \frac{1}{2}$

(2) If A denotes at least one head
then A = {(H, T) (T, H) (H, H)}
$\therefore \quad P(A) = \frac{3}{4}$

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20. (B) In a simultaneous throw of two dice

Sample Space = $6 \times 6 = 36$

Favourable cases are = (2, 6) (3, 5) (4, 4) (5, 3) (6, 2)

So, The required probability = $\frac{5}{36}$

21. (A) A leap year has 366 days = 52 weeks + 2 days. These 2 days can be (Sunday, Monday), (Monday, Tuesday), (Tuesday, Wednesday) …… or (Saturday, Sunday). Out of these total 7 out comes there are 2 cases favourable to the desired event *i.e.* (Sunday, Monday) and (Monday, Tuesday)

$\therefore$ Required probability = $\frac{2}{7}$

22. (B) An ordinary year has 365 days *i.e.* 52 weeks and 1 day. So the probability that this day is a Sunday is $\frac{1}{7}$.

23. (A) Clearly n (S) = 52 and there are 16 face cards.

$\therefore$ $P(E) = \frac{16}{52} = \frac{4}{13}$

24. (C) Clearly n (S) = 52. There are 26 red cards (including 2 kings) and there are 2 more kings.

Let (E) be the event of getting either a red card or a king.

Then, $n(E) = 28$

$\therefore$ $P(E) = \frac{n(E)}{n(S)} = \frac{28}{52} = \frac{7}{13}$

25. (A) n (S) = Number of ways of drawing 2 cards out of 52

$= {}^{52}C_2 = \frac{52 \times 51}{2 \times 1} = 1326$

n (E) = Number of ways of drawing 2 cards out of 4

$= {}^{4}C_2 = \frac{4 \times 3}{2} = 6$

$\therefore$ $P(E) = \frac{6}{1326} = \frac{1}{221}$

26. (C) Clearly, n (S) = 52, there are 4 kings and 4 queens

$\therefore$ $P(E) = \frac{n(E)}{n(S)} = \frac{8}{52} = \frac{2}{13}$

27. (B) There are 13 hearts and 3 more kings

$\therefore$ P (heart or a king) = $\frac{(13+3)}{52} = \frac{4}{13}$

$\therefore$ P (neither a heart nor a king) = $1 - \frac{4}{13} = \frac{9}{13}$

28. (A) Let E and F be the event of getting a spade and that of getting a king respectively.

Then E $\cap$ F is the event of getting a king or spade

$\therefore$ $n(E) = 13$

$n(F) = 4$

and $n(E \cap F) = 1$

So, $P(E) = \frac{13}{52} = \frac{1}{4}$

$P(F) = \frac{4}{52} = \frac{1}{13}$

and $P(E \cap F) = \frac{1}{52}$

$\therefore$ P (a spade or a king) = $P(E \cup F)$

$= P(E) + P(E) - P(E \cap F)$

$= \left(\frac{1}{4} + \frac{1}{13} - \frac{1}{52}\right) = \frac{4}{13}$

29. (C) Total number of ways,

${}^{11}C_2 = \frac{\lfloor 11}{\lfloor 9 \ \lfloor 2}$

$= \frac{11 \times 10}{2} = 55$

When none is blue then either 2 should be black or 2 should be red or 1 black and 1 red.

$\therefore$ No. of favourable ways

$= {}^{5}C_2 + {}^{3}C_2 + {}^{5}C_1 \times {}^{3}C_1$

$= 10 + 3 + 15 = 28$

Hence reqd. probability = $\frac{28}{55}$

30. (D) Total number of ways

$= {}^{11}C_2 = 55$

and favourable ways = ${}^{5}C_1 \times {}^{3}C_1$

$= 5 \times 3 = 15$

$\therefore$ Reqd. probability = $\frac{15}{55} = \frac{3}{11}$

31. (A) Total number of ways

$= {}^{11}C_3 = \frac{\lfloor 11}{\lfloor 8 \ \lfloor 3} = 165$

No. of favourable ways = ${}^{5}C_3 = \frac{\lfloor 5}{\lfloor 3 \ \lfloor 2}$

$= \frac{5 \times 4}{2} = 10$

$\therefore$ Reqd. probability = $\frac{10}{165} = \frac{2}{23}$

32. (C) P (M) = m, P (p) = p, P (c) = c

$\because$ The probability of at least one success

$= P(M \cup P \cup C)$

$= m + p + c - mp - mc - pc + mcp = \frac{3}{4}$ …(1)

The probability of at least two successes

$= mc\bar{p} + m\bar{c}p + \bar{m}cp + mcp$

$= mc(1-p) + mp(1-c) + (1-m)cp + mcp$

$= mc + mp + cp - 2mcp = \frac{1}{2}$ …(2)

The probability of exactly two success

$= mc\bar{p} + m\bar{c}p + \bar{m}cp$

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$= mc\,(1-p) + mp\,(1-c) + cp\,(1-m)$

$= mc + mp + cp - 3\,mcp = \frac{2}{5}$ …(3)

(2) & (3) gives,

$\Rightarrow \quad mcp = \frac{1}{2} - \frac{2}{5} = \frac{1}{10}$

$\therefore \quad mc + mp + cp = \frac{2}{10} + \frac{1}{2} = \frac{1}{5} + \frac{1}{2} = \frac{7}{10}$

From (1),

$m + p + c - \frac{7}{10} + \frac{1}{10} = \frac{3}{4}$

$\Rightarrow \quad m + p + c = \frac{3}{4} + \frac{7}{10} - \frac{1}{10} = \frac{27}{20}$

Thus, $pmc = \frac{1}{10}$ is a true relation.

33. (C) Number of possible cases = 100 × 100 for $7^m + 7^n$ to be divisible by 5, one of the term has to end with 9 and other with 1 (7^m cannot be divided by 9)

$\Rightarrow$ m can be 2, 6, 10, 14, …… 98 (25 values)

and n can be 4, 8, 12 …… 100 (25 values)

Since m and n can interchange

$\therefore$ Required probability

$$= \frac{2 \times 25 \times 25}{100 \times 100} = \frac{1}{8}$$

34. (B)

35. (A) You can have W, W, B (I II III) or W, B, W (I II III) or B, W, W (I II III)

Reqd. probability

$$= \frac{3}{4} \cdot \frac{2}{4} \cdot \frac{3}{4} + \frac{3}{4} \cdot \frac{2}{4} \cdot \frac{1}{4} + \frac{1}{4} \cdot \frac{2}{4} \cdot \frac{1}{4}$$

$$= \frac{9}{32} + \frac{3}{32} + \frac{1}{32} = \frac{13}{32}$$

36. (B) W.W.W.W.W.W.W

First we place seven white balls at places marked W. If we place three black balls at dot places. Then no two black balls will be placed adjacently.

Total no. of dot places = 8

$\therefore$ No. of favourable ways for black balls

$= {}^8C_3$

$= \frac{8 \times 7 \times 6}{1 \times 2 \times 3} = 56$

Total no. of equally likely cases $= \frac{10!}{7!\,3!}$

$= \frac{10 \times 9 \times 8}{1 \times 2 \times 3} = 15 \times 8 = 120$

$\therefore$ Reqd. probability $= \frac{56}{120} = \frac{7}{15}$

37. (B) Total balls in the box = 5

Second red ball can be drawn in two ways

Case I : First ball is white and second ball is red.

Its probability $= \frac{3}{5} \cdot \frac{2}{4} = \frac{6}{20} = \frac{3}{10}$

Case II : First ball is red and second ball is red

Its probability $= \frac{2}{5} \cdot \frac{1}{4} = \frac{2}{20} = \frac{1}{10}$

Hence, reqd. probability

$$= \frac{3}{10} + \frac{1}{10} = \frac{4}{10} = \frac{2}{5}$$

38. (B)

39. (D) Let Probability for odd $= p$

$\therefore$ Probability for even $= 2p$

$\because \quad p + 2p = 1$

$\Rightarrow \quad 3p = 1$

$\Rightarrow \quad p = \frac{1}{3}$

$\therefore$ Probability for odd = $\frac{1}{3}$, Probability for even = $\frac{2}{3}$.

Sum of two nos. is even means either both are odd or both are even

$\therefore$ Reqd. probability $= \frac{1}{3} \times \frac{1}{3} + \frac{2}{3} \times \frac{2}{3}$

[$\because$ die is thrown twice]

$$= \frac{1}{9} + \frac{4}{9} = \frac{5}{9}$$

40. (C) $\because$ Probability for 3 = (1, 2), (2, 1) $= \frac{2}{36}$

$\Rightarrow$ Probability for 5 = (1, 4), (2, 3), (3, 2), (4, 1) $= \frac{4}{36}$

$\Rightarrow$ Probability for 11 (5, 6), (6, 5) $= \frac{2}{36}$

$\therefore$ Reqd. probability $= \frac{2}{36} + \frac{4}{36} + \frac{2}{36}$

$$= \frac{8}{36} = \frac{2}{9}$$

41. (B) $\because \quad P(\bar{A}) = 0{\cdot}2$

$\therefore \quad P(A) = 1 - 0{\cdot}2 = 0{\cdot}8$

and $P(\bar{B}) = 0{\cdot}3$

$\therefore \quad P(B) = 1 - 0{\cdot}3 = 0{\cdot}7$

Required probability

$= P(\bar{A} \cup \bar{B}) = P(\overline{A \cap B})$

$= 1 - P(A \cap B) = 1 - P(A)\,P(B)$

$= 1 - (0{\cdot}8)\,(0{\cdot}7) = 1 - 0{\cdot}56 = 0{\cdot}44$

42. (D) $\because \quad P(A) = \frac{5}{9}$

$\therefore \quad P(\bar{A}) = 1 - \frac{5}{9} = \frac{4}{9}$

$\because \quad P(\bar{B}) = \frac{5}{11}$

$\therefore \quad P(B) = 1 - \frac{5}{11} = \frac{6}{11}$

Probability that none of them will occur

$= P(\bar{A} \cap \bar{B}) = P(\bar{A}).\,P(\bar{B})$

$= \frac{4}{9} \times \frac{5}{11} = \frac{20}{99}$

Hence,

Reqd. probability $= 1 - \frac{20}{99} = \frac{79}{99}$

$= 0{\cdot}798 \simeq 0{\cdot}8$

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43. (A) $\because$ $P(M) = \frac{1}{4}; P(W) = \frac{1}{3}$

$\Rightarrow$ $P(\bar{M}) = 1 - \frac{1}{4} = \frac{3}{4}$

$\Rightarrow$ $P(\bar{W}) = 1 - \frac{1}{3} = \frac{2}{3}$

Reqd. probability $= P(\bar{M})\, P(\bar{W}) = \frac{3}{4}\cdot\frac{2}{3} = \frac{1}{2}$

44. (A) The total number of cases is 2^{100}. The number of favourable cases are ${}^{100}C_1 + {}^{100}C_3 + \ldots\ldots + {}^{100}C_{99}$

$= 2^{100-1} = 2^{99}$

$\therefore$ Reqd. probability $= \frac{2^{99}}{2^{100}} = \frac{1}{2}$

45. (D) $\because$ Probability in each trial (shooting)

$= 0{\cdot}3$

$\therefore$ Reqd. probability $= (0{\cdot}3)^{10}$

46. (A)

47. (A) $\because$ $p = \frac{1}{5}$

$\therefore$ $q = 1 - \frac{1}{5} = \frac{4}{5}$

The probability that none will hit in 10 shots

$= (4/5)^{10}$

$\therefore$ Reqd. probability $= 1 - \left(\frac{4}{5}\right)^{10}$

48. (C) $\because$ $x^2 - 13x - 30 \le 0$

$\Rightarrow$ $(x+2)(x-15) \le 0$

$\Rightarrow$ $-2 \le x \le 15$

But x is a natural number.

$\therefore$ $1 \le x \le 15$

$\therefore$ Reqd. Probability $P = \frac{15}{100} = \frac{3}{20}$

49. (B) Corresponding to n tosses, the Probability of getting no head $= \left(\frac{1}{2}\right)^n$ and, therefore, the Probability of getting at least one head

$= 1 - \left(\frac{1}{2}\right)^n$

Now, $1 - \left(\frac{1}{2}\right)^n \ge \frac{99}{100}$

$\Rightarrow$ $\left(\frac{1}{2}\right)^n \le \frac{1}{100} \Rightarrow n \ge 7$

$\left[\left(\frac{1}{2}\right)^7 = 7{\cdot}8 \times 10^{-3}\right]$

50. (A) From the set of odd numbers < 100, if we exclude multiples of 5. We get the set of numbers < 100 and relatively prime to 100. The number of such numbers $= 50 - 10 = 40$

$\therefore$ Reqd. Probability $= p = \frac{40}{100} = \frac{2}{5}$

51. (C) Corresponding to each arrangement of $(n-m)$ other books, there is a unique arrangement of the m volumes of the science book in ascending order and $\lfloor m$ arrangement of the m volumes in random order

$\therefore$ Reqd. Prob. $= p = \frac{1}{\lfloor m}$.

52. (A) $\because$ $P(A+B+C)$

$= P(A) + P(B) + P(C) - P(AB) - P(BC) - P(AC) + P(ABC)$

$\Rightarrow$ $0{\cdot}75 = 0{\cdot}3 + 0{\cdot}4 + 0{\cdot}8 - 0{\cdot}08 - P - 0{\cdot}28 + 0{\cdot}09$

$= 1{\cdot}23 - P$

$\Rightarrow$ $P \le 1{\cdot}23 - 0{\cdot}75$

$[\because P(A+B+C) \ge 0{\cdot}75]$

$\Rightarrow$ $P \le 0{\cdot}48$ …(1)

Again $P(A+B+C) \le 1$

$\Rightarrow$ $P = 1{\cdot}23 - P(A+B+C)$

$\therefore$ $P \ge 1{\cdot}23 - 1 \ge 0{\cdot}23$

Thus, $0{\cdot}23 \le P \le 0{\cdot}48$.

53. (D) $\because$ Probability that no man out of n men aged x years will die in a year $= (1-p)^n$.

$\therefore$ Probability that out of n men at least one will die in a year $= 1 - (1-p)^n$.

When at least one man dies, any one out of the n men may be the first to die

$\therefore$ Reqd. Probability that a particular man M_k will die and be the first to die

$= \frac{1}{n}[1 - (1-p)^n]$

54. (A) $\because$ Probability of machine failing during a day,

i.e. $p = 0{\cdot}95$

$\therefore$ q = probability of its working during a day

$= 1 - p = 1 - 0{\cdot}95 = 0{\cdot}05$

Required probability

$= q^4 = (0{\cdot}05)^4$

$= 0{\cdot}00000625$

55. (B) $n(S) = {}^{10}C_7 = {}^{10}C_3$

$n(E) = {}^{8}C_3$

$\therefore$ $P(E) = \frac{n(E)}{n(S)} = \frac{7}{15}$

56. (B) Probability of multiple of $2 = \frac{3}{6} = \frac{1}{2}$

Probability of multiple of $3 = \frac{2}{6} = \frac{1}{3}$

Since there are two dice.

$\therefore$ The required probability

$= 2 \times \frac{1}{2} \times \frac{1}{3} = \frac{1}{3}$

57. (A) $\because$ $B \cap \bar{C} = (A \cap B \cap \bar{C}) \cup (\bar{A} \cap B \cap \bar{C})$ …(1)

and $(A \cap B \cap \bar{C}) \cap (\bar{A} \cap B \cap \bar{C}) = \phi$

$\Rightarrow$ $P(B \cap \bar{C}) = P(A \cap B \cap \bar{C}) + P(\bar{A} \cap B \cap \bar{C})$

$= \frac{1}{3} + \frac{1}{3} = \frac{2}{3}$

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Also, $B = (B \cap C) \cup (B \cap \bar{C})$ …(2)

and $(B \cap C) \cap (B \cap \bar{C}) = \phi$

$\Rightarrow P(B)\frac{3}{4} = P(B \cap C) + P(B \cap \bar{C})$

$\Rightarrow = P(B \cap C) + \frac{2}{3}$

$\therefore P(B \cap C) = \frac{3}{4} - \frac{2}{3} = \frac{1}{12}$

58. (D) Total no. of cases $= {}^6P_2 = 6 \times 5 = 30$

Non-favourable cases are

(4, 5), (5, 4), (4, 6), (6, 4), (5, 6), (6, 5)

$\therefore$ Probability that event will not happen

$= \frac{6}{6 \times 5} = \frac{1}{5}$

$\therefore$ Reqd. probability $= 1 - \frac{1}{5} = \frac{4}{5}$

59. (A) If the product of the four numbers ends in one of the digits 1, 3, 7 or 9, each number should have the last digit as one of these 4 digits.

$\therefore$ The number of favourable cases $= 4^4$

Total number of all possible cases $= 10^4$

Hence, the required probability

$= \frac{4^4}{10^4} = \frac{2^4}{5^4} = \frac{16}{625}$

60. (B) If the last digit in the product is to 2, 4, 6, 8 the last digit in all the n numbers should not be 0 and 5 and the last digit of all numbers should not be selected exclusively from the set of number {1, 3, 7, 9}

$\therefore$ Favourable number of cases

$= 8^n - 4^n$

But generally the last digit can be any one of 0, 1, 2, 3, …… 9.

Hence, the total number of ways $= 10^n$

Hence, the required probability

$= \frac{8^n - 4^n}{10^n} = \frac{4^n - 2^n}{5^n}$

61. (D) The probability that head is shown in one coin is $\frac{1}{2}$. The probability that the sum of the numbers on the dice is a prime = the proability that the following pair of numbers on the dice is a prime = the probability that following pair of number are getting on the dice, namely (1, 1), (1, 2), (2, 1), (1, 4), (4, 1), (2, 3), (3, 2), (1, 6), (6, 1), (2, 5), (5, 2), (3, 4), (4, 3), (6, 5), (5, 6) $= \frac{15}{36}$.

$\therefore$ The required probability $= \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{15}{36} = \frac{5}{48}$.

62. (A) The favourable cases are (1, 3), (2, 4), (3, 5), (4, 6) and (1, 4), (2, 5), (3, 6) and their reversed cases like (3, 1), (4, 2), (5, 3) …….

Total number of favourable cases

$= 2 \times 7$

$\therefore$ Required Probability

$P(E) = \frac{14}{36} = \frac{7}{18}$

63. (C) Total number of cases is 17.

$\because$ Number divisible by 3 are 3, 6, 9, 12, 15

(These are 5 in number)

Number divisible by 7 are 7, 14.

(These are 2 in number)

There are two favourable number of cases

Total no. of favourable number

$= 5 + 2 = 7$

Required probability = 7/17.

64. (A) Probability of getting head in one trial $= \frac{1}{2}$

$\therefore$ Reqd. Probability of getting heads in both the trials $= \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

65. (A) $\because$ Total no. of favourable cases *i.e.*, (5, 10, 15, 20, 25, 30, ……, 105, 110, 115, 120) = 24.

$\therefore$ Reqd. Prob. $= \frac{24}{120} = \frac{1}{5}$

66. (D) No. of white balls $= 7$

Red balls $= 9$

Total no. of balls $= 7 + 9 = 16$

Probability of drawing a white ball $= \frac{7}{16}$

67. (C) Total ways = 100

Squares of following no's lie between 1 and 100, 1^2, 2^2, 3^2, 4^2, 5^2, 6^2, 7^2, 8^2, 9^2, 10^2

(which are 10 in numbers.)

So, Required probability $= \frac{10}{100} = \frac{1}{10}$

68. (A) Total ways ${}^{52}C_3 = 22100$

There are 4 suits in a pack of cards so three suit can be selected in ${}^4C_3$ ways and one card each from different unit can be selected as $= {}^{13}C_1 \times {}^{13}C_1 \times {}^{13}C_1$ ways

So, favourable ways $= {}^4C_3 \times {}^{13}C_1 \times {}^{13}C_1 \times {}^{13}C_1$

$= 8788$

$\therefore$ Required Probability $= \frac{8788}{22100} = \frac{169}{425}$

69. (B) Total ways = 52

There is one queen of club and one king of heart favourable ways = 1 + 1 = 2.

$\therefore$ Required probability $= \frac{2}{52} = \frac{1}{26}$

70. (B) Total ways = 52

There are 13 cards of diamond, 4 cards of king, but one card is king of diamond which is counted both in diamond and king cards

$\Rightarrow$ Favourable ways $= 13 + 4 - 1 = 16$

$\therefore$ Required probability $= \frac{16}{52} = \frac{4}{13}$

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Partnership

Important Points/Facts

When two or more than two persons run a business jointly. They are called partners and the deal is known as partnership. It is of two kinds : (i) Simple and (ii) Compound.

1. Simple Partnership : If the capitals of the partners are invested for the same period the partnership is called simple.

Rule I. When investment of all the partners are for the same time, the profit or loss is divided among them in the ratio of their investments.

2. Compound Partnership : If the capitals of the partners are invested for different lengths of time, the partnership is called compound.

Rule II. When investments are for different times then equivalent capitals are calculated for a unit of time by multiplying the capital with the number of units of time. The profit or loss is now divided in the ratio of these capitals.

For example : If A and B invested their capitals for different length of time, then

$$\frac{\text{Capital of A} \times \text{A's time of investment}}{\text{Capital of B} \times \text{B's time of investment}} = \frac{\text{Profit of A}}{\text{Profit of B}}$$

Note I : A partner who manages the business is called a **working partner** and the one who simply invests the money is called a **sleeping partner.**

II. In every examination the questions are generally set on compound partnership. But such questions are first converted into simple partnership and then solved.

Examples

Q. 1. A and B started a business in partnership with Rs. 50,000 and Rs. 60,000 respectively. A is also a working partner and gets 10% of the total profit for looking after the business. How much is the share of B less than the share of A in the profit of Rs. 55,000 ?

Solution : Ratio of two Capital of A and B

$= 50{,}000 : 60{,}000$

$= 5 : 6$

$\because$ A gets 10% of the total profit for looking after the business.

$\therefore$ Income received by A for looking after the business

$=$ 10% Rs. 55,000

$=$ Rs. 5500

Rest of the profit

$= 55{,}000 - 5500$

$=$ Rs. 49500

Now, from this amounts of profit. A and B will get their shares of profit in the ratio of their invested capitals.

Profit received by

$$A = 49{,}500 \times \frac{5}{11}$$

$=$ Rs. 22,500

$\therefore$ Total share of

$A = 22500 + 5500$

$=$ Rs. 28,000

Again share of

$$B = 49500 \times \frac{6}{11}$$

$= 27000$

$\therefore$ Hence share of B is Rs. 1,000 = [28,000 – 27,000] less than the share of A.

Short Method :

$\because$ Since A gets 10% of the total profit for looking after the business therefore, B will get the share of profit from 90% of the total profit.

$\therefore$ Share of profit B gets

$$= 55000 \times \frac{6}{11} \times \frac{90}{100}$$

$=$ Rs. 27,000

$\therefore$ Share of income A gets

$= 55{,}000 - 27{,}000$

$=$ Rs. 28,000

$\therefore$ Required difference

$=$ Rs. (28,000 – 27,000)

$= 1000$ **Ans.**

Q. 2. The partners A, B, C start a business. Twice the investment of A is equal to thrice the capital of B and the capital of B is four times the capital of C. Find the share of each out of a profit of Rs. 2,97,000.

Solution : Let C's capital = Rs. x then B's capital = Rs. $4x$

Now, 2 (A's capital) = 3 (B's capital) = $3 \times 4x$

$$\therefore \text{ A's capital} = \left(\frac{3 \times 4x}{2}\right) = 6x$$

So, ratio of share of A, B and C = $6x : 4x : x = 6 : 4 : 1$.

$$\therefore \text{ A's share} = \text{Rs.} \left(297000 \times \frac{6}{11}\right)$$

$=$ Rs. 1,62,000

$$\text{B's share} = \text{Rs.} \left(297000 \times \frac{4}{11}\right)$$

$=$ Rs. 108000

and C's share

$$= \text{Rs.} \left(297000 \times \frac{1}{11}\right)$$

$=$ Rs. 27000.

Q. 3. A, B, C hire a meadow for Rs. 2934·60. A puts in 10 oxen for 20 days. B 30 oxen for 8 days C 16 oxen for 9 days. Find the rent paid by each.

Solution :

Ratio of rent to be paid by A, B and C

$= (10 \times 20 : 30 \times 8 : 16 \times 9)$

$= 25 : 30 : 18$

$\therefore$ Rent to be paid by

$$A = \text{Rs.} \left(2934{\cdot}60 \times \frac{25}{73}\right)$$

$=$ Rs. 1005

Rent to be paid by

$$B = \text{Rs.} \left(2934{\cdot}60 \times \frac{30}{73}\right)$$

$=$ Rs. 1206

Rent to be paid by

$C =$ Rs. [2934·60 – (1005 + 1206)

$=$ Rs. 723·60

Q. 4. A began a business with Rs. 2100 and is joined afterwards by B with Rs. 3600. After how many months did B join, if the

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profits at the end of the year are divided equally ?

Solution : Suppose B joines after x months. Then B's money remained invested for $(12 - x)$ months.

$\because \quad 2100 \times 12 = 3600 \times (12 - x)$

$\Rightarrow \quad 3600\,x = 43200 - 25200$

$\therefore \qquad x = \dfrac{18000}{3600} = 5$

So, B, joined after 5 months.

Q. 5. Dilip and Manohar started a business by investing Rs. 1,00,000 and Rs. 1,50,000 respectively. Find the share of each out of a profit of Rs. 24,000.

Solution : Ratio of shares of Dilip and Manohar

$= 100000 : 150000 = 2 : 3$

$\therefore$ Dilip's share

$= \text{Rs.} \left(24000 \times \dfrac{2}{5}\right) = \text{Rs. } 9600$

Manohar's share

$= \text{Rs.} \left(24000 \times \dfrac{3}{5}\right) = \text{Rs. } 14400$

Q. 6. Sanjay and Raju started a business and invested Rs. 20,000 and Rs. 25,000 respectively. After 4 months, Raju left and Naresh joined by investing Rs. 15,000. At the end of the year there was a profit of Rs. 4,600. What is the share of Naresh ?

Solution : Ratio of shares of Sanjay, Raju and Naresh

$= 20{,}000 \times 12 : 25{,}000 \times 4 : 15000 \times 8$

$= 12 : 5 : 6$

$\therefore$ Share of Naresh

$= \text{Rs.} \left(4600 \times \dfrac{6}{23}\right) = \text{Rs. } 1200$

Exercise

1. In a partnership A invests (1/6) of the capital for (1/6) of the time, B invests (1/3) of the capital for (1/3) of the time and C, the rest of the capital for the whole time. Out of a profit of Rs. 4,600 B's share is—
   (A) Rs. 800 (B) Rs. 1000
   (C) Rs. 650 (D) Rs. 960
2. A, B, C enter into a partnership and their capitals are in the proportion of $\frac{1}{3} : \frac{1}{4} : \frac{1}{5}$. A withdraws half his capital at the end of 4 months. Out of a total annual profit of Rs. 847 A's share is—
   (A) Rs. 252 (B) Rs. 280
   (C) Rs. 315 (D) Rs. 412
3. A and B start a business with initial investments in the ratio 12 : 11 and their annual profits were in the ratio 4 : 1. If A invested the money for 11 months. B invested the money for—
   (A) 3 months (B) $3\frac{2}{3}$ months
   (C) 4 months (D) 6 months
4. A and B started a joint firm. A's investment was thrice the investment of B and the period of his investment was two times the period of investment of B. If B got Rs. 4,000 as profit then their total profit is—
   (A) Rs. 24,000
   (B) Rs. 16,000
   (C) Rs. 28,000
   (D) Rs. 20,000
5. A, B and C enter into partnership by making investments in the ratio 3 : 5 : 7. After a year, C invests another Rs. 3,37,600 while A withdrew Rs. 45,600. The ratio of investments then changes to 24 : 59 : 167. How much did A invest initially ?
   (A) Rs. 45,600
   (B) Rs. 96,000
   (C) Rs. 1,41,600
   (D) None of these
6. A and B enter into partnership. A invests Rs. 16,000 for 8 months and B remains in the business for 4 months. Out of a total profit, B claims $\frac{2}{7}$ of the profit. B contributed—
   (A) Rs. 11,900
   (B) Rs. 10,500
   (C) Rs. 13,600
   (D) Rs. 12,800
7. A, B and C enter into partnership. A invests some money at the beginning. B invests double the amount after 6 months and C invests thrice the amount after 8 months. If the annual profit be Rs. 18,000, C's share is—
   (A) Rs. 7500 (B) Rs. 7200
   (C) Rs. 6000 (D) Rs. 5750
8. A, B and C invest Rs. 2,000, Rs. 3,000 and Rs. 4,000 in a business. After one year A removed his money but B and C continued for one more year. If the net profit after 2 years be Rs. 3,200 then A's share in the profit is—
   (A) Rs. 1000 (B) Rs. 600
   (C) Rs. 800 (D Rs. 400
9. A and B enter into partnership investing Rs. 12,000 and Rs. 16,000 respectively. After 8 months C joins them with a capital of Rs. 15,000. The share of C in a profit of Rs. 45600 after 2 years will be—
   (A) Rs. 21200
   (B) Rs. 19200
   (C) Rs. 14400
   (D) Rs. 12000
10. Dilip, Ram and Amar started a shop by investing Rs. 27,000, Rs. 81,000 and Rs. 72,000 respectively. At the end of one year the profit was distributed. If Ram's share of profit be Rs. 36,000, then the total profit was—
    (A) Rs. 108000
    (B) Rs. 16000
    (C) Rs. 80000
    (D) None of these
11. Manoj got Rs 6000 as his share out of a total profit of Rs. 9,000 which he and Ramesh earned at the end of one year. If Manoj invested Rs. 20,000 for 6 months. Whereas Ramesh invested his amount for the whole year, what was the amount invested by Ramesh ?
    (A) Rs. 30000
    (B) Rs. 40000
    (C) Rs. 10000
    (D) Rs. 5000
12. Rs. 700 is divided among A, B and C so that A receives half as much as B and B half as much as C. Then C's share is—
    (A) Rs. 200 (B) Rs. 300
    (C) Rs. 400 (D) Rs. 600

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13. A and B entered into a partnership investing Rs. 16000 and Rs. 12000 respectively. After 3 months. A withdrew Rs. 5000 while B invested Rs. 5000 more. After 3 more months. C joins the business with a capital of Rs. 21000. The share of B exceeds that of C, out of a total profit of Rs. 26400 after one year, by—
(A) Rs. 1200 (B) Rs. 2400
(C) Rs. 3600 (D) Rs. 4800

14. Jayant started a business, investing Rs. 6000. Six months later Madhu joined him, investing Rs. 4000. If they made a profit of Rs. 5200 at the end of the year. How much must be the share of Madhu ?
(A) Rs. 2080 (B) Rs. 1300
(C) Rs. 1800 (D) Rs. 2600

15. A, B and C subscribe Rs. 47,000 for a business. A subscribes Rs. 7000 more than B and B Rs. 5,000 more than C. Out of a total profit of Rs. 9,400, B receives—
(A) Rs. 4400 (B) Rs. 3000
(C) Rs. 2000 (D) Rs. 1737.90

16. Karim invests Rs. 30000 for one year in a shop. How much his partner Raunaq should invest in order that the profit after one year must be in the ratio 2 : 3 ?
(A) Rs. 20000
(B) Rs. 40000
(C) Rs. 45000
(D) Rs. 18000

17. Kanti started a business investing Rs. 9000. Five months later Sudhakar joined him by investing Rs. 8000. If they make a profit of Rs. 6970 at the end of year. Sudhakar's share of profit is—
(A) Rs. 3690 (B) Rs. 1883.78
(C) Rs. 2380 (D) Rs. 3864

18. A, B and C are three partners in a business. If twice the investment of A is equal to thrice the capital of B and the capital of B is four times the capital of C. Out of a total profit of Rs. 5,940 the share of C is—
(A) Rs. 700 (B) Rs. 900
(C) Rs. 740 (D) Rs. 540

19. If 6 (A's capital) = 8 (B's capital) = 10 (C's capital) then the ratio of their capitals is—
(A) 3 : 4 : 5
(B) 12 : 15 : 20
(C) 20 : 15 : 12
(D) 6 : 8 : 10

20. A's capital is equal to twice B's capital and B's capital is three times C's capital. The ratio of the capital is—
(A) 2 : 1 : 3 (B) 1 : 2 : 6
(C) 6 : 3 : 1 (D) 1 : 3 : 6

21. Three partners A, B and C invest Rs. 26000, Rs. 34000 and Rs. 10000 respectively in a business. Out of a profit of Rs. 3500. B's share is—
(A) Rs. 1300 (B) Rs. 1700
(C) Rs. 500 (D) Rs. 1500

22. A and B invest in a business in the ratio 3 : 2 if 5% of the total profit goes to charity and A's share is Rs. 855, total profit is—
(A) Rs. 1576 (B) Rs. 1537.50
(C) Rs. 1500 (D) Rs. 1425

23. A, B and C contract a work for Rs. 550. Together A and B are to do $\frac{7}{11}$ of the work. The share of C should be—
(A) Rs. $183\frac{1}{3}$ (B) Rs. 200
(C) Rs. 300 (D) Rs. 400

24. A, B and C enter into a partnership with shares in the ratio $\frac{7}{2}:\frac{4}{3}:\frac{6}{5}$. After 4 months, A increases his share by 50%. If the total profit at the end of one year be Rs. 21600, then B's share in the profit is—
(A) Rs. 2100 (B) Rs. 2400
(C) Rs. 3600 (D) Rs. 4000

25. A is a working and B is a sleeping partner in a business. A puts in Rs. 12,000 and B Rs. 20,000. A receives 10% of the profits for managing, the rest being divided in proportion to their capitals. Out of a total profit of Rs. 9600 the money received by A is—
(A) Rs. 3240 (B) Rs. 4200
(C) Rs. 3600 (D) Rs. 4500

26. Four milkmen rented a pasture. A grazed 18 cows for 4 months, B, 25 cows for 2 months. C, 28 cows for 5 months and D, 21 cows for 3 months. If A's share of rent is Rs. 360, the total rent of the field is—
(A) Rs. 1500 (B) Rs. 1600
(C) Rs. 1625 (D) Rs. 1650

27. Jagmohan, Rooplal and Pandeyji rented a video cassette for one week at a rent of Rs. 350. If they use it for 6 hours. 10 hours and 12 hours respectively. The rent to be paid by Pandeyji is—
(A) Rs. 75 (B) Rs. 125
(C) Rs. 135 (D) Rs. 150

28. A, B and C start a business. A invests 3 times as much as B invests and B invests two-third of what C invests. Then, the ratio of capitals of A, B and C is—
(A) 3 : 9 : 2 (B) 6 : 10 : 15
(C) 5 : 3 : 2 (D) 6 : 2 : 3

29. A sum of money is to be divided among A, B and C in the ratio 2 : 3 : 7. If the total share of A and B together is Rs. 1500 less than C. What is A's share in it ?
(A) Rs. 1000
(B) Rs. 1500
(C) Rs. 2000
(D) Data inadequate

30. A and B invest Rs. 3000 and Rs. 4000 in a business. A receives Rs. 10 per months out of the profit as a remuneration for running the business and the rest of profit is divided in proportion to the investments. In a year A totally receive Rs. 390. What does B receive ?
(A) Rs. 630 (B) Rs. 360
(C) Rs. 480 (D) Rs. 380

31. Three Hikers A, B and C start on a trip with Rs. 50 each and agree to share the expenses equally. If at the end of the trip. A has Rs. 20 left with him. B Rs. 30 and C Rs. 40 how must they settle their accounts ?
(A) C must pay Rs. 10 to A
(B) A must pay Rs. 10 to B
(C) A must pay Rs. 10 to C
(D) Can't be settled

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32. A, B and C enter into partnership by making investments in the ratio 3 : 5 : 7. After a year C invests another Rs. 337600 while A withdraws Rs. 45600. The ratio of investments then changes to 14 : 29 : 167. How much did A invest initially ?
(A) Rs. 233364·71
(B) Rs. 9600
(C) Rs. 141600
(D) 233374·72

33. A, B and C contract a work for Rs. 1100. Together A and B are to do $\frac{7}{11}$ of the work. The share of C should be—
(A) Rs. 400 (B) Rs. 300
(C) Rs. 200 (D) Rs. $183\frac{1}{3}$

34. A, B and C can do a work in 20, 25 and 30 days respectively. They undertook to finish the work together for Rs. 2220, then the share of A exceeds that of B by—
(A) Rs. 120 (B) Rs. 180
(C) Rs. 300 (D) Rs. 600

35. What is the difference in the share of profit between P and Q in a joint business at the end of the year ?
(1) P invested Rs. 80000 and withdrew Rs. 20000 after 6 months.
(2) Q joined four months after the business was started.
(3) Q's amount was 80 per cent of P's amount during the last 6 months.
(A) Only 1 and 2
(B) Only 2 and 3
(C) All 1, 2 and 3 together are required
(D) Even with all 1, 2 and 3 the answer cannot be arrived at

36. Pramod started a business with Rs. 40000. After 4 months Vikas also joined him with Rs. 60000. If at the end of the year, the profit is Rs. 16000, what is the share of Vikas in the profit ?
(A) Rs. 8000
(B) Rs. 4000
(C) Rs. 12000
(D) Rs. 10000

37. Alok started a business with Rs. 75000. After 3 months Chandan also joined him with Rs. 60000. If at the end of the year, the profit is Rs. 16000. What is the share of Chandan in the profit ?
(A) Rs. 6000 (B) Rs. 10000
(C) Rs. 8000 (D) Rs. 4500

38. Gopal started a business with Rs. 3000. After 6 months Dinesh also joined him with Rs. 2000. If at the end of the year the profit is Rs. 2600. What is the share of Dinesh in the profit ?
(A) Rs. 1733 (B) Rs. 1950
(C) Rs. 866 (D) Rs. 650

39. A started a business by investing Rs. 8000. 3 months later B joined him with Rs. 5000. If at the end of a year total profit earned was Rs. 2350. How much is the share of A more than the share of B ?
(A) Rs. 600 (B) Rs. 800
(C) Rs. 400 (D) Rs. 850

40. Rakesh started a business by investing Rs. 70000. 8 months later Vinod also joined him with Rs. 180000. Total profit, in what ratio should be divided between them ?
(A) 8 : 7
(B) 6 : 5
(C) 7 : 5
(D) None of these

41. Subodh started a business, investing Rs. 45000. After 4 months. Nepal joined him investing Rs. 30000. If the total profit earned by them at the end of the year was Rs. 13,000 what would be the difference between the shares of Subodh and Nepal ?
(A) Rs. 7000
(B) Rs. 3000
(C) Rs. 9000
(D) None of these

42. Four persons decided to start a restaurant by sharing equal amount of the total investment. After some calculations they found that if they get two more equal investors, each of the four will have to pay Rs. 12000 less. What was the total investment ?
(A) Rs. 24000
(B) Rs. 72000
(C) Rs. 144000
(D) Rs. 288000

43. Sanjay and Komal started a business with Rs. 15000 each. After 8 months Komal withdrew Rs. 10000. If at the end of a year there was a profit of Rs. 32000. What was the share of Sanjay in the profit ?
(A) Rs. 18000
(B) Rs. 18500
(C) Rs. 16500
(D) Rs. 16000

Answers with Hints

1. (A) Suppose A invests Rs. $\frac{x}{6}$ for $\frac{y}{6}$ months. B invests Rs. $\frac{x}{3}$ for $\frac{y}{3}$ months and C invests Rs. $\left[x-\left(\frac{x}{6}+\frac{x}{3}\right)\right]$ for y months.

Ratio of their investments $= \left(\frac{x}{6}\times\frac{y}{6}\right) : \left(\frac{x}{3}\times\frac{y}{3}\right) : \left(\frac{x}{2}\times y\right)$

$= \frac{1}{36} : \frac{1}{9} : \frac{1}{2} = 1 : 4 : 18$

$\therefore$ B's share = Rs. $\left(4600\times\frac{4}{23}\right)$ = Rs. 800

2. (B) Ratio of capitals in the beginning $= \frac{1}{3} : \frac{1}{4} : \frac{1}{5}$

$= 20 : 15 : 12.$

Ratio of investments for the whole year

$= (20\times 4 + 10\times 8) : (15\times 12) : (12\times 12)$

$= 40 : 45 : 36$

$\therefore$ A's share = Rs. $\left(847\times\frac{40}{121}\right)$ = Rs. 280

3. (A) Suppose B invested the money for x months.
Then the ratio of investments = $(12\times 11 : 11x)$

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$= 12 : x$

$\therefore \quad \frac{12}{x} = \frac{4}{1} \Rightarrow x = 3$ months.

4. (C) Suppose B invested Rs. x for y months.
Then A's investment is Rs. $3x$ for $2y$ months.
Ratio of investments of A and B = $6xy : xy = 6 : 1$.
Now B's share = Rs. 4,000
$\therefore$ A's share = Rs. 24,000
Hence, Total profit = Rs. 28,000

5. (C) Let initial investments be $3x$, $5x$ and $7x$ rupees.
$\because (3x - 45600) : 5x : (7x + 337600) = 24 : 59 : 167$
$\Rightarrow \quad \frac{3x - 45600}{5x} = \frac{24}{59}$
$\therefore \quad x = 47200$
$\therefore$ Initial investment of A = Rs. (47200×3)
= Rs. 141600

6. (D) Ratio of profits of A and B = $\frac{5}{7} : \frac{2}{7} = 5 : 2$
$\because \quad \frac{16000 \times 8}{x \times 4} = \frac{5}{2}$
$\Rightarrow \quad 20x = 256000$
$\therefore \quad x = 12800$
So, B contributed Rs. 12800.

7. (C) Suppose A invested Rs. x.
Then A : B : C = $12x : 6 \times (2x) : 4 \times (3x)$
= 1 : 1 : 1
$\therefore$ C's share = Rs. $\left(18000 \times \frac{1}{3}\right)$
= Rs. 6000

8. (D) A : B : C = $2000 \times 12 : 3000 \times 24 : 4000 \times 24$
= 1 : 3 : 4
A's share = Rs. $\left(3200 \times \frac{1}{8}\right)$ = Rs. 400

9. (D) Ratio of shares = $12000 \times 24 : 16000 \times 24 : 15000 \times 16 = 6 : 8 : 5$
$\therefore$ C's share = Rs. $\left(45600 \times \frac{5}{19}\right)$
= Rs. 12000

10. (C) Ratio of shares = 27000 : 81000 : 72000
= 3 : 9 : 8
If Ram's share is Rs. 9 then total profit
= Rs. 20
If Ram's share is Rs. 36000 then total profit
= Rs. $\left(\frac{20}{9} \times 36000\right)$
= Rs. 80000

11. (D) Let the amount invested by Ramesh = Rs. x
Then $20000 \times 6 : 12x = 6000 : 3000$
$\Rightarrow \quad \frac{120000}{12x} = \frac{2}{1}$
$\therefore \quad x = 5000$

12. (C) Let C's share = Rs. x
Then B's share = Rs. $\frac{x}{2}$
and A's share = Rs. $\frac{x}{4}$
$\therefore \quad A : B : C = \frac{x}{4} : \frac{x}{2} : x = 1 : 2 : 4$
Hence C's share = Rs. $\left(700 \times \frac{4}{7}\right)$ = Rs. 400

13. (C) A : B : C = Rs. $(16000 \times 3 + 11000 \times 9) : (12000 \times 3 + 17000 \times 9) : (21000 \times 6)$
= 147 : 189 : 126
= 7 : 9 : 6
$\therefore$ (B's share) – (C's share) = Rs. $\left[\left(26400 \times \frac{9}{22}\right) - \left(26400 \times \frac{6}{22}\right)\right]$
= Rs. (10800 – 7200) = Rs. 3600

14. (B) Ratio of their shares = $6000 \times 12 : 4000 \times 6 = 3 : 1$
$\therefore$ Madhu's share = Rs. $\left(5200 \times \frac{1}{4}\right)$
= Rs. 1300

15. (B) Suppose C invests Rs. x
Then B's investment = Rs. $(x + 5000)$
and A's investment = Rs. $(x + 12000)$
$\because x + x + 5000 + x + 12000$
= 47000
$\Rightarrow \quad x = 10000$
Thus A : B : C = 22000 : 15000 : 10000
= 22 : 15 : 10
$\therefore$ B's share = Rs. $\left(9400 \times \frac{15}{47}\right)$
= Rs. 3000

16. (C) $\because \quad \frac{30000}{x} = \frac{2}{3}$
$\Rightarrow \quad 2x = 90000$
$\therefore \quad x = 45000$

17. (C) $\because$ Ratio of shares = $9000 \times 12 : 8000 \times 7$
= 108 : 56 = 27 : 14
$\therefore$ Sudhakar's share = Rs. $\left(6970 \times \frac{14}{41}\right)$
= Rs. 2380

18. (D) Let C's capital = Rs. x. Then B's capital = Rs. $4x$
$\because \quad 2$ (A's capital) = 3 (B's capital) = $12x$
$\Rightarrow \quad$ A's capital = $6x$
$\Rightarrow \quad A : B : C = 6x : 4x : x$
$= 6 : 4 : 1$
$\therefore \quad$ C's share = Rs. $\left(5940 \times \frac{1}{11}\right)$
= Rs. 540

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19. (C) Let 6 (A's capital) = 8 (B's capital)
= 10 (C's capital) = x

Then A's capital = $\frac{x}{6}$ B's capital = $\frac{x}{8}$

and C's capital = $\frac{x}{10}$

$\therefore$ Ratio of capitals of A, B and C = $\frac{x}{6} : \frac{x}{8} : \frac{x}{10}$
= 20 : 15 : 12.

20. (C) Let C's capital = Rs. x
Then B's capital = Rs. $3x$ and A's capital = Rs. $6x$.
$\therefore$ Ratio of capitals of A, B and C = $6x : 3x : x$
= 6 : 3 : 1

21. (B) Ratio of shares of A, B, C = 26000 : 34000 : 10000 = 13 : 17 : 5

$\therefore$ B's share = Rs. $\left(3500 \times \frac{17}{35}\right)$
= Rs. 1700

22. (C) Let the total profit be Rs. 100.
After paying to charity,

A's share = Rs. $\left(95 \times \frac{3}{5}\right)$ = Rs. 57

If A's share is Rs. 57, then total profit = Rs. 100
If A's share is Rs. 855, then total profit
= Rs. $\left(855 \times \frac{100}{51}\right)$
= Rs. 1500

23. (B) C's share = Rs. $\left(550 \times \frac{4}{11}\right)$ = Rs. 200

24. (D) Given Ratio = $\frac{7}{2} : \frac{4}{3} : \frac{6}{5}$ = 105 : 40 : 36
Let them initially invest Rs. 105, Rs. 40 and Rs. 36 respectively.
Ratio of investments
= [105 × 4 + (150% of 105) × 8] : (40 × 12) : (36 × 12)
= 1680 : 480 : 432 = 35 : 10 : 9

$\therefore$ B's share = Rs. $\left(21600 \times \frac{10}{54}\right)$
= Rs. 4000

25. (B) For management A receives
= Rs. 960
Balance = Rs. (9600 – 960)
= Rs. 86400
Ratio of their investments = 12000 : 20000 = 3 : 5

$\therefore$ A's share = Rs. $\left(8640 \times \frac{3}{8}\right)$
= Rs. 3240
So A receives = Rs. (3240 + 960)
= Rs. 4200

26. (C) Ratio of rent = (18 × 4 : 25 × 2 : 28 × 5 : 21 × 3)
= 72 : 50 : 140 : 63
Let the total rent = Rs. x
Then A's share = Rs. $\left(x \times \frac{72}{325}\right)$ = Rs. $\left(\frac{72x}{325}\right)$

$\because$ $\frac{72x}{325}$ = 360

$\therefore$ x = $\left(\frac{325 \times 360}{72}\right)$ = Rs. 1625

27. (D) Ratio of rent = 6 : 10 : 12 = 3 : 5 : 6

$\therefore$ Pandeyji has to pay = Rs. $\left(350 \times \frac{6}{14}\right)$
= Rs. 150

28. (D) Suppose C invests Rs. x then, B invests Rs. $\left(\frac{2x}{3}\right)$ and A invests Rs. $(2x)$.

$\therefore$ Ratio of investments of A, B, C = $2x : \frac{2x}{3} : x$
= 6 : 2 : 3

29. (B) $\because$ $7x - (2x + 3x)$ = Rs. 1500

$\Rightarrow$ x = Rs. 750

$\therefore$ Share of A = $2x$ = Rs. 1500

30. (B) Total Profit – Remuneration = Balance profit
This balance profit is divided in proportion to their investments

$\because$ $\frac{\text{Balance Profit of A}}{\text{Balance Profit of B}} = \frac{\text{Investment of A}}{\text{Investment of B}}$

$\Rightarrow \frac{390 - 10 \times 12}{\text{Balance of Profit of B}} = \frac{3000}{4000} = \frac{3}{4}$

(Since remuneration of A is Rs. 10 per month)

$\Rightarrow$ Balance profit of B = $4 \times \frac{270}{3}$ = Rs. 360

Since B does not get any remuneration, hence B receives Rs. 360 at the end of the year.

31. (A)

32. (A) Let the initial investments of A, B, C be Rs. $3x$, Rs. $5x$ and Rs. $7x$ respectively. Then
$(3x - 45600) : 5x : (7x + 337600) = 14 : 59 : 167$

$\Rightarrow$ $\frac{3x - 45600}{5x} = \frac{14}{29}$

$\Rightarrow$ x = 77788·24

$\therefore$ A invested initially Rs. (77788·24 × 3)
= Rs. 233364·71

33. (A)

34. (B) Ratio of shares = Ratio of 1 day's work
= $\frac{1}{20} : \frac{1}{25} : \frac{1}{30}$
= 15 : 12 : 10

$\therefore$ A's share = Rs. $\left(2220 \times \frac{15}{37}\right)$ = Rs. 900

B's share = Rs. $\left(2220 \times \frac{12}{37}\right)$ = Rs. 720

$\therefore$ A's share exceeds B's share = Rs. 180

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35. (D) The profit earned at the end of the year is not given, hence all the three statements together are also not sufficient to answer the question.

36. (A) Ratio between the investment of Pramod and Vikas

$= 40000 \times 12 : 60000 \times 8$

$= 480000 : 480000$

$= 1 : 1$

Total profit = Rs. 16000

Share of Vikas in profit $= \frac{1}{2} \times 16000$

= Rs. 8,000.

37. (A) Ratio between the investment of Alok and Chandan

$= 75000 \times 12 : 60000 \times 9$

$= 900000 : 540000$

$= 90 : 54 = 5 : 3$

Total profit = Rs. 16000

$\therefore$ Chandan's share $= \frac{3}{(5+3)} \times 16000$

= Rs. 6000

38. (D) Ratio between the investment of Gopal and Dinesh

$= 3000 \times 12 : 2000 \times 6$

$= 36000 : 12000$

$= 3 : 1$

Dinesh's share $= \frac{1}{(3+1)} \times 2600$

= Rs. 650

39. (D) Ratio between the investment of A and B

$= 8000 \times 12 : 5000 \times 9$

$= 96000 : 45000$

$= 32 : 15$

Total profit = Rs. 2350

$\because$ A's share $= \frac{32}{(32+15)} \times 2350$

= Rs. 1600

$\therefore$ B's share = 2350 – 1600

= Rs. 750

$\therefore$ Required difference

= 1600 – 750

= Rs. 850

40. (D) Ratio between the investment of Rakesh and Vinod

$= 70000 \times 12 : 180000 \times 4$

$= 840000 : 720000$

$= 7 : 6$

Hence profit sharing ratio = 7 : 6.

41. (D) Ratio between the investment of Subodh and Nepal

$= 45000 \times 12 : 30000 \times 8$

$= 540000 : 240000$

$= 9 : 4$

Total profit = Rs. 13000

$\therefore$ Subodh's share $= \frac{9}{(9+4)} \times 13000$

= Rs. 9000

$\therefore$ Nepal's share = 13000 – 9000

= Rs. 4000

$\therefore$ Required difference = 9000 – 4000

= Rs. 5000

42. (C) Let investment of each person be Rs. x

Total investment of 4 people = $4 \times x$ = Rs. $4x$

Investment of each person when two more people join them = Rs. $(x - 12000)$

$\therefore$ Total investment of 6 people = 6 $(x - 12000)$

$\because \quad 4x = 6(x - 12000)$

$\Rightarrow \quad 4x = 6x - 72000$

$\Rightarrow \quad 2x = 72000$

$\therefore \quad x = 36000$

Hence total investment = 4×36000

= Rs. 144000

43. (A) Sanjay's investment for 1 month

$= 15000 \times 12$

= Rs. 180000

Komal's investment for 1 month

$= 15000 \times 8 + (15000 - 10000) \times 4$

$= 120000 + 20000$

= Rs. 140000

$\therefore$ Ratio between the investment of Sanjay and Komal

$= 180000 : 140000$

$= 9 : 7$

$\therefore$ Sanjay's profit $= \frac{9}{(9+7)} \times 32000$

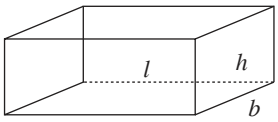
= Rs. 18000

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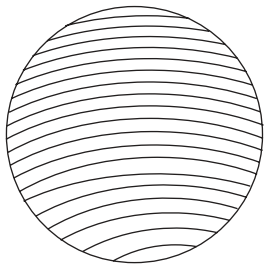
Volume and Surface Area

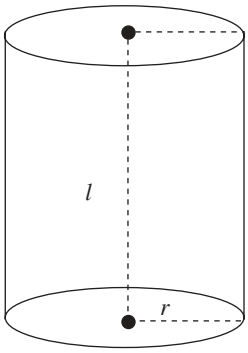
Formulae

1. **Cuboid**—Let, length = l, breadth = b and height = h units.
   (i) Volume of Cuboid
   = $(l \times b \times h)$ cubic units.
   (ii) Whole surface of cuboid
   = $2(lb + bh + lh)$ sq. units.
   (iii) Diagonal of cuboid
   = $\sqrt{l^2 + b^2 + h^2}$ units.
2. **Cube**—Let each edge (or side) of a cube be a units, then—
   (i) Volume of the cube
   = a^3 cubic units.
   (ii) Whole surface of the cube
   = $(6a^2)$ sq. units.
   (iii) Diagonal of the cube
   = $\left(a\sqrt{3}\right)$ units.
3. **Cylinder—**Let the radius of the base of a cylinder be r units and its height (or length) be h units, then—
   (i) Volume of the cylinder
   = $(\pi r^2 h)$ cu. units.
   (ii) Curved surface area of the cylinder
   = $(2\pi rh)$ sq. units.
   (iii) Total surface area of the cylinder
   = $(2\pi rh + 2\pi r^2)$ sq. units.
4. **Sphere**—Let the radius of a sphere be r units, then—
   (i) Volume of the sphere
   = $\left(\frac{4}{3}\pi r^3\right)$ cu. units.
   (ii) Surface area of the sphere
   = $(4\pi r^2)$ sq. units.
   (iii) Volume of a hemisphere
   = $\left(\frac{2}{3}\pi r^3\right)$ cu. units.
   (iv) Curved surface area of the hemisphere
   = $(2\pi r^2)$ sq. units.
   (v) Whole surface area of the hemisphere
   = $(2\pi r^2 + \pi r^2)$
   = $(3\pi r^2)$ sq. units.
5. **Cone**—Let r be the radius of the base, h the height and l the slant height of a cone, then—
   (i) Slant height $l = \sqrt{h^2 + r^2}$
   (ii) Volume of the cone
   = $\left(\frac{1}{3}\pi r^2 h\right)$ cu. units.
   (iii) Curved surface area of the cone
   = (πrl) sq. units
   = $\left(\pi r\sqrt{r^2 + h^2}\right)$ sq. units.
   (iv) Total surface area of the cone = $(\pi rl + \pi r^2)$ sq. units.

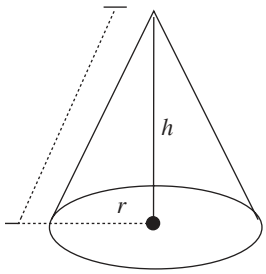


Cuboid

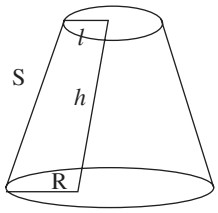

Sphere



Cylinder



Cone



Frustum of a Cone

Examples

Q. 1. The surface area of a cube is 384 cm^2. Find its volume.

Solution : $6a^2 = 384$
$\Rightarrow \quad a^2 = 64$
$\Rightarrow \quad a = 8$
$\therefore \quad$ Volume = $(8 \times 8 \times 8)$ cm^3
= 512 cm^3

Q. 2. The diagonal of a cube is $4\sqrt{3}$ m. Find its volume and surface area.

Solution : Let the edge of the cube be a metres
Then $\sqrt{3}a = 4\sqrt{3}$ or $a = 4$
$\therefore \quad$ Edge = 4 m
So, Volume = $(4 \times 4 \times 4)$m^3
= 64 m^3
Surface area = $6a^2$
= $(6 \times 4 \times 4)$m^2 = 96 m^2

Q. 3. Find the length of the longest pole that can be placed in a room 5 m long, 4 m broad and 3 m high.

Solution : Length of longest pole
= Length of diagonal
= $\sqrt{5^2 + 4^2 + 3^2}$m
= $\sqrt{50}$ m = $5\sqrt{2}$ m
= $(5 \times 1{\cdot}41)$ m = 7·05 m.

Q. 4. Find the volume, surface area and the length of diagonal of a cuboid 12 m long, 9 m broad and 8 m high.

Solution : Volume
= $(12 \times 9 \times 8)$ m^3 = 864 m^3
Surface area
=$2 \times (12 \times 9 + 9 \times 8 + 12 \times 8)$m^2
= 552 m^2
Diagonal = $\sqrt{(12)^2 + (9)^2 + (8)^2}$
= $\sqrt{289}$ m = 17 m.

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Q. 5. Three cubes of sides 6 cm, 8 cm and 1 cm are melted to form a new cube. Find the length of the edge of the new cube.

Solution : Volume of new cube

$= [(6)^3 + (8)^3 + (1)^3]\ cm^3$

$= 729\ cm^3$

$\therefore$ Edge of new cube

$= (9 \times 9 \times 9)^{1/3} = 9$ cm

Q. 6. The capacity of a cylindrical tank is 6160 m^3. If the radius of its base is 14 m, find the depth of the tank.

Solution :

$\because \frac{22}{7} \times 14 \times 14 \times h = 6160$

$\therefore \quad h = \left(6160 \times \frac{7}{22} \times \frac{1}{14 \times 14}\right)$

$= 10$ m

Exercise

1. A wooden box of dimensions 8 m × 7 m × 6 m is to carry rectangular boxes of dimensions 8 cm × 7 cm × 6 cm. The maximum number of boxes that can be carried in 1 wooden box is—
   (A) 1200000 (B) 1000000
   (C) 9800000 (D) 7500000
2. Given that 1 cubic cm of marble weighs 25 gms, the weighs of a marble black 28 cm in width and 5 cm thick is 112 kg. The length of the block is—
   (A) 36 cm (B) 37·5 cm
   (C) 32 cm (D) 26·5 cm
3. The sum of length, breadth and depth of a cuboid is 19 cm and its diagonal is $5\sqrt{5}$ cm. Its surface area is—
   (A) 361 cm^2 (B) 125 cm^2
   (C) 236 cm^2 (D) 486 cm^2
4. If the length breadth and the height of cuboid are in the ratio 6 : 5 : 4 and if the total surface area is 33300 cm^2, then the length, breadth and height in cm. are respectively—
   (A) 90, 85, 60 (B) 85, 75, 60
   (C) 90, 75, 70 (D) 90, 75, 60
5. If the length of diagonal of a cube is $8\sqrt{3}$ cm, then its surface area is—
   (A) 512 cm^2 (B) 384 cm^2
   (C) 192 cm^2 (D) 768 cm^2
6. The length of longest rod that can fit in a cubical vessel of side 10 cm, is—
   (A) 10 cm
   (B) $10\sqrt{2}$ cm
   (C) $10\sqrt{3}$ cm
   (D) None of these
7. The length of longest pole that can be placed on the floor of a room is 10 m and the length of the longest pole that can be placed in the room is $10\sqrt{2}$ m. The height of the room is—
   (A) 6 m (B) 7·5 m
   (C) 8 m (D) 10 m
8. The length of diagonal of a cube is $\left(14 \times \sqrt{3}\right)$ cm. The volume of the cube is—
   (A) $2744\sqrt{3}\ cm^3$
   (B) 2744 cm^3
   (C) 588 cm^3
   (D) 3528 cm^3
9. The maximum length of a pencil that can be kept in a rectangular box of dimensions 8 cm × 6 cm × 2 cm is—
   (A) $2\sqrt{13}$ cm
   (B) $2\sqrt{14}$ cm
   (C) $2\sqrt{26}$ cm
   (D) $10\sqrt{2}$ cm
10. The length of longest rod that can be placed in a room 20 m long, 16 m broad and 12 m high, is—
    (A) 20 m (B) 16·4 m
    (C) 48 m (D) 28·2 m
11. The length of the diagonal of a cuboid 30 cm long, 24 cm broad and 18 cm high, is—
    (A) 30 cm (B) $15\sqrt{2}$ cm
    (C) 60 cm (D) $30\sqrt{2}$ cm
12. The volume of a cube is 512 cm^3. Its surface area is—
    (A) 64 cm^2 (B) 256 cm^2
    (C) 384 cm^2 (D) 512 cm^2
13. The surface area of a cube is 726 m^2. Its volume is—
    (A) 1300 m^3 (B) 1331 m^3
    (C) 1452 m^3 (D) 1542 m^3
14. The surface area of a cuboid 22 cm by 12 cm by 7·5 cm is—
    (A) 1980 cm^2
    (B) 2076 cm^2
    (C) 1038 cm^2
    (D) None of these
15. The surface area of a cube of side 27 cm is—
    (A) 2916 cm^2 (B) 729 cm^2
    (C) 4374 cm^2 (D) 19683 cm^2
16. A tank 3 m long, 2 m wide and 1·5 m deep is dug in a field 22 m long and 14 m wide. If the earth dug out is evenly spread out over the field, the rise in level of the field will be—
    (A) 0·299 cm
    (B) 0·29 cm
    (C) 2·98 cm
    (D) 4·15 cm
17. Two cubes have volumes in the ratio 1 : 27. The ratio of their surface areas is—
    (A) 1 : 3 (B) 1 : 8
    (C) 1 : 9 (D) 1 : 18
18. If each edge of a cube is increased by 50%, the percentage increase in surface area is—
    (A) 50% (B) 75%
    (C) 100% (D) 125%
19. The difference in volumes of two cubes is 152 m^3 and the difference in their one face areas is 20 m^2. If the sum of their edges is 10 m, the product of their edges is—
    (A) 21 (B) 24
    (C) 36 (D) 48
20. If each side of a cube is doubled, then its volume—
    (A) Is doubled
    (B) Becomes 4 times
    (C) Becomes 6 times
    (D) Becomes 8 times
21. Three metal cubes of sides 5 cm, 4 cm and 3 cm are melted and recast into a new cube. The length of the edge of this cube, is—
    (A) 6 cm
    (B) 8 cm
    (C) 10 cm
    (D) None of these
22. If the volumes of two cubes are in the ratio 8 : 1, the ratio of their edges, is—
    (A) 8 : 1
    (B) $2\sqrt{2}$: 1
    (C) 2 : 1
    (D) None of these

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23. Half cubic metre of gold sheet is extended by hammering so as to cover an area of 1 hectare. The thickness of the sheet is—
(A) 0·5 cm (B) 0·05 cm
(C) 0·005 cm (D) 0·0005 cm

24. In a shower, 5 cm of rain falls. The volume of water that falls on 2 hectares of ground, is—
(A) 100 m^3 (B) 1000 m^3
(C) 10 m^3 (D) 10000 m^3

25. A river 2 m deep and 45 m wide is running at the rate of 3 km/hr. The amount of water that runs into the sea per minute is—
(A) 4500 m^3 (B) 27000 m^3
(C) 3000 m^3 (D) 2100 m^3

26. Bricks are worth Rs. 750 per 1000 and their length, breadth and height 25 cm, 12·5 cm and 7·5 cm respectively. The cost of bricks required to build a wall 200 m long, 1·8 m high and 37·5 cm thick is—
(A) Rs. 42,600
(B) Rs. 43,200
(C) Rs. 40,750
(D) Rs. 41,860

27. A metal sheet 27 cm long, 8 cm broad and 1 cm thick is melted into a cube. The difference between the surface areas of two solids is—
(A) 284 cm^2 (B) 286 cm^2
(C) 296 cm^2 (D) 300 cm^2

28. The area of the base of a rectangular tank is 6500 sq. cm and the volume of water contained in it is 2·6 cubic metres. The depth of water is—
(A) 3·5 m (B) 4 m
(C) 5 m (D) 8 m

29. The volume of a wall, 5 times as high as it is broad and 8 times as long as it is high, is 12·8 m^3. The breadth of the wall is—
(A) 30 cm (B) 40 cm
(C) 22·5 cm (D) 25 cm

30. The number of small cubes with edges of 10 cm that can be accommodated in a cubical box 1 metre edge is—
(A) 10 (B) 100
(C) 1000 (D) 10000

31. The volume of a sphere is 38808 cu. cm. The curved surface area of the sphere is—
(A) 5544 sq. cm
(B) 1386 sq. cm
(C) 8316 sq. cm
(D) 4158 sq. cm

32. The curved surface area of a sphere is 1386 sq. cm. Its volume, is—
(A) 2772 cm^3 (B) 4158 cm^3
(C) 4851 cm^3 (D) 5544 cm^3

33. A right cylindrical vessel is full with water. How many right cones having the same diameter and height as those of the right cylinder will be needed to store that water—
(A) 2 (B) 3
(C) 4 (D) 5

34. A right cylinder and a right circular cone have the same radius and the same volume. The ratio of the height of the cylinder to that of the cone is—
(A) 3 : 5 (B) 2 : 5
(C) 3 : 1 (D) 1 : 3

35. A cylindrical vessel of radius 4 cm contains water. A solid sphere of radius 3 cm is lowered into the water until it is completely immersed. The water level in the vessel will rise by—
(A) 4·5 cm (B) 2·25 cm
(C) $\frac{4}{9}$ cm (D) $\frac{2}{9}$ cm

36. The radius of a circular cylinder is the same as that of a sphere. Their volumes are equal. The height of the cylinder is—
(A) $\frac{4}{3}$ times its radius
(B) $\frac{2}{3}$ times its radius
(C) Equal to its radius
(D) Equal to its diameter

37. If 1 cubic cm of cast iron weighs 21 gm, then the weight of a cast iron pipe of length 1 m with a bore of 3 cm and in which the thickness of the metal is 1 cm, is—
(A) 21 kg (B) 24·2 kg
(C) 26·4 kg (D) 18·6 kg

38. A hollow garden roller 63 cm wide with a girth of 440 cm is made of iron 4 cm thick. The volume of iron used is—
(A) 56372 cubic m
(B) 107712 cubic cm
(C) 54982 cubic cm
(D) 57636 cubic cm

39. The number of solid spheres, each of diameter 6 cm that could be moulded to form a solid metal cylinder of height 45 cm and diameter 4 cm, is—
(A) 3 (B) 4
(C) 5 (D) 6

40. The length of the wire of 0·2 mm radius that can be drawn after melting a solid copper sphere of diameter 18 cm, is—
(A) 24·3 m (B) 243 m
(C) 2430 m (D) 24300 m

41. The radius of a wire is decreased to one-third. If volume remains the same, length will increase—
(A) 1 time (B) 3 times
(C) 6 times (D) 9 times

42. The height of cylinder is 14 cm and its curved surface area is 264 sq. cm. The volume of the cylinder is—
(A) 308 cm^3 (B) 396 cm^3
(C) 1448 cm^3 (D) 1232 cm^3

43. The length of cylinder is 80 cm and the diameter of its base is 7 cm. The whole surface of the cylinder is—
(A) 1837 cm^2 (B) 1760 cm^2
(C) 3080 cm^2 (D) 1942 cm^2

44. The area of the card board needed to make a box of size 25 cm × 15 cm × 8 cm will be—
(A) 390 cm^2 (B) 1000 cm^2
(C) 1390 cm^2 (D) 2780 cm^2

45. The dimensions of an open box are 52 cm, 40 cm and 29 cm. Its thickness is 2 cm. If 1 cm^3 of metal used in the box weight 0·5 gm, the weight of the box is—
(A) 8·56 kg (B) 7·76 kg
(C) 7·576 kg (D) 6·832 kg

46. If the volumes of two cones are in the ratio 1 : 4 and their diameters are in the ratio 4 : 5, then the ratio of their heights is—
(A) 1 : 5 (B) 5 : 4
(C) 5 : 16 (D) 25 : 64

47. If a right circular cone of vertical height 24 cm has a volume of 1232 cm^3, then the area of its curved surface is—
(A) 1254 cm^2 (B) 704 cm^2
(C) 550 cm^2 (D) 154 cm^2

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48. A radius of the base of a right circular cone is 6 cm and its slant height is 28 cm. The curved surface area of the cone is—
(A) 268 sq. cm
(B) 528 sq. cm
(C) 462 sq. cm
(D) 658 sq. cm

49. A cylindrical piece of metal of radius 2 cm and height 6 cm is shaped into a cone of same radius. The height of the cone is—
(A) 18 cm (B) 14 cm
(C) 12 cm (D) 8 cm

50. A cylindrical vessel 60 cm in diameter is partially filled with water. A sphere 60 cm in diameter is gently dropped into the vessel. To what further height will water rise in the cylinder ?
(A) 15 cm (B) 30 cm
(C) 40 cm (D) 25 cm

51. The radius of two cylinders are in the ratio of 2 : 3 and their heights are in the ratio 5 : 3. The ratio of their volumes is—
(A) 27 : 20 (B) 20 : 27
(C) 4 : 9 (D) 9 : 4

52. The ratio of total surface area to lateral surface area of a cylinder whose radius is 80 cm and height 20 cm, is—
(A) 2 : 1 (B) 3 : 1
(C) 4 : 1 (D) 5 : 1

53. If the volume and surface area of a sphere are numerically the same then its radius is—
(A) 1 unit (B) 2 units
(C) 3 units (D) 4 units

54. A spherical ball of lead, 3 cm in diameter is melted and recast into three spherical balls. The diameter of two of these are 1·5 cm and 2 cm respectively. The diameter of the third ball is—
(A) 2·66 cm (B) 2·5 cm
(C) 3 cm (D) 3·5 cm

55. How many bullets can be made out of a cube of lead whose edge measures 22 cm, each bullet being 2 cm in diameter ?
(A) 5324 (B) 2662
(C) 1347 (D) 2541

56. A spherical lead ball of radius 10 cm is melted and small lead balls of radius 5 mm are made. The total number of possible small lead balls—
(A) 800 (B) 125
(C) 400 (D) 8000

57. Two circular cylinders of equal volume have their heights in the ratio 1 : 2. Ratio of their radii is—
(A) $1 : \sqrt{2}$ (B) $\sqrt{2} : 1$
(C) 1 : 2 (D) 1 : 4

58. The radii of two spheres are in the ratio 1 : 2. The ratio of their surface areas is—
(A) 1 : 2 (B) 1 : 4
(C) $1 : \sqrt{2}$ (D) 3 : 8

59. The curved surface areas of two spheres are in the ratio 1 : 4. The ratio of their volumes is—
(A) 1 : 4 (B) $1 : 2\sqrt{2}$
(C) 1 : 8 (D) 1 : 64

60. Volume of a hemisphere is 19404 cubic cm. The total surface area is—
(A) 2772 sq. cm
(B) 4158 sq. cm
(C) 5544 sq. cm
(D) 1386 sq. cm

61. The volume of a sphere is $\frac{88}{21} \times (14)^3$ cm^3. The curved surface of this sphere is—
(A) 2424 cm^2 (B) 2446 cm^2
(C) 2464 cm^2 (D) 2484 cm^2

62. A cylinder and a cone have the same height and same radius of the base. The ratio between the volumes of the cylinder and the cone is—
(A) 1 : 3 (B) 3 : 1
(C) 1 : 2 (D) 2 : 1

63. If the radius of a sphere is doubled, then its volume is increased by—
(A) 100% (B) 200%
(C) 700% (D) 800%

64. If the radius of a sphere is doubled, then its surface area is increased by—
(A) 100% (B) 200%
(C) 300% (D) 50%

65. If the height of a cone is doubled, then its volume is increased by—
(A) 100% (B) 200%
(C) 300% (D) 400%

66. The percentage increase in the surface area of a cube when each side is doubled, is—
(A) 25% (B) 50%
(C) 150% (D) 300%

67. The cost of painting the four walls of a room is Rs. 350. The cost of painting a room three times in length, breadth and height respectively will be—
(A) Rs. 1050 (B) Rs. 1400
(C) Rs. 3150 (D) Rs. 4200

68. The length of canvas 1·1 m wide required to build a conical tent of height 14 m and the floor area 346·5 m^2, is—
(A) 665 m (B) 525 m
(C) 490 m (D) 860 m

69. The area of the base of a right circular cone is 154 cm^2 and its height is 14 cm. The curved surface of the cone is—
(A) $\left(154 \times \sqrt{5}\right)$ cm^2
(B) 11 cm^2
(C) $\left(154 + \sqrt{7}\right)$ cm^2
(D) 5324 cm^2

70. A cone of height 7 cm and base radius 3 cm is curved from a rectangular block of wood 10 cm × 5 cm × 2 cm. The percentage of wood wasted is—
(A) 34% (B) 46%
(C) 54% (D) 66%

71. The material of a cone is converted into the shape of a cylinder of equal radius. If the height of the cylinder is 5 cm, the height of the cone is—
(A) 10 cm (B) 15 cm
(C) 18 cm (D) 24 cm

72. A solid consists of a circular cylinder with an exact fitting right circular cone placed on the top. The height of the cone is h. If the total volume of the solid is three times the volume of the cone, then the height of the cylinder is—
(A) $2h$ (B) $4h$
(C) $\frac{2h}{3}$ (D) $\frac{3h}{2}$

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Answers with Hints

1. (B) Number of boxes
$$= \frac{\text{Volume of wooden box in cm}^3}{\text{Volume of 1 small box}}$$
$$= \frac{800 \times 700 \times 600}{8 \times 7 \times 6} = 1000000$$

2. (C) Volume $= \left(\frac{112 \times 1000}{25}\right)$ cu. cm.
$= 4480 \text{ cm}^3$
$\therefore \quad x \times 28 \times 5 = 4480$
$\Rightarrow \quad x = \left(\frac{4480}{28 \times 5}\right) \text{cm} = 32 \text{ cm}.$

3. (C) $\because \quad l + b + h = 19$
and $\quad l^2 + b^2 + h^2 = \left(5\sqrt{5}\right)^2 = 125$
$\because \quad (l + b + h)^2 = (19)^2$
$\Rightarrow (l^2 + b^2 + h^2) + 2(lb + bh + lh)$
$= 361$
$\Rightarrow \quad 2(lb + bh + lh) = (361 - 125)$
$= 236$
$\therefore \quad$ Surface area $= 236 \text{ cm}^2.$

4. (D) Let length $= 6x$, breadth $= 5x$ and height $= 4x$ in cm
$\because 2(6x \times 5x + 5x \times 4x + 6x \times 4x) = 33300$
$\Rightarrow \quad 148x^2 = 33300$
$\Rightarrow \quad x^2 = \frac{33300}{148} = 225$
$\Rightarrow \quad x = 15$
$\therefore$ Length $= 90$ cm, Breadth $= 75$ cm, Height $= 60$ cm

5. (B) $\because \sqrt{3}a = 8\sqrt{3} \Rightarrow a = 8$
$\therefore \quad$ Surface area $= 6a^2$
$= (6 \times 8 \times 8) \text{ cm}^2$
$= 384 \text{ cm}^2$

6. (C) Longest rod $= \sqrt{(10)^2 + (10)^2 + (10)^2} \text{ cm}$
$= \sqrt{300} \text{ cm} = 10\sqrt{3} \text{ cm}.$

7. (D) $\because \quad l^2 + b^2 = (10)^2 = 100$
and $\quad l^2 + b^2 + h^2 = \left(10\sqrt{2}\right)^2 = 200$
$\Rightarrow \quad h^2 = (200 - 100) = 100$
$\therefore \quad h = 10 \text{ m}$

8. (B) $\because \quad \sqrt{3}a = 14 \times \sqrt{3} \Rightarrow a = 14$
$\therefore$ Volume of the cube $= (14 \times 14 \times 14) \text{ cm}^3$
$= 2744 \text{ cm}^3$

9. (C) Length of pencil $= [(8^2) + (6)^2 + (2)^2] \text{ cm}$
$= \sqrt{104} \text{ cm}$
$= 2\sqrt{26} \text{ cm}$

10. (D) Length of the rod $= \sqrt{(20)^2 + (16)^2 + (12)^2} \text{ m}$
$= \sqrt{800} \text{ m}$
$= 20\sqrt{2} \text{ m} = (20 \times 1{\cdot}41) \text{ m}$
$= 28{\cdot}2 \text{ m}$

11. (D) Diagonal $= \sqrt{(30)^2 + (24)^2 + (18)^2}$
$= \sqrt{1800} \text{ cm} = 30\sqrt{2} \text{ cm}.$

12. (C) $\because \quad a^3 = 512 = 8 \times 8 \times 8$
$\Rightarrow \quad a = 8 \text{ cm}$
$\therefore \quad$ Surface area $= 6a^2$
$= [6 \times (8)^2] \text{ cm}^2$
$= 384 \text{ cm}^2$

13. (B) $6a^2 = 726$
$\Rightarrow \quad a^2 = 121$
$\Rightarrow \quad a = 11 \text{ cm}$
$\therefore$ Volume of the cube $= (11 \times 11 \times 11) \text{ cm}^3$
$= 1331 \text{ cm}^3$

14. (C) Surface area
$= 2(22 \times 12 + 12 \times 7{\cdot}5 + 22 \times 7{\cdot}5) \text{ cm}^2$
$= 1038 \text{ cm}^2$

15. (C) Surface area $= [6 \times (27)^2] \text{ cm}^2$
$= 4374 \text{ cm}^2$

16. (C) Earth dug out $= (3 \times 2 \times 1{\cdot}5) \text{ m}^3$
$= 9 \text{ m}^3$
Area on which earth has been spread
$= (22 \times 14 - 3 \times 2) \text{ m}^2$
$= 302 \text{ m}^2$
$\therefore \quad$ Rise in level $= \frac{\text{Volume}}{\text{Area}} = \left(\frac{9}{302}\right) \text{m}$
$= \left(\frac{9 \times 100}{302}\right) \text{cm} = 2{\cdot}98 \text{ cm}$

17. (C) Let the volumes be x^3 and $27x^3$
$\therefore$ Their edges are x and $3x$
Ratio of their surface area
$= 6x^2 : 54x^2 = 1 : 9$

18. (D) Let original length of cube $= x$
Then, its surface area $= 6x^2$
New edge $= \left(\frac{150}{100}x\right)$
$= \frac{3}{2}x$
New surface area $= 6 \times \left(\frac{3}{2}x\right)^2$
$= \left(6 \times \frac{9}{4}x^2\right)$
$= \left(\frac{27}{2}\right)x^2$

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Increase in surface area $= \left(\frac{27}{2} - 6\right) x^2$

$= \frac{15}{2} x^2$

$\therefore$ Increase per cent $= \left(\frac{15}{2} x^2 \times \frac{1}{6x^2} \times 100\right)\%$

$= 125\%$

19. (B) Let the edges of the two cubes be x and y metres

Then, $x^3 - y^3 = 152$

and $(x^2 - y^2) = 20$

Also, $(x + y) = 10$

So, $(x - y) = \left(\frac{x^2 - y^2}{x + y}\right)$

$= \frac{20}{10} = 2$

Now, $\frac{x^3 - y^3}{x - y} = \left(\frac{152}{2}\right)$

$\Rightarrow x^2 + y^2 + xy = 76$

$\Rightarrow (x + y)^2 - xy = 76$

$\Rightarrow xy = (x + y)^2 - 76$

$= (10)^2 - 76 = 24$

20. (D) Let the edge of original cube = x cm

Edge of new cube $= (2x)$ cm

Ratio of their volumes $= x^3 : (2x)^3$

$= x^3 : 8x^3$

$= 1 : 8$

Thus the volume be comes 8 times.

21. (A) Volume of new cube $= [(5)^3 + (4)^3 + (3)^3]$ cm^3

$= 216$ cm^3

Edge of this cube $= (6 \times 6 \times 6)^{1/3} = 6$ cm

22. (C) Let their volumes be $8x^3$ and x^3 respectively

Then, their edges are $2x$ and x respectively

$\therefore$ Ratio of their edges $= 2 : 1$

23. (C) Thickness $= \frac{\text{Volume}}{\text{Area}}$

$= \left(\frac{1}{2} \times \frac{1}{10000}\right)$ m

$= \left(\frac{1 \times 100}{2 \times 10000}\right)$ cm

$= 0{\cdot}005$ cm

24. (B) Volume $= \left(2 \times 10000 \times \frac{5}{100}\right)$ m^3

$= 1000$ m^3

25. (A) Speed per min. $= \left(\frac{3 \times 1000}{60}\right)$ m $= 50$ m

Volume of water running per min.

$= (45 \times 2 \times 50)$ m^2

$= 4500$ m^3

26. (B) Number of bricks required

$= \frac{\text{Volume of wall in cm}^3}{\text{Volume of 1 brick}}$

$= \left(\frac{200 \times 100 \times 1{\cdot}8 \times 100 \times 37{\cdot}5}{25 \times 12{\cdot}5 \times 7{\cdot}5}\right)$

$= 57{,}600$

$\therefore$ Required cost

$= \text{Rs.} \left(\frac{750 \times 57{,}600}{1000}\right)$

$= \text{Rs. } 43{,}200$

27. (B) Volume of cube formed $= 216$ cm^3

$\therefore$ Edge of the cube $= (6 \times 6 \times 6)^{1/3}$

$= 6$ cm

Surface area of original metal sheet

$= 2\,(27 \times 8 + 8 \times 1 + 27 \times 1)$ cm^2

$= 502$ cm^2

Surface area of the cube formed

$= [6 \times (6)^2]$ cm$^2 = 216$ cm^2

$\therefore$ Required difference in areas of two solids

$= (502 - 216)$ cm^2

$= 286$ cm^2

28. (B) Let depth = x cm.

Then, $x \times 6500 = 2{\cdot}6 \times 100 \times 100 \times 100$

$\therefore x = \left(\frac{2{\cdot}6 \times 100 \times 100 \times 100}{6500}\right)$ cm

$= 400$ cm $= 4$ m

29. (B) Let breadth = x metres. Then, height = $5x$ metres and length = $40x$ metres

$\therefore x \times 5x \times 40x = 12{\cdot}8$

$\Rightarrow x^3 = \frac{12{\cdot}8}{200} = \frac{128}{2000}$

$= \frac{64}{1000}$

$\therefore x = \frac{4}{10}$

Thus, breadth $= \left(\frac{4}{10}\right)$ m

$= \left(\frac{4 \times 100}{10}\right)$ cm $= 40$ cm

30. (C) Number of Cubes $= \frac{100 \times 100 \times 100}{10 \times 10 \times 10}$

$= 1000$

31. (A) $\because \frac{4}{3} \times \frac{22}{7} \times r^3 = 38808$

$\Rightarrow r^3 = \left(38808 \times \frac{7}{22} \times \frac{3}{4}\right)$

$= (21)^3$

$\therefore r = 21$ cm

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So, Curved surface area of sphere

$= 4\pi r^2$

$= \left(4 \times \frac{22}{7} \times 21 \times 21\right) \text{cm}^2$

$= 5544 \text{ cm}^2$

32. (C) $4\pi r^2 = 1386$

$\Rightarrow r^2 = \left(\frac{1386}{4} \times \frac{7}{22}\right)$

$= \frac{441}{4}$

$\therefore r = \frac{21}{2}$

$\therefore$ Volume $= \left(\frac{4}{3} \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times \frac{21}{2}\right) \text{cm}^3$

$= 4851 \text{ cm}^3$

33. (B) Let x cones be needed

Then, $\frac{1}{3}\pi r^2 h \times x = \pi r^2 h \Rightarrow x = 3.$

34. (D) Let the height of cylinder = h

and height cone = H

Then, $\pi r^2 h = \frac{1}{3}\pi r^2 \text{H}$

$\Rightarrow \frac{h}{\text{H}} = \frac{1}{3} = 1 : 3$

35. (B) $\because \pi \times (4)^2 \times h = \frac{4}{3}\pi \times (3)^3$

$\therefore h = \frac{9}{4} \text{cm}$

$= 2{\cdot}25 \text{ cm}$

36. (A) $\because \frac{4}{3}\pi r^3 = \pi r^2 h$

$\Rightarrow h = \frac{4}{3} r$

$\therefore$ Height $= \frac{4}{3}$ times its radius.

37. (C) External radius $= 2{\cdot}5$ cm,

length $= 100$ cm

$\therefore$ External volume $= [\pi \times (2{\cdot}5)^2 \times 100] \text{ cm}^3$

Internal radius $= 1{\cdot}5$ cm

$\therefore$ Internal volume $= [\pi \times (1{\cdot}5)^2 \times 100] \text{ cm}^3$

Volume of metal

$= [\pi \times (2{\cdot}5)^2 \times 100 - \pi \times (1{\cdot}5)^2 \times 100] \text{ cm}^3$

$= \pi \times 100 \times [(2{\cdot}5)^2 - (1{\cdot}5)^2] \text{ cm}^3$

$= \left(\frac{22}{7} \times 100 \times 4 \times 1\right) \text{cm}^3$

$\therefore$ Weight of metal

$= \left(\frac{22}{7} \times 100 \times 4 \times 1 \times \frac{21}{1000}\right) \text{kg}$

$= 26{\cdot}4 \text{ kg.}$

38. (B) $\because$ Circumference of the girth $= 440$ cm

$\therefore 2\pi r = 440$

$\Rightarrow r = \left(\frac{440}{2} \times \frac{7}{22}\right)$

$= 70$ cm

Thus, Outer radius $= 70$ cm

Inner radius $= (70 - 4)$ cm

$= 66$ cm

Volume of iron $= \pi [(70)^2 - (66)^2] \times 63 \text{cm}^3$

$= \left(\frac{22}{7} \times 136 \times 4 \times 63\right) \text{cm}^3$

$= 107712 \text{ cm}^3$

39. (C) Let the number of spheres be x

Then, $x \times \frac{4}{3}\pi \times (3)^3 = \pi \times (2)^2 \times 45$

$\Rightarrow 36x = 180$

$\therefore x = \frac{180}{36} = 5$

40. (D) Radius of sphere $= 9$ cm

Volume of sphere $= \left[\frac{4}{3} \times \pi \times (9)^3\right] \text{cm}^3$

$= (972\,\pi) \text{ cm}^3$

Radius of wire $= 0{\cdot}2$ mm

$= \left(\frac{2}{10 \times 10}\right)$ cm

$= \frac{1}{50}$ cm

Let the length of wire be

$= x$ cm

Then, $972\,\pi = \pi \times \left(\frac{1}{50}\right)^2 \times x$

$\Rightarrow x = (972 \times 50 \times 50)$ cm

$\therefore$ Length of wire $= \left(\frac{972 \times 50 \times 50}{100}\right)$ m

$= 24{,}300$ m

41. (D) Let original radius $= r$ and original length $= h$

New radius $= \frac{1}{3} r$

Let new length $= \text{H}$

Then, $\pi r^2 h = \pi \left(\frac{1}{3} r\right)^2 \times \text{H}$

$= \frac{\pi r^2 \text{H}}{9}$

$\therefore \text{H} = 9h$

Thus, the length becomes 9 times.

42. (B) $\because 2\pi r h = 264$

$\Rightarrow 2 \times \frac{22}{7} \times r \times 14 = 264$

$\therefore r = 3$

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So, Volume $= \pi r^2 h$

$= \left(\frac{22}{7} \times 3 \times 3 \times 14\right) \text{cm}^3$

$= 396 \text{ cm}^3$

43. (A) $\because$ $r = 3{\cdot}5$ cm

and $h = 80$ cm

$\therefore$ Whole surface

$= 2\pi rh + 2\pi r^2 = 2\pi r\,(h + r)$

$= \left[2 \times \frac{22}{7} \times 3{\cdot}5 \times (80 + 3{\cdot}5)\right] \text{cm}^2$

$= 22 \times 83{\cdot}5$

$= 1837 \text{ cm}^2$

44. (C) Area needed

$= 2\,(25 \times 15 + 15 \times 8 + 25 \times 8) \text{ cm}^2$

$= 2\,[375 + 120 + 200]$

$= 1390 \text{ cm}^2$

45. (D)

46. (D) Since the diameters are in the ratio 4 : 5. It follows that their radii are in the ratio 4 : 5.

Let them be $4r$ and $5r$. Let the heights be h and H.

$\because$ Ratio of volumes $= \dfrac{\frac{1}{3}\pi \times (4r)^2 \times h}{\frac{1}{3}\pi \times (5r)^2 \times \text{H}}$

$= \dfrac{16\,h}{25\,\text{H}}$

$\Rightarrow \quad \dfrac{16\,h}{25\,\text{H}} = \dfrac{1}{4}$

$\therefore \quad \dfrac{h}{\text{H}} = \left(\frac{1}{4} \times \frac{25}{16}\right)$

$= \dfrac{25}{64} = 25 : 64.$

47. (C) $\because$ $\frac{1}{3} \times \frac{22}{7} \times r^2 \times 24 = 1232$

$\Rightarrow \quad r^2 = \left(1232 \times \frac{7}{22} \times \frac{3}{24}\right)$

$= 49$

$\therefore \quad r = 7$ cm

Now, $r = 7$

and $h = 24$

So, $l = \sqrt{7^2 + (24)^2}$

$= \sqrt{625} = 25$ cm

$\therefore$ Curved surface area $= \pi rl$

$= \left(\frac{22}{7} \times 7 \times 25\right) \text{cm}^2$

$= 550 \text{ cm}^2$

48. (B) Curved surface area $= \pi rl$

$= \left(\frac{22}{7} \times 6 \times 28\right) \text{cm}^2$

$= 528 \text{ cm}^2$

49. (A) $\therefore$ $\frac{1}{3}\pi \times (2)^2 \times h = \pi \times (2)^2 \times 6$

$\Rightarrow \quad h = 18$ cm

50. (C) Let h and H be the heights of water level before and after the dropping of the sphere.

Then, $[\pi \times (30)^2 \times \text{H}] - [\pi \times (30)^2 \times h]$

$= \frac{4}{3}\pi \times (30)^3$

$\Rightarrow \quad \pi \times 900 \times (\text{H} - h) = \frac{4}{3}\pi \times 27000$

$\therefore \quad (\text{H} - h) = 40$ cm

51. (B) Let their radii be $2r$ and $3r$ and heights $5h$ and $3h$ respectively.

$\therefore$ Ratio of their volumes $= \dfrac{\pi\,(2r)^2 \times 5\,h}{\pi\,(3r)^2 \times 3\,h}$

$= \dfrac{20}{27} = 20 : 27$

52. (D) $\dfrac{\text{Total surface area}}{\text{Lateral surface area}} = \dfrac{2\pi\,rh + 2\pi r^2}{2\pi rh}$

$= \dfrac{2\pi r\,(h + r)}{2\pi\,rh} = \left(\dfrac{h + r}{h}\right)$

$= \left(\dfrac{20 + 80}{20}\right) = \dfrac{5}{1}$

$= 5 : 1$

53. (C) $\frac{4}{3}\pi r^3 = 4\pi r^2$

$\Rightarrow \quad r = 3$ units.

54. (B) $\because$ $\frac{4}{3}\pi r^3 = \frac{4}{3}\pi \times \left[\left(\frac{3}{2}\right)^3 - \left\{\left(\frac{3}{4}\right)^3 + 1^3\right\}\right]$

$\Rightarrow \quad r^3 = \frac{125}{64} = \left(\frac{5}{4}\right)^3$

$\Rightarrow \quad r = \frac{5}{4}$

$\therefore$ Diameter $= \left(\frac{5}{4} \times 2\right)$ cm

$= 2{\cdot}5$ cm.

55. (D) Number of bullets $= \dfrac{\text{Volume of cube}}{\text{Volume of 1 bullet}}$

$= \left(\dfrac{22 \times 22 \times 22}{\frac{4}{3} \times \frac{22}{7} \times 1 \times 1 \times 1}\right)$

$= 2541.$

56. (D) Number of balls $= \dfrac{\text{Volume of big ball}}{\text{Volume of 1 small ball}}$

$= \dfrac{\frac{4}{3} \times \pi \times 10 \times 10 \times 10}{\frac{4}{3} \times \pi \times 0{\cdot}5 \times 0{\cdot}5 \times 0{\cdot}5}$

$= 8000$

57. (B) Let their heights be h and $2h$ and radii be x and y respectively.

Then, $\pi r^2 h = \pi y^2\,(2h)$

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$\Rightarrow \quad \frac{x^2}{y^2} = \frac{2}{1}$

$\therefore \quad \frac{x}{y} = \frac{\sqrt{2}}{1} = \sqrt{2} : 1$

58. (B) Let their radii be x and $2x$.

Ratio of their surface areas $= \frac{4\pi x^2}{4\pi (2x)^2} = \frac{1}{4}$

$= 1 : 4$

59. (C)

60. (B) $\frac{2}{3} \times \frac{22}{7} \times r^3 = 19404$ c.c.

$\Rightarrow \quad r^3 = \left(19404 \times \frac{7}{22} \times \frac{3}{2}\right) = 9261$ c.c.

$= (21)^3$ c.c.

$\therefore \quad r = 21$ cm

Total Surface area $= 3\pi r^2$

$= \left(3 \times \frac{22}{7} \times 21 \times 21\right)$ cm^2

$= 4158$ cm^2

61. (C) $\because \frac{4}{3} \times \frac{22}{7} \times r^3 = \frac{88}{21} \times (14)^3$

$\Rightarrow \quad r = 14$

$\therefore$ Curved surface $= \left(4 \times \frac{22}{7} \times 14 \times 14\right)$ cm^2

$= 2464$ cm^2

62. (B) Ratio of their volumes

$= \frac{\pi r^2 h}{\frac{1}{3}\pi r^2 h} = \frac{3}{1}$

$= 3 : 1$

63. (C) Original volume $= \frac{4}{3}\pi r^3$

New volume $= \frac{4}{3}\pi (2r)^3 = \frac{32}{3}\pi r^3$

Required increase % $= \left(\frac{28}{3}\pi r^3 \times \frac{3}{4\pi r^3}\right) \times 100\%$

$= 700\%$

64. (C) Original area $= 4\pi r^2$, New area $= 4\pi (2r)^2$

$= 16\ \pi r^2$

Required increase % $= \left(\frac{12\ \pi r^2}{4\pi r^2} \times 100\right)\%$

$= 300\%$

65. (A) Original volume $= \frac{1}{3}\pi r^2 h$;

New volume $= \frac{1}{3}\pi r^2 (2h)$

$= \frac{2}{3}\pi r^2\ h$

Required increase % $= \left(\frac{\frac{1}{3}\pi r^2\ h}{\frac{1}{3}\pi r^2 h} \times 100\right)\%$

$= 100\%$

66. (D) Original area $= 6a^2$

New area $= 6\ (2a)^2 = 24a^2$

Required increase % $= \left(\frac{18a^2}{6a^2} \times 100\right)\%$

$= 300\%$

67. (C) Area of 4 walls of the room

$= [2\ (l + b) \times h]$ m^2

Area of 4 walls of new room

$= [2\ (3l + 3b) \times 3h]$m^2

$= 9\ [2\ (l + b) \times h]$ m^2

$\therefore$ Cost of painting the 4 walls of the new room

$=$ Rs. (9×350)

$=$ Rs. 3150

68. (B)

69. (A) $\because \quad \frac{22}{7} \times r^2 = 154$

$\Rightarrow \quad r^2 = \left(154 \times \frac{7}{22}\right)$

$= 49$

$\therefore \quad r = 7$ cm

and $\quad h = 14$

So, $\quad l = \sqrt{(7)^2 + (14)^2}$

$= \sqrt{245} = 7\sqrt{5}$ cm

$\therefore$ Area of curved surface

$= \pi r l$

$= \left(\frac{22}{7} \times 7 \times 7\sqrt{5}\right)$ cm^2

$= 154\sqrt{5}$ cm^2

70. (A) Total volume of cuboid

$= (10 \times 5 \times 2)$ cm^3

$= 100$ cm^3

Volume curved $= \left(\frac{1}{3} \times \frac{22}{7} \times 3 \times 3 \times 7\right)$ cm^3

$= 66$ cm^3

% of Wood wasted $= (100 - 66)\%$

$= 34\%$

71. (B) $\because \quad \frac{1}{3}\pi r^2 \times h = \pi r^2 \times 5$

$\therefore \quad h = 15$ cm

72. (C) Let the height of the cylinder be H and its radius

$= r$

Then, $\quad \pi r^2\ \mathrm{H} + \frac{1}{3}\pi r^2\ h = 3 \times \frac{1}{3}\pi r^2\ h$

$\Rightarrow \quad \pi r^2\ \mathrm{H} = \frac{2}{3}\pi r^2 h$

$\therefore \quad \mathrm{H} = \frac{2}{3} h.$

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Races and Games of Skill

Races—A contest of speed in running, riding, driving sailing or rowing is called a race. The ground of path on which contests are made is called a race course. The point from which a race begins is known as a starting point. The point set to bound a race is called a winning post or a goal. The person who first reaches the winning post is called a winner. If all the persons contesting a race reach the goal exactly at the same time, then the race is said to be a dead heat race.

Suppose A and B are two contestants in a race. If before the start of the race, A is at the starting point and B is ahead of A by 15 metres. Then A is said to give B, a start of 15 metres. To cover a race of 200 metres in this case A will have to cover a distance of 200 metres and B will have to cover (200 – 15) or 185 metres only.

In a 100 metres race A can give B 15 metres or A can give B, a start of 15 metres or A beats B by 15 metres means that while A runs 100 metres, B runs (100 – 15) or 85 metres.

Games—A game of 100 means that the person among the contestants who scores 100 points first is the winner. If A scores 100 points, while B scores only 80 points, then we say that A can give B 20 points.

Examples

Q. 1. A and B run a km and A wins by 1 minute. A and C run a km and 'A' wins by 375 metres. B and C run a km and B wins by 30 seconds. Find the time taken by each to run a km.

Solution : Since A beats B by 60 seconds and B beats C by 30 seconds. So, A beats C by 90 seconds. But, it being given that A beats C by 375 metres. So it means that C covers 375 metres in 90 seconds.

$\therefore$ Time taken by C to cover 1 km $= \left(\frac{90}{375} \times 1000\right)$ seconds

$= 240$ seconds

Time taken by A to cover 1 km

$= (240 - 90)$ seconds

$= 150$ seconds

Time taken by B to cover 1 km

$= (240 - 30)$ seconds

$= 210$ seconds.

Q. 2. In a kilometre race, if A gives B, a start of 40 metres, then A wins by 19 seconds, but if A gives B, a start of 30 seconds then B wins by 40 metres. Find the time taken by each to run a kilometre.

Solution : Suppose that the time taken by A and B to run 1 km is x and y seconds respectively.

When A gives B a start of 40 metres then A has run 1000 metres, while B has to run only 960 metres.

Time taken by A to run 1000 m $= x$ sec.

Time taken by B to run 960 metres $= \left(\frac{y}{1000} \times 960\right)$ sec.

$= \left(\frac{24}{25} y\right)$ sec.

Clearly, $\because \frac{24}{25} y - x = 19$

$\Rightarrow \quad 24y - 25x = 475 \quad \ldots(i)$

Again, A gives B, a start of 30 seconds, then B runs for y seconds, while A runs for $(y - 30)$ seconds.

Now, $\because$ In x seconds, A covers 1000 metres

$\therefore$ In $(y - 30)$ seconds A will cover $= \left[\frac{1000}{x} \times (y - 30)\right]$ metres

So, $1000 - \frac{1000 \times (y - 30)}{x} = 40$

$\Rightarrow 25y - 24x = 750 \quad \ldots(ii)$

Solving (i) and (ii) we get,

$x = 125$ and $y = 150$

$\therefore$ Time taken by A to run 1 km $= 125$ seconds

Time taken by B to run 1 km $= 150$ seconds

Q. 3. A can run a kilometre in 4 minutes 50 seconds and B in 5 minutes. How many metres start can A give B in a kim race. So that the race may and in a dead heat.

Solution : Time taken by A to run 1 km = 4 mts. 50 sec. = 290 sec.

Time taken by B to run 1 km = 5 mts. = 300 sec.

$\therefore$ A can give B, a start of (300 – 290) or 10 second

Now, in 300 seconds, B runs 1000 metres.

$\therefore$ In 10 seconds, B runs $\left(\frac{1000}{300} \times 10\right)$ m $= 33\frac{1}{3}$ m

So, A can give B a start of $33\frac{1}{3}$ metres.

Q. 4. In a 100 metres race, A runs with 6 kms. per hour. If A gives B a start of 4 metres and still beats him by 12 seconds. What is the speed of B ?

Solution : Time taken by A to cover 100 metres

$= \left(\frac{60 \times 60}{6000} \times 100\right)$ seconds

$= 60$ seconds

$\therefore$ B covers (100 – 4) or 96 m in (60 + 12) sec. or 72 sec.

Hence, speed of B

$= \left(\frac{60 \times 60 \times 60}{72 \times 1000}\right)$ km/hr.

$= 4{\cdot}8$ km/hr.

Q. 5. A can run a km in 3 min. 10 sec. and B in 3 min. 20 sec. By what distance can A beat B ?

Solution :

$\because$ A beats B by 10 seconds.

Distance covered by B in 200 seconds $= 1000$ metres.

Distance covered by B in 10 seconds $= \frac{1000}{200} \times 10$

$= 50$ metres

$\therefore$ A beats B by 50 metres.

Q. 6. A, B and C are the three contestants in a km race. If A can give B a start of 40 metres and A can give C a start of 64 metres how many metres start can B give C ?

Solution : While A covers 1000 metres, B covers (1000 – 40) or 960

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metres and C covers (1000 – 64) or 936 metres.

Now, when B covers 960 metres. C covers 936 metres.

∴ When B covers 1000 metres, C covers $\left(\frac{936}{960} \times 1000\right)$ metres

= 975 metres

So, B can give C a start of (1000 – 975) or 25 metres.

Q. 7. A runs $1\frac{2}{3}$ times as fast as B. If A gives B a start of 80 metres how far must the winning post be so that A and B might reach it at the same time ?

Solution : The races of A and B are as 5 : 3

i.e., in a race of 5 metres, A gains 2 metres over B.

2 metres are gained by A in a race of 5 metres.

80 metres will be gained by A in a race of

$= \left(\frac{5}{2} \times 80\right)$ metres = 200 metres

∴ Winning post is 200 metres away from the starting point.

Q. 8. In a km race A beats B by 35 metres or 7 seconds. Find A's time over the course.

Solution : Here B runs 35 metres in 7 seconds.

∴ B's time over the course

$= \left(\frac{7}{35} \times 1000\right)$ sec.

= 200 seconds.

So, A's time over the course

= (200 – 7) sec.

= 193 seconds

= 3 min. 13 sec.

Exercise

1. A runs $1\frac{3}{4}$ times as fast as B. If A gives B a start of 60 metres. How far must the winning post be in order that A and B reach it at the same time ?
   (A) 105 metres
   (B) 80 metres
   (C) 140 metres
   (D) 45 metres
2. A can run 20 metres while B runs 25 metres. In a km race B beats A by—
   (A) 250 metres
   (B) 225 metres
   (C) 200 metres
   (D) 125 metres
3. In a 100 metres race A can give B 10 metres and C 28 metres. In the same race, B can give C—
   (A) 18 metres (B) 20 metres
   (C) 27 metres (D) 9 metres
4. In a 100 metres race, A can beat B by 25 metres and B can beat C by 4 metres. In the same race, A can beat C by—
   (A) 29 metres (B) 21 metres
   (C) 28 metres (D) 26 metres
5. In a 300 metres race A beats B by 15 metres or 5 seconds. A's time over the course is—
   (A) 100 seconds
   (B) 95 seconds
   (C) 105 seconds
   (D) 90 seconds
6. A can run a kilometre in 4 min. 54 sec. and B in 5 min. How many metres start can A give B in a km race so that the race may end in a dead heat ?
   (A) 20 metres (B) 16 metres
   (C) 18 metres (D) 14·5 metres
7. A can run 100 metres in 27 seconds and B in 30 seconds. A will beat B by—
   (A) 9 metres
   (B) 10 metres
   (C) $11\frac{1}{8}$ metres
   (D) 12 metres
8. At a game of billiards, A can give B 15 points in 60 and A can give C 20 in 60. How many points can B give C in a game of 90 ?
   (A) 30 points (B) 20 points
   (C) 10 points (D) 12 points
9. In a game of 100 points, A can give B 20 points and C 28 points. Then B can give C—
   (A) 8 points (B) 10 points
   (C) 14 points (D) 40 points
10. A and B take part in a 100 metres race. A runs at 5 km per hour. A gives B a start of 8 metres and still beats him by 8 seconds. Speed of B is—
    (A) 5·15 km/hr
    (B) 4·14 km/hr
    (C) 4·25 km/hr
    (D) 4·4 km/hr
11. A can beat B by 31 metres and C by 18 metres in a race of 200 metres. In a race of 350 metres C will beat B by—
    (A) 22·75 metres
    (B) 25 metres
    (C) $7\frac{4}{7}$ metres
    (D) 19·5 metres
12. In a 100 metres race, A beats B by 10 metres and C by 13 metres. In a race of 180 metres, B will beat C by—
    (A) 5·4 metres
    (B) 4·5 metres
    (C) 5 metres
    (D) 6 metres
13. In a 500 metres race, the ratio of speeds of two contestants A and B is 3 : 4. A has a start of 140 metres. Then, A wins by—
    (A) 60 metres (B) 40 metres
    (C) 20 metres (D) 10 metres
14. A can run 20 metres while B runs 25 metres. In a km race B beats A by—
    (A) 25 m (B) 225 m
    (C) 200 m (D) 125 m
15. A can run a kilometre in 4 minutes 50 seconds and B in 5 minutes. How many metres start can A give B in a km race, so that the race may end in a dead heat ?
    (A) 30 m
    (B) $16\frac{2}{3}$ m
    (C) $33\frac{1}{3}$ m
    (D) None of these
16. A can run a km in 3 min. 10 sec. and B in 3 min. 20 sec. By what distance can A beat B ?
    (A) 40 m (B) 50 m
    (C) 45 m (D) 60 m
17. A takes 4 mins 50 secs. while B takes 5 mins. to complete the

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race. A beats B by $33\frac{1}{3}$ metres. Find the length of the course—

(A) 1·1 km (B) 100 m

(C) 10 km (D) 1000 m

18. In a 500 metres race, B gives A a start of 160 metres. The ratio of the speeds of A and B is 2 : 3. Who wins and by how much ?

(A) $6\frac{2}{3}$ m (B) 8 m

(C) $8\frac{1}{3}$ m (D) $6\frac{1}{3}$ m

19. A can run one km in half a minute less time than B. In a kilometre race, B gets a start of 100 metres and loses by 100 metres. Find the time A and B take to run a kilometre—

(A) 5 min, $5\frac{1}{2}$ min

(B) 2 min, $2\frac{1}{2}$ min

(C) 3 min, $3\frac{1}{2}$ min

(D) None of these

20. A can run a km in 3 minutes 10 secs. and B in 3 mins. 20 secs. By what distance can A beat B ?

(A) 50 metres (B) 40 metres

(C) 45 metres (D) 55 metres

21. In a 400 metres race, A gives B a start of 5 seconds and beats him by 15 metres. In another race of 400 metres. A beats B by $7\frac{1}{7}$ seconds. Find their speeds—

(A) 8 m/sec, 6 m/sec

(B) 9 m/sec, 6 m/sec

(C) 8 m/sec, 7 m/sec

(D) None of these

22. A can run 330 metres in 41 seconds and B in 44 seconds. By how many seconds will B win if he has 30 metres start ?

(A) 2 sec. (B) 1 sec.

(C) 3 sec. (D) 15 sec.

23. In a 100 metres race. A runs at a speed of 2 metres per seconds. If A gives B a start of 4 metres and still beats him by 10 seconds, find the speed of B—

(A) 1·6 m/sec.

(B) 4 m/sec.

(C) 1 m/sec.

(D) 2·6 m/sec.

24. P can run a kilometre in 4 minutes 50 seconds and Q in 5 minutes. By what distance can P beat Q ?

(A) 30 m (B) $16\frac{2}{3}$ m

(C) $33\frac{1}{3}$ m (D) $26\frac{2}{3}$ m

25. P runs 1 km in 4 minutes and Q in 4 minutes 10 secs. How many metres start can P give Q in 1 kilometre race, so that the race may end in a dead heat ?

(A) 40 m

(B) 50 m

(C) 30 m

(D) None of these

26. A runs $1\frac{1}{3}$ as fast as B. If A gives B a start of 30 minutes. How far must be the winning post, so that the race ends in a dead heat ?

(A) 150 m

(B) 100 m

(C) 120 m

(D) None of these

27. A, B and C are the three contestants in one km race. If A can give B a start of 40 metres and A can give C a start of 64 metres. How many metres start can B give C ?

(A) 20 m

(B) 25 m

(C) 35 m

(D) None of these

28. A can give B a start of 20 metres and C a start of 39 metres in a walking race of 400 metres. How much can B give C a start ?

(A) 20 m (B) 15 m

(C) 18 m (D) 25 m

29. In a flat race, A beats B by 15 metres and C by 29 metres. When B and C run over the course together, B wins by 15 metres. Find the length of the course—

(A) 220 m (B) 325 m

(C) 225 m (D) 250 m

30. A, B and C are three participants in one km race. If A can give B a start of 40 metres and B can give C a start of 25 metres, how many metres A can give C a start ?

(A) 64 m (B) 32 m

(C) 60 m (D) 44 m

31. A can give B 40 metres start and A can give C 50 metres start in a 200 metres race. While B can give C two seconds over the course. How long does each take to run 200 metres ?

(A) 24 sec., 30 sec., 32 sec.

(B) 20 sec., 31 sec., 32 sec.

(C) 20 sec., 30 sec., 32 sec.

(D) 24 sec., 30 sec., 31 sec.

32. X, Y and Z are the three contestants in one km race. If X can give Y a start of 50 metres and X can also give Z a start of 69 metres, how many metres start Y can give Z ?

(A) 10 m (B) 40 m

(C) 20 m (D) 25 m

33. In one km race A beats B by 5 seconds or 40 metres. How long does B take to run the kilometre ?

(A) 125 sec

(B) 120 sec

(C) 130 sec

(D) None of these

34. Rashid can run 880 metres race in 2 minutes 24 seconds and Hamid in 2 minutes 40 seconds. How many metres start can Rashid give Hamid in a 880 metres race to make a dead heat ?

(A) 88 ms (B) 77 ms

(C) 80 ms (D) 98 ms

35. A can run 440 metres in 51 seconds and B in 55 seconds. By how many seconds will B win if he has 40 metres start ?

(A) 10 sec

(B) 1 sec

(C) 4 sec

(D) Can't be determined

36. A can run 200 metres in 35 seconds and B in 38 seconds. By what distance can A beat B ?

(A) $15\frac{11}{19}$ m

(B) $15\frac{15}{19}$ m

(C) $15\frac{5}{19}$ m

(D) None of these

37. A can run 100 m in $15\frac{1}{3}$ and B in 16 seconds. If B receives 4 metres start, who wins and by what distance ?

(A) A wins by $\frac{1}{6}$ m

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(B) B wins by $\frac{1}{6}$ m

(C) A wins by 6 m

(D) B wins by 8 m

38. A can run 440 m in 1 min 30 seconds and B in 1 min 39 seconds. If B receives 40 metres start, who wins by what distance ?
(A) A wins by 4 metres
(B) B wins by 4 metres
(C) A wins by 8 metres
(D) Dead heat

39. Two boys, A and B run at $4\frac{1}{2}$ and 6 km an hour respectively. A having 190 metres start, who wins and by how much the course being 1 km ?
(A) B wins by 60 m
(B) A wins by 60 m
(C) A wins by 80 m
(D) B wins by 80 m

40. In one km race A beats B by 100 metres and C by 200 metres, by how much can B beat C in a race of 1350 metres ?
(A) 150 m (B) 160 m
(C) 140 m (D) 135 m

41. In a 100 metres race A can beat B by 10 metres and B can beat C by 10 metres. By how much can A beat C in the same race ?
(A) 10 m
(B) 12 m
(C) 19 m
(D) Can't be determined

42. A can beat B by 25 m in a $\frac{1}{4}$ km race and B can beat C by 20 metres in a $\frac{1}{2}$ km race. By how much can A beat C in one km race ?
(A) 130 m
(B) 126 m
(C) 136 m
(D) Data inadequate

43. In a race of 600 m, A can beat B by 60 m and in a race of 500 m, B can beat C by 50 m. By how many metres will A beat C in a race of 400 m ?
(A) 70 m
(B) 76 m
(C) $77\frac{1}{3}$ m
(D) None of these

44. In a race of 600 m. A can beat B by 50 m and in a race of 500 m, B can beat C by 60 m. By how many metres will A beat C in a race of 400 m ?
(A) 76 m (B) $76\frac{1}{3}$ m
(C) 77 m (D) $77\frac{1}{3}$ m

45. A can give B 40 metres and C 82 metres in a 880 metres race while B can give C 9 seconds over the course. Find the time C takes to run 880 metres—
(A) 1 min. (B) 180 min.
(C) 3 min. (D) 60 sec.

46. A can give B 10 metres and C 20 metres in a 100 metres race. B can give C 1 second over the course of 100 metres. How long does each take to run 100 metres ?
(A) 7·2 sec., 8 sec., 9 sec.
(B) 6·2 sec., 8 sec., 10 sec.
(C) 7·2 sec., 9 sec., 10 sec.
(D) Data inadequate

47. A can give B 40 metres and C 80 metres in a 400 metres race. B can give C 4 seconds over the course of 400 metres. How long does A take to run 400 metres ?
(A) 28 sec. (B) 28·2 sec.
(C) 28·8 sec. (D) 29 sec.

48. A can give B 20 points, A can give C 32 points and B can give C 15 points. How many points make the game ?
(A) 1000 (B) 100
(C) 500 (D) 250

49. A can give B 20 points in 100 and B can give C 20 points in 100. How many in 100 can A give C ?
(A) 26 (B) 36
(C) 46 (D) 30

50. Two persons A and B run a 5 km race on a round course of 400 m. If their speed be in the ratio 5 : 4 how often does the winner pass the other ?
(A) 3 times (B) 1 time
(C) 2 times (D) $2\frac{1}{2}$ times

Answers with Hints

1. (C) Ratio of races of A and B = 7 : 4
i.e., 3 metres are gained by A in a race of 7 metres
$\therefore$ 60 metres are gained by A in a race of $\left(\frac{7}{3}\times 60\right)$
= 140 metres

2. (C) In a 25 metres race B beats A by 5 metres.
In one km race B beats A by $\left(\frac{5}{25}\times 1000\right)$
= 200 metres

3. (B) A : B : C = 100 : 90 : 72
$\therefore$ B : C = $\frac{90}{72} = \frac{\left(90\times\frac{100}{90}\right)}{\left(72\times\frac{100}{90}\right)}$
= $\frac{100}{80}$ = (100 : 80)
So, B can give C 20 metres.

4. (C) A : B = 100 : 75 and B : C = 100 : 96
$\therefore$ A : C = $\frac{A}{B}\times\frac{B}{C} = \frac{100}{75}\times\frac{100}{96} = \frac{100}{72}$ = 100 : 72
So, A beats C by (100 – 72) = 28 metres

5. (B) 15 metres are covered by B in 5 seconds.
300 metres are covered by B in $\left(\frac{5}{15}\times 300\right)$
= 100 seconds.
$\therefore$ Time taken by A = (100 – 5) = 95 seconds

6. (A) Distance covered by B in 6 seconds
= $\left(\frac{1000}{300}\times 6\right)$ metres = 20 metres

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Thus, A beats B by 20 metres.

So, for a dead heat race A must give B a start of 20 metres.

7. (B) Distance covered by B in 3 seconds

$$= \left(\frac{100}{30} \times 3\right) \text{ metres} = 10 \text{ metres}$$

$\therefore$ A beats B by 10 metres.

8. (C) $\because$ A : B : C = 60 : 45 : 40

$$\therefore \quad B : C = \frac{45}{40} = \frac{9}{8} = \frac{9 \times 10}{8 \times 10} = \frac{90}{80}$$

So, if B scores 90, then C scores 80.

$\therefore$ B can give C 10 points in a game of 90.

9. (B) $\because$ A : B : C = 100 : 80 : 72

$$\therefore \quad B : C = \frac{80}{72} = \frac{10}{9} = \frac{100}{90}$$

Thus, if B scores 100, then C scores 90.

$\therefore$ B can give C 10 points in a game of 100 points.

10. (B) A's speed $= \left(5 \times \frac{5}{18}\right)$ m./sec. $= \frac{25}{18}$ m/sec.

$\because$ Time taken by A to cover 100 metres

$$= \left(100 \times \frac{18}{25}\right) \text{ sec.} = 72 \text{ sec.}$$

$\Rightarrow$ B covers 92 metres in (72 + 8) or 80 sec.

$$\therefore \text{ B's speed } = \left(\frac{92}{80} \times \frac{18}{5}\right) \text{ km/hr.}$$

$$= 4{\cdot}14 \text{ km/hr.}$$

11. (B) $\because$ A : B : C = 200 : 169 : 182

$$\therefore \quad \frac{C}{B} = \frac{182}{169} = \frac{182 \times \left(\frac{350}{182}\right)}{169 \times \left(\frac{350}{182}\right)} = \frac{350}{325}$$

So, while C covers 350 metres, B covers 325 metres.

$\therefore$ C beats B by 25 metres in a race of 350 metres.

12. (D) A : B : C = 100 : 90 : 87

$$\therefore \quad \frac{B}{C} = \frac{90}{87} = \frac{90 \times 2}{87 \times 2} = \frac{180}{174}$$

So, while B covers 180 metres, C covers

$$= 174 \text{ metres.}$$

$\therefore$ B beats C by 6 metres.

13. (C) To reach the winning post A will have to cover a distance of (500 – 140) = 360 metres.

While, A covers 3 metres, B covers 4 metres.

$\therefore$ A covers 360 metres, B covers $\left(\frac{4}{3} \times 360\right)$

$$= 480 \text{ metres.}$$

So, A reaches the winning post while B remains 20 metres behind.

$\therefore$ A wins by 20 metres.

14. (C) In a 25 metres race, B beats A by 5 metres.

In a km race B beats A by $\left(\frac{5}{25} \times 1000\right)$

$$= 200 \text{ metres.}$$

15. (C) Applying the given rule, we have, here A is winner and B is loser $\frac{290}{(1000 - x)} = \frac{300}{1000}$

$$\Rightarrow \quad 2900 = 3000 - 3x$$

$$\therefore \quad x = \frac{100}{3} = 33\frac{1}{3} \text{ metres.}$$

Hence, A can give B a start of $33\frac{1}{3}$ metres in a race of 1 km.

16. (B) A beats B by 10 seconds.

$\therefore$ Distance covered by B in 200 sec.

$$= 1000 \text{ metres.}$$

$$\Rightarrow \text{ Distance covered by B in 10 sec. } = \frac{1000}{200} \times 10$$

$$= 50 \text{ metres.}$$

$\therefore$ A beats B by 50 metres in a race of 1 km.

17. (D) $\because$ $\frac{\text{Loser's time}}{\text{Winner's distance}} = \frac{\text{Beat time}}{\text{Beat distance}}$

Since winner's distance = Length of course

$$\Rightarrow \quad \frac{5 \times 60}{L} = \frac{10}{33\frac{1}{3}}$$

$$\therefore \quad L = 1000 \text{ metres.}$$

18. (A) Let after time t seconds, B reaches 500 metres, then A reaches X_A metres.

$$\because \quad \frac{X_A - 160}{500} = \frac{V_A \times t}{V_B \times t}$$

(Since B gives A a start of 160 m)

$$\Rightarrow \quad \frac{X_A - 160}{500} = \frac{2}{3}$$

$$\therefore \quad X_A = 493\frac{1}{3} \text{ metres.}$$

$$\therefore \quad \text{B beats A by } \left(500 - 493\frac{1}{3}\right) = 6\frac{2}{3} \text{ metres}$$

19. (B) $\because$ $\frac{\text{Winner's time}}{\text{Loser's distance}} = \frac{\text{Loser's time}}{\text{Winner's distance}}$

Since A is the winner and B is the loser

$$\Rightarrow \quad \frac{\left(t - \frac{1}{2}\right)}{1000 - (100 + 100)} = \frac{t}{1000}$$

$$\therefore \quad t = \frac{5}{2} \text{ minutes}$$

$$= 2\frac{1}{2} \text{ min.}$$

Hence time of A and B are 2 min. and $2\frac{1}{2}$ minutes.

20. (A) We have A is the winner and B is the loser.

$\because$ $\frac{190}{1000 - x} = \frac{200}{1000}$ [where x = required distance]

$\Rightarrow$ $1000 - x = 950$

$\therefore$ $x = 50$ metres

Hence, A will beat 3 by 50 metres in a race of 1 km.

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21. (C)

22. (B) B runs 330 metres in 44 seconds.

$\therefore$ B runs (330 – 30) metres in $\frac{44}{330} \times 300$ secs.

i.e., 40 secs.

But A runs 330 metres in 41 seconds.

So, B wins by (41 – 40) seconds, *i.e.*, 1 second.

23. (A) Here A is the winner and B is the loser.

$\because$ Loser's time – winner's time = beat time + start time $\Rightarrow$ B's time – A's time = 10 + 0.

$$\Rightarrow \quad \frac{\text{B's distance}}{\text{B's speed}} - \frac{\text{A's distance}}{\text{A's speed}} = 10$$

$$\Rightarrow \quad \frac{(100-4)}{\text{B's speed}} - \frac{100}{2} = 10$$

$$\Rightarrow \quad \frac{96}{\text{B's speed}} = 10 + 50 = 60$$

$$\therefore \quad \text{B's speed} = 1{\cdot}6 \text{ metres/sec.}$$

Hence, the speed of B is 1·6 metres/sec.

24. (C) Here P is the winner and Q is the loser.

$$\because \quad \frac{\text{Loser's time}}{\text{winner's distance}} = \frac{\text{beat time + start time}}{\text{beat distance + start distance}}$$

$$\Rightarrow \quad \frac{300}{1000} = \frac{10+0}{\text{beat distance} + 0}$$

$$\Rightarrow \quad \text{Beat distance} = \frac{100}{3} \text{ metres.}$$

$\therefore$ P beats Q by $33\frac{1}{3}$ metres in 1 kilometre race.

25. (A) P runs 1 kilometre in 4 minutes (= 240 seconds)

Q runs a kilometre in 4 minutes 10 sec. (= 250 seconds)

$\therefore$ P can beat Q by 10 seconds in 1 km. race

But if P gives Q a start of 10 seconds or x metres so that the race may end in a dead heat, *i.e.*, beat time = 0 and beat distance = 0

$$\because \quad \frac{\text{Loser's time}}{\text{winner's distance}} = \frac{\text{beat time + start time}}{\text{beat distance + start distance}}$$

$$\Rightarrow \quad \frac{250}{1000} = \frac{0+10}{0+x}$$

$$\therefore \quad x = 40$$

Hence if P gives Q a start of 40 metres in a race of one kilometre the race will end in a dead heat.

26. (C) Assuming L = distance of the winning post such that the race ends in a dead heat, *i.e.*, both the participants A and B reach the winning post at the same time.

$\because$ Time taken by A = time taken by B

$$\Rightarrow \quad \frac{L}{\frac{4}{3}v} = \frac{L-30}{v} \quad \therefore L = 120$$

$\left[\text{Since } t = \frac{d}{v}; \text{ where } d = \text{distance and } v = \text{speed}\right]$

$\therefore$ Length of race (distance) of winning post is 120 metres.

27. (B) While A covers 1000 metres, B covers (1000 – 40) or 960 metres and C covers (1000 – 64) or 936 metres.

Now, when B covers 960 metres, C covers 936 metres.

$\therefore$ When B covers 1000 metres

$$\text{C covers } \left(\frac{936}{960} \times 1000\right) = 975 \text{ metres}$$

So, B can give C a start of (1000 – 975) m

= 25 metres.

28. (A) $\because \quad (L - x_{12})x_{23} = L(x_{13} - x_{12})$

$$\Rightarrow \quad (400-20)x_{23} = 400(39-20)$$

$$\therefore \quad x_{23} = 20 \text{ metres}$$

29. (C) Using $(L - x_{12})x_{23} = L(x_{13} - x_{12})$

where x_{12} = A beats B by 15 metres

x_{23} = B beats C by 15 metres

x_{13} = A beats C by 29 metres

L = Length of course = ?

$$\because \quad (L-15)15 = L(29-15)$$

$$\therefore \quad L = 225 \text{ metres}$$

30. (A) Here A is the winner (Ist).

Since B can give C a start therefore B becomes IInd and C becomes IIIrd in the race.

$$\because \quad (L - x_{12})x_{23} = L(x_{13} - x_{12})$$

$$\Rightarrow \quad (1000-40) \times 25 = 1000 \times (x_{13} - 40)$$

$$\Rightarrow \quad 960 \times 25 = 1000 \times (x_{13} - 40)$$

$$\Rightarrow \quad (x_{13} - 40) = \frac{96 \times 25}{100} = 24$$

$$\Rightarrow \quad x_{13} = 64 \text{ metres}$$

Hence, A can give C a start of 64 metres.

31. (A)

32. (C) Here X becomes Ist, Y becomes IInd and Z becomes IIIrd in the race.

$$\because \quad (L - x_{12})x_{23} = L(x_{13} - x_{12})$$

where,

Ist (X) gives IInd (Y) a start of $x_{12} = 50$ metres

Ist (X) gives IIIrd (Z) a start of $x_{13} = 69$ metres

IInd (Y) gives IIIrd (Z) a start of x_{23} = ?

Length of race (L) = 1000 metres

$$\Rightarrow \quad (1000-50)x_{23} = 1000(69-50)$$

$$\therefore \quad x_{23} = 20 \text{ metres}$$

Hence Y gives Z a start of 20 metres.

33. (A) Time taken by A to complete the course

$$= \frac{5}{40}(1000-40) = 120 \text{ seconds}$$

$\therefore$ Time taken by B to run the km = (120 + 5)

= 125 seconds

34. (A) We have the distance by which Rashid can beat Hamid $= 880\left(1 - \frac{144}{160}\right) = 88$ m

$\therefore$ Rashid can give Hamid 88 metres start in the race to make a dead heat.

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35. (B) A can beat B by $440\left(1-\frac{51}{55}\right)$ m

$= 32$ metres

But from the question, B has a 40 metres start *i.e.*, B will beat A by $40 - 32 = 8$ metres.

$\therefore$ Required time $= \frac{55}{440} \times 8 = 1$ second.

36. (B) A can beat B by $200\left(1-\frac{35}{38}\right)$ m $= \frac{300}{19}$ m

$= 15\frac{15}{19}$ m.

37. (A) We first calculate the distance by which A will beat B *i.e.*,

$100\left(1-\frac{46}{48}\right) = \frac{100}{24} = \frac{25}{6} = 4\frac{1}{6}$ metres.

But from the question, B receives 4 metres start still A wins by $\left(4\frac{1}{6}-4\right) = \frac{1}{6}$ m

38. (D) A can beat B by $440\left(1-\frac{90}{99}\right) = \frac{440}{11}$ m

$= 40$ m.

39. (A) Time taken by A to cover 1 km $= \left(\frac{2}{9}\times 60\right) = \frac{40}{3}$ min. and time taken by B to cover 1 km $= \frac{1}{6}\times 60$ = 10 min. B will beat A (if we do not take into account the fact that A having 190 metres start) by $1000\left(1-\frac{3\times 10}{40}\right) = 250$ metres. Now, we consider the fact that the A is having 190 metres start, therefore, B wins the race by (250 – 190) = 60 metres.

40. (A) Required distance

$= \frac{(200-100)}{(1000-100)}\times 1350 = 150$ metres

41. (C) $\because \left(\frac{x-10}{100-10}\right)\times 100 = 10$

$\Rightarrow (x-10) = 9$

$\therefore x = 19$ m

42. (C) A can beat B by $(25 \times 4) = 100$ metres in one km race B can beat C by $(20 \times 2) = 40$ metres in one km race. Let the required distance = x metres.

$\because \left(\frac{x-100}{1000-100}\right)\times 1000 = 40$

$\Rightarrow x - 100 = 36$

$\therefore$ Req. distance = $x = 100 + 36 = 136$ metres

43. (B) A can beat B by $\frac{60}{600}\times 400$

$= 40$ m in 400 m race

B can beat C by $\frac{50}{500}\times 400$

$= 40$ m in 400 m race

Let A will beat C in a race of 400 m by x m

$\because \left(\frac{x-40}{400-40}\right)\times 400 = 40$

$\Rightarrow x - 40 = 36$

$\therefore x = 40 + 36 = 76$ m

44. (D) A can beat B by $= \frac{50}{600}\times 400$

$= \frac{100}{3}$ m in 400 m race

B can beat C by $= \frac{60}{500}\times 400$

$= 48$ m in 400 m race

Let A can beat C in a race of 400 m by x m

$\because \frac{(x-48)}{(400-48)}\times 400 = \frac{100}{3}$

$\Rightarrow (x-48) = \frac{352}{4\times 3} = \frac{88}{3}$

$\therefore x = 48 + \frac{88}{3} = \left(48 + 29\frac{1}{3}\right)$ m

$= 77\frac{1}{3}$ m.

45. (C) Required time $= 9\left(\frac{880-40}{82-40}\right) = 180$ sec.

$= 3$ min.

46. (A) Time taken by A

$= \left[\frac{(100-10)(100-20)}{(20-10)}\right]\frac{1}{100}$

$= \frac{72}{10} = 7{\cdot}2$ sec.

Time taken by B $= \left(\frac{100-20}{20-10}\right)1 = \frac{80}{10} = 8$ sec.

Time taken by C $= \left(\frac{100-10}{20-10}\right)1 = \frac{90}{10} = 9$ sec.

47. (C) Time taken by A

$= \left[\frac{(400-40)(400-80)}{(80-40)}\right].\frac{4}{400}$

$= 28{\cdot}8$ sec.

48. (B) Let the number of points make the game = x

$\because x\left(\frac{32-20}{x-20}\right) = 15$

$\Rightarrow 12x = 15x - 300$

$\Rightarrow -3x = -300$

$\therefore x = 100$ points

49. (B) Let A can give C x points in 100

$\because \left(\frac{x-20}{100-20}\right)\times 100 = 20$

$\Rightarrow (x-20)\,5 = 80$

$\Rightarrow x - 20 = 16$

$\therefore x = 36$

50. (C) Required answer $= \frac{5000}{400\times 5}$

$= \frac{5}{2} = 2\frac{1}{2} = 2$ times

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Odd Man Out and Series

1. Turn odd man out : As the phrase speaks itself in this type of problems, a set of numbers is given in such a way that each one, except one satisfies a particular definite property. The one which does not satisfy that characteristic is to be taken out.

Some important properties of numbers are given below :

(I) Prime numbers : A counting number greater than 1, which is divisible by itself and 1 only, is called a prime number, *e.g.,* 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97 etc.

(II) Odd numbers : A number not divisible by 2, is an odd number *e.g.,* 1, 3, 5, 7, 9, 11, 13, 15 etc.

(III) Even numbers : A number divisible by 2, is an even number *e.g.,* 2, 4, 6, 8, 10 etc.

(IV) Perfect squares : A counting number whose square root is a counting number, is called a perfect square. *e.g.,* 1, 4, 9, 16, 25, 36, 49, 64 etc.

(V) Perfect cubes : A counting number whose cube-root is a counting number, is called a perfect cube, *e.g.,* 1, 8, 27, 64, 125 etc.

(VI) Multiples of a number : A number which is divisible by a given number is called the multiple of a number *e.g.,* 3, 6, 9, 12 etc. are all multiples of 3.

(VII) Numbers in A.P. : Some given numbers are said to be in A.P. If the difference between two consecutive numbers is same *e.g.,* 13, 11, 9, 7, 5, 3, 1, – 1 – 3 etc.

(VIII) Numbers in G.P. : Some given numbers are in G.P. If the ratio between two consecutive numbers remains the same *e.g.,* 48, 12, 3 etc.

Exercise

1. 2, 5, 10, 17, 26, 37, 50, 64 :
   (A) 50 (B) 26
   (C) 37 (D) 64
2. 331, 482, 551, 263, 383, 242, 111 :
   (A) 263 (B) 383
   (C) 242 (D) 111
3. 835, 734, 642, 751, 853, 981, 532 :
   (A) 751 (B) 853
   (C) 981 (D) 532
4. 385, 462, 572, 396, 427, 671, 264 :
   (A) 385 (B) 427
   (C) 671 (D) 264
5. 1, 5, 14, 30, 50, 55, 91 :
   (A) 5 (B) 50
   (C) 55 (D) 91
6. 8, 27, 64, 100, 125, 216, 343 :
   (A) 27 (B) 100
   (C) 125 (D) 343
7. 1, 4, 9, 16, 20, 36, 49 :
   (A) 1 (B) 9
   (C) 20 (D) 49
8. 10, 25, 45, 54, 60, 75, 80 :
   (A) 10 (B) 45
   (C) 54 (D) 75
9. 16, 25, 36, 72, 144, 196, 225 :
   (A) 36 (B) 72
   (C) 196 (D) 225
10. 41, 43, 47, 53, 61, 71, 73, 81 :
    (A) 61 (B) 71
    (C) 73 (D) 81
11. 6, 9, 15, 21, 24, 28, 30 :
    (A) 28 (B) 21
    (C) 24 (D) 30
12. 1, 4, 9, 16, 23, 25, 36 :
    (A) 9 (B) 23
    (C) 25 (D) 36
13. 3, 5, 9, 11, 14, 17, 21 :
    (A) 21 (B) 17
    (C) 14 (D) 9
14. 10, 14, 16, 18, 21, 24, 26 :
    (A) 26 (B) 24
    (C) 21 (D) 18
15. 3, 5, 7, 12, 13, 17, 19 :
    (A) 19 (B) 17
    (C) 13 (D) 12
16. 1, 2, 6, 15, 31, 56, 91 :
    (A) 31 (B) 91
    (C) 56 (D) 15
17. 25, 36, 49, 81, 121, 169, 225 :
    (A) 36 (B) 49
    (C) 121 (D) 169
18. 8, 13, 21, 32, 47, 63, 83 :
    (A) 47 (B) 63
    (C) 32 (D) 83
19. 56, 72, 90, 110, 132, 150 :
    (A) 72 (B) 110
    (C) 132 (D) 150
20. 6, 13, 18, 25, 30, 37, 40 :
    (A) 25 (B) 30
    (C) 37 (D) 40
21. 5, 16, 6, 16, 7, 16, 9 :
    (A) 9
    (B) 7
    (C) 6
    (D) None of these
22. 1, 8, 27, 64, 124, 216, 343 :
    (A) 8 (B) 27
    (C) 64 (D) 124
23. 46080, 3840, 384, 48, 24, 2, 1 :
    (A) 1 (B) 2
    (C) 24 (D) 384
24. 582, 605, 588, 611, 634, 617, 600 :
    (A) 634 (B) 611
    (C) 605 (D) 600
25. 36, 54, 18, 27, 9, 18·5, 4·5 :
    (A) 4·5 (B) 18·5
    (C) 54 (D) 18
26. 22, 33, 66, 99, 121, 279, 594 :
    (A) 33 (B) 121
    (C) 279 (D) 594
27. 4, 5, 7, 10, 14, 18, 25, 32 :
    (A) 7 (B) 14
    (C) 18 (D) 32
28. 2, 5, 10, 50, 500, 5000 :
    (A) 0 (B) 5
    (C) 10 (D) 5000
29. 253, 136, 352, 460, 324, 631, 244 :
    (A) 136 (B) 324
    (C) 352 (D) 631
30. 19, 28, 39, 52, 67, 84, 102 :
    (A) 52 (B) 102
    (C) 84 (D) 67

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31. 11, 13, 17, 19, 23, 29, 31, 37, 41, (…) :
(A) 43 (B) 47
(C) 53 (D) 51

32. 1, 8, 27, 64, 125, 216, (…) :
(A) 354 (B) 343
(C) 392 (D) 245

33. 1, 4, 9, 16, 25, 36, 49, (…) :
(A) 54 (B) 56
(C) 64 (D) 81

34. 5, 10, 13, 26, 29, 58, 61, (…) :
(A) 122 (B) 64
(C) 125 (D) 128

35. 4 – 8, 16 – 32, 64 — (…) :
(A) 128 (B) – 128
(C) 192 (D) – 192

36. 8, 27, 125, 343, 1331 :
(A) 1331
(B) 343
(C) 125
(D) None of these

37. 10, 14, 28, 32, 64, 68, 132 :
(A) 32 (B) 68
(C) 132 (D) 28

38. 4, 9, 19, 39, 79, 160, 319 :
(A) 319 (B) 160
(C) 79 (D) 39

39. 3, 10, 21, 36, 55, 70, 105 :
(A) 105 (B) 70
(C) 36 (D) 55

40. 125, 123, 120, 115, 108, 100, 84 :
(A) 123 (B) 115
(C) 100 (D) 84

41. 16, 36, 64, 81, 100, 144, 190 :
(A) 81 (B) 100
(C) 190 (D) 36

42. 125, 127, 130, 135, 142, 153, 165 :
(A) 130 (B) 142
(C) 153 (D) 165

43. 4, 6, 8, 9, 10, 11, 12 :
(A) 10 (B) 11
(C) 12 (D) 9

44. 105, 85, 60, 30, 0, – 45, – 90 :
(A) 0 (B) 85
(C) – 45 (D) 60

45. 52, 51, 48, 43, 34, 27, 16 :
(A) 27 (B) 34
(C) 43 (D) 48

46. Find the wrong number in the series 3, 8, 15, 24, 34, 48, 63 :
(A) 15 (B) 24
(C) 34 (D) 48

47. Complete the series 2, 5, 9, 19, 37 … :
(A) 76
(B) 74
(C) 75
(D) None of these

48. 9, 12, 11, 14, 13, (…), 15 :
(A) 12 (B) 16
(C) 10 (D) 17

49. 71, 76, 69, 74, 67, 72, (…) :
(A) 77 (B) 65
(C) 80 (D) 76

50. 1, 2, 4, 8, 16, 32, 64, (…), 256 :
(A) 148 (B) 128
(C) 154 (D) 164

51. 10, 5, 13, 10, 16, 20, 19, (…) :
(A) 22 (B) 40
(C) 38 (D) 23

52. 8, 7, 11, 12, 14, 17, 17, 22, (…) :
(A) 27 (B) 20
(C) 22 (D) 24

53. 2, 4, 12, 48, 240, (…) :
(A) 960 (B) 1440
(C) 1080 (D) 1920

54. 7, 26, 63, 124, 215, 342, (…) :
(A) 481 (B) 511
(C) 391 (D) 421

55. 165, 195, 255, 285, 345, (…) :
(A) 375 (B) 420
(C) 435 (D) 390

56. 8, 24, 12, 36, 18, 54, (…) :
(A) 27 (B) 108
(C) 68 (D) 72

57. 2, 6, 12, 20, 30, 42, 56, (…) :
(A) 60 (B) 64
(C) 72 (D) 70

58. 15, 31, 63, 127, 255, (…) :
(A) 513 (B) 511
(C) 517 (D) 523

59. 3, 7, 6, 5, 9, 3, 12, 1, 15, (…) :
(A) 18 (B) 13
(C) – 1 (D) 3

60. 16, 33, 65, 131, 261, (…) :
(A) 523 (B) 521
(C) 613 (D) 721

61. 196, 169, 144, 121, 100, 80, 64 :
(A) 169 (B) 144
(C) 121 (D) 100
(E) 80

62. 1, 3, 10, 21, 64, 129, 356, 777 :
(A) 10 (B) 21
(C) 64 (D) 129
(E) 356

63. 3, 7, 15, 39, 63, 127, 255, 511 :
(A) 7 (B) 15
(C) 39 (D) 63
(E) 127

64. 445, 221, 109, 46, 25, 11, 4 :
(A) 221 (B) 109
(C) 46 (D) 25
(E) 11

65. 19, 26, 33, 46, 59, 74, 91 :
(A) 26 (B) 33
(C) 46 (D) 59
(E) 74

66. 2880, 480, 92, 24, 8, 4, 2 :
(A) 2880 (B) 480
(C) 92 (D) 24
(E) 4

67. 3, 7, 15, 27, 63, 127, 255 :
(A) 7 (B) 15
(C) 27 (D) 63
(E) 127

68. 7, 8, 18, 57, 228, 1165, 6996 :
(A) 8 (B) 18
(C) 57 (D) 228
(E) 127

69. 64, 71, 80, 91, 104, 119, 135, 155 :
(A) 71 (B) 80
(C) 104 (D) 119
(E) 135

70. 40960, 10240, 2560, 640, 200, 40, 10 :
(A) 640 (B) 40
(C) 200 (D) 2560
(E) 10240

71. 1, 1, 2, 6, 24, 96, 720 :
(A) 720 (B) 96
(C) 24 (D) 6
(E) 2

72. 190, 166, 145, 128, 112, 100, 91 :
(A) 100 (B) 166
(C) 145 (D) 128
(E) 112

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73. Find out the wrong number in the series 125, 106, 88, 76, 65, 58, 53.
(A) 125 (B) 106
(C) 88 (D) 76
(E) 65

74. Find out the wrong number in the series 5, 15, 30, 135, 405, 1215, 3645.
(A) 3645 (B) 1215
(C) 405 (D) 30
(E) 15

75. Find out the wrong number in the series 2, 9, 28, 65, 126, 216, 344 :
(A) 2 (B) 28
(C) 65 (D) 126
(E) 216

Answers with Hints

1. (D) The pattern is $x^2 + 1$, where $x = 1, 2, 3, 4, 5, 6, 7, 8$ etc. But 64 is out of pattern.
2. (B) In each number except 383, the product of first and third digit is the middle one.
3. (A) In each number except 751, the difference of third and first digit is the middle one.
4. (B) In each number except 427, the middle digit is sum of the other two.
5. (B) The pattern is 1^2, $1^2 + 2^2$, $1^2 + 2^2 + 3^2$, $1^2 + 2^2 + 3^2 + 4^2$, $1^2 + 2^2 + 3^2 + 4^2 + 5^2$, $1^2 + 2^2 + 3^2 + 4^2 + 5^2 + 6^2$. But 50 is not of this pattern.
6. (B) The pattern is 2^3, 3^3, 4^3, 5^3, 6^3, 7^3. But 100 is not a perfect cube.
7. (C) The pattern is 1^2, 2^2, 3^2, 4^2, 5^2, 6^2, 7^2. But, instead of 5^2, it is 20, which is to be turned out.
8. (C) Each of the numbers except 54, is a multiple of 5.
9. (B) Each of the numbers except 72, is a perfect square.
10. (D) Each of the numbers except 81, is a prime number.
11. (A) Each of the numbers except 28, is a multiple of 3.
12. (B) Each of the given numbers except 23, is a perfect square.
13. (C) Each of the numbers except 14, is an odd number.
14. (C) Each of the numbers except 21, is an even number.
15. (D) Each of the numbers except 12, is a prime number.
16. (B) Add 1^2, 2^2, 3^2, 4^2, 5^2, 6^2. So, 91 is wrong.
17. (A) The numbers are squares of odd natural numbers, starting from 5 up to 15. So, 36 is wrong.
18. (A) Go on adding 5, 8, 11, 14, 17, 20. So, the number 47 is wrong and must be replaced by 46.
19. (D) The numbers are 7×8, 8×9, 9×10, 10×11, 11×12, 12×13. So, 150 is wrong.
20. (D) The difference between two successive terms from the beginning are 7, 5, 7, 5, 7, 5. So, 40 is wrong.
21. (A) Terms at odd places are 5, 6, 7, 8 etc. and each term at even place is 16. So, 9 is wrong.
22. (D) The numbers are 1^3, 2^3, 3^3, 4^3 etc. So, 124 is wrong. It must have been 5^3 *i.e.,* 125.
23. (C) The terms are successively divided by 12, 10, 8, 6 … etc. So, 24 is wrong.
24. (A) Alternately 23 is added and 17 is subtracted from the terms. So, 634 is wrong.
25. (B) The terms are alternately multiplied by 1·5 and divided by 3. However 18·5 does not satisfy it.
26. (C) Each number except 279 is a multiple of 11.
27. (C) 2nd = (1st + 1) : 3rd = (2nd + 2); 4th = (3rd + 3); 5th = (4th + 4). But 18 = 6th ≠ 5th + 5 = 14 + 5 = 19.
28. (D) Pattern is 1st × 2nd = 3rd; 2nd × 3rd = 4th, 3rd × 4th = 5th. But 4th × 5th = 50 × 500 = 25000 ≠ 5000 = 6th.
29. (B) Sum of the digits in each number, except 324 is 10.
30. (B) The pattern is $x^2 + 3$, where $x = 4, 5, 6, 7, 8, 9$ etc. But 102 is out of pattern.
31. (A) Numbers are all primes. The next prime is 43.
32. (B) Numbers are 1^3, 2^3, 3^3, 4^3, 5^3, 6^3. So, the missing number is $7^3 = 343$.
33. (C) Numbers are 1^2, 2^2, 3^2, 4^2, 5^2, 6^2, 7^2. So, the next number is $8^2 = 64$.
34. (A) Numbers are alternately multiplied by 2 and increased by 3. So, the missing number = 61 × 2 = 122.
35. (B) Each number is the preceding number multiplied by – 2. So, the required number is – 128.
36. (D) The numbers are cubes of primes *i.e.,* 2^3, 3^3, 5^3, 7^3, 11^3. Clearly, none is wrong.
37. (C) Alternately, we add 4 and double the next. So, 132 is wrong. It must be (68 × 2) *i.e.,* 136.
38. (B) Double the number and add 1 to it, to get the next number. So, 160 is wrong.
39. (B) The pattern is 1×3, 2×5, 3×7, 4×9, 5×11, 6×13, 7×15 etc.
40. (C) Prime numbers 2, 3, 5, 7, 11, 13 have successively been subtracted. So, 100 is wrong. It must be (108 – 11) *i.e.,* 97.
41. (C) Each number is the square of a composite number except 190.
42. (D) Prime numbers 2, 3, 5, 7, 11, 13 are to be added successively. So, 165 is wrong.
43. (B) Each number is a composite number except 11.
44. (A) Subtract 20, 25, 30, 35, 40, 45 from successive numbers. So 0 is wrong.
45. (B) Subtract 1, 3, 5, 7, 9, 11 from successive numbers. So, 34 is wrong.
46. (C) The difference between consecutive terms are respectively. 5, 7, 9, 11 and 13. So, 34 is a wrong number.
47. (C) Second number is one more than twice the first third number is one less than twice the second, fourth

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number is one more than twice the third, fifth number is one less than the fourth. Therefore, the sixth number is one more than twice the fifth. So, the missing number is 75.

48. (B) Alternately, we add 3 and subtract 1.
49. (B) Alternately, we add 5 and subtract 7.
50. (B) Each previous number is multiplied by 2.
51. (B) There are two series (10, 13, 16, 19) and (5, 10, 20, 40) one increasing by 3 and another multiplied by 2.
52. (B) There are two series (8, 11, 14, 17, 20) and (7, 12, 17, 22). Increasing by 3 and 5 respectively.
53. (B) Go on multiplying the given numbers by 2, 3, 4, 5, 6. So, the correct next number is 1440.
54. (B) Numbers are $(2^3 - 1)$, $(3^3 - 1)$, $(4^3 - 1)$ $(5^3 - 1)$, $(6^3 - 1)$ $(7^3 - 1)$ etc. So, the next number is $(8^3 - 1) = (512 - 1) = 511$.
55. (C) Each number is 15 multiplied by a prime number *i.e.,* 15×11, 15×13, 15×17, 15×19, 15×23. So, the next number is $15 \times 29 = 435$.
56. (A) Numbers are alternately multiplied by 3 and divided by 2. So, next number = $54 \div 2 = 27$.
57. (C) The pattern is 1×2, 2×3, 3×4, 4×5, 5×6, 6×7, 7×8. So, the next number is $8 \times 9 = 72$.
58. (B) Each number is double the preceding one plus 1. So, the next number is $(255 \times 2) + 1 = 511$.
59. (C) There are two series, beginning respectively with 3 and 7. In one 3 is added and in another 2 is subtracted. The next number is $1 - 2 = -1$.
60. (A) Each number is twice the preceding one with 1 added or subtracted alternately. So, the next number is $(2 \times 261 + 1) = 523$.
61. (E) Numbers must be $(14)^2$, $(13)^2$, $(11)^2$, $(10)^2$, $(9)^2$, $(8)^2$. So, 80 is wrong.
62. (E) $A \times 2 + 1$, $B \times 3 + 1$, $C \times 2 + 1$, $D \times 3 + 1$ and so on $\therefore$ 356 is wrong.
63. (C) Go on multiplying 2 and adding 1 to get the next number. So, 39 is wrong.
64. (C) Go on subtracting 3 and dividing the result by 2 to obtain the next number. Clearly, 46 is wrong.
65. (B) Go on adding 7, 9, 11, 13, 15, 17 respectively to obtain the next number. So, 33 is wrong.
66. (C) Go on dividing by 6, 5, 4, 3, 2, 1 respectively to obtain the next number. Clearly, 92 is wrong.
67. (C) Go on multiplying the number by 2 and adding 1 to it to get the next number. So, 27 is wrong.
68. (D) Let the given numbers be A, B, C, D, E, F, G. Then $A \times 1 + 1$, $B \times 2 + 2$, $C \times 3 + 3$, $D \times 4 + 4$, $E \times 5 + 5$, $F \times 6 + 6$ are the required numbers. Clearly, 228 is wrong.
69. (E) Go on adding 7, 9, 11, 13, 15, 17, 19 respectively to obtain the next number. So, 135 is wrong.
70. (C) Go on dividing by 4 to get the next number. So, 200 is wrong.
71. (B) Go on multiplying with 1, 2, 3, 4, 5, 6 to get the next number. So, 96 is wrong.
72. (D) Go on subtracting 24, 21, 18, 15, 12, 9 from the numbers to get the next number. Clearly, 128 is wrong.
73. (C) Go on subtracting prime numbers 19, 17, 13, 11, 7, 5 from the numbers to get the next number. So, 88 is wrong.
74. (D) Multiply each term by 3 to obtain the next term. Hence, 30 is a wrong number.
75. (E) $2 = (1^3 + 1)$; $9 = (2^3 + 1)$; $28 = (3^3 + 1)$; $65 = (4^3 + 1)$; $126 = (5^3 + 1)$; $216 \neq (6^3 + 1)$ and $344 = (7^3 + 1)$

$\therefore$ 216 is a wrong number.

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Calendar

Under this heading we mainly deal with finding the day of the week on a particular given date. The process of finding it lies in obtaining the number of odd days.

The number of days more than the complete number of weeks in a given period are called odd days.

LEAP AND ORDINARY YEAR. Every year which is divisible by 4 such as 1992 is called a leap year. Every 4th century is a leap year but no other century is a leap year *viz*, 400, 800, 1200, 1600 are all leap years, but none of 700, 900, 1100 etc. is a leap year.

An ordinary year has 365 days *i.e.,* (52 weeks + 1 day).

A leap year has 366 days *i.e.,* (52 weeks + 2 days).

An ordinary year has 1 odd day and a leap year has 2 odd days.

A century *i.e.,* 100 years has 76 ordinary years and 24 leap years.

∴ 100 years = 76 ordinary year + 24 leap years.

= (76 × 52) weeks + 76 days

+ (24 × 52) weeks + 48 days

= (5217 weeks + 5 days)

= 5 odd days

i.e.,

100 years contain 5 odd days.

200 years contain 10 and therefore **3 odd days.**

300 years contain 15 and therefore **1 odd day.**

400 years contain (20 + 1) and therefore **0 odd day.**

Similarly, the years 800, 1200, 1600 etc. contain no odd day.

We count days according to number of odd days. Sunday for 0 odd day. Monday for 1 odd day and so on.

Examples

Q. 1. Prove that any date in March is the same day of the week as the corresponding date in November of that year.

Sol. In order to prove the required result, we have to show that the total number of odd days between last day of February and last day of October is zero.

Number of days between these dates are :

March, April, May, June, July, Aug, Sept, Oct

31 + 30 + 31 + 30 + 31 + 31 + 30 + 31 = 245 days = 35 weeks = 0 odd day. Hence the result follows.

Q. 2. Prove that the last day of a century cannot be either Tuesday, Thursday or Saturday.

Sol. Ist century, *i.e.,* 100 years contain 76 ordinary years and 24 leap years and therefore, (76 + 48) or 124 odd days or 5 odd days.

∴ The last day of Ist century is 'Friday'.

Two centuries *i.e.,* 200 years contains 152 ordinary years and 48 leap years and therefore (152 + 96) or 248 or 3 odd days.

∴ The last day of 2nd century is 'Wednesday'.

Three centuries *i.e.,* 300 years contain 228 ordinary years and 72 leap years and therefore (228 + 144) or 372 or 1 odd day.

∴ The last day of third century is 'Monday'.

Four centuries *i.e.,* 400 years contain 303 ordinary years and 97 leap years and therefore, (303 + 194) or 497 or 0 odd day.

∴ The last day of 4th century is 'Sunday'.

Since the order is continually kept in successive cycles, we see that the last day of a century cannot be Tuesday, Thursday or Saturday.

Q. 3. Prove that the calendar for 1990 will serve for 2001 also.

Sol. In order that the calendar for 1934 and 1945 be the same, Ist January of both the years must be on the same day of the week. For this, the total number of odd days between 31st Dec. 1933 and 31st Dec. 1944 must be zero.

Odd days are as under :

Year	1990	1991	1992	1993	1994	1995
Odd days	1	1	2	1	1	1
Year	1996	1997	1998	1999	2000	(leap)
Odd day	2	1	1	1	2	

∴ Total number of odd days = 14 days *i.e.,* 0 odd day. Hence, the result follows.

Exercise

1. Smt. Indira Gandhi died on 31st October, 1984. The day of the week was :
   (A) Monday
   (B) Tuesday
   (C) Wednesday
   (D) Friday
2. Today is Friday. After 62 days it will be :
   (A) Friday (B) Thursday
   (C) Saturday (D) Monday
3. Monday falls on 4th April, 1988. What was the day of 3rd November, 1987 ?
   (A) Monday (B) Sunday
   (C) Tuesday (D) Wednesday
4. On July, 2, 1985, it was Wednesday the day of the week on July 2, 1984 was :
   (A) Wednesday
   (B) Tuesday
   (C) Monday
   (D) Thursday
5. On January 12, 1980, it was Saturday. The day of the week on January 12, 1979 was :
   (A) Saturday (B) Friday
   (C) Sunday (D) Thursday
6. January 1, 1992 was a Wednesday, what day of the week will it be on January 1, 1993 ?
   (A) Monday (B) Tuesday
   (C) Sunday (D) Friday
7. P. V. Narsimha Rao was elected party leader on 29th May, 1991. What was the day of the week ?
   (A) Tuesday
   (B) Friday

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(C) Wednesday
(D) Sunday

8. The first republic day of India was celebrated on 26th January, 1950. It was :
(A) Monday (B) Tuesday
(C) Thursday (D) Friday

9. How many days are there from 2nd January 1993 to 15th March 1993 ?
(A) 72 (B) 73
(C) 74 (D) 71

10. Today is Ist August. The day of the week is Monday. This is a leap year. The day of the week on this day after 3 years will be :
(A) Wednesday
(B) Thursday
(C) Friday
(D) Saturday

11. The year next to 1991 having the same calendar as that of 1990 is :
(A) 1998 (B) 2001
(C) 2002 (D) 2003

12. The year next to 1990 having the same calendar as that of 1988 is :
(A) 1990 (B) 1992
(C) 1993 (D) 1995

13. The number of odd days in a leap year is :
(A) 1 (B) 2
(C) 3 (D) 4

14. January 16, 1997 was a Thursday. What day of the week will it be on January 4, 2000 ?
(A) Tuesday
(B) Thursday
(C) Wednesday
(D) Friday

Answers with Hints

1. (C) 1600 years contains 0 odd day; 300 years contain 1 odd day. Also, 83 years contains 20 leap years and 63 ordinary years and therefore, (40 + 0) odd days *i.e.,* 5 odd days.

∴ 1983 years contain (0 + 1 + 5) *i.e.,* 6 odd days

Number of days from Jan. 1984 to 31st Oct 1984

= (31 + 29 + 31 + 30 + 31 + 30 + 31 + 31 + 30 + 31)

= 305 days

= 4 odd days

∴ Total number of odd days = 6 + 4 = 3 odd days

So, 31st Oct 1984 was Wednesday

2. (B) Each day of the week is repeated after 7 days

∴ After 63 days, it would be Friday

So, After 62 days, it would be Thursday

3. (C) Counting the number of days after 3rd November, 1987 we have

Nov., Dec., Jan., Feb., March, April

days = 27 + 31 + 31 + 29 + 31 + 4 = 153 days containing 6 odd days *i.e.,* (7 – 6) = 1 day beyond the day on 4th April, 1988 So, the day was Tuesday.

4. (C) The year 1984 being a leap year, it has 2 odd days. So, the day on 2nd July, 1985 is two days beyond the day on 2nd July, 1984.

But, 2nd July 1985 was Wednesday

∴ 2nd July, 1984 was Monday

5. (B) The year 1979 being an ordinary year, it has 1 odd day. So, the day on 12th January 1980, is one day beyond the day on 12th January, 1979

But January 12, 1980 being Saturday

∴ January 12, 1979 was Friday.

6. (D) 1992 being a leap year, it has 2 odd days. So, the first day of the year 1993 will be two days beyond Wednesday *i.e.,* it will be Friday.

7. (C) Try yourself. It was Wednesday.

8. (C) 1600 years have 0 odd day and 300 years have 1 odd day. 49 years contain 12 leap years and 37 ordinary years and therefore (24 + 37) odd days *i.e.,* 5 odd days *i.e.,* 1949 years contain (0 + 1 + 5) = 6 odd days. 26 days of January contain 5 odd days.

Total odd days = (6 + 5) = 11 or 4 odd days.

So, the day was Thursday

9. (B) Jan., Feb., March

30 + 28 + 15 = 73 days

10. (B) This being a leap year none of the next 3 years is a leap year. So, the day of the week will be 3 days beyond Monday *i.e.,* it will be Thursday.

11. (C) We go on counting the odd days from 1991 onwards till the sum is divisible by 7. The number of such days are 14 upto the year 2001.

So, the calendar for 1991 will be repeated in the year 2002.

12. (C) Starting with 1988, we go on counting the number of odd days till the sum is divisible by 7

Year	1988	1989	1990	1991	1992
Odd days	2	1	1	1	2

= 7; *i.e.,* odd days.

∴ Calendar for 1993 is the same as that of 1988.

13. (B) A leap year has (52 weeks + 2 days).

So, the number of odd days in a leap year is 2

14. (A) First we look for the leap years during this period 1997, 1998, 1999 are not leap years

1998 and 1999 together have net 2 odd days

No. of days remaining in 1997 = 365 – 16 = 349 days

= 49 weeks 6 odd days

January 4, 2000 gives 4 odd days

∴ Total no. of odd days = 2 + 6 + 4 = 12 days = 7 days (1 week) + 5 odd days

Hence, January 4, 2000 will be 5 days beyond Thursday *i.e.,* it will be on Tuesday.

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Chain Rule

The method of finding the fourth proportional when the other three are given is called simple proportion or rule of three. Repeated use of the rule of three is called **compound proportion.**

Direct proportion—Two quantities are said to directly proportional if on the increase or decrease of the one, the other increases or decreases the same extent.

Ex. (i) Cost of articles is directly proportional to number of articles *i.e.* more articles, more cost and less articles, less cost.

(ii) The work done is directly proportional to the number of men employed to do the work *i.e.*, more men, more work and less men, less work.

Indirect proportion—Two quantities are said to be indirectly proportional if on the increase of the one, the other decrease to the same extent and vice-versa.

Ex. (i) Less number of days required to finish a work, more persons are to be employed.

(ii) The time taken to cover a distance is inversely proportional to the speed of the car, *i.e.* more speed, less is the time taken.

Examples

Q. 1. A contract is to be completed in 56 days and 104 men were set to work, each working 8 hours a day. After 30 days $\frac{2}{5}$ of the work is completed. How many additional men may be employed, so that the work may be completed in time, each man now working 9 hours a day ?

Solution : Remaining work

$$= \left(1 - \frac{2}{5}\right) = \frac{3}{5}$$

Remaining period

$$= (56 - 30)$$

$$= 26 \text{ days}$$

$\because$ more work, more men (Direct)
more day less men (Indirect)
more hours per day, less man (Indirect)

$$\Rightarrow \left.\begin{array}{l}\text{Work } \frac{2}{5} : \frac{3}{5} \\ \text{Days } 26 : 30 \\ \text{Hours } 9 : 8\end{array}\right\} :: 104 : x$$

$$\therefore x = \frac{3 \times 30 \times 8 \times 104 \times 5}{5 \times 2 \times 26 \times 9} = 160$$

No. of additional men

$$= 160 - 104 = 56$$

Q. 2. If 8 men, working 9 hours a day can build a wall 18 metres long 2 metres broad and 12 metres high in 10 days. How many men will be required to build a wall 32 metres long, 3 metres broad and 9 metres high, by working 6 hours a day in 8 days ?

Solution : Since the number of men is to be found out, we compare each item with the number of men, as shown below—

More length, more men required (Direct proportion)

More breadth, more men required (Direct proportion)

More height, more men required (Direct proportion)

Less daily working hrs. more men required (Indirect proportion)

Less day to finish work, more men required (Indirect proportion)

$$\because \left.\begin{array}{l}\text{Length } 18 : 32 \\ \text{Breadth } 2 : 3 \\ \text{Height } 12 : 9 \\ \text{Daily hrs. } 6 : 9 \\ \text{Days } 8 : 10\end{array}\right\} :: 8 : x$$

$$\Rightarrow 18 \times 2 \times 12 \times 6 \times 8 \times x$$

$$= 32 \times 3 \times 9 \times 9 \times 10 \times 8$$

$$\therefore x = \frac{32 \times 3 \times 9 \times 9 \times 10 \times 8}{18 \times 2 \times 12 \times 6 \times 8}$$

$$= 30 \text{ men.}$$

$\therefore$ Required number of men

$$= 30$$

Q. 3. If 20 men can build a wall 112 metres long in 6 days, what length of a similar wall can be built by 25 men in 3 days ?

Solution : Since the length is to be found out, we compare each item with the length as shown below :

More men, more length built (Direct proportion)

Less days, less length built (Direct proportion)

$$\because \left.\begin{array}{l}\text{Men } 20 : 25 \\ \text{Days } 6 : 3\end{array}\right\} :: 112 : x$$

$$\Rightarrow 20 \times 6 \times x$$

$$= 25 \times 3 \times 112$$

$$\therefore \quad x = \frac{25 \times 3 \times 112}{20 \times 6}$$

$$= 70 \text{ metres.}$$

Q. 4. If 36 men can do a certain piece of work in 25 days. In how many days will 15 men do it ?

Solution : Clearly, less is the number of men employed, more will be the number of days taken to finish the work. So, inverse ratio of men is equal to ratio of times taken.

Let the required number of days be x

Then, $15 : 36 :: 25 : x$

$$\Rightarrow \quad \frac{15}{36} = \frac{25}{x}$$

$$\therefore \quad x = \frac{36 \times 25}{15} = 60$$

$\therefore$ Required number of days

$$= 60$$

Q. 5. If 15 dolls cost Rs. 35, what do 39 dolls cost ?

Solution : Clearly more dolls more cost. (Direct proportion)

So, ratio of dolls is the same as ratio of costs.

Now, let the costs of 39 dolls be Rs. x.

Then, $15 : 39 :: 35 : x$

$$\Rightarrow \quad \frac{15}{39} = \frac{35}{x}$$

$$\therefore \quad x = \frac{35 \times 39}{15}$$

$$= \text{Rs. } 91$$

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Exercise

1. If x men working x hours per day can do x units of a work in x days, then y men working y hours per day would be able to complete in y days—
   (A) $\frac{x^2}{y^3}$ units of work
   (B) $\frac{x^3}{y^2}$ units of work
   (C) $\frac{y^2}{x^3}$ units of work
   (D) $\frac{y^3}{x^2}$ units of work

2. If 17 labourers can dig a ditch 26 metres long in 18 days working 8 hours a day. How many labourers should be engaged to dig a similar ditch 39 metres long in 6 days, each labourer working 9 hours a day ?
   (A) 51 (B) 68
   (C) 85 (D) 34

3. 20 men complete one-third of a piece of work in 20 days. How many more men should be employed to finish the rest of the work in 25 more days ?
   (A) 10 (B) 12
   (C) 15 (D) 20

4. A garrison had provisions for a certain number of days. After 10 days (1/5)th of the men desert and it is found that the provisions will now last just as long as before. How long was that ?
   (A) 35 days (B) 15 days
   (C) 25 days (D) 50 days

5. A garrison of 500 men had provisions for 24 days. However a reinforcement of 300 men arrived. The food will now last for—
   (A) 18 days (B) $17\frac{1}{2}$ days
   (C) 16 days (D) 15 days

6. 120 men had provisions for 200 days. After 5 days, 30 men died due to an epidemic. The remaining food will last for—
   (A) 150 days (B) $146\frac{1}{4}$ days
   (C) 245 days (D) 260 days

7. If 18 pumps can raise 2170 tonnes of water in 10 days, working 7 hours a day. In how many days will 16 pumbs raise 1736 tonnes, working 9 hour a day ?
   (A) 9 days (B) 8 days
   (C) 7 days (D) 6 days

8. If 4 examiners can examine a certain number of answer books in 8 days by working 5 hours a day. For how many hours a day would 2 examiners have to work in order to examine twice the number of answer books in 20 days ?
   (A) 6 hours (B) 8 hours
   (C) 9 hours (D) $7\frac{1}{2}$ hours

9. If 20 men working 7 hours a day can do a piece of work in 10 days. In how many days will 15 men working for 8 hours a day to the same piece of work ?
   (A) $15\frac{5}{21}$ days
   (B) $11\frac{2}{3}$ days
   (C) $6\frac{9}{16}$ days
   (D) $4\frac{1}{5}$ days

10. If 300 men can do a piece of work in 16 days. How many men would do (1/5) of the work in 15 days ?
    (A) 56 (B) 64
    (C) 60 (D) 72

11. If 20 men can build a wall 112 metres long in 6 days, what length of a similar wall can be built by 25 men in 3 days ?
    (A) 140 metres
    (B) 44·8 metres
    (C) 105 metres
    (D) 70 metres

12. If 3 persons weave 168 shawls in 14 days, how many shawls will 8 persons weave in 5 days ?
    (A) 90 (B) 105
    (C) 126 (D) 160

13. If six men working 8 hours a day earn Rs. 840 per week then 9 men working 6 hours a day will earn per week—
    (A) Rs. 840 (B) Rs. 945
    (C) Rs. 1620 (D) Rs. 1680

14. If 18 binders bind 900 books in 10 days, how many binders will be required to bind 660 books in 12 days ?
    (A) 55 (B) 14
    (C) 13 (D) 11

15. If the rent for grazing 40 cows for 20 days is Rs. 370, how many cows can graze for 30 days on Rs. 111 ?
    (A) 6 (B) 8
    (C) 5 (D) 12

16. In a hospital there is a consumption of 1350 litres of milk for 70 patients for 30 days. How many patients will consume 1710 litres of milk in 28 days ?
    (A) 59 (B) 85
    (C) 95 (D) 105

17. If 40 persons consume 60 kg of rice in 15 days, then in how many days will 30 persons consume 12 kg of rice ?
    (A) $3\frac{3}{4}$ days (B) 4 days
    (C) $6\frac{1}{4}$ days (D) 9 days

18. On a scale of a map 0·8 cm represents 8·8 km. If the distance between two points on the map is 80·5 cm., the distance between these two points is approximately—
    (A) 9 km (B) 70 km
    (C) 90 km (D) 885 km

19. If 22·5 metres of a uniform iron rod weighs 85·5 kg. What will be the weight of 6 metres of the same rod ?
    (A) 22·8 kg
    (B) 25·6 kg
    (C) 28 kg
    (D) None of these

20. 16 men can reap a field in 30 days. In how many days will 20 men reap the field ?
    (A) 25 days (B) 24 days
    (C) $10\frac{2}{3}$ days (D) $37\frac{1}{2}$ days

21. If 21 cows eat that much as 15 buffaloes, how many cows will eat that much as 35 buffaloes ?
    (A) 49
    (B) 56

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(C) 45
(D) None of these

22. Ten pipes through which water flows at the same rate can fill a tank in 24 minutes. If two pipes go out of order, how long will the remaining pipes take to fill the tank ?
(A) 40 minutes
(B) 45 minutes
(C) $19\frac{1}{5}$ minutes
(D) 30 minutes

23. If (4/5)th of a cistern is filled in 1 minute, how much more time will be required to fill the rest of it ?
(A) 20 seconds
(B) 15 seconds
(C) 12 seconds
(D) 22 seconds

24. If Raghu can walk a distance of 5 kms in 20 minutes, how long he can go in 50 minutes ?
(A) 10·5 km (B) 12 km
(C) 12·5 km (D) 13·5 km

25. A rope makes 140 rounds of the circumference of a cylinder, whose radius of the base is 14 cms. How many times can it go round a cylinder with radius 20 cms ?
(A) 98
(B) 17
(C) 200
(D) None of these

26. A contractor employed 30 men to do a piece of work in 38 days. After 25 days, he employed 5 men more and the work was finished one day earlier. How many days he would have been behind if he had not employed additional men ?
(A) 1 day (B) $1\frac{1}{4}$ days
(C) $1\frac{3}{4}$ days (D) $1\frac{1}{2}$ days

27. 2 men and 7 boys can do a piece of work in 14 days. 3 men and 8 boys can do the same in 11 days. 8 men and 6 boys can do 3 times the amount of this work in—
(A) 21 days (B) 18 days
(C) 24 days (D) 36 days

28. If 3 men or 6 boys can do a piece of work in 10 days, working 7 hours a day, how many days will it take to complete a work twice as large with 6 men and 2 boys working together for 8 hours a day ?
(A) $7\frac{1}{2}$ days (B) $8\frac{1}{2}$ days
(C) 9 days (D) 6 days

29. If 5 engines consume 6 metric tonnes of coal when each is running 9 hours a day. How much coal will be needed for 8 engines each running 10 hours a day, it being given that 3 engines of the former type consume as much as 4 engines of latter type ?
(A) 8 metric tonnes
(B) $8\frac{8}{9}$ metric tonnes
(C) $3\frac{1}{8}$ metric tonnes
(D) 6·48 metric tonnes

30. If 9 men working $7\frac{1}{2}$ hours a day can finish a work in 20 days, then how many days will be taken by 12 men, working 6 hours a day to finish the work, it being given that 3 men of latter type work as much as 2 men of the former type in the same time ?
(A) $12\frac{1}{2}$ (B) 13
(C) $9\frac{1}{2}$ (D) 11

31. If a certain number of workmen can do a piece of work in 25 days, in what time will another set of an equal number of men do a piece of work twice as great supposing that 2 of the first set can do as much work in an hour as 3 of the second set can do in an hour ?
(A) 60 days (B) 75 days
(C) 90 days (D) 105 days

32. 15 men take 21 days of 8 hours each to do a piece of work. How many days of 6 hours each would 21 women take if 3 women do as much work as 2 men ?
(A) 20 (B) 25
(C) 18 (D) 30

33. A contract is to be completed in 56 days and 104 men were set to work each working 8 hours a day. After 30 days $\frac{2}{5}$ of the work is completed. How many additional men may be employed, so that the work may be completed in time each man now working 9 hours a day ?
(A) 60 (B) 56
(C) 70 (D) 42

34. A contractor undertakes to do a piece of work in 40 days. He engages 100 men at the beginning and 100 more after 35 days and completes the work in stipulated time. If he had not engaged the additional men, how many days behind, schedule would it be finished ?
(A) 5 (B) 6
(C) 3 (D) 9

35. A contractor undertook to do a certain piece of work in 9 days. He employed certain number of labourers but 6 of them being absent from the very first day. The rest could finish the work in 15 days. The number of men originally employed were—
(A) 12 (B) 15
(C) 18 (D) 24

36. If 12 boys can earn Rs. 240 in 5 days. How many boys can earn Rs. 420 in 21 days ?
(A) 15 doys
(B) 5 boys
(C) 17 boys
(D) None of these

37. If 27 kg of corn would feed 42 horses for 21 days, in how many days would 36 kg of it feed 21 horses ?
(A) 28 days (B) 42 days
(C) 56 days (D) $31\frac{1}{2}$ days

38. If 5 men working 6 hours a day can reap a field in 20 days. In how many days will 15 men reap the field, working 8 hours a day?
(A) 5 days (B) 6 days
(C) $7\frac{1}{2}$ days (D) 9 days

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Answers with Hints

1. (D) More men, more work (Direct)
More working hrs., more work (Direct)
More days, more work (Direct)

$$\Rightarrow \begin{matrix}\text{Men} & x : y \\ \text{Working hrs.} & x : y \\ \text{Day} & x : y\end{matrix}\Big\} :: x : z$$

$$\therefore \quad Z = \frac{y \times y \times y \times x}{x \times x \times x}$$

$$= \frac{y^3}{x^2} \text{ units of work.}$$

2. (B) More length more labourers (Direct)
More daily hours, less labourers (Indirect)
Less days, more labourers (Indirect)

$$\Rightarrow \begin{matrix}\text{Length} & 26 : 39 \\ \text{Daily hrs.} & 9 : 8 \\ \text{Days} & 6 : 18\end{matrix}\Big\} :: 17 : x$$

$$\therefore \quad x = \frac{39 \times 8 \times 18 \times 17}{26 \times 9 \times 6}$$

$$= 68 \text{ labourers.}$$

3. (B) Work done $= \frac{1}{3}$, work to be done $= \frac{2}{3}$
Now, more work, more men (Direct)
More days, less men (Indirect)

$$\Rightarrow \begin{matrix}\text{Work} & \frac{1}{3} : \frac{2}{3} \\ \text{Days} & 25 : 20\end{matrix}\Big\} :: 20 : x$$

$$\therefore \quad x = \left(\frac{2}{3} \times 20 \times 20 \times \frac{3}{25}\right)$$

$$= 32 \text{ men.}$$

So, 12 more men should be employed.

4. (D) Let initially there be x men having provisions for y days.
After 10 days, x men had provisions for $(y - 10)$ days
These provisions were for $\left(x - \frac{x}{5}\right)$ *i.e.*, $\frac{4x}{5}$ men for y days.

$$\therefore \quad x(y - 10) = \frac{4x}{5} \cdot y$$

$$\Rightarrow \quad xy - 50x = 0$$

$$\Rightarrow \quad x(y - 50) = 0$$

$$\Rightarrow \quad y - 50 = 0$$

$$\therefore \quad y = 50 \text{ days.}$$

5. (D) More men less number of days (Indirect)

$$800 : 500 :: 24 : x$$

$$\therefore \quad x = \left(\frac{500 \times 24}{800}\right)$$

$$= 15 \text{ days}$$

6. (D) The remaining food is sufficient for 120 men for 195 days.
But, now remaining men = 90
Less men, more days (Indirect)

$$\because \quad 90 : 120 :: 195 : x$$

$$\therefore \quad x = \left(\frac{120 \times 195}{90}\right)$$

$$= 260 \text{ days}$$

7. (C) Less pumps, more days (Indirect)
Less water, less days (Direct)
More working hrs., less days (Indirect)

$$\Rightarrow \begin{matrix}\text{Pumps} & 16 : 18 \\ \text{Water} & 2170 : 1736 \\ \text{Working hours} & 9 : 7\end{matrix}\Big\} :: 10 : x$$

$$\therefore \quad x = \left(\frac{18 \times 1736 \times 7 \times 10}{16 \times 2170 \times 9}\right)$$

$$= 7 \text{ days.}$$

8. (B) Less examiners, more hours per day (Indirect)
More days, less hours per day (Indirect)
More answer books, more hours per day (Direct)

$$\Rightarrow \begin{matrix}\text{Examiners} & 2 : 4 \\ \text{Days} & 20 : 8 \\ \text{Ans. Books} & 1 : 2\end{matrix}\Big\} :: 5 : x$$

$$\therefore \quad x = \frac{4 \times 8 \times 2 \times 5}{2 \times 20 \times 1}$$

$$= 8 \text{ hours per day}$$

9. (B) Less men, more days (Indirect)
More working hours, less days (Indirect)

$$\Rightarrow \begin{matrix}\text{Men} & 15 : 20 \\ \text{Working hrs.} & 8 : 7\end{matrix}\Big\} :: 10 : x$$

$$\therefore \quad x = \left(\frac{20 \times 7 \times 10}{15 \times 8}\right) = 11\frac{2}{3} \text{ days.}$$

10. (B) Less days, more men (Indirect)
Less work, less men (Direct)

$$\Rightarrow \begin{matrix}\text{Days} & 15 : 16 \\ \text{Work} & 1 : \frac{1}{5}\end{matrix}\Big\} :: 300 : x$$

$$\therefore \quad x = \left(16 \times \frac{1}{5} \times 300 \times \frac{1}{15 \times 1}\right)$$

$$= 64 \text{ men}$$

11. (D) More men, more length built (Direct)
Less days, less length built (Direct)

$$\begin{matrix}\text{Men} & 20 : 25 \\ \text{Days} & 6 : 3\end{matrix}\Big\} :: 112 : x$$

$$\therefore \quad x = \left(\frac{25 \times 3 \times 112}{20 \times 6}\right) = 70 \text{ metres}$$

12. (D) More persons, more shawls (Direct)
Less days, less shawls (Direct)

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Persons 3 : 8
Day 14 : 5
} : : 168 : x

$\therefore \quad x = \frac{8 \times 5 \times 168}{3 \times 14} = 160$ shawls.

13. (B) More men, more earning (Direct)
Less hours, less earning (Direct)

Men 6 : 9
Hours/Day 8 : 6
} : : 840 : x

$\therefore \quad x = \frac{9 \times 6 \times 840}{6 \times 8}$

$= \text{Rs. } 945.$

14. (D) Less books, less number of binders (Direct)
More days, less number of binders (Indirect)

Books 900 : 660
Day 12 : 10
} : : 18 : x

$\therefore \quad x = \left(\frac{660 \times 10 \times 18}{900 \times 12}\right)$

$= 11.$

15. (B) More days, less cows (Indirect)
Less rent, less cows (Direct)

Days 30 : 20
Rent 370 : 111
} : : 40 : x

$\therefore \quad x = \left(\frac{20 \times 111 \times 40}{30 \times 370}\right)$

$= 8$ cows.

16. (C) More litre, more patients (Direct)
Less days, more patients (Indirect)

Litres 1350 : 1710
Days 28 : 30
} : : 70 : x

$\Rightarrow \quad 1350 \times 28 \times x = 1710 \times 30 \times 70$

$\therefore \quad x = \frac{1710 \times 30 \times 70}{1350 \times 28}$

$= 95$ patients

17. (B) Less men, more days (Indirect)
Less kg. less days (Direct)

$\because$ Men 30 : 40
Kgs 60 : 12
} : : 15 : x

$\Rightarrow \quad 30 \times 60 \times x = 40 \times 12 \times 15$

$\therefore \quad x = \left(\frac{40 \times 12 \times 15}{30 \times 60}\right)$

$= 4$ days

18. (D) More distance on the map, more actual distance. (Direct)

$\because$ 0·8 : 80·5 : : 8·8 : x.

$\Rightarrow \quad 0{\cdot}8 \times x = 80{\cdot}5 \times 8{\cdot}8$

$\therefore \quad x = \frac{80{\cdot}5 \times 8{\cdot}8}{0{\cdot}8} = 885{\cdot}5$ km

$= 885$ km.

19. (A) Less length, less weight (Direct)

$\because \quad 22{\cdot}5 : 6 : : 85{\cdot}5 : x$

$\Rightarrow \quad 22{\cdot}5 \times x = 6 \times 85{\cdot}5$

$\therefore \quad x = \frac{6 \times 85{\cdot}5}{22{\cdot}5}$

$= 22{\cdot}8$ kg.

20. (B) More men, less days (Indirect)

$\because \quad 20 : 16 : : 30 : x$

$\therefore \quad x = \left(\frac{16 \times 30}{20}\right)$

$= 24$

21. (A) $\because$ 15 buffaloes = 21 cows

$\therefore$ 35 buffaloes $= \left(\frac{21}{15} \times 35\right)$ cows

$= 49$ cows.

22. (D) $\because$ Less pipes, more time (Indirect)

$\Rightarrow \quad 8 : 10 : : 24 : x$

$\therefore \quad x = \left(\frac{10 \times 24}{8}\right)$

$= 30$ minutes

23. (B) Remaining part = (1/5)
Less part to be filled, less time taken (Direct)

$\Rightarrow \quad \frac{4}{5} : \frac{1}{5} = 1 : x$

$\therefore \quad x = \left(\frac{1}{5} \times 1 \times \frac{5}{4}\right) = \frac{1}{4}$ min.

$= 15$ seconds.

24. (C) $\because$ More time, more distance covered (Direct)

$\Rightarrow \quad 20 : 50 : : 5 : x$

$\therefore \quad x = \left(\frac{50 \times 5}{20}\right)$

$= 12{\cdot}5$ km.

25. (A) $\because$ More radius, less rounds (Indirect)

$\Rightarrow \quad 20 : 14 : 140 : x$

$\therefore \quad x = \left(\frac{14 \times 140}{20}\right)$

$= 98$ times.

26. (A) After 25 days, 35 men complete the work in 12 days.

$\because$ 35 men can finish the remaining work in 12 days.

$\therefore$ 30 men can finish it in $= \frac{12 \times 35}{30} = 14$ days

i.e., 1 day behind.

27. (A) $\because$ (2×14) men + (7×14) boys

$= (3 \times 11)$ men + (8×11) boys

$\Rightarrow \quad 5$ men = 10 boys

$\Rightarrow \quad 1$ man = 2 boys

$\therefore \quad 2$ men + 7 boys = 11 boys

and 8 men + 6 boys = 22 boys

Now, more boys, less days (Indirect)
More work, more days (Direct)

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Boys 22 : 11
Work 1 : 3
} : : 14 : x

$\therefore \quad x = \dfrac{11 \times 3 \times 14}{22 \times 1} = 21$ days

28. (A) (6 men + 2 boys) = 14 boys

Now, more work, more number of days (Direct)

More boys, less number of days (Indirect)

More hours per day, less number of days (Indirect)

Work 1 : 2
Boys 14 : 6
Hrs./Day 8 : 7
} : : 10 : x

$\therefore \quad x = \dfrac{2 \times 6 \times 7 \times 10}{1 \times 14 \times 8} = 7\dfrac{1}{2}$ days.

29. (A) More engine, more coal (Direct)

More hrs. a day, more coal (Direct)

More rate of consumption, more coal (Direct)

Engine 5 : 8
Hrs/Days 9 : 10
Rate $\frac{1}{3} : \frac{1}{4}$
} : : 6 : x

$\therefore \quad x = \left(8 \times 10 \times \dfrac{1}{4} \times 6 \times \dfrac{1}{5} \times \dfrac{1}{9} \times 3\right)$

= 8 metric tonnes.

30. (A) More men, less days (Indirect)

Less hours a day, more days (Indirect)

More speed, less days (Indirect)

Men 12 : 9
Hrs./Day 6 : $7\frac{1}{2}$
Speed $\frac{1}{2} : \frac{1}{3}$
} : : 20 : x

$\therefore \quad x = \left(9 \times \dfrac{15}{2} \times \dfrac{1}{3} \times 20 \times \dfrac{2}{12 \times 6 \times 1}\right)$

$= 12\dfrac{1}{2}$ days.

31. (B) Speed of doing work of first and second set of men is $\frac{1}{2} : \frac{1}{3}$.

Now, more work, more time (Direct)

Less speed, more time (Indirect)

$\because$ Work 1 : 2
Speed $\frac{1}{3} : \frac{1}{2}$
} : : 25 : x

$\therefore \quad x = \left(2 \times \dfrac{1}{2} \times 25 \times \dfrac{3}{1 \times 1}\right) = 75$ days.

32. (D) 3 Women = 2 men

So 21 women = 14 men

Now, less men, more days (Indirect)

Less hours, more days (Indirect)

Men 14 : 15
Working hrs. 6 : 8
} : : 21 : x

$\therefore \quad x = \left(\dfrac{15 \times 8 \times 21}{14 \times 6}\right) = 30$ days.

33. (B) Remaining work = $\left(1 - \dfrac{2}{5}\right) = \dfrac{3}{5}$

Remaining period = (56 – 30)

= 26 days

Now, the problem becomes : 104 men working 8 hrs. a day can finish (2/5) work in 30 days, how many men working 9 hrs. a day can finish (3/5) work in 26 days ?

More work, more men (Direct)

Less days, more men (Indirect)

More hours, less men (Indirect)

$\because$ Work $\frac{2}{5} : \frac{3}{5}$
Days 26 : 30
Hrs./Day 9 : 8
} : : 104 : x

$\therefore \quad x = \left(\dfrac{3}{5} \times 30 \times 8 \times 104 \times \dfrac{5}{2} \times \dfrac{1}{26} \times \dfrac{1}{9}\right)$

= 160

So, additional no. of men to be employed

= (160 – 104) = 56.

34. (A) [(100 × 35) + (200 × 5)] working for 1 day can finish the work

Thus, 4500 men can finish it in 1 day

So, 100 men can finish it in = $\left(\dfrac{4500}{100}\right)$

= 45 days

i.e., 5 days behind schedule.

35. (B) Let there be x men at the beginning

Now, less men would take more days

$\because 15 : 9 : : x : (x - 6)$

$\Rightarrow 15 \times (x - 6) = 9x$

$\therefore \quad x = 15$ men.

36. (B) More money, more boys (Direct)

More days, less boys (Indirect)

Money 240 : 420
Days 21 : 5
} : : 12 : x

$\therefore \quad x = \left(\dfrac{420 \times 5 \times 12}{240 \times 21}\right)$

= 5 boys

37. (C) More corn, more days (Direct)

Less horses, more days (Indirect)

Corn 27 : 36
Horse 21 : 42
} : : 21 : x

$\therefore \quad x = \dfrac{36 \times 42 \times 21}{27 \times 21} = 56$ days.

38. (A) More men, less days (Indirect)

More working hrs., less days (Indirect)

Men 15 : 5
Working hrs. 8 : 6
} : : 20 : x

$\therefore \quad x = \dfrac{5 \times 6 \times 20}{15 \times 8} = 5$ days.

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Boats and Streams

Important Points

(i) Direction along the stream is called **downstream**.

(ii) Direction against the stream is called **upstream**.

(iii) Let, speed of boat in still water be a km/hr and the speed of stream be b km/hr. Then

Speed downstream

$= (a + b)$ km/hr.

Speed upstream

$= (a - b)$ km/hr.

(iv) If a man rows in still water at a km/hr and the rate of current or stream is b km/hr. then—

Man's rate with the current

$= (a + b)$ km/hr.

Man's rate against the current

$= (a - b)$ km/hr.

Rate in still water

$= \frac{1}{2}$ [(rate with the current) + (rate against the current)]

Rate of current

$= \frac{1}{2}$ [(rate with the current) – (rate against the current)]

Examples

Q. 1. A man can row 30 km upstream and 44 km downstream in 10 hours. Also, he can row 40 km upstream and 55 km downstream in 13 hours. Find the rate of current and the speed of the man in still water.

Solution : Let, rate upstream = x km/hr. and rate downstream = y km/hr.

Then $\frac{30}{x} + \frac{44}{y} = 10$ …(i)

$\frac{40}{x} + \frac{55}{y} = 13$ …(ii)

$\Rightarrow$ $30u + 44v = 10$ …(iii)

$40u + 55v = 13$ …(iv)

where $u = \frac{1}{x}$

and $v = \frac{1}{y}$

Solving (iii) and (iv)

we get $u = \frac{1}{5}$ and $v = \frac{1}{11}$

$\therefore$ $\frac{1}{x} = \frac{1}{5}$

and $\frac{1}{y} = \frac{1}{11}$

i.e. $x = 5$ and $y = 11$

$\therefore$ Rate in still water

$= \frac{1}{2}(5 + 11)$ km/hr.

$= 8$ km/hr.

Rate of current

$= \frac{1}{2}(11 - 5)$ km/hr.

$= 3$ km/hr.

Q. 2. A man can row 6 km/hr in still water. When the river is running at 1·2 km/hr, it takes him 1 hour to row to a place and back. How far is the place ?

Solution : Man's rate down stream = (6 + 1·2) km/hr = 7·2 km/hr.

Man's rate upstream = (6 – 1·2) = 4·8 km/hr.

Let required distance be x km. Then

$\frac{x}{7{\cdot}2} + \frac{x}{4{\cdot}8} = 1$

$\Rightarrow$ $4{\cdot}8x + 7{\cdot}2x = 7{\cdot}2 \times 4{\cdot}8$

$\therefore$ $x = \frac{7{\cdot}2 \times 4{\cdot}8}{12}$

$= 2{\cdot}88$ km.

Q. 3. In a stream running at 2 km/hr a motor boat goes 10 km upstream and back again to the starting point in 55 minutes. Find the speed of motor boat in still water.

Solution : Let the speed of motor boat in still water be x km/hr

Then Speed down stream

$= (x + 2)$ km/hr

and Speed upstream

$= (x - 2)$ km/hr

$\because$ $\frac{10}{x+2} + \frac{10}{x-2} = \frac{55}{60}$

$\Rightarrow$ $11x^2 - 240x - 44 = 6$

$\Rightarrow$ $(x - 22)(11x + 2) = 0$

$\therefore$ $x = 22$ km/hr

Q. 4. A man can row 6 km/hr in still water. It takes him twice as long to row up as to row down the river. Find the rate of stream.

Solution : Let men's rate upstream $= x$ km/hr

Then, men's rate downstream

$= 2x$ km/hr

$\therefore$ Man's rate in still water

$= \frac{1}{2}(x + 2x)$ km/hr

$\because$ $\frac{3x}{2} = 6$

$\Rightarrow$ $x = 4$ km/hr

Thus, man's rate upstream

$= 4$ km/hr

Man's rate downstream

$= 8$ km/hr

$\therefore$ Rate of stream

$= \frac{1}{2}(8 - 4)$ km/hr

$= 2$ km/hr

Q. 5. A man rows downstream 30 km and upstream 18 km, taking 5 hours each time. What is the velocity of current ?

Solution : Man's rate downstream

$= \left(\frac{30}{5}\right)$ km/hr

$= 6$ km/hr

Man's rate upstream

$= \left(\frac{18}{5}\right)$ km/hr

$\therefore$ Velocity of current

$= \frac{1}{2}\left(6 - \frac{18}{5}\right)$ km/hr

$= 1{\cdot}2$ km/hr

Q. 6. A man can row upstream at 11 km/hr and downstream at 16 km/hr. Find man's rate in still water and the rate of current.

Solution : Rate in still water

$= \frac{1}{2}(11 + 16)$ km/hr

$= 13{\cdot}5$ km/hr

Rate of current

$= \frac{1}{2}(16 - 11)$ km/hr

$= 2{\cdot}5$ km/hr

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Exercise

1. A boat travels upstream from B to A and downstream from A to B in 3 hours. If the speed of the boat in still water is 9 km/hr and the speed of the current is 3 km/hr the distance between A and B is—
   (A) 4 km (B) 6 km
   (C) 8 km (D) 12 km

2. A boat goes 40 km. upstream in 8 hours and 36 km. downstream in 6 hours. The speed of the boat in standing water is—
   (A) 6·5 km/hr (B) 6 km/hr
   (C) 5·5 km/hr (D) 5 km/hr

3. If a man's rate with the current is 12 km/hr. and the rate of the current is 1·5 km/hr then man's rate against the current is—
   (A) 9 km/hr
   (B) 6·75 km/hr
   (C) 5·25 km/hr
   (D) 7·5 km/hr

4. If a man rows at 5 km/hr in still water and 3·5 km/hr against the current his rate along the current is—
   (A) 8·5 km/hr (B) 6·5 km/hr
   (C) 6 km/hr (D) 4·25 km/hr

5. The speed of a boat downstream is 15 km/hr and the speed of the stream is 1·5 km/hr. The speed of the boat upstream is—
   (A) 13·5 km/hr
   (B) 16·5 km/hr
   (C) 12 km/hr
   (D) 8·25 km/hr

6. The speed of a boat in still water is 2 km/hr. If its speed upstream be 1 km/hr, then speed of the stream is—
   (A) 1·5 km/hr
   (B) 3 km/hr
   (C) 1 km/hr
   (D) None of these

7. A man can row downstream at 14 km/hr and upstream at 9 km/hr. Man's rate in still water is—
   (A) 5 km/hr
   (B) 23 km/hr
   (C) 11·5 km/hr
   (D) None of these

8. A man can row with the stream at 11 km/hr and against the stream at 8 km/hr. The speed of the stream is—
   (A) 3 km/hr (B) 9·5 km/hr
   (C) 1·5 km/hr (D) 6 km/hr

9. A man can swim 3 km/hr in still water. If the velocity of the stream be 2 km/hr, the time taken by him to swim to a place 10 km upstream and back is—
   (A) $8\frac{1}{3}$ hrs (B) $9\frac{1}{5}$ hrs
   (C) 10 hrs (D) 12 hrs

10. A man can row three quarters of a kilometre against the stream in $11\frac{1}{4}$ minutes and return in $7\frac{1}{2}$ minutes. The speed of the man in still water is—
    (A) 2 km/hr (B) 3 km/hr
    (C) 4 km/hr (D) 5 km/hr

11. A man can row $9\frac{1}{3}$ km/hr in still water and he finds that it takes him thrice as much time to row up than as to row down the same distance in river. The speed of the current is—
    (A) $3\frac{1}{3}$ km/hr (B) $3\frac{1}{9}$ km/hr
    (C) $1\frac{1}{4}$ km/hr (D) $4\frac{2}{3}$ km/hr

12. The current of a stream runs at 1 km/hr. A motor boat goes 35 km upstream and back again to the starting point in 12 hours. The speed of motor boat in still water is—
    (A) 6 km/hr (B) 7 km/hr
    (C) 8·5 km/hr (D) 8 km/hr

13. A boat covers 24 km upstream and 36 km downstream in 6 hours while it covers 36 km upstream and 24 km downstream in $6\frac{1}{2}$ hours. The velocity of the current is—
    (A) 1·5 km/hr (B) 1 km/hr
    (C) 2 km/hr (D) 2·5 km/hr

14. The current of a stream runs at the rate of 4 km/hr. A boat goes 6 km and back to the starting point in 2 hours. The speed of the boat in still water is—
    (A) 6 km/hr (B) 7·5 km/hr
    (C) 8 km/hr (D) 6·8 km/hr

15. A man rows to a place 48 km distant and back in 14 hours. He finds that he can row 4 km with the stream in the same time as 3 km against the stream. The rate of the stream is—
    (A) 0·5 km/hr (B) 1 km/hr
    (C) 3·5 km/hr (D) 1·8 km/hr

16. A boat moves upstream at the rate of 1 km in 10 minutes and downstream at the rate of 1 km in 6 minutes. The speed of the current is—
    (A) 1 km/hr (B) 1·5 km/hr
    (C) 2 km/hr (D) 2·5 km/hr

17. A man rows upstream 16 km and downstream 28 km taking 5 hours each time. The velocity of the current is—
    (A) 2·4 km/hr (B) 1·2 km/hr
    (C) 3·6 km/hr (D) 1·8 km/hr

18. Speed of a boat in standing water is 6 km/hr and the speed of the stream is 1·5 km/hr. A man rows to a place at a distance of 22·5 km and comes back to the starting point. The total time taken by him, is—
    (A) 6 hrs 30 min
    (B) 8 hrs 24 min
    (C) 8 hrs
    (D) 4 hrs 12 min

19. A man can row at 5 km/hr in still water and the velocity of current is 1 km/hr. It takes him 1 hour to row to a place and back. How far is the place ?
    (A) 2·5 km (B) 2·4 km
    (C) 3 km (D) 3·6 km

20. The speed of a boat in still water is 2 km/hr. If its speed upstream be 1 km/hr, then speed of the stream is—
    (A) 2 km/hr
    (B) 3 km/hr
    (C) 1 km/hr
    (D) None of these

21. A boat goes 14 km upstream in 56 minutes. The speed of stream is 2 km/hr. The speed of boat in still water is—
    (A) 6 km/hr (B) 15 km/hr
    (C) 14 km/hr (D) 17 km/hr

22. The speed of a boat in still water is 10 km/hr. If its speed down

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stream be 13 km/hr, then speed of the stream is—

(A) 1·5 km/hr
(B) 3 km/hr
(C) 11·5 km/hr
(D) 5·75 km/hr

23. A boat goes 12 km upstream in 48 minutes. The speed of stream is 2 km/hr. The speed of boat in still water is—

(A) 13 km/hr
(B) 2·25 km/hr
(C) 17 km/hr
(D) 15 km/hr

24. The speed of a boat in still water is 12 km per hour. Going downstream it moves at the rate of 19 km per hour. The speed of the boat against the stream is—

(A) 5 km/hr
(B) 3 km/hr
(C) 8 km/hr
(D) Data inadequate

25. If a man rows at the rate of 5 km/hr in still water and his rate against the current is 3·5 km/hr, then the man's rate along the current is—

(A) 8·5 km/hr
(B) 6·5 km/hr
(C) 6 km/hr
(D) 4·25 km/hr

26. A man can row 44 km downstream in 4 hours. If the man's rowing rate in still water is 8 km/hr, then find in what time will he cover 25 km upstream ?

(A) 5 hours (B) 6 hours
(C) 4·5 hours (D) 4 hours

27. A man rows upstream 16 km and downstream 27 km taking 5 hours each time. What is the velocity of current ?

(A) 2 km/hr
(B) 2·1 km/hr
(C) 1·1 km/hr
(D) None of these

28. A boat moves downstream at the rate of one km in $7\frac{1}{2}$ minutes and upstream at the rate of 5 km an hour. What is the velocity of current ?

(A) 1·3 km/hr
(B) 1·2 km/hr
(C) 1·6 km/hr
(D) 1·5 km/hr

29. A person rows a kilometre down the stream in 10 minutes and upstream in 30 minutes. Find the velocity of the stream—

(A) 1 km/hr (B) 2 km/hr
(C) 3 km/hr (D) 4 km/hr

30. A man can row three quarters of a km against the stream in 11 minutes 15 seconds and return in 7 minutes 30 seconds. Find the speed of the man in still water and also the speed of the stream—

(A) 5 km/hr; 2 km/hr
(B) 5 km/hr; 1 km/hr
(C) 6 km/hr; 2 km/hr
(D) 4 km/hr; 1 km/hr

31. A boat's man goes 48 km downstream in 8 hours and returns back in 12 hours. Find the speed of the boat in still water and the rate of the stream—

(A) 5 km/hr; 1 km/hr
(B) 10 km/hr; 2 km/hr
(C) 6 km/hr; 1·5 km/hr
(D) None of these

32. The speed of a boat downstream is 15 km/hr and the speed of the stream is 1·5 km/hr. The speed of the boat upstream is—

(A) 13·5 km/hr
(B) 16·5 km/hr
(C) 12 km/hr
(D) 8·25 km/hr

33. A man can row 60 km downstream in 6 hours. If the speed of the current is 3 km/hr, then find in what time will he be able to cover 16 km upstream ?

(A) 4·5 hours (B) 4 hours
(C) 5 hours (D) 5·5 hours

34. A man can row three quarters of a km against the stream in $11\frac{1}{2}$ minutes and return in $7\frac{1}{3}$ minutes. Find the speed of the man in still water. What is the speed of the stream ?

(A) 5·025 km/hr, 1·115 km/hr
(B) 6 km/hr, 2 km/hr
(C) 4 km/hr, 1 km/hr
(D) None of these

35. A man can row 4·5 km/hr in still water and he finds that it takes him twice as long to row up as to row down the river. Find the rate of stream—

(A) 2 km/hr (B) 1·5 km/hr
(C) 2·5 km/hr (D) 1·75 km/hr

36. The speed of a boat in still water is 15 km/hr and the rate of current is 3 km/hr. The distance travelled downstream in 12 minutes is—

(A) 3·6 km (B) 2·4 km
(C) 1·2 km (D) 1·8 km

37. Speed of a boat in standing water is 7 km/hr and the speed of the stream is 1·5 km/hr. A distance of 7·7 km, going upstream is covered in—

(A) 1 hr. 15 min.
(B) 1 hr. 12 min.
(C) 1 hr. 24 min.
(D) 2 hr. 6 min.

38. A man can row upstream 32 km in 4 hours. If the speed of current is 2 km/hr, find how much he can go downstream in 6 hours ?

(A) 70 km (B) 72 km
(C) 64 km (D) 81 km

39. A man can row upstream 36 m in 6 hours. If the speed of a man in still water is 8 km/hr, find how much he can go downstream in 10 hours—

(A) 150 km (B) 80 km
(C) 90 km (D) 100 km

40. The speed of a boat in still water is 4 km/hr and the speed of current is 2 km/hr. If the time taken to reach a certain distance upstream is 9 hours, find the time it will take to go to same distance downstream—

(A) 2 hrs (B) 2·5 hrs
(C) 3·5 hrs (D) 3 hrs

41. A man rows 8 km/hr in still water. If the river is running at 2 km/hr, it takes 32 minutes to row to a place and back. How far is the place ?

(A) 1·5 km (B) 2·5 km
(C) 2 km (D) 3 km

42. A motor boat can travel at 10 km/hr in still water. It travelled

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91 km downstream in a river and then returned taking altogether 20 hours. Find the rate of flow of river—

(A) 6 km/hr (B) 2 km/hr
(C) 3 km/hr (D) 4 km/hr

43. Ramesh can row a certain distance downstream is 6 hours and return the same distance in 9 hours. If the speed of Ramesh in still water is 12 km/hr, find the speed of the stream.

(A) 2·4 km/hr
(B) 2 km/hr
(C) 3 km/hr
(D) Data inadequate

44. A boat takes 3 hours to travel from place M to N downstream and back from N to M upstream. If the speed of the boat in still water is 4 km, what is the distance between the two places ?

(A) 8 km
(B) 12 km
(C) 6 km
(D) Data inadequate

45. A man rows to a place 48 km distance and back in 14 hours. He finds that he can row 4 km with the stream in the same time as 3 km against the stream. Find the rate of the stream—

(A) 1 km/hr (B) 2 km/hr
(C) 1·5 km/hr (D) 2·5 km/hr

Answers with Hints

1. (D) Speed downstream
$= (9 + 3)$ km/hr $= 12$ km/hr
Speed upstream $= (9 - 3)$ km/hr $= 6$ km/hr
Let the distance
AB $= x$ km
Then, $\frac{x}{6} + \frac{x}{12} = 3 \Rightarrow 2x + x = 36$
$\Rightarrow x = 12$
$\therefore$ Distance AB $= 12$ km

2. (C) Speed upstream
$= \left(\frac{40}{8}\right)$ km/hr $= 5$ km/hr
Speed downstream
$= \left(\frac{36}{6}\right)$ km/hr $= 6$ km/hr
Speed of boat in still water
$= \frac{1}{2}(5 + 6)$ km/hr $= 5{\cdot}5$ km/hr

3. (A) Let the rate against the current be x km/hr.
Then, $\frac{12 - x}{2} = 1{\cdot}5 \Rightarrow 12 - x = 3$
$\Rightarrow x = 9$ km/hr

4. (B) Let the rate along the current be x km/hr
Then, $\frac{x + 3{\cdot}5}{2} = 5$
$\Rightarrow x = (10 - 3{\cdot}5) = 6{\cdot}5$ km/hr

5. (C) Let the speed of boat in still water be x km/hr
Then, $x + 1{\cdot}5 = 15 \Rightarrow x = 13{\cdot}5$
$\therefore$ Speed upstream $= (13{\cdot}5 - 1{\cdot}5)$ km/hr
$= 12$ km/hr

6. (C) Let the speed of stream be x km/hr
Then, speed upstream $= (2 - x)$ km/hr
$2 - x = 1 \Rightarrow x = 1$ km/hr

7. (C) Man's rate in still water
$= \frac{1}{2}(14 + 9)$ km/hr $= 11{\cdot}5$ km/hr

8. (C) Speed of stream
$= \frac{1}{2}(11 - 8)$ km/hr $= 1{\cdot}5$ km/hr

9. (D) Speed upstream $= (3 - 2)$ km/hr $= 1$ km/hr
Speed downstream $= (3 + 2)$ km/hr $= 5$ km/hr
Total time taken $= \left(\frac{10}{1} + \frac{10}{5}\right)$ hr $= 12$ hrs.

10. (D) $\because$ Speed upstream $= \left(\frac{3}{4} \times \frac{4}{45} \times 60\right)$ km/hr
$= 4$ km/hr
Speed upstream $= \left(\frac{3}{4} \times \frac{2}{15} \times 60\right)$ km/hr
$= 6$ km/hr
$\therefore$ Speed in still water $= \frac{1}{2}(4 + 6)$ km/hr
$= 5$ km/hr

11. (D) Let speed upstream
$= x$ km/hr
Then, speed downstream
$= 3x$ km/hr
$\therefore$ Speed in still water
$= \frac{1}{2}(x + 3x)$ km/hr $= 2x$ km/hr
Speed of the current
$= \frac{1}{2}(3x - x)$ km/hr $= x$ km/hr
$\because$ $2x = \frac{28}{3} \Rightarrow x = \frac{14}{3} = 4\frac{2}{3}$ km/hr.

12. (A) Let the speed in still water be x km/hr
$\because$ $\frac{35}{x - 1} + \frac{35}{x + 1} = 12$
$\Rightarrow 35\,(2x) = 12\,(x^2 - 1)$
$\Rightarrow 12x^2 - 70x - 12 = 0$
$\Rightarrow 12x^2 - 72x + 2x - 12 = 0$
$\Rightarrow 12x\,(x - 6) + 2\,(x - 6) = 0$
$\Rightarrow (x - 6)\,(12x + 2) = 0$
$\therefore x = 6$ km/hr

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13. (C) Let the speed upstream be x km/hr and the speed downstream be y km/hr respectively.

Then, $\frac{24}{x} + \frac{36}{y} = 6$

$\Rightarrow$ $24u + 36v = 6$, …(1)

$\left[\text{where } u = \frac{1}{x},\ v = \frac{1}{y}\right]$

and $\frac{36}{x} + \frac{24}{y} = \frac{13}{2}$

$\Rightarrow$ $36u + 24v = \frac{13}{2}$ …(2)

Adding these equations, we get

$60\,(u + v) = \frac{25}{2}$

$\Rightarrow$ $u + v = \frac{5}{24}$ …(3)

Subtracting, we get

$12\,(u - v) = \frac{1}{2}$

$\Rightarrow$ $u - v = \frac{1}{24}$ …(4)

Solving Eq. (3) and Eq. (4)

we get, $u = \frac{1}{8}$ and $v = \frac{1}{12}$

$\therefore$ $x = 8$ km/hr and $y = 12$ km/hr

$\therefore$ Velocity of current $= \frac{1}{2}(12 - 8)$ km/hr

$= 2$ km/hr

14. (C) Let the speed in still water be x km/hr

Then, $\frac{6}{x+4} + \frac{6}{x-4} = 2$

$\Rightarrow$ $6\,[x - 4 + x + 4] = 2\,(x^2 - 16)$

$\Rightarrow$ $x^2 - 16 = 6x$

$\Rightarrow$ $x^2 - 6x - 16 = 0$

$\Rightarrow$ $(x - 8)(x + 2) = 0$

$\therefore$ $x = 8$ km/hr

15. (B) Suppose he moves 4 km downstream in x hrs.

Then, Speed downstream $= \left(\frac{4}{x}\right)$ km/hr

Speed upstream $= \left(\frac{3}{x}\right)$ km/hr

$\because$ $\frac{48}{\frac{4}{x}} + \frac{48}{\frac{3}{x}} = 14$

$\Rightarrow$ $12x + 16x = 14$

$\Rightarrow$ $x = \frac{1}{2}$

$\therefore$ Speed downstream $= 8$ km/hr

Speed upstream $= 6$ km/hr

$\therefore$ Rate of stream $= \frac{1}{2}(8 - 6)$ km/hr

$= 1$ km/hr

16. (C) Speed upstream $= 6$ km/hr

Speed downstream $= 10$ km/hr

$\therefore$ Speed of the current $= \frac{1}{2}(10 - 6)$ km/hr

$= 2$ km/hr

17. (B) Speed downstream $= \left(\frac{28}{5}\right)$ km/hr

$= 5{\cdot}6$ km/hr

Speed upstream $= \left(\frac{16}{5}\right)$ km/hr

$= 3{\cdot}2$ km/hr

Velocity of current $= \frac{1}{2}(5{\cdot}6 - 3{\cdot}2)$ km/hr

$= 1{\cdot}2$ km/hr

18. (C) Speed upstream $= (6 - 1{\cdot}5)$ km/hr

$= 4{\cdot}5$ km/hr

Speed downstream $= (6 + 1{\cdot}5)$ km/hr

$= 7{\cdot}5$ km/hr

Total time taken $= \left(\frac{22{\cdot}5}{4{\cdot}5} + \frac{22{\cdot}5}{7{\cdot}5}\right)$ hrs

$= (5 + 3)$ hrs.

$= 8$ hrs.

19. (B) Speed downstream $= (5 + 1)$ km/hr

$= 6$ km/hr

Speed upstream $= (5 - 1)$ km/hr

$= 4$ km/hr

Let the required distance be x km

Then, $\frac{x}{6} + \frac{x}{4} = 1$

$\Rightarrow$ $2x + 3x = 12$

$\therefore$ $x = 2{\cdot}4$ km

20. (C) $\because$ $2 - y = 1$

$\therefore$ $y = 2 - 1 = 1$ km/hr

21. (D) $\because$ Rate upstream $= \frac{14 \times 60}{56} = 15$ km/hr

$\Rightarrow$ $(x - 2) = 15$

$\therefore$ $x = 17$ km/hr

22. (B) $\because$ $10 + y = 13$

$\therefore$ $y = 13 - 10 = 3$ km/hr

23. (C) $\because$ $\frac{12 \times 60}{48} = (x - 2)$

$\therefore$ $x = 15 + 2 = 17$ km/hr

24. (A) $\because$ $(x + 19)\frac{1}{2} = 12$

$\therefore$ $x = 24 - 19 = 5$ km/hr

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25. (B) $\because \quad (x + 3{\cdot}5)\,\frac{1}{2} = 5$

$\therefore \quad x = 10 - 3{\cdot}5 = 6{\cdot}5$ km/hr

26. (A) $\because$ Man's rate in still water

$= \frac{1}{2}$ [man's rate with current plus his rate against current]

$\Rightarrow \quad 8 = \frac{1}{2}\left[\frac{44}{4} + \frac{25}{t}\right]$

$\Rightarrow \quad 16 = 11 + \frac{25}{t}$

$\therefore \quad t = 5$ hours

27. (C) $\because$ Man's rate upstream $= \frac{16}{5}$ km/hr

Man's rate downstream $= \frac{27}{5}$ km/hr

$\therefore$ Velocity of the current $= \frac{1}{2}\left(\frac{27}{5} - \frac{16}{5}\right)$ km/hr

$= 1{\cdot}1$ km/hr

28. (D) $\because$ Rate downstream $= \left(\frac{2}{15} \times 60\right)$ km/hr

$= 8$ km/hr

Rate upstream $= 5$ km/hr

$\therefore$ Velocity of the current $= \frac{1}{2}(8 - 5)$ km/hr

$= 1{\cdot}5$ km/hr

29. (B) 30. (B)

31. (A) Rate downstream $= \frac{48}{8} = 6$ km/hr

Rate upstream $= \frac{48}{12} = 4$ km/hr

$\therefore$ Speed of boat in still water $= \frac{1}{2}(6 + 4) = 5$ km/hr

Rate of stream $= \frac{1}{2}(6 - 4) = 1$ km/hr.

32. (C) $\because \quad (15 - y)\,\frac{1}{2} = 1{\cdot}5$

$\therefore \quad y = 15 - 3 = 12$ km/hr

33. (B) $\because \quad 3 = \frac{1}{2}\left[\frac{60}{6} - \frac{16}{t}\right]$

$\therefore \quad t = 4$ hours

34. (A) The boat travels with stream at $\frac{3}{4} \times \frac{60}{7\frac{1}{3}}$

$= 6{\cdot}14$ km/hr

The boat travels against the stream at

$\frac{3}{4} \times \frac{60}{11\frac{1}{2}} = 3{\cdot}91$ km/hr

$\therefore$ Speed of man in still water $= \frac{1}{2}(6{\cdot}14 + 3{\cdot}91)$

$= 5{\cdot}025$ km/hr

and Speed of stream $= \frac{1}{2}(6{\cdot}14 - 3{\cdot}91)$

$= 1{\cdot}115$ km/hr

35. (B)

36. (A) Required distance $= (15 + 3)\,\frac{12}{60}$

$= \frac{18}{5} = 3{\cdot}6$ km

37. (C) $\because \quad (7 - 1{\cdot}5)\,T = 7{\cdot}7$

$\therefore \quad T = \frac{7{\cdot}7}{5{\cdot}5} = 1$ hr. 24 minutes

38. (B) $\because$ Upstream rate $= \frac{32}{4} = 8$ km/hr

$\Rightarrow$ Speed of man in still water

$= 8 + 2 = 10$ km/hr

$\Rightarrow$ Downstream rate $= (10 + 2) = 12$ km/hr

Now, the required distance $= (10 + 2)\,6 = 72$ km

39. (D) $\because$ Speed of current $= 8 - \frac{36}{6} = 2$ km/hr

$\Rightarrow$ Rate downstream $= (8 + 2) = 10$ km/hr

$\therefore$ Required distance $= (8 + 2) \cdot 10 = 100$ km

40. (D) Upstream distance $= (4 - 2) \cdot 9 = 18$ km

$\therefore$ Required time $= \frac{18}{(4 + 2)} = 3$ hrs.

$\because \quad \frac{D}{(8 - 2)} + \frac{D}{(8 + 2)} = \frac{32}{60}$

41. (C) $\Rightarrow \quad \frac{2 \cdot D \cdot 8}{8^2 - 2^2} = \frac{32}{60}$

$\therefore \quad D = 2$ km

42. (C) Let the rate of flow of river $= x$ km/hr

$\because \quad \frac{91}{(10 + x)} + \frac{91}{(10 - x)} = 20$

$\Rightarrow 91\left[\frac{10 - x + 10 + x}{(10 + x)\,(10 - x)}\right] = 20$

$\Rightarrow \quad 91 \times 20 = 20\,(10^2 - x^2)$

$\Rightarrow \quad x^2 = 10^2 - 91 = 9$

$\therefore \quad x = 3$ km/hr.

43. (A) $\because \quad Z\left(\frac{9 + 6}{9 - 6}\right) = 12$

$\therefore \quad Z = 2{\cdot}4$ km/hr

44. (D) Let the distance between M and N and the speed of current be d km and x km/hr respectively.

According to the question $= \frac{d}{4 + x} + \frac{d}{4 - x} = 3$

In the above equation we have only one equation but two variables. Hence cannot be determined.

(Data inadequate)

45. (A) Suppose that the man takes x hours to cover 4 km downstream and x hours to cover 3 km upstream.

Then, $\frac{48x}{4} + \frac{48x}{3} = 14$

$\Rightarrow \quad x = \frac{1}{2}$

$\therefore$ Rate upstream $= \frac{3}{(1/2)} = 6$ km/hr

and rate downstream $= \frac{4}{(1/2)} = 8$ km/hr

$\therefore$ Rate of the stream $= (8 - 6)\,\frac{1}{2} = 1$ km/hr.

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Trains

Important Points

(i) Time taken by a train x metres long in passing a signal post or a pole or a standing man is the same as the time taken by the train to cover x metres with its own speed.

(ii) Time taken by a train x metres long in passing a stationary object of length y metres (such as a bridge or a tunnel or a platform or a train at rest) is the same as the time taken by the train to cover $(x + y)$ metres with its own speed.

(iii) Suppose two trains or two bodies are moving in the same direction at u km/hr and v km/hr respectively such that $u > v$, then their relative speed = $(u - v)$ km/hr

If their lengths be x km and y km respectively, then Time taken by the faster train to cross the slower train (moving in the same direction)

$$= \left(\frac{x+y}{u-v}\right) \text{ hrs.}$$

(iv) Suppose two trains or two bodies are moving in opposite directions at u km/hr and v km/hr., then their relative speed

$= (u + v)$ km/hr

If their length be x km and y km, then,

Time taken to cross each other

$$= \left(\frac{x+y}{u+v}\right) \text{hrs}$$

(v) If two trains start at the same time from two points A and B towards each other and after crossing, they take a and b hours in reaching B and A respectively. Then,

A's speed : B's speed : : $\sqrt{b} : \sqrt{a}$.

Examples

Q. 1. A train running at 25 km/hr takes 18 seconds to pass a platform. Next, it takes 12 seconds to pass a man walking at 5 km/hr in the opposite direction. Find the length of the train and that of the platform.

Solution : Let the length of train = x metres and length of platform

$= y$ metres.

Speed of train

$$= \left(25 \times \frac{5}{18}\right) \text{ m/sec}$$

$$= \left(\frac{125}{18}\right) \text{ m/sec.}$$

$\because \quad \dfrac{(x+y)}{\frac{125}{18}} = 18$

$\Rightarrow \dfrac{18(x+y)}{125} = 18$

$\Rightarrow \quad x + y = 125 \qquad \ldots(i)$

Speed of train relative to man

$= (25 + 5)$ km/hr

$$= \left(30 \times \frac{5}{18}\right) \text{ m/sec}$$

$$= \left(\frac{25}{3}\right) \text{ m/sec.}$$

$\therefore \quad x \times \dfrac{3}{25} = 12$

$\Rightarrow \quad x = \left(\dfrac{25 \times 12}{3}\right)$

$= 100$ m

Putting $x = 100$ in (i) we get

$y = 25$

$\therefore$ Length of train = 100 metres

Length of platform = 25 metres

Q. 2. A train 100 m long takes 9 seconds to cross a man walking at 5 km/hr in the direction opposite to that of the train. Find the speed of the train.

Solution. Let the speed of the train be x km/hr

Relative speed = $(x + 5)$ km/hr

$$= \frac{5(x+5)}{18} \text{ m/sec}$$

Distance covered in passing the man = 100 m

$\because \quad \dfrac{100}{\frac{5(x+5)}{18}} = 9$

$\Rightarrow \quad 1800 = 45(x + 5)$

$\Rightarrow \quad x = 35$

$\therefore$ Speed of the train = 35 km/hr.

Q. 3. A man sitting in a train which is travelling at 50 km/hr observes that a goods train, travelling in opposite direction, takes 9 seconds to pass him. If the goods train is 150 m long, find its speed.

Solution : Relative speed of goods train

$$= \left(\frac{150}{9}\right) \text{ m/sec}$$

$$= \left(\frac{150}{9} \times \frac{18}{5}\right)$$

$= 60$ km/hr.

$\therefore$ Speed of goods train

$= (60 - 50)$

$= 10$ km/hr.

Q. 4. Two trains are moving in the same direction at 50 km/hr and 30 km/hr. The faster train crosses a man in the slower train in 18 seconds. Find the length of the faster train.

Solution : Relative speed of faster train $= (50 - 30)$ km/hr

$$= \left(20 \times \frac{5}{18}\right) \text{ m/sec}$$

$$= \left(\frac{50}{9}\right) \text{ m/sec.}$$

Distance covered in 18 sec at this speed $= \left(18 \times \dfrac{50}{9}\right)$

$= 100$ m

$\therefore$ Length of faster train = 100 m

Q. 5. Two trains 128 m and 132 m long are running towards each other on parallel lines at 42 km/hr and 30 km/hr respectively. In what time will they be clear of each other from the moment they meet ?

Solution : Relative speed of both trains $= (42 + 30)$ km/hr

$$= \left(72 \times \frac{5}{18}\right) = 20 \text{ m/sec.}$$

Distance covered in passing each other $= (128 + 132) = 260$ m

$\therefore$ Required time

$$= \left(\frac{260}{20}\right) = 13 \text{ sec.}$$

Q. 6. A train 110 m long is running at 60 km/hr. In what time will it pass a man, running in the direction opposite to that of the train at 6 km/hr ?

Solution : Speed of the train relative to man = $(60 + 6)$ km/hr

$$= \left(66 \times \frac{5}{18}\right) = \left(\frac{55}{3}\right) \text{ m/sec}$$

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Distance covered by it in passing the man = 110 m

$\therefore$ Time taken in passing the man

$= \left(110 \times \frac{3}{55}\right) = 6$ sec.

Q. 7. A train 125 m long is running at 50 km/hr. In what time will it pass a man, running at 5 km/hr in the same direction in which the train is going ?

Solution : Speed of train relative to man = (50 – 5) km/hr

$= \left(45 \times \frac{5}{18}\right)$ m/sec

$= \left(\frac{25}{2}\right)$ m/sec

Distance covered in passing the man = 125 m

$\therefore$ Time taken by it in passing the man $= \left(125 \times \frac{2}{25}\right) = 10$ sec.

Q. 8. A train passes a standing man in 2 seconds and a platform 50 m long in $4\frac{1}{2}$ seconds. Find the length of the train and its speed.

Solution : Let the speed be x km/hr or $\left(\frac{5x}{18}\right)$ m/sec

Let the length of the train be y metres.

$\because \quad \frac{y}{\frac{5x}{18}} = 2$

$\Rightarrow \quad 10x = 18y$

$\Rightarrow \quad 5x = 9y \quad \ldots(1)$

Also, $\frac{y+50}{\frac{5x}{18}} = \frac{9}{2}$

$\Rightarrow 36(y + 50) = 45x$

$\Rightarrow \quad 5x - 4y = 200 \quad \ldots(2)$

$\Rightarrow \quad 9y - 4y = 200$

$\therefore \quad y = 40$ metres

$\Rightarrow \quad 5x = 9 \times 40$

$\therefore \quad x = \frac{9 \times 40}{5}$

$= 72$ km/hr.

Q. 9. A train 160 m long is running at 40 km/hr. In how much time will it pass a platform 140 m long ?

Solution : Speed of the train

$= \left(40 \times \frac{5}{18}\right)$

$= \left(\frac{100}{9}\right)$ m/sec

$\because$ Distance covered in passing the platform = (160 + 140) = 300 m

$\therefore$ Required time taken

$= \left(300 \times \frac{9}{100}\right)$

$= 27$ sec.

Q. 10. Find the time taken by a train 120 m long, running at 54 km/hr. in crossing an electric pole.

Solution :

Speed = 54 km/hr

$= \left(54 \times \frac{5}{18}\right)$ m/sec

$= 15$ m/sec

Distance moved in passing the pole = 120 m

Required time taken

$= \frac{120}{15}$

$= 8$ sec.

Exercise

1. A train 270 metres long is moving at a speed of 25 kmph. It will cross a man coming from the opposite direction at a speed of 2 km per hour in—
   (A) 36 seconds
   (B) 32 seconds
   (C) 28 seconds
   (D) 24 seconds

2. A train 100 metres long travels at 70 km per hour. A man is running at 10 km per hour in the same direction in which the train is going. The train will pass the man in—
   (A) 6 seconds (B) $6\frac{2}{3}$ seconds
   (C) 7 seconds (D) 8 seconds

3. A train 700 m long is running at the speed of 72 km per hour. If it crosses a tunnel in 1 minute, then the length of the tunnel is—
   (A) 500 m (B) 550 m
   (C) 600 m (D) 700 m

4. A train 100 metres long, running at 36 kmph takes 25 seconds to pass a bridge. The length of the bridge is—
   (A) 150 metres
   (B) 144 metres
   (C) 90 metres
   (D) 540 metres

5. A person sees a train passing over 1 km long bridge. The length of the train is half that of bridge. If the train clears the bridge in 2 minutes the speed of the train is—
   (A) 50 km/hr (B) 45 km/hr
   (C) 60 km/hr (D) 30 km/hr

6. A train 50 metres long passes a platform 100 m long in 10 seconds. The speed of the train is—
   (A) 10 km/hr (B) 15 km/hr
   (C) 54 km/hr (D) 100 km/hr

7. A train 300 metres long passes a standing man is 15 seconds. The speed of the train is—
   (A) 40 km/hr (B) 50 km/hr
   (C) 60 km/hr (D) 72 km/hr

8. The length of the train that takes 8 seconds to pass a pole where it runs at a speed of 36 km/hr is—
   (A) 288 metres
   (B) 45 metres
   (C) 48 metres
   (D) 80 metres

9. A train running at the speed of 45 kmph took 12 seconds in passing a certain point. Then the length of the train must be—
   (A) 90 metres
   (B) 120 metres
   (C) 150 metres
   (D) 540 metres

10. A train 120 metres long is running at a rate of 54 km/hr. Time taken by the train to cross a tunnel 130 metres long is—
    (A) $8\frac{1}{3}$ seconds
    (B) $16\frac{2}{3}$ seconds
    (C) 10 seconds
    (D) 15 seconds

11. A train 280 metres long is moving at a speed of 60 km/hr. The time taken by the train to cross a platform 220 metres long is—
    (A) 20 seconds
    (B) 25 seconds

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(C) 30 seconds
(D) 35 seconds

12. A train 250 metres long, running with a speed of 50 km/hr will pass an electric pole in—
(A) 30 seconds
(B) 18 seconds
(C) 72 seconds
(D) 60 seconds

13. A train 75 metres long is running with a speed of 20 km/hr. It will pass a standing man in—
(A) 12 seconds
(B) 13·5 seconds
(C) 14 seconds
(D) 15·5 seconds

14. A speed of 16 metres per second is the same as—
(A) 40·3 km/hr
(B) 57·6 km/hr
(C) 51·16 km/hr
(D) None of these

15. A train moves with the speed of 180 km/hr, then its speed in metres per second is—
(A) 5 (B) 30
(C) 40 (D) 50

16. A train running at a certain speed crosses a stationary engine in 20 seconds. To find out the speed of the train, which of the following information is necessary ?
(A) Only the length of the train
(B) Only the length of the engine
(C) Either the length of the train or the length of the engine
(D) Both the length of the train and the length of the engine

17. A train overtakes two persons who are walking in the same direction in which the train is going, at the rate of 2 kmph and 4 kmph and passes them completely in 9 and 10 seconds respectively. The length of the train is—
(A) 72 metres (B) 54 metres
(C) 50 metres (D) 45 metres

18. Two stations A and B are 110 kms apart on a straight line. One train starts from A at 7 a. m. and travels towards B at 20 km per hour speed. Another train starts from B at 8 a. m. and travels towards A at a speed of 25 km per hour. At what time will they meet ?
(A) 9 a. m.
(B) 10 a. m.
(C) 11 a. m.
(D) None of these

19. A train 100 metres long moving at a speed of 50 kmph crosses a train 120 metres long coming from opposite direction in 6 seconds. The speed of second train is—
(A) 132 kmph (B) 82 kmph
(C) 60 kmph (D) 50 kmph

20. Two trains running in the same direction at 40 kmph and 22 kmph completely pass one another in 1 minute. If the length of the first train is 125 metres, the length of second train is—
(A) 125 metres
(B) 150 metres
(C) 200 metres
(D) 175 metres

21. Two trains are running in opposite directions with a speed of 62 kmph and 40 kmph respectively. If the length of one train is 250 metres and they cross each other in 18 seconds, the length of the other train is—
(A) 145 metres
(B) 230 metres
(C) 260 metres
(D) Cannot be determined

22. A train 100 metres in length passes a milestone in 10 seconds and another train of the same length travelling in opposite direction in 8 seconds. The speed of the second train is—
(A) 36 kmph (B) 48 kmph
(C) 54 kmph (D) 60 kmph

23. A train travelling at 36 kmph completely crosses another train having half its length and travelling in the opposite direction at 54 kmph, in 12 seconds. If it also passes a railway platform in $1\frac{1}{2}$ minutes, the length of the platform is—
(A) 560 metres
(B) 620 metres
(C) 700 metres
(D) 750 metres

24. A train speeds past a pole in 15 seconds and speeds past a platform 100 metres long in 25 seconds. Its length in metres is—
(A) 200
(B) 150
(C) 50
(D) Data inadequate

25. A 150 metre long train crosses a man walking at the speed of 6 kmph in the opposite direction in 6 seconds. The speed of the train in km/hr is—
(A) 66 (B) 84
(C) 96 (D) 106

26. A train is running at the rate of 40 kmph. A man also is going in the same direction parallel to the train at the speed of 25 kmph. If the train crosses the man in 48 sec, the length of the train is—
(A) 50 metres
(B) 100 metres
(C) 150 metres
(D) 200 metres

27. A train of length 150 metres takes 10 seconds to pass over another train 100 metres long coming from the opposite direction. If the speed of the first train be 30 kmph, the speed of the second train is—
(A) 54 kmph (B) 60 kmph
(C) 72 kmph (D) 36 kmph

28. A train takes 5 seconds to pass an electric pole. If the length of the train is 120 metres, the time taken by it to cross a railway platfom 180 metres long, is—
(A) $12\frac{1}{2}$ seconds
(B) $7\frac{1}{2}$ seconds

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(C) $6\frac{1}{2}$ seconds

(D) $3\frac{1}{3}$ seconds

29. A train moving at the rate of 36 km per hour crosses a standing man in 10 seconds. It will cross a platform 55 metres long in—
(A) $5\frac{1}{2}$ seconds
(B) 6 seconds
(C) $7\frac{1}{2}$ seconds
(D) $15\frac{1}{2}$ seconds

30. A train crosses a platform 100 metres long in 60 seconds at a speed of 45 km per hour. The time taken by the train to cross an electric pole is—
(A) 8 seconds
(B) 1 minute
(C) 52 seconds
(D) Data inadequate

31. Two trains of equal length are running on parallel lines in the same direction at the rate of 46 kmph and 36 kmph. The faster train passes the slower train in 36 seconds. The length of each train is—
(A) 50 metres (B) 72 metres
(C) 80 metres (D) 82 metres

32. Two trains are running on parallel lines in the same direction at a speed of 50 km and 30 km per hour respectively. The faster train crosses a man in slower train in 18 seconds. The length of the faster train is—
(A) 170 metres
(B) 100 metres
(C) 98 metres
(D) 85 metres

33. Two trains A and B start from station X and Y towards Y and X respectively. After passing each other they take 4 hours 48 minutes and 3 hour 20 minutes to reach Y and X respectively. If train A is moving at 45 km/hr, then the speed of train B is—
(A) 60 km/hr
(B) 54 km/hr
(C) 64·8 km/hr
(D) 37·5 km/hr

34. Two trains 132 metres and 108 metres long are running in opposite directions, one at the rate of 32 kmph and another one at the rate of 40 kmph. From the moment they meet they will cross each other in—
(A) 10 seconds
(B) 11 seconds
(C) 12 seconds
(D) 13 seconds

35. A train 300 m long crossed a platform 900 m long in 1 minute 12 seconds. The speed of the train in km/hr was—
(A) 45 (B) 50
(C) 54 (D) 60

36. How long will a train 130 m long travelling at 40 km an hour, take to pass a kilometre stone ?
(A) 12 sec (B) 11·7 sec
(C) 11·2 sec (D) 11 sec

37. A train travelling at 30 km an hour took $13\frac{1}{2}$ sec in passing a certain point. Find the length of the train—
(A) 113 metres
(B) 112 metres
(C) 112·5 metres
(D) None of these

38. A train 110 metres in length runs through a station at the rate of 36 km per hour. How long will it take to pass a given point ?
(A) 11 sec (B) 12 sec
(C) 13 sec (D) 15 sec

39. A train 135 metres long is running with a speed of 54 km per hour. In what time will it pass a telegraph post ?
(A) 9 sec (B) 12 sec
(C) 8 sec (D) 6 sec

40. A train 550 metres long is running with a speed of 55 km per hour. In what time will it pass a signal post ?
(A) 30 sec (B) 24 sec
(C) 42 sec (D) 36 sec

41. A train 160 metres long passes a standing man in 18 seconds. What is the speed of the train ?
(A) 28 km/hr
(B) 36 km/hr
(C) 32 km/hr
(D) None of these

42. A train 120 metres long, crosses a pole in 10 seconds. The speed of the train is—
(A) 40 km/hr
(B) 43·2 km/hr
(C) 45 km/hr
(D) None of these

43. A train crosses a platform in 30 seconds at a speed of 45 km/hr. How much time will it take to cross an electric pole if the length of the platform is 100 metres ?
(A) 8 seconds
(B) 30 seconds
(C) 52 minutes
(D) None of these

44. A train 110 metres long travels at 60 km/hr. How long does it take to cross a telegraph post ?
(A) 6 sec (B) 5·6 sec
(C) 6·6 sec (D) 6·8 sec

45. Find the length of a bridge, which a train 130 metres long travelling at 45 km an hour, can cross in 30 seconds ?
(A) 240 m (B) 235 m
(C) 250 m (D) 245 m

46. A column of men, extending 250 metres in length takes one hour to march through a street at the rate of 50 paces a minute, each pace being 75 cm. Find the length of the street ?
(A) 2 km (B) 1 km
(C) 1·5 km (D) 2·5 km

47. It is noticed that exactly half a minute elapses between the time when the engine of a train 50 m long enters a tunnel 500 m long and the time when the last carriage of the train leaves the tunnel. Find at how many km per hour the train is travelling—
(A) 66 km/hr
(B) 55 km/hr

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(C) 64 km/hr

(D) None of these

48. A train 540 m long is running with a speed of 72 km/hr. In what time will it pass a tunnel 160 m long ?

(A) 40 sec (B) 30 sec

(C) 35 sec (D) 42 sec

49. A train 200 m long is running with a speed of 72 km/hr. In what time will it pass a platform 160 m long ?

(A) 18 sec (B) 21 sec

(C) 15 sec (D) 20 sec

50. A train 240 m long passes a bridge 120 m long in 24 sec. Find the speed with which the train in moving—

(A) 45 km/hr (B) 54 km/hr

(C) 36 km/hr (D) 42 km/hr

51. A train 150 m long passes a telegraph post in 12 seconds. Find in what time, it will pass a bridge 250 m long ?

(A) 32 sec (B) 36 sec

(C) 25 sec (D) 24 sec

52. A train 280 m long is moving at a speed of 60 km/hr. The time taken by the train to cross a platform 220 m long is—

(A) 20 sec (B) 25 sec

(C) 30 sec (D) 35 sec

53. A train 50 m long passes a platform 100 m long in 10 seconds. The speed of the train in m/sec is—

(A) 150 (B) 50

(C) 10 (D) 15

54. A train 700 m long is running at the speed of 72 km/hr. If it cross a tunnel in 1 minute, then the length of the tunnel—

(A) 700 m (B) 600 m

(C) 550 m (D) 500 m

55. A train 110 m long travels at 60 km/hr. How long does it take to cross a platform 240 metres long ?

(A) 21 sec (B) 20 sec

(C) 18 sec (D) 24 sec

56. A train with 90 km/hr crosses a bridge in 36 seconds. Another train 100 m shorter crosses the same bridge at 45 km/hr. Find the time taken by the second train to cross the bridge—

(A) 64 sec (B) 60 sec

(C) 72 sec (D) 1 hr

57. A train 110 metres in length travels at 60 km/hr. In what time will it pass a man who is walking against the train at 6 km an hour ?

(A) $7\frac{1}{3}$ seconds

(B) 6 seconds

(C) $6\frac{2}{3}$ seconds

(D) Data inadequate

58. Two trains 70 m and 80 m long respectively, run at the rates of 68 km and 40 km an hour respectively on parallel rails in opposite directions. How long do they take to pass each other ?

(A) 5 seconds

(B) 10 seconds

(C) 12 seconds

(D) 6 seconds

59. Two trains 132 metres and 108 metres in length are running towards each other on parallel lines. One at the rate of 32 km/hr and another at 40 km/hr. In what time will they be clear of each other from the moment they meet ?

(A) 12 sec.

(B) 9 sec.

(C) 15 sec.

(D) Data inadequate

60. A train 100 metres long takes $7\frac{1}{5}$ seconds to cross a man walking at the rate of 5 km/hr in a direction opposite to that of the train. Find the speed of the train—

(A) 54 km/hr (B) 45 km/hr

(C) 42 km/hr (D) 36 km/hr

Answers with Hints

1. (A) Relative speed = (25 + 2) = 27 km/hr

$= \left(27 \times \frac{5}{18}\right)$ m/sec.

$= \left(\frac{15}{2}\right)$ m/sec.

Time taken by the train to pass the men

$= \left(270 \times \frac{2}{15}\right)$

= 36 sec.

2. (A) Relative speed of the train

= (70 – 10)

= 60 km/hr

$= \left(60 \times \frac{5}{18}\right)$

$= \left(\frac{50}{3}\right)$ m/sec.

∴ Time taken by the train to pass the man

$= \left(100 \times \frac{3}{50}\right) = 6$ sec.

3. (A) Speed of the train $= \left(72 \times \frac{5}{18}\right) = 20$ m/sec

Let the length of tunnel = x metres

Then, $\frac{(700 + x)}{60} = 20$

$\Rightarrow$ $700 + x = 1200$

$\therefore$ $x = 500$ metres

4. (A) Speed $= \left(36 \times \frac{5}{18}\right) = 10$ m/sec

Let the length of the bridge

= x m

Distance covered = $(100 + x)$ m

Time taken = 25 sec

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$\because \quad \frac{(100+x)}{25} = 10 \text{ m/sec}$

$\Rightarrow \quad 100 + x = 250$

$\therefore \quad x = 150 \text{ metre}$

5. (B) Distance covered in $\frac{2}{60}$ hours

$= \left(1 + \frac{1}{2}\right) = \frac{3}{2}$ km

Distance covered in 1 hour

$= \left(\frac{3}{2} \times \frac{60}{2}\right) = 45$ km

So, speed of the train

$= 45$ km/hr.

6. (C) $\because$ Distance covered by train in 10 sec

$= (50 + 100) = 150$ m

$\therefore$ Speed $= \left(\frac{150}{10}\right)$ m/sec

$= \left(15 \times \frac{18}{5}\right) = 54$ km/hr

7. (D) $\because$ Speed $= \frac{\text{Distance}}{\text{Time}} = \left(\frac{300}{15}\right)$

$= 20$ m/sec

$= \left(20 \times \frac{18}{5}\right) = 72$ km/hr

8. (D) Speed of the train $= \left(36 \times \frac{5}{18}\right)$

$= 10$ m/sec.

Distance $= (\text{Time} \times \text{Speed}) = (8 \times 10)$

$= 80$ metres

$\therefore$ Length of the train $= 80$ metres

9. (C) $\because$ Speed $= \left(45 \times \frac{5}{18}\right) = \left(\frac{25}{2}\right)$ m/sec

Distance $= (\text{Time} \times \text{Speed})$

$= \left(12 \times \frac{25}{2}\right)$ metres $= 150$ metres

$\therefore$ Length of the train

$= 150$ metres

10. (B) $\because$ Speed of the train

$= \left(54 \times \frac{5}{18}\right) = 15$ m/sec

$\therefore$ Time taken by the train to cross the tunnel

= Time taken by it to cover (120 + 130) m

$= \left(\frac{250}{15}\right)$ sec $= 16\frac{2}{3}$ sec

11. (C) $\because$ Speed of the train

$= \left(60 \times \frac{5}{18}\right)$ m/sec $= \left(\frac{50}{3}\right)$ m/sec

$\therefore$ Time taken by the train to cross the platform

= Time taken by it to cover (280 + 220) m

$= \left(500 \times \frac{3}{50}\right)$ sec $= 30$ sec

12. (B) $\because$ Speed of the train

$= \left(50 \times \frac{5}{18}\right) = \left(\frac{125}{9}\right)$ m/sec

$\therefore$ Time taken by the train to pass the pole

$= \left(250 \times \frac{9}{125}\right) = 18$ sec

13. (B) $\because$ Speed of the train

$= \left(20 \times \frac{5}{18}\right) = \left(\frac{50}{9}\right)$ m/sec

$\therefore$ Time taken by the train to pass the man

$= \left(75 \times \frac{9}{50}\right) = 13{\cdot}5$ sec

14. (B) 16 m/sec $= \left(16 \times \frac{18}{5}\right) = 57{\cdot}6$ km/hr

15. (D) 180 km/hr $= \left(180 \times \frac{5}{18}\right) = 50$ m/sec

16. (D) Since the sum of the length of the train and the length of the engine is needed, so both the lengths must be known.

17. (C) Let the length of the train be x km and its speed be y km/hr

Then, speed of train relative to first man

$= (y - 2)$ km/hr

Speed of train relative to second man

$= (y - 4)$ km/hr

$\because \quad \frac{x}{y-2} = \frac{9}{60 \times 60}$

and $\quad \frac{x}{y-4} = \frac{10}{60 \times 60}$

$\therefore \quad 9y - 18 = 3600x \quad \ldots(1)$

and $\quad 10y - 40 = 3600x \quad \ldots(2)$

So, $\quad 9y - 18 = 10y - 40$

$\Rightarrow \quad y = 22$

$\because \quad \frac{x}{22-2} = \frac{9}{3600}$

$\therefore \quad x = \frac{20 \times 9}{3600} = \frac{1}{20}$ km

$= \left(\frac{1}{20} \times 1000\right) = 50$ m.

18. (B) Suppose they meet x hrs after 7 a. m.

$\therefore$ Distance covered by A in x hrs

$= (20 \times x)$ km

Distance covered by B in $(x - 1)$ hrs

$= 25\,(x - 1)$ km

$\because \quad 20x + 25\,(x - 1) = 110$

$\Rightarrow \quad 45x = 135$

$\therefore \quad x = 3$ hours

So, they meet at 10 a. m.

19. (B) Let the speed of the second train be x km/hr

Relative speed of both trains

$= (50 + x)$ km/hr

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$= \left[(50 + x) \times \frac{5}{18}\right]$

$= \left(\frac{250 + 5x}{18}\right)$ m/sec

$\because \frac{(100 + 120)}{\left(\frac{250 + 5x}{18}\right)} = 6$

$\Rightarrow 220 \times 18 = 6\,(250 + 5x)$

$\Rightarrow 30x = 3960 - 1500$

$\therefore x = \frac{2460}{30} = 82$

$\therefore$ Speed of the second train

$= 82$ km/hr

20. (D) $\because$ Relative speed of the train

$= (40 - 22)$ km/hr

$= \left(18 \times \frac{5}{18}\right)$ m/sec

$= 5$ m/sec.

Let the length of 2nd train be x metres.

Then, $\frac{(125 + x)}{5} = 60$ sec.

$\Rightarrow 125 + x = 300$

$\Rightarrow x = 175$

$\therefore$ Length of second train

$= 175$ metres.

21. (C) Let the length of another train

$= x$ metres

Their relative speed $= (62 + 40)$ km/hr

$= \left(102 \times \frac{5}{18}\right)$

$= \left(\frac{85}{3}\right)$ m/sec

$\because \frac{250 + x}{\left(\frac{85}{3}\right)} = 18$

$\Rightarrow \frac{3\,(250 + x)}{85} = 18$

$\Rightarrow 250 + x = 510$

$\Rightarrow x = 260$

$\therefore$ Length of another train

$= 260$ metres.

22. (C) Speed of first train $= \left(\frac{100}{10}\right) = 10$ m/sec.

Let the speed of second train be x m/sec

$\because$ Relative speed $= (10 + x)$ m/sec

$\therefore \frac{200}{10 + x} = 8$

$\Rightarrow 200 = 80 + 8x$

$\Rightarrow x = 15$

$\therefore$ Speed of second train $= 15$ m/sec

$= \left(15 \times \frac{18}{5}\right)$

$= 54$ km/hr.

23. (C) Let the length of slower train be x metres and the length of faster train be $\left(\frac{x}{2}\right)$ metres

Their relative speed $= (36 + 54)$ km/hr

$= \left(90 \times \frac{5}{18}\right)$

$= 25$ m/sec

$\because \frac{3x}{2 \times 25} = 12$

$\Rightarrow 3x = 600$

$\Rightarrow x = 200$

$\therefore$ Length of slower train $= 200$ metres

Let the length of platform be y metres

Then, $\frac{200 + y}{\left(36 \times \frac{5}{18}\right)} = 90$ sec.

$\Rightarrow 200 + y = 900$

$\Rightarrow y = 700$ metres

Length of platform $= 700$ metres.

24. (B) Let the length of the train be x metres and its speed be y metres/sec.

Then, $\frac{x}{y} = 15 \Rightarrow y = \frac{x}{15}$ …(1)

Now, $\frac{(x + 100)}{25} = \frac{x}{15} \Rightarrow x = 150$ m.

25. (B) Let the speed of the train be x km/hr

Relative speed of the train

$= (x + 6)$ km/hr

$= \left[(x + 6) \times \frac{5}{18}\right]$ m/sec

$\because \frac{150}{6} = \frac{(x + 6) \times 5}{18}$

$\Rightarrow 5x + 30 = 450$

$\therefore x = 84$ km/hr

26. (D) $\because$ Relative speed of the train

$= (40 - 25)$ km/hr

$= \left(15 \times \frac{5}{18}\right)$

$= \left(\frac{25}{6}\right)$ m/sec

$\therefore$ Length of the train $= \left(48 \times \frac{25}{6}\right)$

$= 200$ metres.

27. (B) Relative speed of both trains $= \left(\frac{150 + 100}{10}\right)$

$= 25$ m/sec

$= \left(25 \times \frac{18}{5}\right)$

$= 90$ km/hr

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$\therefore$ Speed of second train = (90 – 30)
= 60 km/hr.

28. (A) Speed of train = $\left(\frac{120}{5}\right)$ = 24 m/sec

Time taken to cross the platform

$= \left(\frac{120 + 180}{24}\right) = 12\frac{1}{2}$ sec.

29. (D) Speed of train = $\left(36 \times \frac{5}{18}\right)$ = 10 m/sec.

Let the length of the train be x metres

Then, $\frac{x}{10} = 10 \Rightarrow x = 100$ metres

$\therefore$ Time taken to cross the platform

$= \left(\frac{100 + 55}{10}\right) = 15\frac{1}{2}$ sec

30. (C) Let the length of train = x metres

Speed of train = $\left(45 \times \frac{5}{18}\right) = \left(\frac{25}{2}\right)$ m/sec.

Distance covered in crossing the platform

= $(x + 100)$ m

$\therefore \quad (x + 100) \times \frac{2}{25} = 60$

$\Rightarrow \quad 2x + 200 = 1500 \Rightarrow x = 650$

Now, time taken to cross the pole

$= \left(650 \times \frac{2}{25}\right) = 52$ sec.

31. (A) Let the length of each train = x metres

Relative speed = (46 – 36) = 10 km/hr.

$= \left(10 \times \frac{5}{18}\right) = \left(\frac{25}{9}\right)$ m/sec

Distance covered in crossing

= $(x + x) = 2x$ metres

$\Rightarrow \quad 2x \times \frac{9}{25} = 36 \quad \therefore x = \frac{25 \times 36}{2 \times 9} = 50$ metres.

32. (B) Relative speed of both trains

= (50 – 30) = 20 km/hr

$= \left(20 \times \frac{5}{18}\right)$

$= \left(\frac{50}{9}\right)$ m/sec.

Let the length of the faster train be x

Then, $x \times \frac{9}{50} = 18$

$\Rightarrow \quad x = \frac{18 \times 50}{9} = 100$ metres

33. (B) $\because \frac{\text{A's speed}}{\text{B's speed}} = \sqrt{\frac{\text{Time taken by B to reach X}}{\text{Time taken by A to reach Y}}}$

$\Rightarrow \quad \frac{45}{\text{B's speed}} = \sqrt{\frac{10}{3} \times \frac{5}{24}} = \frac{5}{6}$

$\therefore$ B's speed = $\left(\frac{45 \times 6}{5}\right)$ km/hr = 54 km/hr.

34. (C) Relative speed of both trains

= (32 + 40) = 72 km/hr

$= \left(72 \times \frac{5}{18}\right) = 20$ m/sec

Distance covered in crossing each other

= (132 + 108) = 240 m

$\therefore$ Required time = $\left(\frac{240}{20}\right) = 12$ sec.

35. (D) Distance covered in 72 sec.

= (300 + 900) m

$\therefore$ Speed = $\left(\frac{1200}{72}\right)$

$= \left(\frac{50}{3}\right)$ m/sec.

$= \left(\frac{50}{3} \times \frac{18}{5}\right)$

= 60 km/hr.

36. (B)

37. (C) $\because$ Speed = 30 km/hr = $30 \times \frac{5}{18} = \frac{25}{3}$ m/sec.

$\therefore$ Length of the train

$= \frac{25}{3} \times \frac{27}{2} = \frac{225}{2} = 112\frac{1}{2}$ metres.

38. (A) Speed of the train

= 36 km/hr = $\frac{36 \times 5}{18} = 10$ m/sec

$\therefore$ Required time = $\frac{110}{10} = 11$ sec

39. (A) 40. (D)

41. (C) Speed of the train

$= \frac{160}{18} \times \frac{18}{5} = 32$ km/hr.

42. (B)

43. (B) Distance covered by the train in crossing the platform

$= \left(\frac{45 \times 30}{3600}\right) = \frac{3}{8}$ km = 375 metres

$\therefore$ Length of train = (375 – 100) = 275 metres

$\therefore$ Time taken to cross the pole

$= \left(275 \div \frac{375}{30}\right)$

$= \left(275 \times \frac{30}{375}\right) = 30$ sec

44. (C)

45. (D) Speed of the train

= 45 km/hr

$= 45 \times \frac{5}{18} = \frac{25}{2}$ m/sec

Let the length of the bridge be x metres

$\because \quad \frac{(x + 130)}{\frac{25}{2}} = 30$

$\Rightarrow \quad x + 130 = 15 \times 25$

$\therefore \quad x = 375 - 130 = 245$ metres.

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46. (A) Speed of the column of men

$$= \frac{50 \times 75}{100 \times 60}$$

$$= \frac{5}{8} \text{ m/sec}$$

Let the length of the street be x metres

$\because \quad (x + 250) = \frac{60 \times 60 \times 5}{8}$

$= 2250$ metres

$\Rightarrow \quad x = (2250 - 250)$ m

$\therefore \quad x = 2000$ m $= 2$ km.

47. (A) Speed of the train

$$= \frac{(50 + 500)}{30}$$

$$= \frac{55}{3} \text{ m/sec}$$

$$= \frac{55}{3} \times \frac{18}{5}$$

$= 66$ km/hr

48. (C) $\because$ Speed of the train $= 72$ km/hr

$$= \left(72 \times \frac{5}{18}\right) = 20 \text{ m/sec.}$$

Sum of the length of the train and tunnel

$= (540 + 160) = 700$ metres

$\therefore$ Required time taken to pass the tunnel

= Time taken to cover 700 metres at 20 m/sec

$$= \left(\frac{700}{20}\right) = 35 \text{ sec}$$

49. (A)

50. (B) Required Speed $= \left(\frac{240 + 120}{24}\right)$

$= 15$ m/sec

$= 15 \times \frac{18}{5}$ km/hr

$= 54$ km/hr

51. (A) $\because$ Speed of the train $= \left(\frac{150}{12}\right)$ m/sec

Required time taken to cross the bridge

$$= \left[(150 + 250) \times \frac{12}{150}\right] = 32 \text{ sec}$$

52. (C) 53. (D)

54. (D) Let the length of tunnel be x metres

Speed of the train $= \left(72 \times \frac{5}{18}\right)$

$= 20$ m/sec

Time taken by the train to cover $(700 + x)$ m in 1 minute

$\because \left(\frac{700 + x}{20}\right)$ sec

$= 1$ minute

$\Rightarrow \quad \frac{700 + x}{20} = 60$

$\therefore \quad x = 500$ m

55. (A)

56. (A) Speed of the first train

$= 90$ km/hr

$$= \frac{90 \times 5}{18}$$

$= 25$ m/sec

Let the length of the bridge be x metre and that of the train be y metre.

$\therefore \quad (x + y) = 25 \times 36 = 900 \qquad \ldots(1)$

Again Speed of the second train

$= 45$ km/hr

$$= \frac{45 \times 5}{18}$$

$$= \frac{25}{2} \text{ m/sec.}$$

$\therefore$ Time taken by the second train to cross the bridge

$$= \frac{x + (y - 100)}{\frac{25}{2}}$$

$$= \frac{(x + y - 100) \times 2}{25}$$

Now, putting the value of $(x + y)$ from eqn. (1) we have

$$\frac{(900 - 100) \times 2}{25} = \frac{800 \times 2}{25}$$

$= 64$ sec

57. (B) $\because$ Relative speed of the train

$= 60 + 6 = 66$ km/hr

$$= \frac{66 \times 5}{18}$$

$$= \frac{55}{3} \text{ m/sec}$$

$\therefore$ Required time $= \frac{110 \times 3}{55} = 6$ sec

58. (A)

59. (A) Relative speed of the train

$= (32 + 40)$

$= 72$ km/hr.

$= \left(72 \times \frac{5}{18}\right)$

$= 20$ m/sec.

Sum of lengths of the trains

$= (132 + 108) = 240$ m

Time taken by the trains in passing each other

$$= \frac{240}{20}$$

$= 12$ sec

60. (B) Let the speed of the train be x km/hr

$\therefore$ Relative speed of the train $= (x + 5)$ km/hr

$= (x + 5) \times \frac{5}{18}$ m/sec

Now, $\frac{(x + 5) \times 5}{18} \times \frac{36}{5} = 100$

$\Rightarrow \quad 2x + 10 = 100$

$\therefore \quad x = 45$

$\therefore$ Required speed of the train $= 45$ km/hr

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Pipes and Cisterns

Intel—A pipe connected with a tank (or a cistern or a reservoir) is called an inlet, if it fills it.

Outlet—A pipe connected with a tank is called an outlet, if it empties it.

Formulae

(i) If a pipe can fill a tank in x hours, then the part filled in 1 hour

$$= \frac{1}{x}$$

(ii) If a pipe can empty a tank in y hours, then the part of the full tank emptied in 1 hour

$$= \frac{1}{y}$$

(iii) If a pipe can fill a tank in x hours and another pipe can empty the full tank in y hours, then the net part filled in 1 hour when both the pipes are opened $= \left(\frac{1}{x} - \frac{1}{y}\right)$

Examples

Q. 1. Two pipes A and B can fill a tank in 36 min. and 45 min. respectively. A waste pipe C can empty the tank in 30 min. First A and B are opened. After 7 min. C is also opened. In how much time the tank is full ?

Solution : Part filled in 7 min.

$$= 7 \times \left(\frac{1}{36} + \frac{1}{45}\right) = \frac{7}{20}$$

Remaining part

$$= \left(1 - \frac{7}{20}\right) = \frac{13}{20}$$

Part filled by (A + B + C) in 1 min. $= \left(\frac{1}{36} + \frac{1}{45} - \frac{1}{30}\right) = \frac{1}{60}$

Now, $\frac{1}{60}$ part is filled by (A + B + C) in 1 min.

So, $\frac{13}{20}$ part will be filled by them in $\left(\frac{60 \times 13}{20}\right) = 39$ min.

$\therefore$ Total time taken to fill the tank = (39 + 7) min. = 46 min.

Q. 2. Two pipes A and B can fill a tank in 24 minutes and 32 minutes respectively. If both the pipes are opened simultaneously, after how much time B should be closed so that the tank is full in 18 min. ?

Solution : Let B be closed after x minutes. Then part filled by (A + B) in x min. + part filled by A in $(18 - x)$ min. = 1

$$\therefore x\left(\frac{1}{24} + \frac{1}{32}\right) + (18 - x) \times \frac{1}{24} = 1$$

$$\text{or} \quad \frac{7x}{96} + \frac{18 - x}{24} = 1$$

$$\text{or} \quad 7x + 4(18 - x) = 96$$

$$\therefore \quad 3x = 24$$

$$\text{or} \quad x = 8$$

So, B should be closed after 8 min.

Q. 3. Two pipes A and B can fill a cistern in 1 hour and 75 minutes respectively. There is also an outlet C. If all the three pipes are opened together, the tank is full in 50 min. How much time will be taken by C to empty the full tank ?

Solution : Work done by C in (1) min. $= \left(\frac{1}{60} + \frac{1}{75} - \frac{1}{50}\right) = \frac{3}{300} = \frac{1}{100}$

$\therefore$ C can empty the full tank in 100 min.

Q. 4. Pipe A can fill a tank in 20 hours while pipe B alone can fill it in 30 hours and pipe C can empty the full tank in 40 hours. If all the pipes are opened together, how much time will be needed to make the tank full ?

Solution : Net part filled in 1 hour $= \left(\frac{1}{20} + \frac{1}{30} - \frac{1}{40}\right) = \frac{7}{120}$

$\therefore$ The tank will be full in $\frac{120}{7}$ *i.e.*, $17\frac{1}{7}$ hours.

Q. 5. A pipe can fill a tank in 15 hours. Due to a leak in the bottom it is filled in 20 hours. If the tank is full, how much time will the leak take to empty it ?

Solution : Work done by the leak in 1 hour

$$= \left(\frac{1}{15} - \frac{1}{20}\right) = \frac{1}{60}$$

$\therefore$ Leak will empty the full tank in 60 hours.

Q. 6. Two pipes A and B can fill a tank in 36 hours and 45 hours respectively. If both the pipes are opened simultaneously, how much time will be taken to fill the tank ?

Solution : Part filled by A alone in 1 hour $= \frac{1}{36}$

Part filled by B alone in 1 hour

$$= \frac{1}{45}$$

$\therefore$ Part filled by (A + B) in 1 hour

$$= \left(\frac{1}{36} + \frac{1}{45}\right) = \frac{9}{180} = \frac{1}{20}$$

Exercise

1. A tank can be filled by one tap in 20 min. and by another in 25 min. Both the taps are kept open for 5 min. and then the second is turned off. In how many minutes more is the tank completely filled ?

   (A) $17\frac{1}{2}$ min. (B) 12 min.

   (C) 11 min. (D) 6 min.

2. A cistern has two taps which fill it in 12 min. and 15 min. respectively. There is also a waste pipe in the cistern. When all the pipes are opened the empty cistern is full in 20 min. How long will the waste pipe take to empty a full cistern ?

   (A) 8 min. (B) 10 min.

   (C) 12 min. (D) 16 min.

3. Two taps can separately fill a cistern in 10 minutes and 15 minutes respectively and when the waste pipe is open, they can together fill it in 18 minutes. The waste pipe can empty the full cistern in—

   (A) 7 minutes

   (B) 9 minutes

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(C) 13 minutes
(D) 23 minutes

4. A tap can fill a tank in 16 minutes and another can empty it in 8 minutes. If the tank is already half full and both the taps are opened together, the tank will be—
(A) Filled in 12 min.
(B) Emptied in 12 min.
(C) Filled in 8 min.
(D) Emptied in 8 min.

5. A tank is filled by a pipe A in 32 minutes and pipe B in 36 minutes. When full, it can be emptied by a pipe C in 20 minutes. If all the three pipes are opened simultaneously, half of the tank will be filled in—
(A) 16 minutes
(B) 24 minutes
(C) 48 minutes
(D) None of these

6. A cistern can be filled by two pipes A and B in 4 hours and 6 hours respectively. When full, the tank can be emptied by a third pipe C in 8 hours. If all the taps be turned on at the same time, the cistern will be full in—
(A) 3 hours 18 min.
(B) 3 hours 26 min.
(C) 3 hours 42 min.
(D) 3 hours 48 min.

7. One tap can fill a cistern in 2 hours and another can empty the cistern in 3 hours. How long will they take to fill the cistern if both the taps are opened ?
(A) 5 hours (B) 6 hours
(C) 7 hours (D) 8 hours

8. A pipe can fill a tank in x hours and another can empty it in y hours. They can together fill it in $(y > x)$—
(A) $(x - y)$ hours
(B) $(y - x)$ hours
(C) $\frac{xy}{(x-y)}$ hours
(D) $\frac{xy}{(y-x)}$ hours

9. A tap can fill a cistern in 8 hours and another can empty it in 16 hours. If both the taps are opened simultaneously, the time (in hours) to fill the tank is—
(A) 8 (B) 10
(C) 16 (D) 24

10. Pipes A and B can fill a tank in 10 hours and 15 hours respectively. Both together can fill it in—
(A) $12\frac{1}{2}$ hours
(B) 6 hours
(C) 5 hours
(D) None of these

11. A cistern has a leak which would empty it in 8 hours. A tap is turned on which admits 6 litres a minute into the cistern and it is now emptied in 12 hours. How many litres does the cistern hold ?
(A) 7580 litres
(B) 7960 litres
(C) 8290 litres
(D) 8640 litres

12. Three pipes A, B and C can fill a cistern in 6 hours. After working at it together for 2 hours, C is closed and A and B can fill it in 7 hours. The time taken by C alone to fill the cistern is—
(A) 10 hours (B) 12 hours
(C) 14 hours (D) 16 hours

13. If two pipes function simultaneously, the reservoir will be filled in 12 hours. One pipe fills the reservoir 10 hours faster than the other. How many hours does the faster pipe take to fill the reservoir ?
(A) 25 hours (B) 28 hours
(C) 30 hours (D) 35 hours

14. Two pipes A and B can fill a tank in 15 hours and 20 hours respectively while a third pipe C can empty the full tank in 25 hours. All the three pipes are opened in the beginning. After 10 hours, C is closed. The time taken to fill the tank is—
(A) 12 hours (B) $13\frac{1}{2}$ hours
(C) 16 hours (D) 18 hours

15. There are two taps to fill a tank while a third to empty it. When the third tap is closed, they can fill the tank in 10 minutes and 12 minutes respectively. If all the three taps be opened, the tank is filled in 15 minutes. If the first two taps are closed, in what time can the third tap empty the tank when it is full ?
(A) 7 min.
(B) 9 min. and 32 sec.
(C) 8 min. and 34 sec.
(D) 6 min.

16. A pipe can fill a cistern in 12 minutes and another pipe can fill it in 15 minutes, but a third pipe can empty it in 6 minutes. The first two pipes are kept open for 5 minutes in the beginning and then the third pipe is also opened. In what time is the cistern emptied ?
(A) 30 min. (B) 33 min.
(C) $37\frac{1}{2}$ min. (D) 45 min.

17. A leak in the bottom of a tank can empty the full tank in 6 hours. An intel pipe fills water at the rate of 4 litres per minute. When the tank is full, the intel is opened and due to the leak the tank is empty in 8 hours. The capacity of the tank is—
(A) 5260 litres
(B) 5760 litres
(C) 5846 litres
(D) 6970 litres

18. Two pipes X and Y can fill a cistern in 24 min. and 32 min. respectively. If both the pipes are opened together, then after how much time Y should be closed so that the tank is full in 18 minutes ?
(A) 6 min. (B) 8 min.
(C) 10 min. (D) 12 min.

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19. A cistern is normally filled in 8 hours but takes two hours longer to fill because of a leak in its bottom. If the cistern is full, the leak will empty it in—
(A) 16 hrs. (B) 20 hrs.
(C) 25 hrs. (D) 40 hrs.

20. A water tank is $\frac{2}{5}$th full pipe A can fill the tank in 10 minutes and the pipe B can empty it in 6 minutes. If both the pipes are open, how long will it take to empty or fill the tank completely ?
(A) 6 minutes to empty
(B) 6 minutes to fill
(C) 9 minutes to empty
(D) 9 minutes to fill

21. A pipe can empty a tank in 12 minutes and another pipe can empty it in 16 minutes. If both the pipes are opened simultaneously, find the time in which a full tank is emptied—
(A) 6 minutes
(B) $6\frac{1}{7}$ minutes
(C) $6\frac{2}{7}$ minutes
(D) None of these

22. There is a leak in the bottom of cistern. When the cistern is thoroughly repaired. It would be filled in $3\frac{1}{2}$ hours. It now takes half an hour longer. If the cistern is full, how long would the leak take to empty the cistern ?
(A) 28 hours (B) 27 hours
(C) 32 hours (D) 24 hours

23. Top A can fill a water tank in 25 minutes, tap B can fill the same tank in 40 minutes and tap C can empty the tank in 30 minutes. If all the three taps are opened together, in how many minutes will the tank be completely filled up or emptied ?
(A) $3\frac{2}{13}$ (B) $15\frac{5}{13}$
(C) $8\frac{2}{13}$ (D) $31\frac{11}{19}$

24. A cistern is normally filled in 8 hrs. but takes 2 hrs. longer to fill because of a leak in its bottom. If the cistern is full, the leak will empty it in—
(A) 16 hrs. (B) 40 hrs.
(C) 25 hrs. (D) 20 hrs.

25. A cistern can be filled by two pipes. A and B in 12 minutes and 14 minutes respectively and can be emptied by a third pipe C in 8 minutes. If all the taps be turned on at the same moment, what part of cistern will remain unfilled at the end of 7 minutes ?
(A) $\frac{5}{24}$ (B) $\frac{19}{24}$
(C) $\frac{7}{24}$ (D) $\frac{17}{24}$

26. A cistern has 3 pipes A, B and C, A and B can fill it in 2 and 3 hours respectively. C is a waste pipe. If all the 3 pipes be opened at once, $\frac{7}{24}$ of the cistern will be filled up in 30 minutes. In what time can C empty the full cistern ?
(A) 3 hours (B) 4 hours
(C) 5 hours (D) 6 hours

27. Two pipes A and B can fill a cistern in 20 minutes and 25 minutes respectively. Both are opened together, but at the end of 5 minutes, B is turned off. How much longer will the cistern take to fill ?
(A) 16 minutes
(B) 18 minutes
(C) 11 minutes
(D) None of these

28. Two pipes, P and Q can fill a cistern in 12 and 15 minutes respectively. Both are opened together, but at the end of 3 minutes the first is turned off. How much longer will the cistern take to fill ?
(A) $8\frac{1}{4}$ minutes
(B) $11\frac{1}{4}$ minutes
(C) $7\frac{3}{4}$ minutes
(D) $8\frac{3}{4}$ minutes

29. A cistern can be filled by two pipes in 30 and 40 minutes respectively. Both the pipes were opened at once, but after some time the first was shut up and the cistern was filled in 10 minutes more. How long after the pipes had been opened was the first pipe shut up ?
(A) $\frac{90}{11}$ minutes
(B) $\frac{90}{7}$ minutes
(C) $\frac{90}{13}$ minutes
(D) $\frac{45}{2}$ minutes

30. Three taps A, B and C can fill a cistern in 10, 15 and 20 minutes respectively. They are all turned on at once, but after 3 minutes C is turned off. How many minutes longer will A and B take to fill the cistern ?
(A) 2 min.
(B) 2 min. 6 sec.
(C) 1 min. 6 sec.
(D) 3 min. 8 sec.

31. Three taps A, B and C can fill a cistern in 10 min., 12 min. and 15 min. respectively. They are all turned on at once, but after $1\frac{1}{2}$ min. B and C are turned off. How many minutes longer will A take then to fill the cistern ?
(A) $6\frac{1}{4}$ min. (B) $7\frac{1}{4}$ min.
(C) $6\frac{3}{4}$ min. (D) $8\frac{3}{4}$ min.

32. A cistern has a leak which would empty it in 15 hours. A tap is turned on which admits 2 litres per hour into the cistern and it is now emptied in 10 hours. How many litres does the cistern hold ?
(A) 50 litres (B) 60 litres
(C) 45 litres (D) 360 litres

33. A cistern can be filled by one of two pipes in 30 minutes and by the other in 36 minutes. Both pipes are opened together for a certain time but being particularly clogged only $\frac{5}{6}$ of the full

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quantity of water flows through the former and only $\frac{9}{10}$ through the latter. The obstructions, however, being suddenly removed the cistern is filled in $15\frac{1}{2}$ minutes from that moment. How long was it before the full flow of water began ?

(A) 1 minute

(B) 2 minute

(C) $2\frac{1}{2}$ minute

(D) $1\frac{1}{2}$ minute

34. Two pipes A and B can fill a tank in 15 hours and 20 hours respectively while a third pipe C can empty the full tank in 25 hours. All the three pipes are opened in the beginning. After 10 hours C is closed. Find in how much time will the tank be full ?

(A) 12 hrs. (B) 8 hrs.

(C) 10 hrs. (D) 14 hrs.

35. Three pipes A, B and C can fill a cistern in 10 hours, 12 hours and 15 hours respectively. First A was opened. After 1 hour, B was opened and after 2 hours from the start of A, C also opened. Find the time in which the cistern is just full—

(A) 2 hrs.

(B) 4 hrs.

(C) 2 hrs. 52 min.

(D) 4 hrs. 52 min.

36. A, B, C are pipes attached to a cistern. A and B can fill it in 20 and 30 minutes respectively. While C can empty it in 15 minutes. If A, B, C be kept open successively for 1 minute each, how soon will the cistern be filled ?

(A) 167 min. (B) 160 min.

(C) 166 min. (D) 164 min.

37. Pipe A fills the cistern in half an hour and pipe B in 40 minutes, but owing to a crack in the bottom of the cistern it is found that pipe A now takes, 40 minutes to fill the cistern. How long will B take now to fill it and how long will the crack take to empty it ?

(A) The leak empties in 1 hour and B fills in 2 hours

(B) B fills in an hour and the leak empties in 2 hours

(C) B fills in an hour and the leak empties in an hour

(D) Data inadequate

38. A cistern which could be filled in 9 hours takes one hour more to be filled owing to a leak in its bottom. If the cistern is full, in what time will the leak empty it ?

(A) 80 hours (B) 85 hours

(C) 90 hours (D) 95 hours

39. A tap can fill a cistern in 8 hours and another can empty it in 16 hours. If both the taps are opened simultaneously, the time (in hours) to fill the tank is—

(A) 8 (B) 10

(C) 16 (D) 24

40. A tap can fill a tank in 25 minutes and another can empty it in 50 minutes. Find whether the tank will be filled up or emptied and in how many minutes ?

(A) Tank is emptied in 20 minutes

(B) Tank is filled up in 25 minutes

(C) Tank is filled up in 20 minutes

(D) Tank is emptied in 25 minutes

Answers with Hints

1. (C) Work done by both the taps in 5 min

$$= 5\left(\frac{1}{20}+\frac{1}{25}\right) = \left(5\times\frac{9}{100}\right) = \frac{9}{20}$$

$$\text{Remaining part} = \left(1-\frac{9}{20}\right) = \frac{11}{20}$$

Now, $\frac{1}{20}$ part is filled in 1 min.

So, $\frac{11}{20}$ part will be filled in 11 min.

Hence, the tank will be full in 11 min. more.

2. (B) Work done by waste pipe in 1 min.

$$= \left(\frac{1}{12}+\frac{1}{15}\right)-\frac{1}{20}$$

$$= \left(\frac{3}{20}-\frac{1}{20}\right) = \frac{1}{10}$$

$\therefore$ Waste pipe can empty the cistern in 10 min.

3. (B) Work done by waste pipe in 1 min.

$$= \left(\frac{1}{10}+\frac{1}{15}\right)-\frac{1}{18}$$

$$= \left(\frac{1}{6}-\frac{1}{18}\right) = \frac{1}{9}$$

$\therefore$ Waste pipe can empty the cistern in 9 min.

4. (D) Part emptied in 1 min.

$$= \left(\frac{1}{8}-\frac{1}{16}\right) = \frac{1}{16}$$

$\therefore$ Time taken to empty the full tank = 16 min.

Hence, time taken to empty the half tank = 8 min.

5. (D) Net filling in 1 min.

$$= \left(\frac{1}{32}+\frac{1}{36}-\frac{1}{20}\right) = \frac{13}{1440}$$

$\therefore$ Time taken to fill the tank

$$= \left(\frac{1440}{13}\right) \text{ min.}$$

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Time taken to fill half of the tank

$$= \left(\frac{1440}{13 \times 2}\right) \text{ min.}$$

$$= \left(\frac{720}{13}\right) \text{ min.} = 55\frac{5}{13} \text{ min.}$$

6. (B) Net filling in 1 hour

$$= \left(\frac{1}{4} + \frac{1}{6} - \frac{1}{8}\right) = \frac{7}{24}$$

$\therefore$ Time taken to fill the cistern

$$= \left(\frac{24}{7}\right) \text{ hrs.} = 3 \text{ hrs. } 26 \text{ min.}$$

7. (B) Net filling in 1 hour

$$= \left(\frac{1}{2} - \frac{1}{3}\right) = \frac{1}{6}$$

$\therefore$ Time taken to fill the cistern

$$= 6 \text{ hours}$$

8. (D) Net filling in 1 hour

$$= \left(\frac{1}{x} - \frac{1}{y}\right) = \left(\frac{y-x}{xy}\right)$$

$\therefore$ Time taken to fill the tank

$$= \left(\frac{xy}{y-x}\right) \text{ hrs.}$$

9. (C) Part filled by intel in 1 hour $= \frac{1}{8}$

Part emptied by outlet in 1 hour $= \frac{1}{16}$

Net filling in 1 hour $= \left(\frac{1}{8} - \frac{1}{16}\right) = \frac{1}{16}$

$\therefore$ Time taken to fill the tank $= 16$ hours.

10. (B) Part filled by A in 1 hour $= \frac{1}{10}$

Part filled by B in 1 hour $= \frac{1}{15}$

Part filled by (A + B) in 1 hour $= \left(\frac{1}{10} + \frac{1}{15}\right)$

$$= \frac{5}{30} = \frac{1}{6}$$

$\therefore$ Both pipes together can fill the tank in 6 hours.

11. (D) Part filled in 1 hour $= \left(\frac{1}{8} - \frac{1}{12}\right) = \frac{1}{24}$

$\therefore$ Time taken to fill the cistern

$= 24$ hours

Water moved in 24 hours $= (6 \times 24 \times 60)$ litres

$= 8640$ litres

Hence, the capacity of the cistern is 8640 litres.

12. (C) Part filled in 2 hours $= 2 \times \frac{1}{6} = \frac{1}{3}$

Remaining part $= \left(1 - \frac{1}{3}\right) = \frac{2}{3}$

(A + B)'s 7 hour's work $= \frac{2}{3}$

$\therefore$ (A + B)'s 1 hour's work $= \left(\frac{2}{3} \times \frac{1}{7}\right) = \frac{2}{21}$

(A + B + C)'s 1 hour's work $= \frac{1}{6}$

C's 1 hour's work $= \left(\frac{1}{6} - \frac{2}{21}\right) = \frac{1}{14}$

Hence, C alone can fill the cistern in 14 hours.

13. (C) Suppose that one pipe takes x hours to fill the reservoir. Then another pipe takes $(x - 10)$ hours.

$$\therefore \quad \frac{1}{x} + \frac{1}{x-10} = \frac{1}{12}$$

$$\Rightarrow \quad 12(x - 10 + x) = x(x - 10)$$

$$\text{or} \quad x^2 - 34x + 120 = 0$$

$$\text{or} \quad (x - 30)(x - 4) = 0$$

$$\therefore \quad x = 30$$

$$\text{or} \quad x = 4$$

So, the faster pipe takes 30 hours to fill the reservoir.

14. (A) Part filled in 10 hours

$$= 10 \times \left(\frac{1}{15} + \frac{1}{20} - \frac{1}{25}\right) = \frac{23}{30}$$

Remaining part

$$= \left(1 - \frac{23}{30}\right) = \frac{7}{30}$$

Now, $\left(\frac{1}{15} + \frac{1}{20}\right)$ part is filled by A and B in 1 hr.

$\frac{7}{30}$ part will be filled by them in $\left(\frac{60}{7} \times \frac{7}{30}\right)$

$= 2$ hrs.

$\therefore$ Total time taken to fill the tank

$= (10 + 2)$ hrs. $= 12$ hrs.

15. (C) Part emptied by the third pipe in 1 min.

$$\left(\frac{1}{10} + \frac{1}{12}\right) - \frac{1}{15} = \frac{7}{60}$$

So, the full tank will be emptied by third pipe in

$$\left(\frac{60}{7}\right) \text{ min.} = 8 \text{ min. } 34 \text{ sec.}$$

16. (D) Part filled in 5 min.

$$5 \times \left(\frac{1}{12} + \frac{1}{15}\right) = 5 \times \frac{9}{60} = \frac{3}{4}$$

Part emptied in 1 min. (when all the pipes are opened)

$$= \frac{1}{6} - \left(\frac{1}{12} + \frac{1}{15}\right) = \left(\frac{1}{6} - \frac{3}{20}\right) = \frac{1}{60}$$

Now, $\frac{1}{60}$ part is emptied in 1 min.

$\frac{3}{4}$ part will be emptied in $\left(60 \times \frac{3}{4}\right) = 45$ min.

17. (B) Part filled by intel in 1 hour

$$= \left(\frac{1}{6} - \frac{1}{8}\right) = \frac{1}{24}$$

So, the intel can fill the tank in 24 hours

$\therefore$ Capacity of the tank

$=$ Water that flows in 24 hours

$= (4 \times 24 \times 60)$ litres

$= 5760$ litres

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18. (B) Let Y be closed after x min.

Then, $x\left(\frac{1}{24}+\frac{1}{32}\right)+(18-x)\frac{1}{24}$

$= 1$

$\Rightarrow \quad \frac{7x}{96}+\frac{18-x}{24} = 1$

or $\quad 7x + 72 - 4x = 96.$

$\therefore \quad 3x = 24$

or $\quad x = 8$ min.

19. (D) Work done by leak in 1 hour

$= \left(\frac{1}{8}-\frac{1}{10}\right)=\frac{1}{40}$

$\therefore$ The leak will empty the cistern in 40 hours.

20. (A) Time taken to fill or empty the whole tank

$= \frac{6\times 10}{6-10} = -15$ minutes

– ve sign shows that the tank will be emptied.

$\therefore \frac{2}{5}$th full of the tank will be emptied in $\frac{15\times 2}{5}$

$= 6$ minutes

21. (D) Required answer

$= \frac{12\times 16}{12+16}=\frac{48}{7}=6\frac{6}{7}$ minutes.

22. (A) Here $x = 3{\cdot}5$ hours and

$y = 3{\cdot}5 + 0{\cdot}5 = 4$ hours

Now apply the given rule.

23. (D) Required answer

$= \frac{25\times 40\times 30}{40\times 30+25\times 30-25\times 40}$

$= \frac{600}{19}=31\frac{11}{19}$ minutes

24. (B) Here $x = 8$ hrs. and $y = 8 + 2 = 10$ hrs.

Now, applying the given rule, we have the

required answer $= \frac{8\times 10}{10-8}= 40$ hrs.

25. (B) Time taken to fill the whole tank

$=\frac{12\times 14\times 8}{14\times 8+12\times 8-12\times 14}=\frac{168}{5}$ minutes

$\therefore$ In 7 minutes $\frac{5}{168}\times 7$

$=\frac{5}{24}$ part of the tank will be filled

$\therefore$ Required answer

$= 1-\frac{5}{24}=\frac{19}{24}$ part.

26. (B) $\because \frac{7}{24}$ of the cistern will be filled up in $\frac{1}{2}$ hr.

$\therefore$ The whole of the cistern will be filled up in

$\left(\frac{1}{2}\times\frac{24}{7}=\frac{12}{7}\right)$ hrs.

Let the pipe C be empty the whole cistern in x hours

Now, applying the given rule we have,

$\frac{2\times 3\times x}{3\times x+2\times x-2\times 3} = \frac{12}{7}$

or $\quad 42x = 60x - 72$

$\therefore \quad x = 4$ hours.

27. (A) $\quad 25\left(1-\frac{t}{20}\right) = 5$

$\therefore \quad t = 16$ minutes

28. (A) $\quad 12\left(1-\frac{t}{25}\right) = 3$

$\therefore \quad t = \frac{45}{4}=11\frac{1}{4}$ minutes

$\therefore \quad$ Required answer $= 11\frac{1}{4}-3=8\frac{1}{4}$ minutes

29. (B) Let the first pipe be shut up after x minutes

Now, applying the above rule, we have

$30\left(1-\frac{x+10}{40}\right) = x$

[Here $t = (x + 10)$ minutes]

or $\quad x = \frac{90}{7}$ minutes

30. (B) $x=\frac{10\times 15\times 20}{10\times 15+10\times 20+15\times 20}=\frac{60}{13}$ minutes

Now, applying the given rule, we have

$\frac{\frac{60}{13}\times y}{y-\frac{60}{13}+3} = 20$

or $\quad y = \frac{21}{10} = 2$ min. 6 seconds.

31. (A) $x=\frac{10\times 12\times 15}{10\times 12+12\times 15+10\times 15}=4$ min.

B and C are turned off after $1\frac{1}{2}$ minutes

$\therefore$ B and C together can fill a cistern in

$\left(\frac{12\times 15}{12+15}=\frac{20}{3}\right)$ min.

Now, applying the given rule, we have

$\frac{4+y}{y-4+\frac{3}{2}} = \frac{20}{3}$

$\therefore \quad y = \frac{25}{4}=6\frac{1}{4}$ minutes

32. (B) Here $w = 2$ litres per hour

$\therefore$ Required answer $= \frac{15\times 10}{15-10}\times 2 = 60$ litres.

33. (A) Net filling in last $15\frac{1}{2}$ minutes

$=\frac{31}{2}\left(\frac{1}{30}+\frac{1}{36}\right)=\frac{341}{360}$

Now, suppose they remained clogged for x minutes.

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Net filling in these x minutes

$$= \left(\frac{x}{30}\times\frac{5}{6}+\frac{x}{36}\times\frac{9}{10}\right)=\frac{19x}{360}$$

Remaining part

$$= \left(1-\frac{19x}{360}\right)=\left(\frac{360-19x}{360}\right)$$

$$\frac{360-19x}{360}=\frac{341}{360} \quad \text{or} \quad x=1.$$

Hence, the pipes remained clogged for 1 minute.

34. (A) Tank filled in 10 hours

$$= 10\left(\frac{1}{15}+\frac{1}{20}-\frac{1}{25}\right)=\frac{23}{30}$$

$$\text{Remaining part} = \left(1-\frac{23}{30}\right)=\frac{7}{30}$$

Work done by (A + B) in 1 hour

$$= \left(\frac{1}{15}+\frac{1}{20}\right)=\frac{7}{60}$$

Now, $\frac{7}{60}$ part is filled by (A + B) in hour

$\therefore \frac{7}{30}$ part will be filled by (A + B) in $\left(\frac{60}{7}\times\frac{7}{30}\right)$ hrs.

$$= 2 \text{ hours}$$

Total time in which the tank is full

$$= 10 + 2 = 12 \text{ hours.}$$

35. (D) [(A's 1 hour work) + (A + B)'s 1 hour work]

$$= \frac{1}{10}+\left(\frac{1}{10}+\frac{1}{12}\right) = \frac{17}{60}$$

$$\text{Remaining part} = \left(1-\frac{17}{60}\right) = \frac{43}{60}$$

$$\text{Now, (A + B + C)'s 1 hour work} = \left(\frac{1}{10}+\frac{1}{12}+\frac{1}{15}\right)$$

$$= \frac{1}{4}$$

$\frac{1}{4}$ part is filled by 3 pipes in 1 hour.

$\frac{43}{60}$ part will be filled by them in $\left(4\times\frac{43}{60}\right)$ hrs.

$$= 2 \text{ hours } 52 \text{ min.}$$

$\therefore$ Total time taken to fill the cistern

$$= 4 \text{ hours } 52 \text{ min.}$$

36. (A) Work done in 3 minutes $= \left(\frac{1}{20}+\frac{1}{30}-\frac{1}{15}\right)$

$$= \frac{1}{60}$$

Clearly, $\frac{55}{60}$ part of cistern is filled in 3×55 or 165 min.

$$\text{Remaining part} = \left(1-\frac{55}{60}\right)=\frac{5}{60}=\frac{1}{12}$$

Now, $\frac{1}{20}$ part is filled by A in 1 min.

and $\left(\frac{1}{12}-\frac{1}{20}\right)$ *i.e.* $\frac{1}{30}$ part is filled by B in 1 min.

$\therefore$ Required time $= (3 \times 55 + 1 + 1)$ min.

$$= 167 \text{ min.}$$

37. (B) Let the leak empties it in x hours

From the given rule, we have

$$\frac{x\times 30}{x-30} = 40$$

$$\therefore \quad x = 120 \text{ minutes} = 2 \text{ hours}$$

Now, from the question, applying the rule, we have time taken by B to fill the tank when crack in the bottom develops

$$= \frac{120\times 40}{120-40}= 60 \text{ minutes}$$

$$= 1 \text{ hour}$$

38. (C) Let the leak empty the full cistern in x hours

Now, applying the given rule

$$\frac{9\times x}{x-9} = 9 + 1 = 0$$

$$\text{or} \quad x = 90 \text{ hours.}$$

39. (C)

40. (B) $\quad T = \frac{25\times 50}{50-25}= + 25$ minutes

+ ve sign shows that tank is filled up in 25 minutes.

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Alligation or Mixture

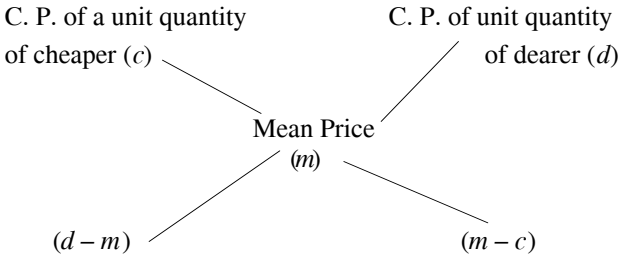
Alligation is the rule that enable us to find the proportion in which the two or more ingredients at the given price must be mixed to produce a mixture at a given price.

Cost price of unit quantity of the mixture is called the Mean price.

Rule of Alligation—If two ingredients are mixed in a ratio, then—

$$\frac{\text{Quantity of Cheaper}}{\text{Quantity of Dearer}} = \frac{\text{(C. P. of dearer) – (Mean Price)}}{\text{(Mean Price) – (C. P. of Cheaper)}}$$

We represent it as under—



(Cheaper quantity) : (Dearer quantity)

= $(d - m) : (m - c)$

Examples

Q. 1. A container contains 80 kg. of milk. From this container, 8 kg of milk was taken out and replaced by water. This process was further repeated two times. How much milk is now contained by the container ?

Remarks—Amount of liquid left after n operations when the container originally contains x units of liquid, from which y units is taken out each time

is $\left[x\left(1-\frac{y}{x}\right)^n\right]$ units

Solution : Amount of milk left

$80\left[\left(1-\frac{8}{80}\right)^3\right]$ kg = 58·34 kg.

Q. 2. A lamp of two metals weighing 18 gm is worth Rs. 87, but if their weights be interchanged, it would be worth Rs. 78·60. If the price of one metal be Rs. 6·70 per gm. find the weight of the other metal in the mixture.

Solution : If one lump is mixed with another lump with the quantities of metals interchanged then the mixture of the two lumps would contain 18 gm of first metal and 18 gm of second metal and the price of the mixture would be Rs. (87 + 78·60) or Rs. 165·60.

∴ Cost of (18 gm of 1st metal + 18 gm of 2nd metal)

= Rs. 165·60

So, cost of (1 gm of 1st metal + 1 gm of 2nd metal)

= Rs. $\frac{165{\cdot}60}{18}$ = Rs. 9·20

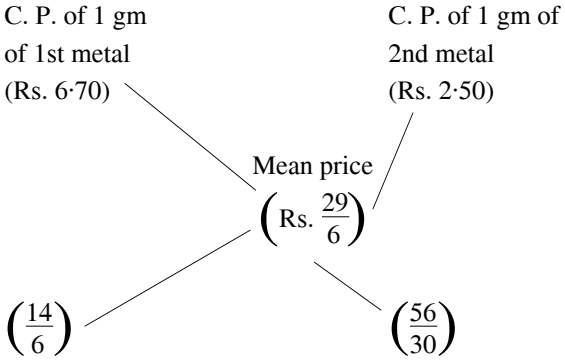
(Cost of 1 gm. of 1st metal) + (Cost of 1 gm of 2nd metal) = Rs. 9·20

Cost of 1 gm of 2nd metal = Rs. (9·20 – 6·70)

= Rs. 2·50

Now, mean price of lump

= Rs. $\left(\frac{87}{18}\right)$ per gm = Rs. $\left(\frac{29}{6}\right)$



∴ By alligation rule

$$\frac{\text{Quantity of 1st metal}}{\text{Quantity of 2nd metal}} = \frac{14}{6} : \frac{56}{30} = 5 : 4$$

In 9 gm of mix. 2nd metal

= 4 gm

In 18 gm of mix. 2nd metal

= $\left(\frac{4}{9} \times 18\right)$ gm = 8 gm.

Q. 3. Two vessels A and B contain milk and water mixed in the ratio 5 : 2 and 8 : 5 respectively. Find the ratio in which these mixtures are to be mixed to get a new mixture containing milk and water in the ratio 9 : 4.

Solution : Let the C. P. of milk be Re. 1 per litre

Milk in 1 litre mix in A

= $\frac{5}{7}$ litre

Milk in 1 litre mix in B

= $\frac{8}{13}$ litre

Milk in 1 litre mix. of this mix.

= $\frac{9}{13}$ litre

C. P. of 1 litre mix. in A

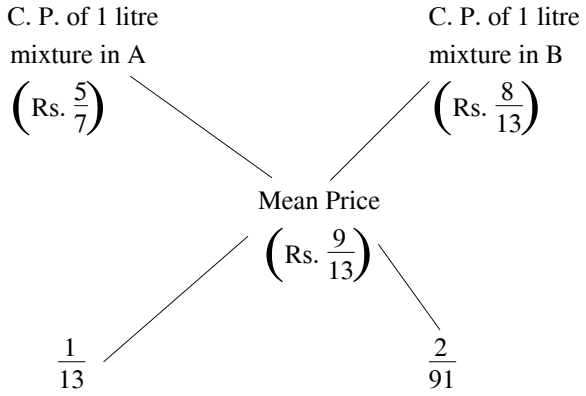
= Rs. $\frac{5}{7}$

C. P. of 1 litre mix. in B

= Rs. $\frac{8}{13}$

Mean price = Rs. $\frac{9}{13}$

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$\therefore$ (Mix. in A) : (Mix. in B)

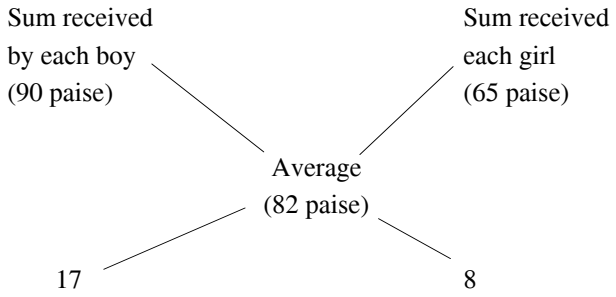
$= \frac{1}{13} : \frac{2}{91}$

$= 7 : 2$

Q. 4. A sum of Rs. 41 was divided among 50 boys and girls. Each boy gets 90 paise and a girl 65 paise. Find the number of boys and girls.

Solution : Average money received by each

$= \text{Rs. } \frac{41}{50} = 82 \text{ Paise}$



By alligation rule

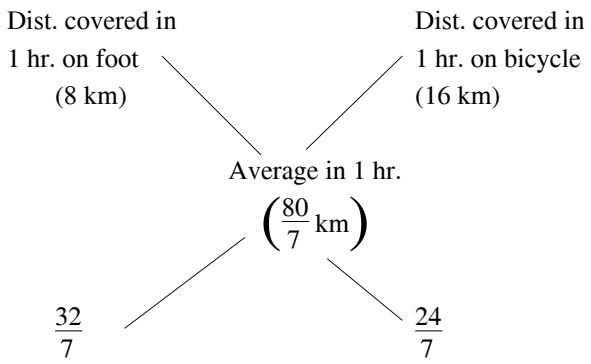
Ratio of boys and girls

$= 17 : 8.$

Q. 5. A man travelled a distance of 80 km in 7 hours partly on foot at the rate of 8 km per hour and partly on bicycle at 16 km per hour. Find the distance travelled on foot.

Solution : Average distance travelled in 1 hr.

$= \frac{80}{7} \text{ km}$



By alligation rule

$\frac{\text{Time taken on foot}}{\text{Time taken by bicycle}} = \frac{32}{24} = 4 : 3$

Thus out of 7 hours in all, he took 4 hours to travel on foot.

Distance covered on foot in 4 hours

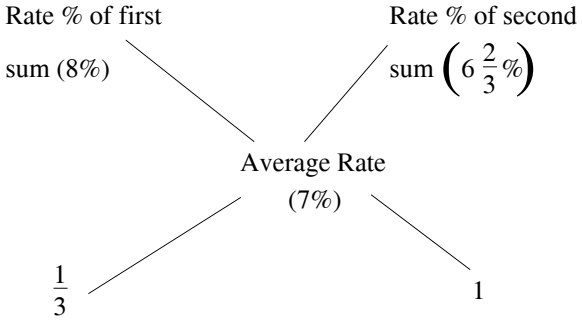
$= (4 \times 8) \text{ km} = 32 \text{ km}$

Q. 6. A man possessing Rs. 8400 lent a part of it at 8% simple interest and the remaining at $6\frac{2}{3}\%$ simple interest. His total income after $1\frac{1}{2}$ years was Rs. 882. Find the sum lent at different rates.

Solution : Total interest on Rs. 8400 for $1\frac{1}{2}$ years is Rs. 882

$\therefore$ Rate of interest $= \frac{100 \times 882 \times 2}{8400 \times 3}$

$= 7\%$



Now,

By alligation rule

$\frac{\text{Money given at 8\% S. I.}}{\text{Money given at } 6\frac{2}{3}\% \text{ S. I.}}$

$= \frac{1}{3} : 1$

$= 1 : 3$

$\therefore$ Money lent at 8% $= \text{Rs. } \left(8400 \times \frac{1}{4}\right)$

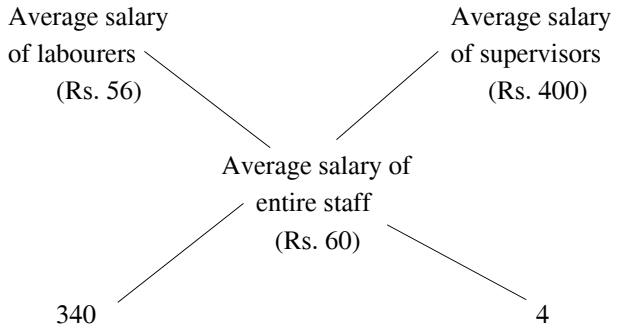
$= \text{Rs. } 2100$

Money lent at $6\frac{2}{3}\%$ $= \text{Rs. } \left(8400 \times \frac{3}{4}\right)$

$= \text{Rs. } 6300.$

Q. 7. The average weekly salary per head of the entire staff of a factory consisting of supervisors and the labourers is Rs. 60. The average salary per head of the supervisors is Rs. 400 and that of the labourers is Rs. 56. Given that the number of supervisors is 12. Find the number of labourers in the factory.

Solution :



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By alligation rule

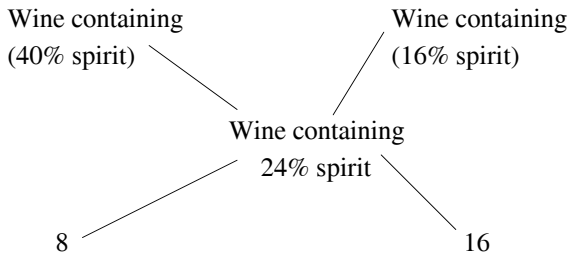
$$\frac{\text{Number of labourers}}{\text{Number of supervisors}} = \frac{340}{4} = \frac{85}{1}$$

Thus, if the number of supervisors is 1, number of labourers = 85

∴ If the number of supervisors is 12, number of labourers = $85 \times 12 = 1020$

Q. 8. A butler stole wine from a butt of sherry which contained 40% of spirit and he replaced,what he had stolen by wine containing only 16% spirit. The butt was then of 24% strength only. How much of the butt did he steel ?

Solution :



∴ By alligation rule

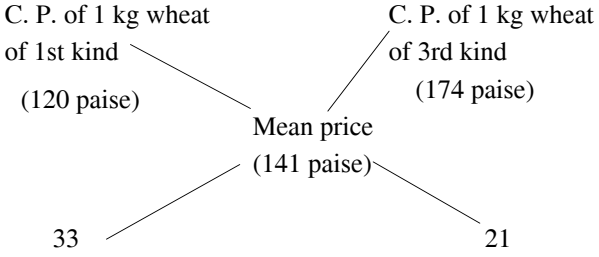
$$\frac{\text{Wine with 40\% spirit}}{\text{Wine with 16\% spirit}} = \frac{8}{16} = \frac{1}{2}$$

i.e., they must be mixed in the ratio (1 : 2)

Thus $\frac{1}{3}$ of the butt of sherry was left and hence the butler drew out $\frac{2}{3}$ of the butt.

Q. 9. In what ratio must a person mix three kinds of wheat costing his Rs. 1·20, Rs. 1·44 and Rs. 1·74 per kg. So, that the mixture may be worth Rs. 1·41 per kg ?

Solution : **Step I**—Mix wheats of first and third kind to get a mixture worth Rs. 1·41 per kg.

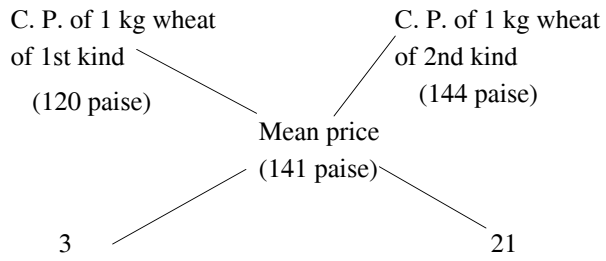


By alligation rule :

$$\frac{\text{Quantity of 1st kind of wheat}}{\text{Quantity of 3rd kind of wheat}} = \frac{33}{21} = \frac{11}{7}$$

i.e.; they must be mixed in the ratio 11 : 7.

Step II : Mix wheats of 1st and 2nd kind to obtain a mixture worth of Rs. 1·41 per kg.



By alligation rule :

$$\frac{\text{(Quantity of 1st kind of wheat)}}{\text{Quantity of 2nd kind of wheat}} = \frac{3}{21} = \frac{1}{7}$$

i.e.; they must be mixed in the ratio 1 : 7

Thus, $\frac{\text{Quantity of 2nd kind of wheat}}{\text{Quantity of 3rd kind of wheat}}$

$$= \frac{\text{Quantity of 2nd kind of wheat}}{\text{Quantity of 1st kind of wheat}} \times \frac{\text{Quantity of 1st kind of wheat}}{\text{Quantity of 3rd kind of wheat}}$$

$$= \left(\frac{7}{1} \times \frac{11}{7}\right)$$

$$= \left(\frac{11}{1}\right)$$

∴ Quantities of wheat of (1st kind : 2nd kind : 3rd kind) $= \left(1 : 7 : \frac{7}{11}\right)$

$= (11 : 77 : 7)$

Q. 10. In what proportion must water be mixed with spirit to gain $16\frac{2}{3}$ % by selling it at cost price ?

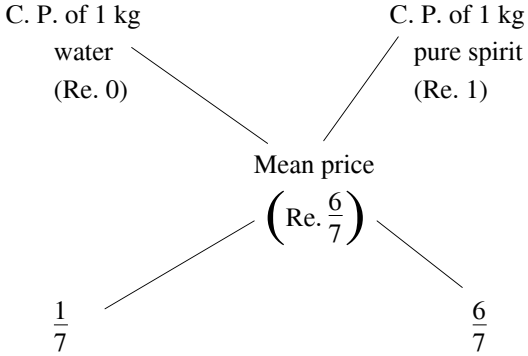
Solution : Let C. P. of spirit be Re. 1 per litre.

Then, S. P. of 1 litre of mixture

$= \text{Re. } 1, \text{Gain} = 16\frac{2}{3}\%$

C. P. of 1 litre of mixture

$$= \text{Rs.} \left(\frac{100 \times 3 \times 1}{350}\right) = \text{Rs.} \frac{6}{7}$$



$$\frac{\text{Quantity of water}}{\text{Quantity of spirit}} = \frac{\frac{1}{7}}{\frac{6}{7}} = \frac{1}{6}$$

or Ratio of water and spirit = 1 : 6.

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Exercise

1. A jar full of whisky contains 40% of alcohol. A part of this whisky is replaced by another containing 19% alcohol and now the percentage of alcohol was found to be 26. The quantity of whisky replaced is—
   (A) $\frac{2}{5}$ (B) $\frac{1}{3}$
   (C) $\frac{2}{3}$ (D) $\frac{3}{5}$

2. Kantilal mixes 80 kg of sugar worth of Rs. 6·75 per kg with 120 kg worth of Rs. 8 per kg. At what rate shall he sell the mixture to gain 20% ?
   (A) Rs. 7·50 (B) Rs. 9
   (C) Rs. 8·20 (D) Rs. 8·85

3. A mixture of 20 kg of spirit and water contains 10% water. How much water must be added to this mixture to raise the percentage of water to 25% ?
   (A) 4 kg (B) 5 kg
   (C) 8 kg (D) 30 kg

4. A merchant has 50 kg. of sugar part of which he sells at 8% profit and the rest at 18% profit. He gains 14% on the whole. The quantity sold at 18% profit is—
   (A) 20 kg (B) 30 kg
   (C) 15 kg (D) 35 kg

5. Rs. 1000 is lent out in two parts, one at 6% simple interest and the other at 8% simple interest. The yearly income is Rs. 75. The sum lent at 8% is—
   (A) Rs. 250 (B) Rs. 500
   (C) Rs. 750 (D) Rs. 600

6. A grocer buys two kind of rice at Rs. 1·80 and Rs. 1·20 per kg respectively. In what proportion should these be mixed, so that by selling the mixture at Rs. 1·75 per kg, 25% may be gained ?
   (A) 2 : 1 (B) 3 : 2
   (C) 3 : 4 (D) 1 : 2

7. 15 litres of a mixture contains 20% alcohol and the rest water. If 3 litres of water be mixed in it, the percentage of alcohol in the new mixture will be—
   (A) 17 (B) $16\frac{2}{3}$
   (C) $18\frac{1}{2}$ (D) 15

8. In what proportion must wheat at Rs. 1·60 per kg be mixed with wheat at Rs. 1·45 per kg. So that the mixture be worth Rs. 1·54 per kg ?
   (A) 2 : 3 (B) 3 : 2
   (C) 3 : 4 (D) 4 : 3

9. In a mixture of 60 litres, the ratio of milk and water is 2 : 1. If the ratio of the milk and water is to be 1 : 2, then the amount of water to be further added is—
   (A) 20 litres (B) 30 litres
   (C) 40 litres (D) 60 litres

10. A can contains a mixture of two liquids A and B in proportion 7 : 5 when 9 litres of mixture are drawn off and the can is filled with B, the proportion of A and B becomes 7 : 9. How many litres of liquid A was contained by the can initially ?
    (A) 25 (B) 10
    (C) 20 (D) 21

11. A sum of Rs. 41 was divided among 50 boys and girls. Each boy gets 90 paise and a girl 65 paise. The number of boys is—
    (A) 16 (B) 34
    (C) 14 (D) 36

12. A dishonest milkman professes to sell his milk at C. P. But he mixes it with water and thereby gains 25%. The percentage of water in the mixture is—
    (A) 25%
    (B) 20%
    (C) 4%
    (D) None of these

13. 729 ml. of a mixture contains milk and water in the ratio 7 : 2. How much more water is to be added to get a new mixture containing milk and water in ratio 7 : 3 ?
    (A) 600 ml
    (B) 710 ml
    (C) 520 ml
    (D) None of these

14. Some amount out of Rs. 7000 was lent at 6% p.a. and the remaining at 4% p. a. If the total simple interest from both the fractions in 5 years was Rs. 1600, the sum lent at 6% p. a. was—
    (A) Rs. 2000
    (B) Rs. 5000
    (C) Rs. 3500
    (D) None of these

15. The ratio of milk and water in 66 kg of adulterated milk is 5 : 1. Water is added to it to make the ratio 5 : 3. The quantity of water added is—
    (A) 22 kg
    (B) 24·750 kg
    (C) 16·500 kg
    (D) 20 kg

16. Two vessels A and B contains milk and water mixed in the ratio 5 : 3 and 2 : 3. When these mixtures are mixed to form a new mixture containing half milk and half water, they must be taken in the ratio—
    (A) 2 : 5 (B) 3 : 5
    (C) 4 : 5 (D) 7 : 3

17. In what ratio must a grocer mix sugar at 72 paise per kg with sugar at 48 paise per kg. So that by selling the mixture at 63 paise per kg he may gain $\frac{1}{6}$ of his outlay ?
    (A) 1 : 3 (B) 3 : 1
    (C) 2 : 3 (D) 3 : 2

18. Sugar at Rs. 15 per kg is mixed with sugar at Rs. 20 per kg in the ratio 2 : 3. Find the price per kg of the mixture—
    (A) Rs. 18 (B) Rs. 16
    (C) Rs. 17 (D) Rs. 19

19. In what proportion should water and wine at Rs. 22·50 a litre be mixed to reduce the price to Rs. 18 a litre ?
    (A) 1 : 4 (B) 4 : 1
    (C) 2 : 3 (D) 3 : 2

20. Currants at Rs. 50 per kg are mixed with currants at Rs. 90 per kg to make a mixture of 17 kg worth Rs. 70 per kg. How many kilograms of each are taken ?
    (A) 8 kg, 9 kg
    (B) $8\frac{1}{2}$ kg of each
    (C) 7 kg, 10 kg
    (D) None of these

21. A person bought 60 quintals of rice of two different sorts for Rs. 4642·50. The better sort costs Rs. 80 per quintal and the worse

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Rs. 75·50 per quintal. How many quintals were there of each sort ?
(A) 25 quintals, 35 quintals
(B) 20 quintals, 40 quintals
(C) 32 quintals, 28 quintals
(D) None of these

22. A man has whisky worth Rs. 22 a litre and another lot worth Rs. 18 a litre. Equal quantities of these are mixed with water to obtain a mixture of 50 litres worth Rs. 16 a litre. Find how much water the mixture contains ?
(A) 5 litre (B) 10 litre
(C) 15 litre (D) 20 litre

23. A petrol pump owner mixed leaded and unleaded petrol in such a way that the mixture contains 10% unleaded petrol. What quantity of leaded petrol should be added to 1 litre mixtures, so that the percentage of unleaded petrol becomes 5% ?
(A) 1000 ml (B) 900 ml
(C) 1900 ml (D) 1800 ml

24. In a mixture of wheat and barley the wheat is 60%. To 400 quintals of the mixture a quantity of barley is added and then the wheat is $53\frac{1}{3}$ % of resulting mixture. How many quintals of barley are added ?
(A) $\frac{400}{7}$ quintals
(B) 50 quintals
(C) $46\frac{2}{3}$ quintals
(D) $53\frac{2}{3}$ quintals

25. 15 litres of a mixture contains 20% alcohol and the rest water. If 3 litres of water be mixed in it, the percentage of alcohol in the new mixture will be—
(A) 17 (B) $16\frac{2}{3}$
(C) $18\frac{1}{2}$ (D) 15

26. 729 ml of a mixture contains milk and water in the ratio 7 : 2. How much more water is to be added to get a new mixture containing milk and water in ratio 7 : 3 ?
(A) 600 ml
(B) 710 ml
(C) 520 ml
(D) None of these

27. In a mixture of 60 litres, the ratio of milk and water is 2 : 1. If the ratio of the milk and water is to be 1 : 2, then the amount of water to be further added is—
(A) 20 litres (B) 30 litres
(C) 40 litres (D) 60 litres

28. A man buys milk at Rs. 5 a litre and mixes it with water. By selling the mixture at Rs. 4 a litre he gains $12\frac{1}{2}$ per cent on his outlay. How much water did each litre of the mixture contain ?
(A) $\frac{32}{45}$ litre
(B) $\frac{13}{45}$ litre
(C) $\frac{32}{13}$ litre
(D) None of these

29. A milk seller pays Rs. 500 per kilolitre for his milk. He adds water to it and sells the mixture at 56 P a litre, thereby making altogether 40% profit. Find the proportion of water to milk which his customers receive ?
(A) 1 : 4 (B) 2 : 3
(C) 1 : 5 (D) 4 : 1

30. Four vessels of equal sizes contains mixture of spirit and water. The concentration of spirit in 4 vessels are 60%, 70%, 75% and 80% respectively. If all the four mixtures are mixed, find in the resultant mixture the ratio of spirit to water—
(A) 57 : 13
(B) 23 : 57
(C) 57 : 23
(D) None of these

31. Two casks of 48 and 42 litres are filled with mixture of wine and water, the proportions in the two casks being respectively 13 : 7 and 18 : 17. If the contents of the two casks be mixed and 20 litres of water added to the whole what will be the proportion of wine to water in the result ?
(A) 13 : 12 (B) 12 : 13
(C) 21 : 31 (D) 31 : 21

32. Three glasses of capacity 2 litres, 5 litres and 9 litres contain mixture of milk and water with milk concentrations 90%, 80% and 70% respectively. The contents of three glasses are emptied into a large vessel. Find the milk concentration and ratio of milk to water in the resultant mixture—
(A) 121 : 39 (B) 131 : 49
(C) 39 : 121 (D) 49 : 131

33. How much water should be added to 60 litres of milk at $1\frac{1}{2}$ litres for Rs. 10, so as to have a mixture worth Rs. $5\frac{1}{3}$ per litre ?
(A) 16 litres (B) 15 litres
(C) 18 litres (D) 20 litres

34. How much chicory at Rs. 24 a kg should be added to 15 kg of tea at Rs. 60 a kg as to make the mixture worth Rs. 39 a kg ?
(A) 21 kg (B) 20 kg
(C) 27 kg (D) 18 kg

35. How many bananas at 5 for Re. 1·20 should be mixed with 300 bananas at 6 for Rs. 2·10, so that they should all be worth Rs. 3·60 a dozen ?
(A) 350 (B) 280
(C) 320 (D) 250

36. A solution of sugar syrup has 15% sugar. Another solution has 5% sugar. How many litre of the second solution must be added to 20 litres of the first solution to make a solution of 10% sugar ?
(A) 10 (B) 5
(C) 15 (D) 20

37. From a cask of wine, containing 64 litres, 8 litres are drawn out and the cask is filled up with water. If the same process is repeated a second, then a third time, what will be the number of litres of wine left in the cask ?
(A) $42\frac{1}{8}$ kg (B) $42\frac{3}{8}$ kg
(C) $48\frac{7}{8}$ kg (D) $42\frac{7}{8}$ kg

38. From a vessel filled with alcohol. $\frac{1}{5}$ of its contents is removed and the vessel is then filled up with

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water. If this be done 5 times in succession, what proportion of the alcohol originally contained in the vessel will have been removed from it ?

(A) $\frac{1024}{3125}$

(B) $\frac{2101}{3125}$

(C) $\frac{1024}{2101}$

(D) None of these

39. From a cask of wine containing 25 litres, 5 litres are withdrawn and the cask is filled with water. The process is repeated a second and then a third time. Find the ratio of wine to water in the resulting mixture—

(A) 64 : 61 (B) 61 : 64

(C) 51 : 54 (D) 46 : 61

40. A vessel contains 125 litres of wine, 25 litres of wine was taken out of the vessel and replaced by water. Then 25 litres of mixture was withdrawn and again replaced by water. The operation was repeated for third time. How much wine is now left in the vessel ?

(A) 54 litres

(B) 25 litres

(C) 64 litres

(D) None of these

41. There are two vessels of equal capacity, one full of milk and the second one-third full of water. The second vessel is then filled up out of the first, the contents of the second are then poured back into the first till it is full and then again the contents of the first are poured back into the second, till it is full. What is the proportion of milk in the second vessel ?

(A) $\frac{20}{37}$ (B) $\frac{20}{27}$

(C) $\frac{37}{20}$ (D) $\frac{27}{20}$

42. Three lumps of gold, weighing respectively 6, 5, 4 g and of 15, 14, $12\frac{1}{2}$ carats fineness are mixed together, what is the fineness of the resulting compound ?

(A) 14 carats (B) 16 carats

(C) 12 carats (D) 18 carats

43. In what ratio must a person mix three kinds of wheat costing him Rs. 1·20, Rs. 1·44 and Rs. 1·74 per kg, so that the mixture may be worth Rs. 1·41 per kg ?

(A) 11 : 77 : 7

(B) 7 : 11 : 77

(C) 11 : 7 : 77

(D) None of these

44. Fresh fruit contains 72% water and dry fruits contains 20% water. How much dry fruit from 100 kg of fresh fruit can be obtained ?

(A) 32 kg (B) 33 kg

(C) 30 kg (D) 35 kg

45. In two alloys Copper and Zinc are related in the ratios of 4 : 1 and 1 : 3. 10 kg of Ist alloy 16 kg of 2nd alloy and some of pure copper are melted together. An alloy was obtained in which the ratio of copper to zinc was 3 : 2. Find the weight of the new alloy—

(A) 34 kg (B) 35 kg

(C) 36 kg (D) 30 kg

Answers with Hints

1. (C) Using the method of alligation

Required ratio = 7 : 14

= 1 : 2

$\therefore$ Required quantity = $\frac{2}{3}$

2. (B) Total C. P. of 200 kg of mixture

= Rs. (80 × 6·75 + 120 × 8)

= Rs. 1500

Average rate = Rs. 7·50 per kg

Required rate = 120% of Rs. 7·50

= Rs. 9 per kg.

3. (A) **In first mixture**

Water = $\left(\frac{10}{100} \times 20\right)$ kg

and Spirit = 18 kg

In second mixture

75 kg spirit is contained in a mixture of 100 kg

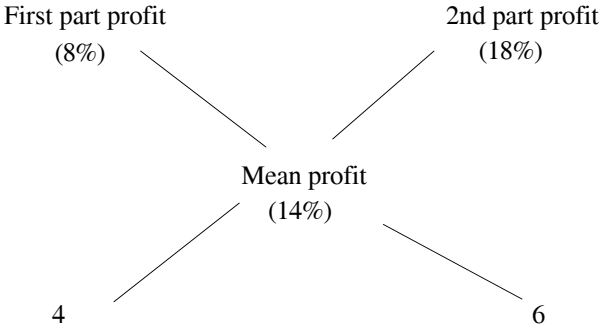
$\therefore$ 18 kg spirit is contained in a mixture of

$\left(\frac{100}{75} \times 18\right)$ = 24 kg

So, water to be added

= (24 – 20) kg = 4 kg.

4. (B)



Ratio of 1st and 2nd part

= 4 : 6 = 2 : 3

Quantity sold at 18% = $\left(50 \times \frac{3}{5}\right)$ kg

= 30 kg

5. (C) Total interest = Rs. 75

Average rate = $\left(\frac{100 \times 75}{1000 \times 1}\right)$ %

= $7\frac{1}{2}$ %

$\therefore$ (Sum at 6%) : (Sum at 8%)

= $\frac{1}{2} : \frac{3}{2} = 1 : 3$

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Hence, sum at 8% = Rs. $\left(1000 \times \frac{3}{4}\right)$

= Rs. 750.

6. (D) S. P. of 1 kg mixture = Rs. 1·75, Gain = 25%

$\therefore$ Mean price = Rs. $\left(\frac{1{\cdot}75 \times 100}{125}\right)$

= Rs. 1·40

$\therefore$ (Dearer rice) : (Cheaper rice)

= 20 : 40

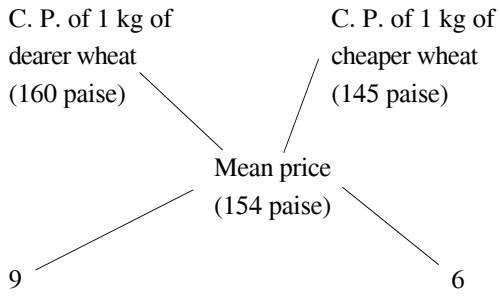
= 1 : 2.

7. (B) Initially, the mixture contains 3 litre of alcohol and 12 litre of water afterwards, the mixture contains 3 litre of alcohol and 15 litre of water.

$\therefore$ Percentage of alcohol = $\left(\frac{3}{18} \times 100\right)\%$

= $16\frac{2}{3}\%$

8. (B)



$\therefore$ (Dearer wheat) : (Cheaper wheat)

= 9 : 6

= 3 : 2

9. (D) Ratio of milk and water in mixture of 60 litre

= 2 : 1

$\therefore$ Quantity of milk = 40 litre

Quantity of water = 20 litre

If ratio of milk and water is to be 1 : 2, then in 40 litres of milk, water should be 80 litre

$\therefore$ Quantity of water to be added

= 60 litre.

10. (D) Let the can initially contain $7x$ litres and $5x$ litre of mixtures A and B respectively. Thus out of $12x$ litre of total mixture, 9 litre were taken out.

Quantity of A in mix. left

= $\left(7x - \frac{9}{12x} \times 7x\right)\left(\frac{28x - 21}{4}\right)$ litre

Quantity of B in mix. left

= $\left(5x - \frac{9}{12x} \times 5x\right)$

= $\left(\frac{20x - 15}{4}\right)$ litres

$\therefore \left(\frac{28x - 21}{4} : \frac{20x - 15}{4} + 9\right) :: (7 : 9)$

or $x = 3$.

11. (B) Average money received by each

= Rs. (41/50)

= 82 paise

Ratio of boys and girls

= 17 : 8

$\therefore$ Number of boys

= $\left(50 \times \frac{17}{25}\right)$

= 34.

12. (B) Let C. P. of 1 litre of milk be Re. 1

Then S. P. of 1 litre of mixture = Rs. 1

Gain = 25%

$\therefore$ C. P. of 1 litre of mixture = Rs. $\left(\frac{100}{125} \times 1\right)$

= Rs. $\frac{4}{5}$

$\therefore$ Ratio of milk and water = $\frac{4}{5} : \frac{1}{5}$

= 4 : 1

Hence, percentage of water in the mixture

= $\left(\frac{100 \times 1}{5}\right)\%$

= 20%.

13. (D) Milk = $\left(729 \times \frac{7}{9}\right)$ = 567 ml

Water = (729 – 567) = 162 ml

Now, $\frac{567}{162 + x} = \frac{7}{3}$

$\Rightarrow$ $x = 81$.

14. (A) Average annual rate = $\left(\frac{1600}{7000} \times \frac{1000}{5}\right)\%$

= $\left(\frac{32}{7}\right)\%$

$\therefore$ (Amount at 6%) : (Amount at 4%)

= $\frac{4}{7} : \frac{10}{7}$ = 2 : 5

Hence, Sum lent at 6% = Rs. $\left(700 \times \frac{2}{7}\right)$

= Rs. 2000.

15. (A) **In first mixture**

Milk = $\left(\frac{66 \times 5}{6}\right)$ = 55 kg

and water = 11 kg

In second mixture

If milk is 55 kg then water = $\left(\frac{3}{5} \times 55\right)$

= 33 kg

$\therefore$ Water to be added = 22 kg.

16. (C) Milk in A = $\frac{5}{8}$ of whole, Milk in B = $\frac{2}{5}$ of whole,

Milk in mixture of A and B = $\frac{1}{2}$

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∵ By alligation rule

$$\text{(Mix. in A) : (Mix. in B)} = \frac{1}{10} : \frac{1}{8}$$
$$= 4 : 5$$

17. (A) $\left(1 + \frac{1}{6}\right) = 1\frac{1}{6}$ of the cost price of a kg of the mixture $= 63$ p

∴ Cost price of a kg of the mixture

$$= \frac{63}{1\frac{1}{6}} = 54 \text{ p}$$

Now, applying the given formula, we have the required answer $= \frac{54 - 48}{72 - 54} = 1 : 3.$

18. (A) $\frac{20 - 2}{Z - 15} = \frac{2}{3}$

∴ $Z =$ Rs. 18 per kg.

19. (A) Required proportion $= \frac{20{\cdot}50 - 18}{18 - 0}$

[Water worths Rs. 0 a litre]

$$= \frac{4{\cdot}50}{18} = 1 : 4.$$

20. (B) Required ratio $= \frac{90 - 70}{70 - 50}$

$$= 1 : 1$$

Hence, $\frac{17}{1 + 1} = 8\frac{1}{2}$ kg of each are taken.

21. (A) Per quintal cost of two different sorts of rice

$$= \frac{4642{\cdot}50}{60}$$
$$= \text{Rs. } 77{\cdot}375 \text{ per quintal}$$

$$\text{Proportion} = \frac{70{\cdot}50 - 77{\cdot}375}{77{\cdot}375 - 80}$$
$$= \frac{1{\cdot}875}{2{\cdot}625}$$
$$= 5 : 7$$

The quantity of better sort

$$= \frac{60}{12} \times 5$$
$$= 25 \text{ quintals}$$

and the quantity of worse sort

$$= \frac{60}{12} \times 7$$
$$= 35 \text{ quintals.}$$

22. (B) Two lots of whisky having equal quantities are mixed

Let the price of mixture of whisky be Rs. x per litre

∴ $\frac{18 - x}{x - 22} = 1$

∴ $x =$ Rs. 20 a litre

Now this mixture is mixed with water and worth Rs. 16 a litre

Hence, the proportion of water to mixture

$$= \frac{20 - 16}{16 - 0}$$
$$= 1 : 4.$$

Quantity of water $= \frac{50}{1 + 4} \times 1$

$$= 10 \text{ litre.}$$

23. (A) Here we have to find the quantity of leaded petrol.

Hence, we have to make certain changes in the given data. % of leaded petrol in the mixture

$$= 100 - 10 = 90\%$$

After addition of leaded petrol (that has to be calculated) percentage of leaded petrol becomes

$$(100 - 5) = 95\%$$

Now, applying the given theorem, we have the required answer $= \left(\frac{95 - 90}{100 - 95}\right) 1000$ ml

$$= 1000 \text{ ml.}$$

24. (B) Here barley is added

Hence $y = 100 - 53\frac{1}{3} = 46\frac{2}{3}$, $x = 100 - 60 = 40\%$

Now, applying the given rule, we have the required answer

$$= \left[\frac{46\frac{2}{3} - 40}{100 - 46\frac{2}{3}}\right] \times 400$$
$$= 50 \text{ quintals.}$$

25. (B) In the mixture, water is added

Hence, % of water in the mixture

$$= 100 - 20$$
$$= 80\%$$

Now applying the given rule, we have the percentage of water in the new mixture

$$= 15\left(\frac{y - 80}{100 - y}\right)$$
$$= 3$$

∴ $y = \frac{500}{6}\%$

∴ Required answer *i.e.* % of alcohol in the new mixture

$$100 - \frac{500}{6} = \frac{100}{6}$$
$$= \frac{50}{3} = 16\frac{2}{3}\%.$$

26. (D) Percentage of water in first mixture

$$= \frac{2}{2 + 7} \times 100$$
$$= \frac{200}{9}\%$$

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Percentage of water in the second mixture

$$= \frac{3}{7+3} \times 100$$

$$= 30\%$$

Now, applying the given rule,

$$\text{Required answer} = \left[\frac{30 - \frac{200}{9}}{100 - 30}\right] \times 729$$

$$= 81 \text{ ml.}$$

27. (D) $60\left[\dfrac{\frac{200}{3} - \frac{100}{3}}{100 - \frac{200}{3}}\right] = 60$ litres.

28. (B) $\text{Required ratio} = \dfrac{4}{(5-4) + \left(\frac{25}{200}\right)^5}$

$$= \frac{32}{13} = 32 : 13$$

The quantity of water that the each litre of the mixture contains $= \dfrac{13}{32+13} \times 1 = \dfrac{13}{45}$ litre.

29. (A) Here $x = \dfrac{500}{1000} = 50$ P, $y = 56$ P, P = 40%

$$\text{Ratio of milk to water} = \frac{56}{(50-56) + \frac{40}{100} \times 50}$$

$$= \frac{4}{1} = 4 : 1$$

$\therefore$ Required answer (*i.e.* ratio of water to milk)

$$= 1 : 4.$$

30. (C) Ratio of spirit to water in the different vessels

$$\Rightarrow \quad \frac{60}{40} = 3 : 2, \qquad \frac{75}{25} = 3 : 1,$$

$$\frac{70}{30} = 7 : 3, \qquad \frac{80}{20} = 4 : 1$$

Now, applying the given rule, we have the required ratio

$$= \left[\frac{3}{5} + \frac{7}{10} + \frac{3}{4} + \frac{4}{5}\right] : \left[\frac{2}{5} + \frac{3}{10} + \frac{1}{4} + \frac{1}{5}\right]$$

$$= \frac{12 + 14 + 15 + 16}{20} : \frac{6 + 6 + 5 + 4}{20}$$

$$= 57 : 23.$$

31. (B) Ratio of wine to water, when 20 litre of water are not added

$$= \left[\frac{13 \times 48}{20} + \frac{18 \times 42}{35}\right] : \left[\frac{7 \times 48}{20} + \frac{17 \times 42}{35}\right]$$

$$= 264 : 186 = 44 : 31$$

Now, 20 litres of water are added

$$\text{Quantity of wine} = \frac{48 + 42}{44 + 31} \times 44$$

$$= \frac{264}{5} \text{ litres}$$

and $\text{Quantity of water} = 20 + \left(\dfrac{48 + 42}{44 + 31} \times 31\right)$

$$= \frac{186}{5} + 20$$

$$= \frac{286}{5}$$

$\therefore \quad \text{Required ratio} = \dfrac{264}{5} : \dfrac{286}{5}$

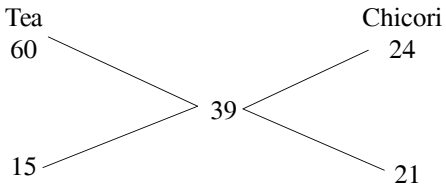
$$= 12 : 13$$

32. (A) Ratio are $\dfrac{90}{10} = 9 : 1, \dfrac{80}{20} = 4 : 1, \dfrac{70}{30} = 7 : 3$

33. (B) Here $x = \dfrac{10 \times 2}{3} = \text{Rs. } \dfrac{20}{3}$ a litre

Now, applying the given rule, we have the required answer $= \left(\dfrac{\frac{20}{3} - \frac{16}{3}}{\frac{16}{3}}\right) \times 60 = 15$ litres

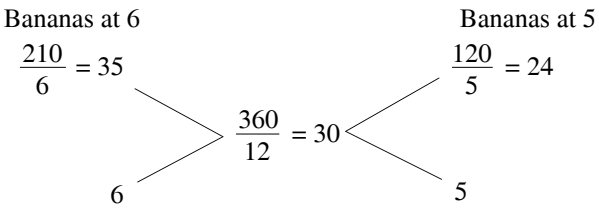
34. (A) By alligation method :



$\therefore$ Ratio of tea and chicori $= 5 : 7$

$\therefore$ Added chicori $= \dfrac{15}{5} \times 7 = 21$ kg

35. (D)



$\therefore \quad \text{Required answer} = \dfrac{300}{6} \times 5 = 250$

36. (D) $\dfrac{15 \times 20 + 5 \times m}{20 + m} = 10$

$\therefore \quad m = 20$ litres

37. (D) $\text{Required answer} = \left(1 - \dfrac{8}{64}\right)^3 \times 64$

$$= \left(\frac{7}{8}\right)^3 \times 64 = 42\frac{7}{8} \text{ kg}$$

38. (B) The alcohol now contained in the vessel

$$= \left(1 - \frac{1}{5}\right)^5 = \left(\frac{4}{5}\right)^5 = \frac{1024}{3125}$$

$\therefore$ Required answer $= 1 - \dfrac{1024}{3124} = \dfrac{2101}{3125}$

39. (A) Quantity of a wine left in the cask

$$= \left(1 - \frac{1}{5}\right)^3 = \left(\frac{4}{5}\right)^3 = \frac{64}{125}$$

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Quantity of water left in the cask

$$= 1 - \frac{64}{125} = \frac{61}{125}$$

$$\therefore \text{ Required ratio } = \frac{\frac{64}{125}}{\frac{61}{125}} = \frac{64}{61} = 64 : 61$$

40. (C) Amount of wine left $= 125\left(1 - \frac{25}{125}\right)^3$

$$= 125 \times \frac{64}{125}$$

$$= 64 \text{ litres.}$$

41. (B) Let M be the vessel containing milk and W the vessel containing water.

	First vessel	**Second vessel**
1st operation	1 M	$\frac{1}{3}$ W
2nd operation	$\frac{1}{3}$ M	$\frac{1}{3}$ W + $\frac{2}{3}$ M
3rd operation	$\frac{1}{3}$ M + $\frac{2}{3}\left(\frac{1}{3}\text{W} + \frac{2}{3}\text{M}\right)$	$\frac{1}{3}\left(\frac{1}{3}\text{W} + \frac{2}{3}\text{M}\right)$
4th operation	$\frac{1}{3}\left[\frac{1}{3}\text{M} + \frac{2}{3}\left(\frac{1}{3}\text{W} + \frac{2}{3}\text{M}\right)\right]$	$\left[\frac{1}{3}\left(\frac{1}{3}\text{W} + \frac{2}{3}\text{M}\right) + \frac{2}{3}\left\{\frac{1}{3}\text{M} + \frac{2}{3}\left(\frac{1}{3}\text{W} + \frac{2}{3}\text{M}\right)\right\}\right]$

Simplifying the quantity on the right hand side, we get the proportions of water and milk in the second vessel.

$$\left[\frac{1}{9}\text{W} + \frac{2}{9}\text{M} + \frac{2}{3}\left\{\frac{1}{3}\text{M} + \frac{2}{9}\text{W} + \frac{4}{9}\text{M}\right\}\right]$$

$$= \frac{1}{9}\text{W} + \frac{2}{9}\text{M} + \frac{2}{9}\text{M} + \frac{4}{27}\text{W} + \frac{8}{27}\text{M}$$

$$\therefore \text{ Proportion of milk} = \frac{2}{9}\text{M} + \frac{2}{9}\text{M} + \frac{8}{27}\text{M} = \frac{20}{27}\text{M}$$

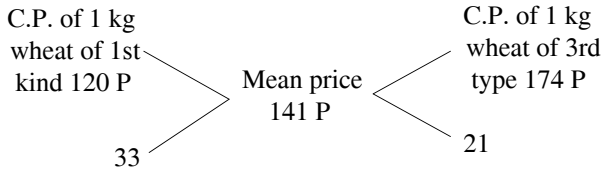
$\therefore \frac{20}{27}$ of the second vessel is milk.

42. (A) Fineness of the compound

$$= \frac{6 \times 15 + 5 \times 14 + 4 \times 12\frac{1}{2}}{6 + 5 \times 4} \text{ carats}$$

$$= \frac{210}{15} \text{ or } 14 \text{ carats}$$

43. (A) **Step I**—Mix wheats of first and third kind to get a mixture worth Rs. 1·41 per kg.

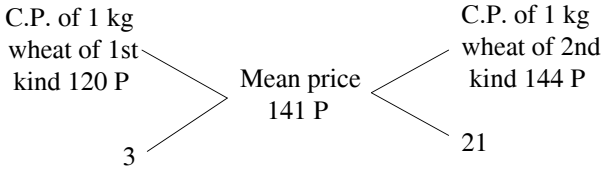


By alligation rule—

$$\frac{\text{quantity of 1st kind of wheat}}{\text{quantity of 3rd kind of wheat}} = \frac{33}{21} = \frac{11}{7}$$

i.e., they must be mixed in the ratio 11 : 7.

Step II—Mix wheat of 1st and 2nd kind to obtain a mixture worth of Rs 1·41 per kg.



$\therefore$ By alligation rule—

$$\frac{\text{quantity of 1st kind of wheat}}{\text{quantity of 2nd kind of wheat}} = \frac{3}{21} = \frac{1}{7}$$

i.e., they must be mixed in the ratio 1 : 7.

Thus, $\frac{\text{(quantity of 2nd kind of wheat)}}{\text{(quantity of 3rd kind of wheat)}}$

$$= \frac{\text{quantity of 2nd kind of wheat}}{\text{quantity of 1st kind of wheat}} \times \frac{\text{quantity of 1st kind of wheat}}{\text{quantity of 3rd kind of wheat}}$$

$$= \left(\frac{7}{1} \times \frac{11}{7}\right) = \left(\frac{11}{1}\right)$$

$\therefore$ Quantities of wheat of (1st kind : 2nd kind : 3rd kind)

$$= 1 : 7 : \frac{7}{11} = 11 : 77 : 7$$

44. (D) We are concerned with solid part of the fruit (pure portion). Assume x kg of dry fruit is obtained.

$\therefore$ Solid part in fresh fruit = Solid part in dry fruit

or $0{\cdot}28 \times 100 = 0{\cdot}8 \times x$

or $x = 35$ kg

$\therefore$ 35 kg of dry fruit can be obtained from 100 kg fresh fruit.

45. (B) Here two alloys are mixed to form a third alloy, hence quantity of only one of the ingredients in each of the alloy will be considered.

Here, pure copper is also added, hence, quantity of copper in all the three alloy will be considered.

Let the amount of pure copper = x kg.

$\therefore$ Pure copper + copper in 1st alloy + copper in 2nd alloy = copper in 3rd alloy.

or $x + \frac{4}{5} \times 10 + \frac{1}{4} \times 16 = \frac{3}{5}(10 + 16 + x)$

or $12 + x = \frac{3}{5}(26 + x)$

or $x = 9$ kg

$\therefore$ Weight of new alloy $= 10 + 16 + 9 = 35$ kg

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Stock and Shares

Stock in order to meet the expenses of a certain plan, the Government of India sometimes raises a loan from the public at a certain fixed rate of interest. Bonds or Promisory notes each of fixed value are issued for sale to the public.

If a man purchases a bond of Rs. 100 at which 5% interest has been fixed by the Government, then the holder of such a bond is said to have a Rs. 100 stock at 5%. Here Rs. 100 is called the face value of the stock. Usually a period is fixed for the repayment of the loan *i.e.*, the stock matures at a fixed date only. Now if a person holding a stock is in need of the money before the date of maturity of stock. He can sell the bond or bonds to some other person whereby the claim of interest is transferred to that person. Stocks are sold and bought in the open market through brokers at stocks exchanges. The broker's charge is usually called 'brokerage'.

Remarks—1. When stock is purchased, brokerage is added to cost price.

2. When stock is sold, brokerage is subtracted from selling price.

The selling price of a Rs. 100 stock is said to be at par above par (or at a premium) and below par (or at a discount) according as the selling price of this stock is Rs. 100 exactly, more than Rs. 100 and less than Rs. 100 respectively.

Remark—'By a Rs. 700, 6% stock at 97; we mean a stock whose face value is Rs. 700, the market price of a Rs. 100 stock is Rs. 97 and the annual interest on this stock is 5% of the face value.

Shares—To start a big concern or a business a large amount of money is needed. This is usually beyond the capacity of one or two individuals. However, some persons together associate to form a company. The company issues a prospectus and invites the public to subscribe. The required capital divided into equal small parts called shares, each of a particular fixed value. The persons who subscribe in share are called shareholders. Sometimes the company asks its shareholders to pay some money immediately and balance after some period. The total money raised immediately is called the paid up capital. Parts of the profits divided amongst the shareholders are called dividends. The original value of a share is called its nominal value. The price of a share in the market is called the market value.

Different kinds of shares—There are two kinds of shares—

(i) **Preference shares**—On these shares a fixed rate to dividend is paid to their holders. Subject to profits of the company.

(ii) **Ordinary or Equity Shares**—After paying the dividends of the preference shareholders, the equity shareholders are paid the dividends which depends upon the profit of the company

Examples

Q. 1. What is the annual income derived from Rs. 1800, 5% stock at 104 ?

Solution : Income from Rs. 100 stock = Rs. 5.

Income from Rs. 1800 stock

$$= \text{Rs.}\left(\frac{5}{100}\times 1800\right)$$

$$= \text{Rs. } 90.$$

Q. 2. How much $4\frac{1}{2}$% stock at 95 can be purchased by investing Rs. 1905, $\left(\text{brokerage } \frac{1}{4}\%\right)$?

Solution : By investing Rs. $\left(95+\frac{1}{4}\right)$ stock purchased = Rs. 100

By investing Rs. 1905, stock purchased

$$= \text{Rs.}\left(\frac{100\times 4\times 1905}{381}\right)$$

$$= \text{Rs. } 2000$$

Q. 3. Find the cash realized by selling Rs. 2400, $5\frac{1}{2}$% stock at 5 premium $\left(\text{brokerage } \frac{1}{4}\%\right)$.

Solution : By selling Rs. 100 stock, cash realized

$$= \text{Rs.}\left(105-\frac{1}{4}\right) = \text{Rs.}\left(\frac{419}{4}\right)$$

By selling Rs. 2400 stock, cash realized

$$= \text{Rs.}\left(\frac{419\times 2400}{4\times 100}\right)$$

= Rs. 2514.

Q. 4. Find the cash required to purchase Rs. 1600, $8\frac{1}{2}$% stock at 105 $\left(\text{brokerage } \frac{1}{2}\%\right)$.

Solution : Cash required for purchasing Rs. 100 stock

$$= \text{Rs.}\left(105+\frac{1}{2}\right)$$

$$= \text{Rs.}\left(\frac{211}{2}\right)$$

Cash required for purchasing Rs. 1600 stock

$$= \text{Rs.}\left(\frac{211\times 1600}{2\times 100}\right)$$

= Rs. 1688.

Q. 5. Find the cost of—

(i) Rs. 9100, $8\frac{3}{4}$% stock at 92.

(ii) Rs. 8500, $9\frac{1}{2}$% stock at 6 premium.

(iii) Rs. 7200, 10% stock at 7 discount.

(iv) Rs. 6400, 8% stock at par $\left(\text{brokerage } \frac{1}{8}\%\right)$.

Solution :

(i) Cost of Rs. 100 stock

= Rs. 92.

Cost of Rs. 9100 stock

$$= \text{Rs.}\left(\frac{92}{100}\times 9100\right)$$

= Rs. 8372

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(ii) Cost of Rs. 100 stock

= Rs. (100 + 6)

= Rs. 106.

Cost of Rs. 8500 stock

= Rs. $\left(\frac{106}{100} \times 8500\right)$

= Rs. 9010.

(iii) Cost of Rs. 100 stock

= Rs. (100 – 7) = Rs. 93

Cost of Rs. 7200 stock

= Rs. $\left(\frac{93}{100} \times 7200\right)$

= Rs. 6696.

(iv) C.P. of Rs. 100 stock

= Rs. $\left(100 + \frac{1}{8}\right)$

= Rs. $\frac{801}{8}$

C.P. of Rs. 6400 stock

= Rs. $\left(\frac{801 \times 6400}{8 \times 100}\right)$

= Rs. 6408.

Q. 6. Find the cost of 96 shares of Rs. 10 each at $\frac{3}{4}$ discount, brokerage being $\frac{1}{4}$ per share.

Solution : Cost of 1 share

= Rs. $\left[\left(10 - \frac{3}{4}\right) + \frac{1}{4}\right]$

= Rs. $\frac{19}{2}$

Cost of 96 shares

= Rs. $\left(\frac{19}{2} \times 96\right)$

= Rs. 912.

Q. 7. Find the income derived from 44 shares of Rs. 25 each at 5 premium $\left(\text{brokerage } \frac{1}{4} \text{ per share}\right)$, the rate of dividend being 5%. Also find the rate of interest on the investment.

Solution : Cost of 1 share

= Rs. $\left(25 + 5 + \frac{3}{4}\right)$

= Rs. $\frac{171}{4}$

Cost of 44 shares

= Rs. $\left(\frac{121}{4} \times 44\right)$

= Rs. 1331

∴ Investment made

= Rs. 1331

Now, face value of 1 share

= Rs. 25.

∴ Face value of 44 shares

= Rs. (44 × 25)

= Rs. 1100

Now, dividend on Rs. 100

= Rs. $\frac{11}{2}$

∴ Dividend on Rs. 1100

= Rs. $\left(\frac{11}{2 \times 100} \times 1100\right)$

= Rs. 60·50

Also income on investment of Rs. 1331 = Rs. 60·50

∴ Income on investment of Rs. 100 = Rs. $\left(\frac{60{\cdot}50}{1331} \times 100\right)$

= 4·55%

Exercise

1. A man invests in a $4\frac{1}{2}$% stock at 96. The interest obtained by him is—
   (A) 4% (B) 4·5%
   (C) 4·69% (D) $\frac{1}{2}$%

2. By investing Rs. 1100 in a $5\frac{1}{2}$% stock one earns Rs. 77. The stock is then quoted at—
   (A) Rs. 93 (B) Rs. 107
   (C) Rs. $78\frac{4}{7}$ (D) Rs. $97\frac{3}{4}$

3. To produce an annual income of Rs. 500 in a 4% stock at 90, the amount of stock needed is—
   (A) Rs. 11250
   (B) Rs. 12500
   (C) Rs. 18000
   (D) Rs. 20000

4. Rs. 2780 are invested party in 4% stock at 75 and 5% stock at 80 to have equal amount of incomes. The investment in 5% stock is—
   (A) Rs. 1500
   (B) Rs. 1280
   (C) Rs. 1434·84
   (D) Rs. 1640

5. A 4% stock yields 5%. The market value of the stock is—
   (A) Rs. 125 (B) Rs. 80
   (C) Rs. 99 (D) Rs. 109

6. By investing in a 6% stock at 96 an income of Rs. 100 is obtained by making an investment of—
   (A) Rs. 1600
   (B) Rs. 1504
   (C) Rs. 1666·66
   (D) Rs. 5760

7. The cash realized by selling a $5\frac{1}{2}$% stock at $106\frac{1}{4}$, brokerage being $\frac{1}{4}$% is—
   (A) Rs. $105\frac{1}{2}$
   (B) Rs. $106\frac{1}{2}$
   (C) Rs. 106
   (D) None of these

8. The income derived from a $5\frac{1}{2}$% stock at 95 is—
   (A) Rs. 5·50
   (B) Rs. 5
   (C) Rs. 5·28
   (D) None of these

9. The cost price of a Rs. 100 stock at 4 discount, when brokerage $\left(\frac{1}{4}\right)$% is—
   (A) Rs. 96
   (B) Rs. $\left(96 + \frac{1}{4}\right)$
   (C) Rs. $\left(96 - \frac{1}{4}\right)$
   (D) Rs. 100

10. A man invested Rs. 4455 in Rs. 10 shares quoted at Rs. 8·25. If the rate of dividend be 6% his annual income is—
    (A) Rs. 267·30
    (B) Rs. 327·80

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(C) Rs. 324
(D) Rs. 103·70

11. A man bought 20 shares of Rs. 50 at 5 discount the rate of dividend being $4\frac{3}{4}\%$. The rate of interest obtained is—
(A) $4\frac{3}{4}\%$ (B) $3\frac{1}{4}\%$
(C) 5·28% (D) 4·95%

12. A man buys Rs. 20 shares paying 9% dividend. The man wants to have an interest of 12% on his money. The market value of each share must be—
(A) Rs. 12 (B) Rs. 15
(C) Rs. 18 (D) Rs. 21

13. By investing in $3\frac{3}{4}\%$ stock at 96, one earn Rs. 100. The investment made is—
(A) Rs. 36000
(B) Rs. 3600
(C) Rs. 2560
(D) Rs. 4800

14. A man invested Rs. 388 in a stock at 97 to obtain an income of Rs. 22. The dividend from the stock is—
(A) 12% (B) 3%
(C) $5\frac{1}{2}\%$ (D) 22·68%

15. Which is better investment, 4% stock at par with an income tax at the rate of 5 paise per rupee or $4\frac{1}{2}\%$ stock at 110 free from income tax ?
(A) 4% at par with income tax
(B) $9\frac{1}{2}\%$ at 110
(C) 5%
(D) 25%

16. A man invest some money party in 3% stock at 96 and party in 4% stock at 120. To get equal dividends from both, he must invest the money in the ratio ?
(A) 16 : 15 (B) 3 : 4
(C) 4 : 5 (D) 3 : 5

17. Which is the better stock, 5% at 143 or $3\frac{1}{2}\%$ at 93 ?
(A) 5% at 143
(B) $3\frac{1}{2}\%$ at 93
(C) Both are equally good
(D) None of these

18. I want to purchase a 6% stock which must yield 5% on my capital. At what price must I buy the stock ?
(A) Rs. 111 (B) Rs. 101
(C) Rs. 83·33 (D) Rs. 120

19. A invested some money in 4% stock at 96. Now, B wants to invest in an equally goods 5% stock. B must purchase a stock, worth of—
(A) Rs. 120 (B) Rs. 124
(C) Rs. 76·80 (D) Rs. 80

20. How much stock at 105 can be purchased for Rs. 1433·25 ?
(A) Rs. 1365
(B) Rs. 1635
(C) Rs. 1355
(D) None of these

21. Find the cost of Rs. 12600 Railway stock at $150\frac{1}{2}$ $\left(\text{dividend } 5\frac{1}{2}\%\right)$—
(A) Rs. 18963
(B) Rs. 19863
(C) Rs. 18933
(D) None of these

22. How much stock can be purchased for Rs. 7350 at 105 ?
(A) Rs. 7500 (B) Rs. 7000
(C) Rs. 7200 (D) Rs. 6800

23. How much stock can be purchased for Rs. 794·50 at 112·5 ? (Brokerage 1%)
(A) Rs. 650 (B) Rs. 485
(C) Rs. 706 (D) Rs. 700

24. How much must 1 pay for Rs. 1365 stock at 104 ? (Brokerage 1%)
(A) Rs. 1433·50
(B) Rs. 1344·25
(C) Rs. 1433·25
(D) None of these

25. Find the cost of Rs. 15000, $5\frac{1}{2}\%$, stock at 99—(Brokerage 1%)
(A) Rs. 15000
(B) Rs. 12500
(C) Rs. 13000
(D) None of these

26. How much $4\frac{1}{2}\%$ stock at 95 can be purchased by investing Rs. 1905 ? $\left(\text{Brokerage } \frac{1}{4}\%\right)$
(A) Rs. 2000 (B) Rs. 2500
(C) Rs. 2200 (D) Rs. 2350

27. What income will be derived from Rs. 3275 of 11% stock ?
(A) Rs. 360·50
(B) Rs. 350·25
(C) Rs. 360·25
(D) None of these

28. What income will be derived by investing Rs. 3000 in $9\frac{1}{2}$ per cent stock at par ?
(A) Rs. 285
(B) Rs. 825
(C) Rs. 385
(D) None of these

29. What annual income will be derived by investing Rs. 1547 in 13 per cent Railway stock at 119 ?
(A) Rs. 189 (B) Rs. 179
(C) Rs. 169 (D) Rs. 159

30. Find what sum of money 1 must invest in a 10 per cent stock at 102 to obtain an income of Rs. 400 per year—
(A) Rs. 4800 (B) Rs. 8040
(C) Rs. 4080 (D) Rs. 8400

31. What income will be derived by investing Rs. 1900 in 8 per cent stock at 5 discount ?
(A) Rs. 160 (B) Rs. 150
(C) Rs. 100 (D) Rs. 180

32. What rate of interest is obtained from investing in $8\frac{1}{2}$ per cent

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stock when the quoted price is 6·5 per cent below par ?

(A) $8\frac{1}{11}\%$ (B) $9\frac{1}{11}\%$

(C) $11\frac{1}{9}\%$ (D) $10\frac{1}{9}\%$

33. What rate % is obtained by investing in 7% stock at 5 discount ? $\left(\text{Brokerage } \frac{1}{4}\%\right)$

(A) 7·35% (B) 7·55%
(C) 7·05% (D) 8%

34. What rate of interest is obtained from investing in $9\frac{1}{2}$ per cent at par ?

(A) $9\frac{1}{2}\%$

(B) $8\frac{1}{2}\%$

(C) $18\frac{2}{3}\%$

(D) None of these

35. What rate of interest is obtained from investing in $9\frac{1}{2}$ per cent stock. When the quoted price is 14 per cent above par ?

(A) $8\frac{1}{3}\%$

(B) $8\frac{2}{3}\%$

(C) $9\frac{1}{3}\%$

(D) Data inadequate

36. What rate of interest is obtained from investing in $12\frac{3}{4}$ per cent stock when the price is at a premium of 2 per cent ?

(A) 25% (B) $8\frac{1}{3}\%$

(C) $12\frac{1}{2}\%$ (D) $11\frac{2}{3}\%$

37. What is the annual income derived from Rs. 1800, 5% stock at 100 ?

(A) Rs. 90 (B) Rs. 100
(C) Rs. 110 (D) Rs. 95

38. What is the annual income by investing Rs. 3000 in 6% stock at 120 ?

(A) Rs. 150 (B) Rs. 100
(C) Rs. 200 (D) Rs. 250

39. Find the annual income derived by investing Rs. 770 in $4\frac{1}{2}\%$ stock at 96— $\left(\text{Brokerage } \frac{1}{4}\%\right)$

(A) Rs. 56 (B) Rs. 46
(C) Rs. 39 (D) Rs. 36

40. Find the cost of 96 shares of Rs. 10 each at $\frac{3}{4}$ discount brokerage being $\frac{1}{4}$ per share—

(A) Rs. 912
(B) Rs. 812
(C) Rs. 712
(D) None of these

41. Find the income derived from 44 shares of Rs. 25 each at 5 premium $\left(\text{brokerage } \frac{1}{4} \text{ per share}\right)$, the rate of dividend being 5%. Also find the rate of interest in the investment—

(A) Rs. 60·5, 4·55%
(B) Rs. 60, 5%
(C) Rs. 80·5, 5·55%
(D) None of these

42. Find the purchase cost of 66 shares of Rs. 35 each at 10 premium, brokerage being 1% per share—

(A) Rs. 3630 (B) Rs. 3360
(C) Rs. 3063 (D) Rs. 3036

43. Which is the better investment ?

(i) 9 per cent stock at 91 or

(ii) 12 per cent stock at 121 ?

(A) Ist investment is more profitable

(B) IInd investment is more profitable

(C) Both (A) and (B) are equal

(D) Can't say

44. Which is the better investment ?

(i) $10\frac{1}{2}\%$ stock at 90 or

(ii) 11% stock at par ?

(A) Ist investment is more profitable

(B) IInd investment is more profitable

(C) Both (A) and (B) are equal

(D) Can't say

45. Which is the better investment ?

(i) $8\frac{1}{4}\%$ stock at 80 or

(ii) 9% stock at 10 discount ?

(A) Ist investment is more profitable

(B) IInd investment is more profitable

(C) Both (A) and (B) are equal

(D) Can't say

46. Which is the better investment ?

(i) $14\frac{1}{4}\%$ stock at 5 below par or

(ii) $15\frac{3}{4}\%$ stock at 5 premium ?

(A) Ist investment is more profitable

(B) IInd investment is more profitable

(C) Both (A) and (B) are equal

(D) Can't say

47. How much money is obtained from the sale of Rs. 30000 stock at 93 ? $\left(\text{Brokerage } 1\frac{1}{2}\%\right)$

(A) Rs. 24750
(B) Rs. 37450
(C) Rs. 27450
(D) None of these

48. How much money is obtained from the sale of Rs. 1700 stock at $106\frac{1}{4}$?

(A) Rs. 1806·25
(B) Rs. 1608·25
(C) Rs. 1808·75
(D) None of these

49. How much stock must be sold to realize Rs. 7350 from a stock at 105 ?

(A) Rs. 7500 (B) Rs. 6920
(C) Rs. 7000 (D) Rs. 6400

50. How much stock must be sold to realize Rs. 8190 from a stock at 118 ? (Brokerage 1%)

(A) Rs. 7100 (B) Rs. 7050
(C) Rs. 6850 (D) Rs. 7000

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Answers with Hints

1. (C) On Rs. 96, he gets Rs. $\frac{9}{2}$.

On Rs. 100, he gets = Rs. $\left(\frac{9 \times 100}{2 \times 96}\right)$

= 4·69%.

2. (C) To earn Rs. 77, investment

= Rs. 1100

To earn Rs. $\frac{11}{2}$, investment

= Rs. $\left(\frac{1100}{77} \times \frac{11}{2}\right)$ = Rs. $78\frac{4}{7}$

3. (B) For an income of Rs. 4, stock needed

= Rs. 100

For an income of Rs. 500, stock needed

= Rs. $\left(\frac{100}{4} \times 500\right)$ = Rs. 12500

4. (B) Let the investment in 4% stock be Rs. x.

Then, investment in 5% stock

= Rs. $(2780 - x)$

Income from 4% stock

= Rs. $\left(\frac{4}{75} \times x\right)$

Income from 5% stock

= Rs. $\left[\left(\frac{5}{80} \times (2780 - x)\right)\right]$

$\therefore \quad \frac{4x}{75} = \frac{2780 - x}{16}$ or = 1500

So, investment in 5% stock

= Rs. (2780 – 1500) = Rs. 1280

5. (B) For an income of Rs. 5, investment = Rs. 100.

For an income of Rs. 4, investment

= Rs. $\left(\frac{100}{5} \times 4\right)$ = Rs. 80

6. (A) For an income of Rs. 6, investment = Rs. 96.

For an income of Rs. 100, investment

= Rs. $\left(\frac{96}{6} \times 100\right)$ = Rs. 1600

7. (C) Cash realized = Rs. $\left(106\frac{1}{4} - \frac{1}{4}\right)$ = Rs. 106

8. (A) Income on Rs. 100 stock = Rs. $5\frac{1}{2}$ = Rs. 5.50

9. (B) C.P. = Rs. $\left(96 + \frac{1}{4}\right)$.

10. (C) Number of shares = $\frac{4455}{8{\cdot}25} = 540$

Face value = Rs. (540×10) = Rs. 5400

Income = Rs. $\left(\frac{6}{100} \times 5400\right)$

= Rs. 324

11. (C) Face value = Rs. (50×20) = Rs. 1000

Dividend = Rs. $\left(\frac{1000 \times 19}{4 \times 100}\right)$ = Rs. $\frac{95}{2}$

Investment = Rs. (45×20) = Rs. 900

Rate = Rs. $\left(\frac{95 \times 100}{2 \times 900}\right)$ = 5·28%

12. (B) Dividend on Rs. 20 = Rs. $\left(\frac{9}{100} \times 20\right)$ = Rs. $\frac{9}{5}$

Rs. 12 is an income on Rs. 100.

$\therefore$ Rs. $\frac{9}{5}$ is an income on Rs. $\left(\frac{100}{12} \times \frac{9}{5}\right)$

= Rs. 15

13. (C) For earning Rs. $\frac{15}{4}$, investment

= Rs. 96

For earning Rs. 100, investment

= Rs. $\left(\frac{96 \times 4}{15} \times 100\right)$

= Rs. 2560

14. (C) When investment is Rs. 388, income

= Rs. 22

When investment is Rs. 97, income

= Rs. $\left(\frac{22}{388} \times 97\right)$

= Rs. 5·50

$\therefore$ Dividend on Rs. 100 stock = $5\frac{1}{2}$%

15. (B) Let investment in each case be Rs. (100×110)

Gross income from 4% stock

= Rs. $\left(\frac{4}{100} \times 100 \times 110\right)$ = Rs. 440

Net income from the stock

= Rs. (440 – 22) = Rs. 418

Net income from $4\frac{1}{2}$% stock

= Rs. $\left(\frac{9 \times 100 \times 110}{2 \times 110}\right)$ = Rs. 450

$\therefore$ Better stock is $4\frac{1}{2}$% at 110.

16. (A) For an income of Re. 1 in 3% stock, investment

= Rs. $\left(\frac{96}{3}\right)$ = Rs. 32

For an income of Re. 1 in 4% stock investment

= Rs. $\left(\frac{120}{4}\right)$ = Rs. 30

$\therefore$ Ratio of investments = 32 : 30 = 16 : 15

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17. (B) Let investment in each case be Rs. (143×93)
Income from 5% stock
$= \text{Rs.} \left(\frac{5}{143} \times 143 \times 93\right) = \text{Rs. } 465$
Income from $3\frac{1}{2}\%$ stock
$= \text{Rs.} \left(\frac{7}{2 \times 93} \times 143 \times 93\right)) = \text{Rs. } 500{\cdot}50$
$\therefore$ $3\frac{1}{2}\%$ stock at 93 is better.

18. (D) For an income of Rs. 5, investment = Rs. 100
For an income of Rs. 6, investment $= \text{Rs.} \left(\frac{100}{5} \times 6\right)$
$= \text{Rs. } 120$

19. (A) For an income of Rs. 4, investment = Rs. 96
For an income of Rs. 5, investment $= \text{Rs.} \left(\frac{96}{4} \times 5\right)$
$= \text{Rs. } 120$

20. (A) $1433\frac{1}{4} = \text{amount of stock} \times \frac{105}{100}$
Amount of stock $= \frac{100 \times 1433\frac{1}{4}}{105} = \text{Rs. } 1365$

21. (A) Required answer $= 12600 \times \frac{301}{200} = \text{Rs. } 18963$

22. (B)

23. (D) $\text{Rs. } 794{\cdot}50 = \frac{112{\cdot}5 + 1}{100} \times \text{Amount of stock}$
$\therefore$ Amount of stock $= \frac{794{\cdot}50 \times 100}{113{\cdot}5} = \text{Rs. } 700$

24. (C) Required answer $= \text{Rs.} \frac{1365 \times (104 + 1)}{100}$
$= \frac{1365 \times 105}{100} = \text{Rs. } 1433{\cdot}25$

25. (A)

26. (A) We put market value *i.e.* 95 in place of (100 − discount), in this case.
Required answer $= \frac{1905}{95 + \frac{1}{4}} \times 100 = \text{Rs. } 2000$

27. (C) Income $= 3275 \times \frac{11}{100} = \text{Rs. } 360{\cdot}25$

28. (A) Required answer $= 3000 \times \frac{19}{200} = \text{Rs. } 285$

29. (C) Required answer $= \frac{1547}{119} \times 13 = \text{Rs. } 169$

30. (C) $400 = \frac{x}{102} \times 10$
or $x = \frac{102 \times 400}{10} = 102 \times 40 = \text{Rs. } 4080$

31. (A) Required income $= \frac{1900}{100 - 5 + 0} \times 8 = \text{Rs. } 160$
[Here value of brokerage is 0]

32. (B) Required answer $= \frac{17}{2(100 - 6{\cdot}5)} \times 100$
$= \frac{17}{187} \times 100 = 9\frac{1}{11}\%$

33. (A) Required answer $= \frac{7}{100 - 5 + 0{\cdot}25} \times 100$
$= 7{\cdot}349 = 7{\cdot}35\%$ (Approx.)

34. (A) Actual rate per cent $= \frac{9\frac{1}{2}}{100 + 0 + 0} \times 100$
$= 9\frac{1}{2}\%$

35. (A) Actual rate per cent $= \frac{9\frac{1}{2}}{100 + 14 + 0} \times 100$
$= \frac{25}{3} = 8\frac{1}{3}\%$

36. (C) Required answer $= \frac{51}{4 \times (100 + 2) + 0} \times 100$
$= \frac{25}{2} = 12\frac{1}{2}\%$

37. (A) $100 = \frac{1800 \times 5}{x} - 0$
or $x = \frac{1800 \times 5}{100} = 90$
$\therefore$ Required answer = Rs. 90

38. (A) $120 = \frac{3000 \times 6}{x} - 0$
$\therefore$ $x = \frac{3000 \times 6}{120} = \text{Rs. } 150$

39. (D) $96 = \frac{770 \times \frac{9}{2}}{x} - \frac{1}{4}$ or $x = \frac{770 \times \frac{9}{2}}{96 + \frac{1}{4}} = \text{Rs. } 36$

40. (A) Required answer $= 96\left(10 - \frac{3}{4} + \frac{1}{4}\right) = \text{Rs. } 912$

41. (A) Cost of shares $= 44\left(25 + 5 + \frac{3}{4}\right)$
$= \text{Rs. } 1331$
$\therefore$ Investment made = Rs. 1331
Now, face value of 1 share = Rs. 25
$\therefore$ Face value of 44 shares = Rs. (44×25)
$= \text{Rs. } 1100$
Now, dividend on Rs. 100 = Rs. $\frac{11}{2}$
$\therefore$ Dividend on Rs. 1100 $= \text{Rs.} \left(\frac{11}{2 \times 100} \times 1100\right)$
$= \text{Rs. } 60{\cdot}50$

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Also, income on investment of Rs. 1331

$= \text{Rs. } 60{\cdot}50$

$\therefore$ Income on investment of Rs. 100

$= \text{Rs. } \left(\frac{60{\cdot}50}{1331} \times 100\right)$

$= 4{\cdot}55\%$

42. (D) Required answer $= 66[35 + 10 + 1] = 46 \times 66$

$= \text{Rs. } 3036.$

43. (B)

(i) 9 — 91 = 1089

(ii) 2 — 121 = 1092

Here (ii) > (i), hence 2nd investment is more profitable.

44. (A)

(i) 21/2 — 90 = 1050

(ii) 11 — 100 = 990

(i) > (ii), Ist is better investment.

45. (A)

(i) $\frac{33}{4}$ — 80 = 742·5

(ii) 9 — 100 – 10 = 90 = 720

Here (i) > (ii), hence (i) is the better investment.

46. (C)

(i) $\frac{57}{4}$ — 100 – 5 = 95 = 1496·25

(ii) $\frac{63}{4}$ — 100 + 5 = 105 = 1496·25

Here (i) = (ii)

$\therefore$ Both investments are equal.

47. (C) Required answer $= 30000 \times \frac{93 - \frac{3}{2}}{100} = 183 \times 150$

$= \text{Rs. } 27450$

48. (A) Required answer $= 1700 \times \frac{425}{4 \times 100}$

$= \text{Rs. } 1806{\cdot}25$

49. (C) $7350 = \text{Amount of stock} \times \frac{105 + 0}{100}$

$\therefore$ Amount of stock $= \frac{7350 \times 100}{105} = \text{Rs. } 7000$

50. (D) $8190 = \frac{118 - 1}{100} \times \text{Amount of stock}$

$\therefore$ Amount of stock $= \frac{8190 \times 100}{117} = \text{Rs. } 7000$

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True Discount

Suppose a sum say Rs. 136 is due 3 years hence and the borrower wants to clear off the debt right now. The question arises as to what money should be paid now. Clearly, the money which amounts to Rs. 136 after 3 years at a standard or agreed rate of interest must be paid now. Let the rate of interest in this case be 12% per annum simple interest. Then clearly, with this rate, Rs. 100 after 3 year will amount to Rs. 136. So clearly, the payment of Rs. 100 now will clear off a debt of Rs. 136 due 3 years hence at 12% per annum. The sum due is called the amount and the money paid now is called the present value or present worth of the sum due and the difference between the amount and the present worth (Rs. 36 in this case) is called the True Discount or Equitable Discount or Mathematical Discount.

Thus, the present value or present worth (p.w.) of a sum due at the end of a given time is the money which amounts to the sum due in that given time and at a given rate.

The sum due is called the amount.

The difference between the sum due at the end of a given time and its present worth is called True Discount (T.D.).

Thus, T.D. = (interest on P.W.) and Amount = (P.W. + T.D.)

Remark—Interest is reckoned on present worth and discount is reckoned on amount.

Formulae—If rate = R% p.a. and Time = T years. Then—

(i) $\text{P.W.} = \dfrac{100 \times (\text{Amount})}{[100 + (\text{R} \times \text{T})]}$

(ii) $\text{T.D.} = \dfrac{(\text{P.W.}) \times \text{R.T.}}{100}$

(iii) $\text{T.D.} = \dfrac{\text{Amount} \times \text{R} \times \text{T}}{100 + (\text{R} \times \text{T})}$

(iv) S.I. on T.D. = (S.I.) – (T.D.)

(v) $\text{Sum} = \left[\dfrac{(\text{S.I.}) \times (\text{T.D.})}{(\text{S.I.}) - (\text{T.D.})}\right]$

(vi) When the sum is put at compound interest, then

$$\text{P.W.} = \frac{\text{Amount}}{\left(1 + \frac{\text{R}}{100}\right)^{\text{T}}}$$

Examples

Q. 1. Find the present worth of Rs. 9950 due $3\frac{1}{4}$ years hence at $7\frac{1}{2}$% per annum simple interest. Also find the discount.

Solution : P.W.

$$= \frac{100 \times \text{Amount}}{100 + (\text{R} \times \text{T})}$$

$$= \text{Rs.}\left[\frac{100 \times 9950}{100 + \left(\frac{15}{2} \times \frac{13}{4}\right)}\right]$$

$$= \text{Rs.}\left(\frac{100 \times 9950 \times 8}{995}\right)$$

= Rs. 8000

Also, T.D.

= [Amount – (P.W.)]

= Rs. (9950 – 8000)

= Rs. 1950

Q. 2. The true discount on a certain sum of money due 3 years hence is Rs. 100 and the simple interest on the same sum for the same time and at the same rate is Rs. 120. Find the sum and the rate per cent.

Solution :

$$\text{Sum due} = \frac{\text{S.I.} \times \text{T.D.}}{(\text{S.I.}) - (\text{T.D.})}$$

$$= \text{Rs.}\left(\frac{120 \times 100}{20}\right)$$

= Rs. 600

$$\text{Rate} = \frac{100 \times 120}{600 \times 3}$$

$$= 6\frac{2}{3}\%$$

Q. 3. The true discount on Rs. 2575 due 4 months hence is Rs. 75. Find the rate per cent of interest.

Solution : P.W.

= Rs. (2575 – 75)

= Rs. 2500

∴ S.I. on Rs. 2500 for 4 months is Rs. 75.

Hence, rate

$$= \frac{100 \times 75 \times 3}{2500 \times 1} = 9\%$$

Q. 4. The true discount on a bill due 10 months hence at 6% per annum is Rs. 26·25. Find the amount of the bill.

Solution : S.I. on Rs. 100 for 10 months at 6% per annum

$$= \text{Rs.}\left(100 \times \frac{10}{12} \times \frac{6}{100}\right)$$

= Rs. 5

∴ Amount

= Rs. (100 + 5) = Rs. 105

So, T.D.

= Rs. (105 – 100) = Rs. 5

If T.D. is Rs. 5, sum due

= Rs. 105

If T.D. is Rs. 26·25, sum due

$$= \text{Rs.}\left(\frac{105}{5} \times 26{\cdot}25\right)$$

= Rs. 551·25

Q. 5. The true discount on Rs. 1860 due after a certain time at 5% is Rs. 60. Find the time after which it is due.

Solution : P.W. = (sum due) – (T.D.) = Rs. (1860 – 60) = Rs. 1800. Since T.D. in interest on P.W., so Rs. 60 is the simple interest on Rs. 1800 at 5% per annum.

∴ Time

$$= \left(\frac{100 \times 60}{1800 \times 5}\right) \text{ years}$$

$$= \left(\frac{2}{3} \times 12\right) \text{ months}$$

= 8 months.

Exercise

1. If Rs. 10 be allowed as true discount on a bill of Rs. 110 due at the end of a certain time. Then the discount allowed on the same sum due at the end of double the time is—
   (A) Rs. 20 (B) Rs. 21, 81
   (C) Rs. 22 (D) Rs. 18, 33
2. The simple interest and the true discount on a certain sum for a given time and at a given rate are Rs. 25 and Rs. 20 respectively. The sum is—
   (A) Rs. 500 (B) Rs. 200
   (C) Rs. 250 (D) Rs. 100

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3. Goods were bought for Rs. 600 and sold the same day for Rs. 650·25 at a credit of 9 months and still there was a gain of 2%. The rate per cent is—

(A) $6\frac{1}{3}\%$ (B) $8\frac{1}{3}\%$

(C) 8% (D) $7\frac{43}{61}\%$

4. The interest on Rs. 750 for 2 years is equal to the true discount on Rs. 810 for the same time and at the same rate. The rate per cent is—

(A) $4\frac{1}{3}\%$ (B) $5\frac{1}{6}\%$

(C) 4% (D) 5%

5. A trader owes a merchant Rs. 901 due 1 year's hence. However, the trader wants to settle the account after 3 months. How much cash should he pay, if rate of interest is 8% per annum—

(A) Rs. 870

(B) Rs. 850

(C) Rs. 828·92

(D) Rs. 846·94

6. The present worth of Rs. 1404 due in two equal half yearly instalments—

(A) Rs. 1325 (B) Rs. 1300

(C) Rs. 1350 (D) Rs. 1500

7. I want to sell my scooter. There are two offers. One at cash payment of Rs. 8100 and another at a credit of Rs. 8250 to be paid after 6 months. If money being worth $6\frac{1}{4}\%$ per annum simple interest, which is the better offer ?

(A) Rs. 8100 in cash

(B) Rs. 8250 due 6 months hence

(C) Both are equally good

(D) Can't be said

8. If the true discount on a sum due 2 years hence at 5% per annum be Rs. 75, then the sum due is—

(A) Rs. 750 (B) Rs. 825

(C) Rs. 875 (D) Rs. 800

9. A has to pay Rs. 220 to B after 1 year. B asks A to pay Rs. 110 in cash and defer the payment of Rs. 110 for 2 years. A agrees to it. Counting the rate of interest at 10% per annum in this new mode of payment—

(A) There is no gain or loss to any one

(B) A gains Rs. 7·34

(C) A loses Rs. 7·34

(D) A loses Rs. 1·66

10. Rs. 20 is the true discount on Rs. 260 due after a certain time. What will be the true discount on the same sum due after half of the former time, the rate of interest being the same ?

(A) Rs. 10 (B) Rs. 10·40

(C) Rs. 15·20 (D) Rs. 13

11. A owes B, Rs. 1120 payable 2 years hence and B owes A, Rs. 1081·50 payable 6 months hence. If they decide to settle their accounts forthwith by payment of ready money and the rate of interest be 6% per annum, then who should pay and how much ?

(A) A Rs. 50 (B) B Rs. 50

(C) A Rs. 70 (D) B Rs. 70

12. A man purchased a cow for Rs. 300 and sold it the same day for Rs. 360, allowing the buyer at the credit of 2 years. If the rate of interest be $7\frac{1}{2}\%$ per annum, then the man has a gain of—

(A) $4\frac{1}{2}\%$ (B) $5\frac{3}{7}\%$

(C) 6% (D) 5%

13. The true discount on a bill due 10 months hence at 6% per annum is Rs. 26·25. The amount of the bill is—

(A) Rs. 1575

(B) Rs. 500

(C) Rs. 650·25

(D) Rs. 551·25

14. The true discount on Rs. 2575 due 4 months hence is Rs. 75. The rate per cent is—

(A) 6% (B) 8%

(C) 9% (D) 5%

15. The true discount on Rs. 1860 due after a certain time at 5% is Rs. 60. The time after which it is due is—

(A) 6 months (B) 8 months

(C) 9 months (D) 10 months

16. A man buys a watch for Rs. 195 in cash and sells it for Rs. 220 at a credit of 1 year. If the rate of interest is 10%, the man—

(A) Gains Rs. 15

(B) Gains Rs. 3

(C) Gains Rs. 5

(D) Loses Rs. 5

17. Find the present worth (PW) and the true discount reckoning 6% per annum simple interest of Rs. 176 due in 20 months time—

(A) Rs. 160, Rs. 16

(B) Rs. 130, Rs. 46

(C) Rs. 150, Rs. 26

(D) None of these

18. A owes B Rs. 456·75 payable $4\frac{1}{2}$ months hence and B owes A Rs. 455·51 payable 3 months hence. If they agree to settle their account by a ready money payment. What sum should be paid over and to whom reckoning the rate of true discount at 4 per cent per annum ?

(A) Re. 1, A (B) Rs. 2, B

(C) Rs. 2, A (D) Re. 1, B

19. Find the present worth of Rs. 264 due in 2 years reakoning simple interest at 5 per cent per annum—

(A) Rs. 240 (B) Rs. 360

(C) Rs. 540 (D) Rs. 260

20. What is the present worth of Rs. 272·61 due in 2 years 73 days at $7\frac{1}{2}$ per cent ?

(A) Rs. 334

(B) Rs. 254

(C) Rs. 234

(D) None of these

21. Find the present value of Rs. 1051·25 due a year hence at $5\frac{1}{8}\%$—

(A) Rs. 1200 (B) Rs. 1000

(C) Rs. 1500 (D) Rs. 1050

22. What sum will discharge a debt of Rs. 5300 due a year and a half hence at 4% per annum ?

(A) Rs. 5000 (B) Rs. 4500

(C) Rs. 4200 (D) Rs. 5250

23. The true discount on a bill due 8 months hence at 12% per annum

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is Rs. 240. Find the amount of the bill and its present worth—
(A) Rs. 3000, Rs. 3240
(B) Rs. 2000, Rs. 2240
(C) Rs. 2100, Rs. 2340
(D) None of these

24. The true discount on a bill due 9 months hence at 6% per annum is Rs. 180. Find the amount of the bill and its present worth—
(A) Rs. 3000, Rs. 3180
(B) Rs. 4000, Rs. 4180
(C) Rs. 4500, Rs. 4680
(D) None of these

25. Find the difference between simple interest and true discount on Rs. 960 due 4 year hence at 5% per annum simple interest—
(A) Rs. 32
(B) Rs. 52
(C) Rs. 42
(D) None of these

26. The difference between the simple interest and the true discount on a certain sum for 6 months at 4% is Rs. 15. Find the sum—
(A) Rs. 32850
(B) Rs. 28250
(C) Rs. 38250
(D) Rs. 38350

27. The difference between the simple interest and the true discount on a certain sum of money for 6 months at 6% is Rs. 27. Find the sum—
(A) Rs. 30900
(B) Rs. 39000
(C) Rs. 20900
(D) Rs. 30600

28. The true discount on a certain sum of money due after $2\frac{1}{2}$ years at 6% per annum is less than the simple interest on the same sum for the same time by Rs. 81. Find the sum—
(A) Rs. 4140 (B) Rs. 4240
(C) Rs. 4150 (D) Rs. 4250

29. The difference between the simple interest and discount on a certain sum of money due 1 year 9 months hence at 4% is Rs. 7·35. What is the sum ?
(A) Rs. 1605 (B) Rs. 1805
(C) Rs. 1525 (D) Rs. 1625

30. If the difference between the interest and discount on a certain sum of money for 6 months at 6% be Rs. 2·25. Find the sum—
(A) Rs. 7525 (B) Rs. 2255
(C) Rs. 2575 (D) Rs. 2755

31. The true discount on Rs. 1860 due 3 years hence is Rs. 60. Find the rate per cent—
(A) 10% (B) 12%
(C) 5% (D) 15%

32. The true discount on Rs. 340 due 5 years hence is Rs. 40. Find the rate per cent—
(A) 3% (B) $2\frac{2}{3}\%$
(C) $3\frac{1}{3}\%$ (D) $3\frac{2}{3}\%$

33. The true discount on Rs. 2080 due 2 years hence is Rs. 80. Find the rate per cent—
(A) 4%
(B) 8%
(C) 2%
(D) None of these

34. If the true discount on Rs. 161 due $2\frac{1}{2}$ years hence be Rs. 21. At what rate per cent is the interest calculated ?
(A) 6% (B) 4%
(C) 8% (D) 12%

35. If the discount on Rs. 2273·70 due at the end of a year and a helf be Rs. 128·70, what is the rate of interest ?
(A) 6% (B) 4%
(C) 3% (D) $4\frac{1}{2}\%$

36. What must be the rate of interest in order that the discount on Rs. 774·76 payable at the end of 3 years may be Rs. 83·01 ?
(A) 3%
(B) 2%
(C) 4%
(D) None of these

37. The present worth of a bill due 7 months hence is Rs. 1200 and if the bill were due at the end of $2\frac{1}{2}$ years, its present worth would be Rs. 1016. Find the rate per cent and the sum of the bill—
(A) 10%, Rs. 1270
(B) 8%, Rs. 1720
(C) 16%, Rs. 1570
(D) 18%, Rs. 1560

38. If the interest on Rs. 50 at $4\frac{1}{2}\%$ be equal to the discount on Rs. 59 for the same time and at the same rate when is the latter sum due ?
(A) 2 years (B) 4 years
(C) 6 years (D) 3 years

39. If the discount on Rs. 3050 be equal to the simple interest on Rs. 3000 for the same time. Find the time, the rate of interest being 5% per annum—
(A) 4 months
(B) 6 months
(C) 3 months
(D) None of these

40. Find the present worth of a bill of Rs. 2420 due 2 years hence at 10% compound interest. Also find the true discount—
(A) Rs. 2000, Rs. 420
(B) Rs. 2200, Rs. 520
(C) Rs. 2100, Rs. 460
(D) None of these

41. Find the true discount on Rs. 39·69 due in 2 years reckoning compound interest at 5%—
(A) Rs. 3·69 (B) Rs. 5
(C) Rs. 5·69 (D) Rs. 4·69

42. If Rs. 10 be allowed as true discount on a bill of Rs. 110 due at the end of a certain time, then the discount allowed on the same sum due at the end of double the time is—
(A) Rs. 20 (B) Rs. 21·81
(C) Rs. 22 (D) Rs. 18·33

43. Rs. 20 is the true discount on Rs. 260 due after a certain time. What will be the true discount on the same sum due after half of the former time, the rate of interest being the same ?
(A) Rs. 10 (B) Rs. 10·40
(C) Rs. 15·20 (D) Rs. 13

44. The true discount on a bill due 10 months hence at 6% per annum is Rs. 26·25. Then the amount of the bill is—
(A) Rs. 551·25
(B) Rs. 550
(C) Rs. 551·50
(D) Rs. 550·25

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Answers with Hints

1. (D) S.I. on Rs. (110 – 10) for a given time = Rs. 10
S.I. on Rs. 100 for double the time = 20
Sum = Rs. (100 + 20) = Rs. 120
T.D. on Rs. 110 = Rs. $\left(\frac{20}{120}\times 110\right)$ = Rs. 18·33

2. (D) Sum = $\frac{(\text{S.I.})\times(\text{T.D.})}{(\text{S.I.})-(\text{T.D.})}$ = Rs. $\left(\frac{25\times 20}{25-20}\right)$
= Rs. 100

3. (B) S.P. = (102% of Rs. 600) = Rs. $\left(\frac{102}{100}\times 600\right)$
= Rs. 612
∴ P.W. of Rs. 650·25 due 9 months hence is Rs. 612.
⇒ Rs. 38·25 is S.I. on Rs. 612 for 9 months
∴ Rate = $\left(\frac{100\times 38\cdot 25}{612\times\frac{3}{4}}\right)\% = 8\frac{1}{3}\%$

4. (C) Since T.D. is S.I. on P.W., we have
Rs. (810 – 750) or Rs. 60 as S.I. on Rs. 750 for 2 years.
∴ Rate = $\left(\frac{100\times 60}{750\times 2}\right) = 4\%$

5. (B) P.W. of Rs. 901 due 9 months hence at 8%
= Rs. $\left\{\frac{100\times 901}{100+\left(8\times\frac{3}{4}\right)}\right\}$ = Rs. $\left(\frac{100\times 901\times 1}{106}\right)$
= Rs. 850

6. (A) P.W. of Rs.702 due 6 months hence
= Rs. $\left\{\frac{100\times 702}{100+8\times\frac{1}{2}}\right\}$ = Rs. 675
∴ Total P.W. = Rs. (675 + 650) = Rs. 1325

7. (A) P.W. of Rs. 8250 due 6 months hence
= Rs. $\left\{\frac{100\times 8250}{100+\left(\frac{25}{4}\times\frac{1}{2}\right)}\right\}$ = Rs. 8000
∴ Rs. 8100 in cash is a better offer.

8. (B) P.W. = $\frac{100\times \text{T.D.}}{\text{R}\times\text{T}}$ = Rs. $\left(\frac{100\times 75}{5\times 2}\right)$
= Rs. 750
∴ Sum due = Rs. (750 + 75) = Rs. 825

9. (D) A has to pay the P.W. of Rs. 220 due 1 year hence, which is
= Rs. $\left[\frac{100\times 220}{100+(10\times 1)}\right]$ = Rs. 200
A, actually pays = Rs. [110 + P.W. of Rs. 110 due 2 years hence]
= Rs. $\left[110+\frac{100\times 110}{100+(10\times 2)}\right]$
= Rs. [110 + 91·66]
= Rs. [201·66]
∴ A loses = Rs. [200 – 201·66] = Rs. 1·66.

10. (B) S.I. on Rs. 240 for a given time = Rs. 20
S.I. on Rs. 240 for half the time = Rs. 10
∴ Rs. 10 is T.D. on Rs. 250
So, T.D. on Rs. 260 = Rs. $\left(\frac{10}{250}\times 260\right)$ = Rs. 10·40

11. (B) P.W. of Rs. 1120 due 2 years hence at 6%
= Rs. $\left[\frac{100\times 1120}{100+(6\times 2)}\right]$ = Rs. 1000
P.W. of Rs. 1081·50 due 6 months hence at 6%
= Rs. $\left[\frac{100\times 1081\cdot 50}{100+\left(6\times\frac{1}{2}\right)}\right]$ = Rs. $\left[\frac{100\times 1081\cdot 50}{103}\right]$
= Rs. 1050
So, A owes B, Rs. 1000 cash and B owes A Rs. 1050 cash.
∴ B must pay Rs. 50 to A.

12. (D) P.W. of Rs. 360 due 2 years hence at $7\frac{1}{7}\%$ per annum = Rs. $\left\{\frac{100\times 360}{100+\left(\frac{50}{7}\times 2\right)}\right\}$
= Rs. $\left\{\frac{100\times 360\times 7}{800}\right\}$
= Rs. 315
∴ S.P. = Rs. 315
Hence, gain % = $\left(\frac{15\times 100}{300}\right) = 5\%$

13. (D) Amount = (T.D.) × $\left\{\frac{100+(\text{R}\times\text{T})}{\text{R}\times\text{T}}\right\}$
= Rs. $\left(\frac{26\cdot 25\times 105}{5}\right)$ = Rs. 551·25

14. (C) P.W. = Rs. (2575 – 75) = Rs. 2500
∴ Rate = $\left(\frac{100\times 75\times 3}{2500\times 1}\right)\% = 9\%$

15. (B) P.W. = (Sum due) – (T.D.)
= Rs. (1860 – 60) = Rs. 1800
Thus, Rs. 60 is S.I. on Rs. 1800 at 5% per annum.
∴ Time = $\left(\frac{100\times 60}{1800\times 5}\right)$ years
= $\frac{2}{3}$ years = 8 months

16. (C) P.W. of Rs. 220 due 1 year hence
= Rs. $\left(\frac{100\times 200}{100+10}\right)$ = Rs. 200
hence, the man gains Rs. 5

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17. (A) P.W. $= \dfrac{100 \times 176}{\left(100 + 6 \times \dfrac{20}{12}\right)} = \text{Rs. } 160$

T.D. = Amount – Present worth

= Rs. 176 – Rs. 160 = Rs. 16

18. (A) Time $= 4\dfrac{1}{2}$ months $= \dfrac{3}{8}$ year,

Rate = 4 per cent

$\therefore$ Amount of Rs. 100 = Rs. $\dfrac{203}{2}$

$\therefore$ P.W. = Rs. $\left(456{\cdot}75 \div \dfrac{203}{2}\right) \times 100$

= Rs. 450

Again, time = 3 months $= \dfrac{1}{4}$ year, rate = 4 per cent

P.W. = Rs. $455{\cdot}51 \times \dfrac{100}{101}$

= Rs. 451

Hence the required sum to be paid to A

= Rs. 451 – Rs. 450 = Re. 1

19. (A) P. W. $= \left[\dfrac{100 \times 264}{100 + (5 \times 2)}\right]$

= Rs. $\left[\dfrac{100 \times 264}{110}\right]$ = Rs. 240.

20. (C) Required answer $= \dfrac{100 \times 272{\cdot}61}{\left(100 + \dfrac{15}{2} \times 2\dfrac{73}{365}\right)}$

$= \dfrac{27261}{\left(100 + \dfrac{33}{2}\right)} = \dfrac{27261 \times 2}{233}$

= Rs. 234.

21. (B) P. W. $= \left[\dfrac{100 \times 1051{\cdot}25}{100 + 41/8 \times 1}\right]$

$= \left[\dfrac{105125 \times 8}{841}\right]$ = Rs. 1000.

22. (A) Required sum $= \dfrac{100 \times 5300}{\left(100 + \dfrac{3}{2} \times 4\right)}$

$= \dfrac{100 \times 5300}{106}$ = Rs. 5000

23. (A) P.W. $= \dfrac{100 \times \text{T.D.}}{\text{R} \times \text{T}} = \dfrac{100 \times 240}{12 \times \dfrac{8}{12}}$ = Rs. 3000

$\because$ P.W. is Rs. 3000

$\therefore$ A = Amount of bill

= P.W. + T.D. = 3000 + 240 = 3240

24. (B) Solve as Q. 23.

25. (A) S.I. – T.D. $= \dfrac{\text{A} \times (\text{R.T.})^2}{100(100 + \text{R.T.})}$

$= \dfrac{960 \times (4 \times 5)^2}{100 \times (100 + 4 \times 5)}$

$= \dfrac{960 \times 20 \times 20}{100 \times 120}$ = Rs. 32

26. (C) $\because$ $15 = \dfrac{\text{A} \times \left(4 \times \dfrac{1}{2}\right)^2}{100\left(100 + 4 \times \dfrac{1}{2}\right)}$

$\Rightarrow$ $15 = \dfrac{\text{A} \times 4}{100 \times 102}$

$\Rightarrow$ $\text{A} = 15 \times 25 \times 102$

$\therefore$ A = Rs. 38,250.

27. (A) Req. amount $= \dfrac{27 \times \left(100 + 6 \times \dfrac{1}{2}\right) \times 100}{\left(6 \times \dfrac{1}{2}\right)^2}$

$= \dfrac{2700 \times 103}{9}$

= Rs. 30900.

28. (A) Req. amount $= \dfrac{81 \times \left(100 + 6 \times \dfrac{5}{2}\right) \times 100}{\left(6 \times \dfrac{5}{2}\right)^2}$

$= \dfrac{8100 \times 115}{225}$

= Rs. 4140

Here, S.I. – T.D. = Rs. 81

29. (A)

30. (C)

31. (A) R $= \dfrac{100 \times \text{T.D.}}{\text{P.W.} \times \text{T}} = \dfrac{100 \times \text{T.D.}}{(\text{A} - \text{T.D.}) \times \text{T}}$

$= \dfrac{100 \times 60}{1800 \times 3} = 10\%$ [since P.W. = A – T.D.]

$\therefore$ The rate per cent is 10% per annum.

32. (B)

33. (C)

34. (A) Required rate per cent $= \dfrac{100 \times 21}{(161 - 21) \times 2\dfrac{1}{2}} = 6\%$.

35. (B)

36. (C) Rate % $= \dfrac{100 \times 83{\cdot}1}{(774{\cdot}76 - 83{\cdot}01) \times 3} = \dfrac{8310}{691{\cdot}75 \times 3}$

= 4%

37. (A) Sum due = P.W. + T.D. = P.W. + S.I. on P.W.

Now, sum due

= (Rs. 1200 + S.I. on Rs. 1200 for 7 months)

Also, sum due

$= \left(\text{Rs. } 1016 + \text{S.I. on Rs. } 1016 \text{ for } \dfrac{5}{2} \text{ years}\right)$

$\therefore \left\{\text{Rs. } 1200 + \text{S.I. on Rs. } \left(1200 \times \dfrac{7}{12}\right) \text{ for 1 year}\right\}$

$= \left\{\text{Rs. } 1016 + \text{S.I. on Rs. } \left(1016 \times \dfrac{5}{2}\right) \text{ for 1 year}\right\}$

$\Rightarrow$ {Rs. 1200 + S.I. on Rs. 700 for 1 year}

= {Rs. 1016 + S.I. on Rs. 2540 for 1 year}

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$\Rightarrow$ S.I. on Rs. (2540 – 700) for 1 year
= Rs. (1200 – 1016)
$\Rightarrow$ S.I. on Rs. 1840 for 1 year = Rs. 184
$\therefore$ Rate = $\frac{100 \times 184}{1840 \times 1} = 10\%$
Also, sum due
= Rs. 1200 + (S.I. on Rs. 1200 for 7 months at 10%)
= Rs. $\left[1200 + \left(1200 \times \frac{7}{12} \times \frac{10}{100}\right)\right]$
= Rs. 1270

Short Method :

$\because$ $\frac{1200}{1016} = \frac{100 + R \times \frac{5}{2}}{100 + R \times \frac{7}{12}}$

$\Rightarrow 1200\left(100 + R \times \frac{7}{12}\right) = 1016\left(100 + R \times \frac{5}{2}\right)$

$\Rightarrow$ 3680 R = 36800
$\therefore$ R = 10%
$\therefore$ Sum due = 1200 + (S.I. on Rs. 1200 for 7 months at 10%).
= Rs. 1270

38. (B) $\because$ $\frac{9}{2} = \frac{59 - 50}{50 \times T} \times 100$
$\therefore$ T = 4 years

39. (A) $\because$ $5 = \frac{3050 - 3000}{3000 \times T} \times 100$
$\therefore$ T = $\frac{1}{3}$ years = 4 months

40. (A) Here sum is put on compound interest,
$\because$ P.W. = $\frac{A}{\left(1 + \frac{r}{100}\right)^n} = \frac{2420}{\left(1 + \frac{10}{100}\right)^2}$
= $\frac{2420 \times 100}{121}$
= Rs. 2000
$\Rightarrow$ T.D. = P.W. – P
$\therefore$ True discount = 2420 – 2000 = Rs. 420.

41. (A) $\because$ P.W. = $\frac{39{\cdot}69}{\left(1 + \frac{5}{100}\right)^2}$
= $\frac{3969 \times 100 \times 100}{100 \times 105 \times 105}$
= Rs. 36
$\therefore$ True discount = Rs. 39·69 – 36 = Rs. 3·69

42. (D) S.I. on Rs. (110 – 10) for a given time = Rs. 10
S.I. on Rs. 100 for double the time = Rs. 20
Sum = Rs. (100 + 20) = Rs. 120
T.D. on Rs. 110 = Rs. $\left(\frac{20}{120} \times 110\right)$ = Rs. 18·33

43. (B) S.I. on Rs. 240 for a given time = Rs. 20
S.I. on Rs. 240 for half of the time = Rs. 10
$\therefore$ Rs. 10 is T.D. on Rs. 250
Req. T.D. on Rs. 260 = Rs. $\left(\frac{10}{250} \times 260\right)$
= Rs. 10·40

44. (A)

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Banker's Discount

Suppose a merchant A purchases goods worth of say Rs. 5000 from another merchant B at a credit of a certain period say 4 months. Then B draws up a draft *i.e.*, prepares a special type of a bill called Hundi or Bill of exchange. On the receipt of the goods A gives an agreement dually signed on the bill stating that he has accepted the bill and money can be withdrawn from his bank account after 4 months of the date of the bill. On this bill there is an order from A to his bank asking to pay Rs. 5000 to B after 4 months. Moreover 3 more days (known as grace days) are added to the date (called nominally due date) of expiry of 4 months and on the date so obtained (called the legally due date) the bill can be presented to the bank by B to collect Rs. 5000 from A's account. Suppose the bill is drawn on 5th January at 4 months, then the nominally due date is 5th May and the legally due date is 8th May. The amount given on the draft or bill is called the face value which is Rs. 5000 in this case.

Now, suppose that B needs the money of this bill earlier than 8th May say on 3rd March. In such a case, B can sell the bill to a banker or a broker who pays him the money against the bill but somewhat less than the face value. Now the natural questions is, as how much cash the banker should pay to B on 3rd March. Actually, if the banker deducts the true discount on the face value for the period from 3rd March to 8th May, he gains nothing. So in order to make some profit, the banker deducts from the face value. The simple interest on the face value for the unexpired time *i.e.*, from 3rd March to 8th May. This deduction is known as Banker's Discount (B.D.) or commercial discount.

Thus B.D. is the S.I. on face value for the period from the date on which the bill was discounted and the legally due date. The money paid by the banker to the bill holder is called the discountable value.

Also, the difference between the banker's discount and the true discount for the unexpired time is called the Banker's Gain (B.G.). Thus, Banker's Gain

$$\text{B.G.} = (\text{B.D.}) - (\text{T.D.})$$

Remark—When date of the bill is not given, grace days are not to be added.

Formulae—

(i) B.D. = S.I. on bill for unexpired time.

(ii) Banker's Gain = (B.D.) – (T.D.)

(iii) B.G. = S.I. on T.D.

(iv) $\text{T.D.} = \sqrt{(\text{P.W.}) \times (\text{B.G.})}$;

$$\text{B.G.} = \frac{(\text{T.D.})^2}{(\text{P.W.})}$$

(v) $\text{B.D.} = \frac{\text{Amount} \times \text{Rate} \times \text{Time}}{100}$

$$\text{T.D.} = \frac{\text{Amount} \times \text{Rate} \times \text{Time}}{100 + (\text{Rate} \times \text{Time})}$$

(vi) $\text{Amount} = \frac{(\text{B.D.}) \times (\text{T.D.})}{(\text{B.D.}) - (\text{T.D.})}$;

$$\text{T.D.} = \frac{\text{B.G.} \times 100}{\text{Rate} \times \text{Time}}$$

Examples

Q. 1. The true discount on a bill of Rs. 1860 due after 8 months is Rs. 60. Find the rate, the banker's discount and the banker's gain.

Solution :

Amount = Rs. 1860, T.D. = Rs. 60

$\therefore$ P.W. = Rs. (1860 – 60) = Rs. 1800

S.I. on Rs. 1800 for 8 months = Rs. 60

$$\therefore \text{Rate} = \left[\frac{100 \times 60}{1800 \times \frac{2}{3}}\right]\% = 5\%$$

$$\text{B.G.} = \frac{(\text{T.D.})^2}{(\text{P.W.})} = \text{Rs.}\ \frac{60 \times 60}{1800} = \text{Rs. } 2$$

B.D. = (T.D.) + (B.G.) = Rs. (60 + 2) = Rs. 62.

Q. 2. The present worth of a bill due sometime hence is Rs. 1100 and the true discount on the bill is Rs. 110. Find the banker's discount and the extra gain the banker would make in the transaction.

Solution :

$$\text{T.D.} = \sqrt{(\text{P.W.}) \times (\text{B.G.})}$$

$$\text{or B.G.} = \frac{(\text{T.D.})^2}{(\text{P.W.})} = \text{Rs.}\left(\frac{110 \times 110}{1100}\right) = \text{Rs. } 11$$

$\therefore$ B.D. = B.G. + T.D. = Rs. (11 + 110) = Rs. 121

Q. 3. The banker's discount and the true discount on a sum of money due 8 months hence are Rs. 52 and Rs. 50, respectively. Find the sum and the rate per cent.

Solution :

$$\text{Sum} = \frac{(\text{B.D.}) \times (\text{T.D.})}{(\text{B.D.}) - (\text{T.D.})} = \text{Rs.}\left(\frac{52 \times 50}{2}\right) = \text{Rs. } 1300$$

Since B.D. is S.I. on sum due. So S.I. on Rs. 1300 for 8 months is Rs. 52. Consequently.

$$\text{Rate} = \left(\frac{100 \times 52}{1300 \times \frac{2}{3}}\right)\% = 6\%$$

Q. 4. The banker's discount on Rs. 1800 at 5% is equal to the true discount on Rs. 1830 for the same time and at the same rate. Find the time.

Solution : S.I. on Rs. 1800 = T.D. on Rs. 1830

$\therefore$ P.W. of Rs. 1830 is Rs. 1800

i.e., Rs. 30 is S.I. on Rs. 1800 at 5%

$$\therefore \text{Time} = \left(\frac{100 \times 30}{1800 \times 5}\right)\text{years} = \frac{1}{3}\text{ years} = 4 \text{ months}$$

Q. 5. If the true discount on a certain sum due 6 months hence at 6% is Rs. 36, what is the banker's discount on the same sum for the same time and at the same rate ?

Solution :

$$\text{B.G.} = \text{S.I. on T.D.} = \text{Rs.}\left(\frac{36 \times 6 \times 1}{100 \times 2}\right) = \text{Rs. } 1{\cdot}08$$

$\therefore$ (B.D.) – (T.D.) = Rs. 1·08

or B.D. = (T.D.) + Rs. 1·08 = Rs. (36 + 1·08) = Rs. 37·08

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Exercise

1. The banker's gain of a certain sum of money is Rs. 36 and the true discount on the same sum for the same time and at the same rate is Rs. 30. The sum is—
   (A) Rs. 1080 (B) Rs. 180
   (C) Rs. 500 (D) Rs. 300

2. The banker's gain of a certain sum due 2 years hence at 5% per annum is Rs. 80. The present worth is—
   (A) Rs. 800 (B) Rs. 1600
   (C) Rs. 1200 (D) Rs. 880

3. The present worth of a certain sum due sometime hence is Rs. 1600 and the true discount is Rs. 160. The banker's gain is—
   (A) Rs. 10 (B) Rs. 16
   (C) Rs. 20 (D) Rs. 24

4. The banker's gain on a certain sum due $2\frac{1}{2}$ years hence is $\left(\frac{3}{23}\right)$ of the banker's discount. The rate per cent is—
   (A) 5% (B) 6%
   (C) $2\frac{14}{23}\%$ (D) $6\frac{2}{3}\%$

5. The banker's discount on a certain sum due 2 years hence is $\frac{11}{10}$ of the true discount. The rate per cent is—
   (A) 11% (B) 10%
   (C) 5% (D) $5\frac{1}{3}\%$

6. The present worth of a certain bill due sometime hence is Rs. 800 and the true discount is Rs. 36. Then the banker's discount is—
   (A) Rs. 37 (B) Rs. 34·38
   (C) Rs. 37·62 (D) Rs. 38·98

7. The true discount on a bill of Rs. 540 is Rs. 90. The banker's discount is—
   (A) Rs. 60 (B) Rs. 150
   (C) Rs. 108 (D) Rs. 110

8. The banker's gain on a sum due 3 years hence at 5% is Rs. 90. The banker's discount is—
   (A) Rs. 690 (B) Rs. 720
   (C) Rs. 810 (D) Rs. 150

9. A bill is discounted at 5% per annum. If banker's discount be allowed at what rate per cent must the proceeds be invested, so that nothing may be lost ?
   (A) 5% (B) $4\frac{19}{21}\%$
   (C) $5\frac{5}{19}\%$ (D) 10%

10. The present worth of a sum due sometimes hence is Rs. 576 and the banker's gain is Re. 1. The true discount is—
    (A) Rs. 16 (B) Rs. 18
    (C) Rs. 24 (D) Rs. 32

11. The banker's discount on a bill due 6 months hence at 6% is Rs. 37·08. The true discount is—
    (A) Rs. 6·18 (B) Rs. 12·36
    (C) Rs. 48 (D) Rs. 36

12. The banker's gain on a bill due 1 year hence at 5% is Re. 1. The true discount is—
    (A) Rs. 15 (B) Rs. 20
    (C) Rs. 25 (D) Rs. 5

13. The banker's discount on a sum of money for $1\frac{1}{2}$ years is Rs. 60 and the true discount on the same sum for 2 years is Rs. 75. The rate per cent is—
    (A) 5% (B) 6%
    (C) $6\frac{2}{3}\%$ (D) $3\frac{1}{3}\%$

14. The banker's discount on Rs. 1600 at 6% is the same as the true discount on Rs. 1624 for the same time and at the same rate. Then the time is—
    (A) 3 months (B) 4 months
    (C) 6 months (D) 8 months

15. The banker's discount on a bill due 1 year 8 months hence is Rs. 50 and the true discount on the same sum at the same rate per cent is Rs. 45. The rate per cent is—
    (A) 6% (B) $6\frac{2}{3}\%$
    (C) $6\frac{1}{2}\%$ (D) $8\frac{44}{59}\%$

16. The true discount on a bill of Rs. 1860 due after 8 months is Rs. 60. Find the banker's discount—
    (A) Rs. 62
    (B) Rs. 52
    (C) Rs. 60
    (D) None of these

17. Find the banker's discount on a bill of Rs. 12750 due 2 months hence and 3% per annum—
    (A) Rs. 63·75 (B) Rs. 61·75
    (C) Rs. 64·75 (D) Rs. 63·25

18. The true discount on a bill of Rs. 3720 due after 4 months is Rs. 120. Find the banker's discount—
    (A) Rs. 122
    (B) Rs. 134
    (C) Rs. 124
    (D) None of these

19. The true discount on a bill of Rs. 1860 due after 8 months is Rs. 60. Find the banker's gain—
    (A) Rs. 1·5 (B) Rs. 2·5
    (C) Rs. 4 (D) Rs. 2

20. Find the banker's gain on a bill of Rs. 6900 due 3 years hence at 5% per annum simple interest—
    (A) Rs. 135 (B) Rs. 125
    (C) Rs. 185 (D) Rs. 145

21. Find the difference between the banker's discount and the true discount on Rs. 8100 for 3 months at 5%—
    (A) Rs. 0·125
    (B) Rs. 1·25
    (C) Rs. 12·5
    (D) None of these

22. The banker's discount on a bill due 6 months hence at 6% is Rs. 37·08. Find the true discount—
    (A) Rs. 38
    (B) Rs. 32
    (C) Rs. 36
    (D) None of these

23. Find the banker's discount on a bill due 3 years hence at 5% being given that the banker's gain is Rs. 90—
    (A) Rs. 550 (B) Rs. 650
    (C) Rs. 690 (D) Rs. 600

24. The banker's gain on a bill due 1 year 4 months hence at $7\frac{1}{2}\%$ per annum simple interest is Rs. 16. Find the sum—
    (A) Rs. 1760 (B) Rs. 1560
    (C) Rs. 1660 (D) Rs. 1860

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25. The banker's gain on a bill due 1 year hence at 5% is Re. 1. The true discount is—
(A) Rs. 15 (B) Rs. 20
(C) Rs. 25 (D) Rs. 5

26. The banker's gain on a bill due 2 years hence at 5% is Rs. 8, find the present worth of the bill—
(A) Rs. 800 (B) Rs. 650
(C) Rs. 750 (D) Rs. 850

27. The present worth of a bill due sometime hence is Rs. 1100 and the true discount on the bill is Rs. 110. Find the banker's discount and the extra gain the banker would make in the transaction—
(A) Rs. 11, Rs. 121
(B) Rs. 21, Rs. 131
(C) Rs. 12, Rs. 122
(D) None of these

28. The banker's discount on Rs. 1650 due a certain time hence is Rs. 165. Find the true discount and the banker's gain—
(A) Rs. 150, Rs. 15
(B) Rs. 160, Rs. 5
(C) Rs. 145, Rs. 20
(D) None of these

29. The present worth of a certain bill due sometime hence is Rs. 1600 and true discount on the bill is Rs. 160. Find the banker's discount and the extra gain the banker would make in the transaction—
(A) Rs. 176, Rs. 18
(B) Rs. 186, Rs. 16
(C) Rs. 176, Rs. 16
(D) None of these

30. The present worth of a sum due some times hence is Rs. 576 and the banker's gain is Re. 1. The true discount is—
(A) Rs. 16 (B) Rs. 18
(C) Rs. 24 (D) Rs. 32

31. The Banker's discount and the true discount on a sum of money due 8 months hence are Rs. 52 and Rs. 50, respectively. Find the sum and the rate per cent—
(A) Rs. 1300, 6%
(B) Rs. 1200, 5%
(C) Rs. 1500, 8%
(D) None of these

32. The interest on a certain sum of money is Rs. 67·20 and the discount on the same sum of money for the same time and at the same rate is Rs. 60. What is sum ?
(A) Rs. 560 (B) Rs. 480
(C) Rs. 590 (D) Rs. 860

33. The banker's discount on Rs. 1600 at 6% is the same as the true discount on Rs. 1624 for the same time and at the same rate. Find the time—
(A) 3 months (B) 4 months
(C) 6 months (D) 8 months

34. The banker's gain on a certain sum due $2\frac{1}{2}$ years hence is $\frac{2}{23}$ of the banker's discount on it for the same time and at the same rate. Find the rate per cent—
(A) 5% (B) 4%
(C) 8% (D) 6%

35. What rate per cent does a man get for his money when in discounting a bill due 10 months hence he deducts 4% of the amount of the bill ?
(A) 5% (B) 6%
(C) 8% (D) 4%

36. A bill drawn on March 8, at 7 months date and was discounted on May 18, at 5%. If the banker's gain is Rs. 3. Find
(I) The true discount—
(A) Rs. 160 (B) Rs. 152
(C) Rs. 153 (D) Rs. 150
(II) The banker's discount and
(A) Rs. 153 (B) Rs. 151
(C) Rs. 155 (D) Rs. 163
(III) The sum of the bill—
(A) Rs. 7650
(B) Rs. 7550
(C) Rs. 7850
(D) None of these

37. The holder of a bill for Rs. 17850 nominally due on 21st May, 1991 received Rs. 357 less than the amount of the bill by having it discounted at 5%. When was it discounted ?
(A) December 29, 1990
(B) December 30, 1989
(C) December 19, 1990
(D) None of these

38. A bill for Rs. 5656 is drawn on July 14 at 5 months. It is discounted on Oct. 5th at 5%—
(I) Banker's discount
(A) Rs. 56·56
(B) Rs. 56
(C) Rs. 56·50
(D) None of these
(II) True discount—
(A) Rs. 50
(B) Rs. 54·56
(C) Rs. 56
(D) None of these
(III) Banker's gain and—
(A) Rs. 6·56
(B) Rs. 1·44
(C) Rs. 0·56
(D) None of these
(IV) Money received by the holder of the bill—
(A) Rs. 5599·56
(B) Rs. 5599·44
(C) Rs. 5599
(D) None of these

39. A banker paid 5767·50 for a bill of Rs. 5840, drawn on April 4 at 6 months. On what day was the bill discounted the rate of interest being 7% ?
(A) 3rd Aug. (B) 4th Aug.
(C) 3rd Sep. (D) 3rd July

40. The banker's discount on a sum of money for $1\frac{1}{2}$ years is Rs. 60 and the true discount on the same sum for 2 years is Rs. 75. The rate per cent is—
(A) 5% (B) 6%
(C) $6\frac{2}{3}\%$ (D) $3\frac{1}{3}\%$

41. A bill is discounted at 5% per annum. If banker's discount be allowed, at what rate per cent must the proceeds be invested, so that nothing may be lost ?
(A) 5% (B) $4\frac{19}{21}\%$
(C) $5\frac{5}{19}\%$ (D) 10%

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Answers with Hints

1. (B) Sum $= \frac{\text{B.D.} \times \text{T.D.}}{\text{B.D.} - \text{T.D.}} = \text{Rs.} \left(\frac{36 \times 30}{6}\right)$

$= \text{Rs. } 180$

2. (A) T.D. $= \frac{\text{B.G.} \times 100}{\text{Rate} \times \text{Time}} = \text{Rs.} \frac{80 \times 100}{5 \times 2} = \text{Rs. } 800$

3. (B) B.G. $= \frac{(\text{T.D.})^2}{\text{P.W.}} = \text{Rs.} \left(\frac{160 \times 160}{1600}\right) = \text{Rs. } 16$

4. (B) Let B.D. be Re. 1. Then B.G. = Re. $\left(\frac{3}{23}\right)$

$\therefore$ T.D. $= \text{Re.} \left(1 - \frac{3}{23}\right) = \text{Re.} \left(\frac{20}{23}\right)$

$$\text{Sum} = \text{Rs.} \left[\frac{\left(1 \times \frac{20}{23}\right)}{\left(1 - \frac{20}{23}\right)}\right] = \text{Rs.} \frac{20}{3}$$

$\therefore$ S.I. on Rs. $\frac{20}{3}$ for $2\frac{1}{2}$ years is Re. 1

$\therefore$ Rate $= \left(\frac{100 \times 1}{\frac{20}{3} \times \frac{5}{2}}\right)\% = 6\%$

5. (C) Let T.D. be Re. 1. Then, B.D.

$= \text{Rs.} \left(\frac{11}{10}\right) = \text{Rs. } 1{\cdot}10$

$\therefore$ Sum $= \text{Rs.} \left(\frac{1{\cdot}10 \times 1}{1{\cdot}10 - 1}\right) \text{Rs.} \frac{1{\cdot}10}{0{\cdot}10} = \text{Rs. } 11$

So, S.I. on Rs. 11 for 2 years is Rs. 1·10

$\therefore$ Rate $= \left(\frac{100 \times 1{\cdot}10}{11 \times 2}\right)\% = 5\%$

6. (C) B.G. $= \frac{(\text{T.D.})^2}{\text{P.W.}} = \text{Rs.} \left(\frac{36 \times 36}{800}\right) = \text{Rs. } 1{\cdot}62$

$\therefore$ B.D. $= (\text{T.D.}) + (\text{B.G.}) = \text{Rs. } (36 + 1{\cdot}62)$

$= \text{Rs. } (37{\cdot}62)$

7. (C) P.W. $= \text{Rs. } (540 - 90) = \text{Rs. } 450$

S.I. on Rs. 450 $= \text{Rs. } 90$

B.D. $=$ S.I. on Rs. 540

$= \text{Rs.} \left(\frac{90}{450} \times 540\right) = \text{Rs. } 108$

8. (A) T.D. $= \frac{\text{B.G.} \times 100}{\text{R} \times \text{T}} = \text{Rs.} \left(\frac{90 \times 100}{5 \times 3}\right)$

$= \text{Rs. } 600$

$\therefore$ B.D. $= \text{Rs. } (600 + 90) = \text{Rs. } 690$

9. (C) Let the sum be Rs. 100. Then B.D. = Rs. 5

Proceeds $= \text{Rs. } (100 - 5) = \text{Rs. } 95$

$\therefore$ Rs. 5 must be the interest on Rs. 95 for 1 year

So, rate $= \left(\frac{100 \times 5}{95 \times 1}\right) = 5\frac{5}{19}\%$

10. (C) T.D. $= \sqrt{\{(\text{P.W.})\} \times \{(\text{B.G.})\}}$

$= \text{Rs. } \sqrt{(576 \times 1)} = \text{Rs. } 24$

11. (D) T.D. $= \frac{\text{B.D.} \times 100}{100 + (\text{R} \times \text{T})} = \text{Rs.} \left\{\frac{37{\cdot}08 \times 100}{100 + \left(6 \times \frac{1}{2}\right)}\right\}$

$= \text{Rs. } 36$

12. (B) T.D. $= \frac{\text{B.G.} \times 100}{\text{R} \times \text{T}} = \text{Rs.} \left(\frac{1 \times 100}{5 \times 1}\right) = \text{Rs. } 20$

13. (D) B.D. for $\left(\frac{3}{2}\right)$ years $= \text{Rs. } 60$

B.D. for 2 years $= \text{Rs.} \left(\frac{60 \times 2}{3} \times 2\right)$

$= \text{Rs. } 80$

Now, B.D. = Rs. 80; T.D. = Rs. 75 and Time = 2 years

$\therefore$ Sum $= \text{Rs.} \left(\frac{80 \times 75}{5}\right)$

$= \text{Rs. } 1200$

$\therefore$ Rs. 80 is S.I. on Rs. 1200 for 2 years.

So, rate $= \left(\frac{100 \times 80}{1200 \times 2}\right)\% = 3\frac{1}{3}\%$

14. (A) S.I. a Rs. 1600 = T.D. on Rs. 1624

$\therefore$ Rs. 1600 is P.W. of Rs. 1624 *i.e.*, Rs. 24 is the S.I. on Rs. 1600 at 6%.

$\therefore$ Time $= \left(\frac{100 \times 24}{1600 \times 6}\right) \text{year} = \frac{1}{4} \text{year}$

$= 3 \text{ months}$

15. (B) Sum $= \frac{\text{B.D.} \times \text{T.D.}}{\text{B.D.} - \text{T.D.}} = \text{Rs.} \left(\frac{50 \times 45}{5}\right) = \text{Rs. } 450$

Now, Rs. 50 is S.I. on Rs. 450 for $\left(\frac{5}{3}\right)$ years

$\therefore$ Rate $= \left(\frac{100 \times 50}{450 \times \frac{5}{3}}\right)\% = 6\frac{2}{3}\%$

16. (A) Amount $= \text{Rs. } 1860$, True discount

$= \text{Rs. } 60$

$\therefore$ Present worth $= \text{Rs. } 1860 - \text{Rs. } 60 = \text{Rs. } 1800$

S.I. on Rs. 1800 for 8 months

$= \text{Rs. } 60$

$\therefore$ Rate $= \left[\frac{100 \times 60}{1800 \times \frac{2}{3}}\right]\% = 5\%$

$\therefore$ Banker's discount $= \frac{1860 \times 5 \times \frac{2}{3}}{100} = \text{Rs. } 62$

17. (A)

18. (C)

19. (D) P.W. $= \text{Rs. } 1860 - \text{Rs. } 60 = \text{Rs. } 1800$

$\therefore$ B.G. $= \frac{(\text{T.D.})^2}{\text{P.W.}} = \frac{60 \times 60}{1800} = \text{Rs. } 2$

20. (A)

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21. (B) Difference between banker's discount and the true discount = Banker's gain.

$$\therefore \text{ Required answer } = \frac{8100 \times 5 \times \frac{1}{4} \times 5 \times \frac{1}{4}}{100\left(100 + 5 \times \frac{1}{4}\right)}$$

$$= \text{Rs. } 1{\cdot}25$$

22. (C) $37{\cdot}08 = \text{T.D.}\left[1 + \frac{3}{100}\right]$

$$\therefore \quad \text{T.D.} = \frac{3708}{103} = \text{Rs. } 36$$

23. (C) $$\text{T.D.} = \frac{90 \times 100}{3 \times 5} = \text{Rs. } 600$$

$\therefore$ Banker's discount = True discount + Banker's gain

= Rs. 600 + Rs. 90

= Rs. 690

24. (A) $$\text{T.D.} = \frac{16 \times 100}{\frac{4}{3} \times \frac{15}{2}} = \text{Rs. } 160$$

B.D. = Rs. 160 + Rs. 16 = Rs. 176

$$\therefore \quad \text{Sum} = \frac{176 \times 100}{\frac{4}{3} \times \frac{15}{2}} = \text{Rs. } 1760$$

25. (B) $$\text{T.D.} = \frac{\text{B.G.} \times 100}{\text{R} \times \text{T}} = \left(\frac{1 \times 100}{5 \times 1}\right) = \text{Rs. } 20$$

26. (A) $$\text{P.W.} = 8 \times \frac{100 \times 100}{10 \times 10} = \text{Rs. } 800$$

27. (A) $$\text{T.D.} = \sqrt{\text{P.W.} \times \text{B.G.}}$$

or $$\text{B.G.} = \frac{(\text{T.D.})^2}{\text{P.W.}} = \left(\frac{110 \times 110}{1100}\right) = \text{Rs. } 11$$

$\therefore$ B.D. = B.G. + T.D. = Rs. (11 + 110) = Rs. 121

28. (A) $$\text{Sum} = \frac{\text{B.D.} \times \text{T.D.}}{\text{B.D.} - \text{T.D.}} = \frac{\text{B.D.} \times \text{T.D.}}{\text{B.G.}}$$

$$\therefore \quad \frac{\text{T.D.}}{\text{B.G.}} = \frac{\text{Sum}}{\text{B.D.}} = \frac{1650}{165} = \frac{10}{1}$$

i.e., if B.G. is Re. 1, T.D. = Rs. 10 or B.D. = Rs. 11

$\therefore$ if B.D. is Rs. 11, T.D. = Rs. 10

If B.D. is Rs. 165, T.D. = Rs. $\left[\frac{10}{11} \times 165\right]$ = Rs. 150

Also, BG = Rs. (165 – 150) = Rs. 15

29. (C) $$160 = \sqrt{1600 \times \text{B.G.}}$$

$$\therefore \quad \text{B.G.} = \frac{160 \times 160}{1600} = \text{Rs. } 16$$

$\therefore$ Banker's discount = 160 + 16 = Rs. 176

[$\because$ B.D. = T.D. + B.G.]

30. (C) $$\text{T.D.} = \sqrt{(\text{P.W.} \times \text{B.G.})} = \sqrt{(576 \times 1)} = \text{Rs. } 24$$

31. (A) $$\text{Sum} = \frac{\text{B.D.} \times \text{T.D.}}{\text{B.D.} - \text{T.D.}} = \left(\frac{52 \times 50}{2}\right) = \text{Rs. } 1300$$

Since B.D. is S.I. on sum due, so S.I. on Rs. 1300 for 8 months is Rs. 52 consequently.

$$\text{Rate} = \left(\frac{100 \times 52}{1300 \times \frac{2}{3}}\right)\% = 6\%$$

32. (A) Interest on Sum – True discount

= Interest on true Discount.

Proof Sum = P.W. + T.D.

$\therefore$ Interest on Sum = Interest on P.W. + Interest on T.D.

= T.D. + Interest on T.D.

Interest on Sum – T.D. = Interest on T.D. or Banker's gain = Int. on T.D.

In the given question, we have

Rs. 67·20 – Rs. 60 = Interest on Rs. 60

$$\therefore \quad \text{Rs. } 7\frac{1}{5} = \text{Interest on Rs. } 60$$

$$\therefore \quad \text{Re. } 1 = \text{Interest on Rs. } \frac{60}{7\frac{1}{5}}$$

$$\therefore \quad \text{Rs. } 67\frac{1}{5} = \text{Interest on Rs. } \frac{60}{7\frac{1}{5}} \times 67\frac{1}{5}$$

$\therefore$ The required sum = Rs. $\frac{60}{7\frac{1}{5}} \times 67\frac{1}{5} = \text{Rs. } 560$

33. (A) S.I. on Rs. 1600 = T.D. on Rs. 1624

$\therefore$ Rs. 1600 is P.W. of Rs. 1624 *i.e.*, Rs. 24 is the S.I. on Rs. 1600 at 6%

$$\therefore \quad \text{Time} = \left(\frac{100 \times 24}{1600 \times 6}\right) = \frac{1}{4} \text{ year}$$

= 3 months

34. (D) Rate per cent $$= \frac{100 \times 2}{5}\left[\frac{3}{23 - 3}\right] = 6\%$$

35. (A) Let the amount of bill be Rs. 100

Money deducted = Rs. 4

Money received by holder of the bill

= Rs. (100 – 4) = Rs. 96

S.I. on Rs. 96 for 10 months = Rs. 4

$$\text{Rate} = \left[\frac{100 \times 4 \times 6}{96 \times 5}\right] = 5\%$$

36. (A) Date on which the bill was drawn

= March 8th and 7 months

Nominally due date = Oct. 8th

Legally due date Oct. 11th.

Date on which the bill was discounted = May 18th

Time for which the bill has yet to run

May, June, July, Aug, Sep, Oct.

$$13 + 30 + 31 + 31 + 30 + 11 = 146 \text{ days} \frac{2}{5} \text{ years}$$

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Now (I) (D) Banker's gain = S.I. on T.D.

i.e. Rs. 3 is S.I. on T.D. for $\frac{2}{5}$ years at 5%

$\therefore$ T.D. = Rs. $\frac{100 \times 3}{5 \times \frac{2}{5}}$ = Rs. 150

(II) (A) B.D. = T.D. + S.I. on T.D.

= Rs. 150 + S.I. on Rs. 150 for $\frac{2}{5}$ years at 5%

= Rs. 150 + Rs. $150 \times \frac{2}{5} \times \frac{5}{100}$

= Rs. 153

(III) (A) Sum = $\frac{\text{B.D.} \times \text{T.D.}}{\text{B.D.} - \text{T.D.}} = \frac{153 \times 150}{153 - 150}$

= Rs. 7650

37. (A) Clearly S.I. on Rs. 17850 at 5% is Rs. 357.

$\therefore$ Time = $\left(\frac{100 \times 357}{17850 \times 5}\right) = \frac{2}{5}$ = 146 days

So, the bill is 146 days prior to 24th May, the legally due date

May, April, March, Feb., Jan., Dec.,

24 + 30 + 31 + 28 + 31 + 2 = 146 days

So, the bill was discounted on 29 Dec., 1990.

38. (I) (A) Face value of the bill = Rs. 5656

Date on which the bill was drawn = July 14th at 5 months.

Nominally due date = December 14th.

Legally due date = December 17th.

Date on which the bill was discounted = October 5th period for which the bill has yet to run.

Oct., Nov., Dec.

26 + 30 + 17 = 73 days or $\frac{1}{5}$ year

$\therefore$ B.D. = S.I. on Rs. 5656 for $\frac{1}{5}$ year at 5%

= Rs. $\left(\frac{5656 \times 1 \times 5}{100 \times 5}\right)$ = Rs. 56·56

(II) (C) T.D. = Rs. $\left\{\frac{5656 \times 5 \times \frac{1}{5}}{100 + \left(5 \times \frac{1}{5}\right)}\right\}$ = Rs. 56

(III) (C) B.G. = B.D. – T.D. = 56 paise.

(IV) (B) Money received by the holder of the bill

= Rs. (5656 – 56·56) =Rs. 5599·44.

39. (A) B.D. = Rs. (5840 – 5767·20)

= Rs. 72·80

Rs. 72·80 is S.I. on Rs. 5840 at 7%.

So, Unexpired time = $\frac{100 \times 72{\cdot}80}{7 \times 5840} = \frac{13}{73}$ years

= 65 days.

Now, date of draw of bill = April, 4 at 6 months.

Nominally due date = October 4.

Legally due date = October 7

So, we must go back 65 days from October 7.

Oct., Sept., Aug. = 7 + 30 + 28

i.e., The bill was discounted on 3rd August.

40. (D) B.D. for $\left(\frac{3}{2}\right)$ years = Rs. 60

B.D. for 2 years = Rs. $\left(\frac{60 \times 2}{3} \times 2\right)$

= Rs. 80

Now, B.D. = Rs. 80, T.D. = Rs. 75

and Time = 2 years.

$\therefore$ Sum = Rs. $\left(\frac{80 \times 75}{5}\right)$

= Rs. 1200

$\therefore$ Rs. 80 is S.I. on Rs. 1200 for 2 years.

So, rate = $\left(\frac{100 \times 80}{1200 \times 2}\right)\% = 3\frac{1}{3}\%$

41. (C) Let the sum be Rs. 100. Then, B.D. = Rs. 5.

Proceeds = Rs. (100 – 5) = Rs. 95.

$\therefore$ Rs. 5 must be the interest on Rs. 95 for 1 year.

So, rate = $\left(\frac{100 \times 5}{95 \times 1}\right) = 5\frac{5}{19}\%$

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Data Analysis

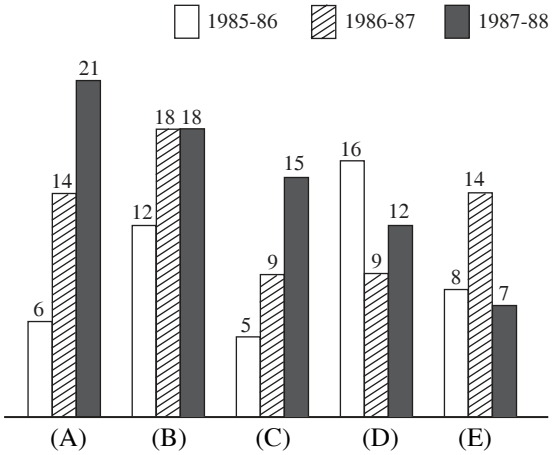
Bar Diagrams

(1) In multiple bar diagrams two or more adjacent vertical bars are drawn to represent two or more phenomenon for the same place or period.

Examples

Q. 1. Examine the following graph carefully and answer the questions given below it :

Production of cotton bales of 100 kg each in lacs in states A, B, C, D & E during 1985-86, 1986-87 and 1987-88.



1. The production of state D in 1986-87 is how many times its production in 1987-88 ?
   (A) 1·33 (B) 0·75
   (C) 0·56 (D) 1·77
2. In which states is there a steady increase in the production of cotton during the given period ?
   (A) A and B (B) A and C
   (C) B only (D) D and E
3. How many tonnes of cotton was produced by state E during the given period ?
   (A) 2900 (B) 29000
   (C) 290000 (D) 2900000
4. How many states showing below average production in 1985-86 showed above average production in 1986-87 ?
   (A) 4 (B) 2
   (C) 3 (D) 1
5. Which of the following statements is false ?
   (A) States A and E showed the same production in 1986-87
   (B) There was no improvement in the production of cotton in state B during 1987-88
   (C) State A has produced maximum cotton during the given period
   (D) Products of states C and D together is equal to that of state B during 1986-87

Answers with Hints

1. (B) $\frac{\text{Production in 1986-87}}{\text{Production in 1987-88}} = \frac{9}{12} = \frac{3}{4}$

   $\therefore$ Production in 1986-87 is $\frac{3}{4}$ times production in 1987-88

   = 0·75 times production in 1987-88.
2. (B) Clearly, there is a steady increase in production in A and C during the given period.
3. (B) Total number of bales produced by E during the given period

   = (8 + 14 + 7) *i.e.*, 29 lacs.

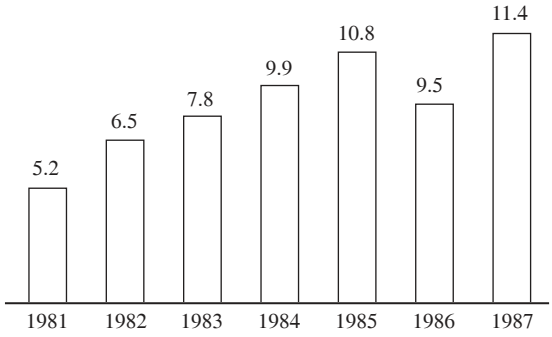
   Its weight = $\left(\frac{29 \times 100000 \times 100}{1000}\right)$ tonnes

   = 29000 tonnes.
4. (D) Average production of states A, B, C, D and E are 13·66, 16, 9·66, 12·33, 9·66.

   So states A, B and E showed below average production in 1985-86, but above average production in 1986-87.
5. (C) State B has 48 lacs of bales, while state A has only 41 lacs of bales during the given period.

Q. 2. Study the following graph carefully and answer the questions given below it—

Export of pearls in crores of Rupees



1. In which year there was maximum percentage increase in export of pearls to that in the previous year ?
   (A) 1982 (B) 1987
   (C) 1985 (D) 1984
2. In which of the following pairs of years was the average export of pearls around 9 crores ?
   (A) 1982 and 1983 (B) 1983 and 1984
   (C) 1984 and 1985 (D) 1985 and 1986

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3. In how many years was the export above the average for the given period ?

(A) 2 (B) 3

(C) 4 (D) 5

4. In which year was the export equal to the average export of the preceding and the following year ?

(A) 1982 (B) 1983

(C) 1985 (D) 1986

5. What was the percentage increase in export from 1986 to 1987 ?

(A) $16\frac{2}{3}\%$ (B) 20%

(C) 19% (D) $33\frac{1}{3}\%$

Answers with Hints

1. (D) Percentage increase in export of pearls in—

(i) 1982 over 1981 $= \frac{1{\cdot}3}{5{\cdot}2} \times 100 = 25\%$

(ii) 1983 over 1982 $= \frac{1{\cdot}3}{6{\cdot}5} \times 100 = 20\%$

(iii) 1984 over 1983 $= \frac{2{\cdot}1}{7{\cdot}8} \times 100 = 26{\cdot}9\%$

(iv) 1985 over 1984 $= \frac{0{\cdot}9}{9{\cdot}9} \times 100 = 9{\cdot}09\%$

(v) 1987 over 1986 $= \frac{1{\cdot}9}{9{\cdot}5} \times 100 = 20\%$

So, the maximum percentage increase in the export was in the year 1984.

2. (B) Average export in 1983 and 1984 is

$= \left(\frac{7{\cdot}8 + 9{\cdot}9}{2}\right) = 8{\cdot}85$ crores

= 9 crores (Approx.)

3. (C) Average

$= \frac{5{\cdot}2 + 6{\cdot}5 + 7{\cdot}8 + 9{\cdot}9 + 10{\cdot}8 + 9{\cdot}5 + 11{\cdot}4}{7}$

$= \frac{61{\cdot}1}{7} = 8{\cdot}73$

So, the export above the average was in the year 1984, 1985, 1986 and 1987.

4. (A) Average of 1981 and 1983

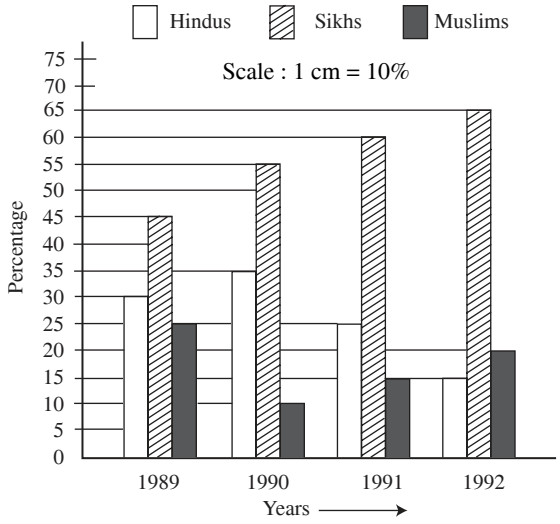
$= \frac{5{\cdot}2 + 7{\cdot}8}{2} = 6{\cdot}5$

= Export in 1982.

5. (B) Percentage increase from 1986 to 1987

$= \left(\frac{11{\cdot}4 - 9{\cdot}5}{9{\cdot}5}\right) \times 100 = \frac{1{\cdot}9}{9{\cdot}5} \times 100 = 20\%.$

Q. 3. Given below is a bar diagram showing the percentage of Hindus, Sikhs and Muslims in a state during the years 1989 to 1992.



Study the above diagram and mark a tick against the correct answer in each one of the following questions—

1. The ratio between Hindus and Sikhs in 1989 was—

(A) 3 : 2 (B) 2 : 3

(C) Cannot be calculated (D) 4 : 5

2. If the total population of the state in 1990 is 1 million, then the Hindus population was—

(A) 35000000 (B) 3500000

(C) 350000 (D) 35000

3. What was the percentage of Sikhs over Hindus in 1991 ?

(A) 35% (B) 40%

(C) 140% (D) 240%

4. What percentage was the decrease in Hindus population from 1989 to 1992 ?

(A) 15% (B) 45%

(C) 50% (D) 25%

5. If the population of the state in 1989 be 6 lakhs, then what is the total population of Hindus and Muslims in this year ?

(A) 270000 (B) 3300000

(C) 330000 (D) 33000

6. During which year was the Hindu percentage maximum ?

(A) 1989 (B) 1990

(C) 1991 (D) 1992

7. What percentage was the increase in Muslim population from 1990 to 1992 ?

(A) 10% (B) 100%

(C) 200% (D) 20%

8. If the total population in 1992 is 2 millions, then the Sikhs population is—

(A) 1300000 (B) 130000

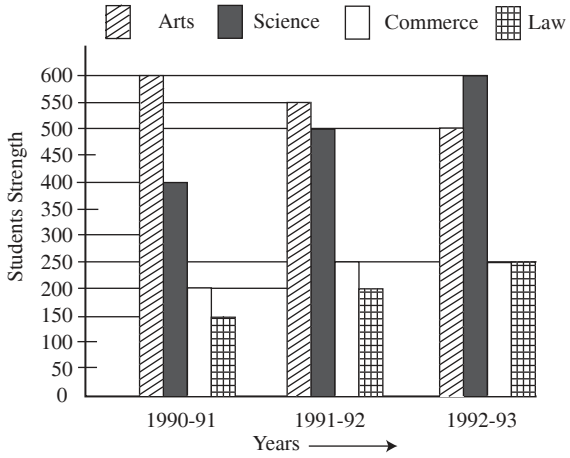
(C) 13000 (D) 13000000

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Answers with Hints

1. (B) In 1989, the percentages of Hindus and Sikhs were 30 and 45 respectively. So, the ratio of Hindus and Sikhs was 30 : 45 or 2 : 3.
2. (C) In 1990, Hindu population
   = 35% of total population
   $= \frac{35}{100} \times (10000{,}00) = 350{,}000$
3. (D) In 1993, Hindus = 25%, Sikhs = 60%
   ∴ Percentage of Sikhs over Hindus
   $= \left(\frac{60}{25} \times 100\right) = 240\%$
4. (C) Hindus in 1989 = 30%
   Hindus in 1992 = 15%
   Over 30, decrease = 15%
   Over 100, decrease $= \left(\frac{15}{30} \times 100\right) = 50\%$
5. (C) In 1989, Sikh population = (45% of 600000)
   $= \left(\frac{45}{100} \times 600000\right) = 270000$
   ∴ (Hindus + Muslims) = 600000 – 270000
   = 330000
6. (B) A quick observation of the chart shows that Hindus in 1989, 90, 91, and 92 were 30%, 35%, 25%, 15% respectively.
   So, the maximum Hindu percentage was in 1990.
7. (B) Muslim population in 1990 = 10%
   Muslim population in 1992 = 20%
   Increase on 10 = 10
   Increase on 100 $= \left(\frac{10}{10} \times 100\right)\%$ = 100%
8. (A) In 1992, Sikh population = (65% of 2000000)
   $= \left(\frac{65}{100} \times 2000000\right)$
   = 1300000

Q. 4. Shown below is the multiple bar diagram depicting the changes in the student's strength of a college in four faculties from 1990-91 to 1992-93. (Scale 1 cm = 100)



Study the above multiple bar chart and mark a tick against the correct answer in each of the following questions—

1. The percentage of students in science faculty in 1990-91 was—
   (A) 26·9% (B) 27·8%
   (C) 29·6% (D) 30·2%
2. The percentage of students in law faculty in 1992-93 was—
   (A) 18·5% (B) 15·6%
   (C) 16·7% (D) 14·8%
3. How many times was the total strength of the strength of commerce students in 1991-92 ?
   (A) 3 times (B) 4 times
   (C) 5 times (D) 6 times
4. During which year the strength of arts faculty was minimum ?
   (A) 1990-91 (B) 1991-92
   (C) 1992-93 (D) None of these
5. How much percent was the increase in science students in 1992-93 over 1990-91 ?
   (A) 50% (B) 150%
   (C) $66\frac{2}{3}\%$ (D) 75%
6. A regular decrease in students strength was in the faculty of—
   (A) Arts (B) Science
   (C) Commerce (D) Law

Answers with Hints

1. (C) Total number of students in 1990-91
   = (600 + 400 + 200 + 150) = 1350
   Number of science students in 1990-91 was 400
   Percentage of science students in 1990-91
   $= \left(\frac{400}{1350} \times 100\right)\% = 29{\cdot}6\%$
2. (B) Total number of students in 1992-93
   = (500 + 600 + 250 + 250) = 1600
   Number of law students in 1992-93 is 250
   Percentage of law students in 1992-93
   $= \left(\frac{250}{1600} \times 100\right)\% = 15{\cdot}6\%$
3. (D) Total strength in 1991-92
   = (550 + 500 + 250 + 200) = 1500
   $\therefore \frac{\text{Total strength}}{\text{Strength of commerce students}}$
   $= \frac{1500}{250} = 6$

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4. (C) A slight look indicates that the strength in arts faculty in 1990-91, 1991-92 and 1992-93 was 550, 600 and 500 respectively. So, it was minimum in 1992-93.

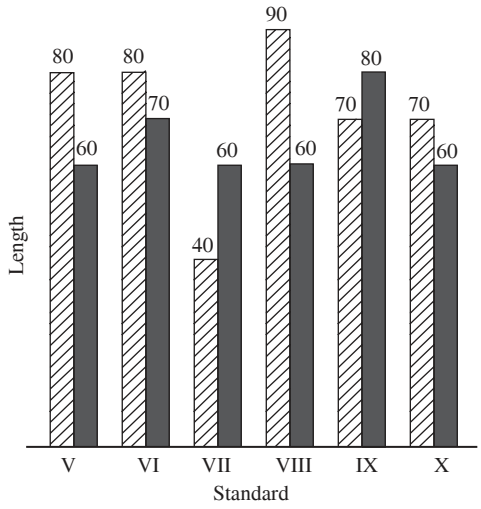
5. (A) Number of science students in 1990-91 was 400

   Number of science students in 1992-93 was 600

   Percentage increase = $\left(\frac{200}{400} \times 100\right)\% = 50\%$

6. (A) As the diagram shows the decrease every year is in arts faculty. So, answer (A) is correct.

Q. 5. Study the following graph and answer the qeustions given below—



1. In which standard is the difference between the results of girls and boys maximum ?
   (A) V (B) VII
   (C) X (D) VIII

2. In which standard is the result of boys less than the average result of the girls ?
   (A) VII (B) IX
   (C) VI (D) VIII
   (E) V

3. In which pair of standards are the results of girls and boys in inverse proportion ?
   (A) V and X (B) V and VI
   (C) VI and VIII (D) V and IX
   (E) VI and IX

4. In which standard is the result of the girls more than the average result of the boys for the school?
   (A) IX (B) VIII
   (C) VI (D) X
   (E) None of these

5. In which standard is the failure of girls lowest ?
   (A) X (B) VII
   (C) VIII (D) V
   (E) None of these

Answers with Hints

1. (D) The difference between the results of girls and boys :

   in V standard is 20; in VI standard is 10; in VII standard is 20; in VIII standard is 30; in IX standard is 10 and in X standard is 10.

   So, it is maximum in VIII standard.

2. (A) Average result of girls

   $= \frac{1}{6}(60 + 70 + 60 + 60 + 80 + 60)$

   $= \frac{390}{6} = 65\%$

   So, in VII standard the result of boys is less than the average result of the girls. Therefore, (A) is correct.

3. (E) In VI standard, the result of boys and girls are in the ratio 8 : 7. While in IX standard, the results of boys and girls are in the ratio 7 : 8.

4. (A) Average result of boys

   $= \frac{1}{6}(80 + 80 + 40 + 90 + 70 + 70)$

   $= \frac{430}{6} = 71{\cdot}7\%$

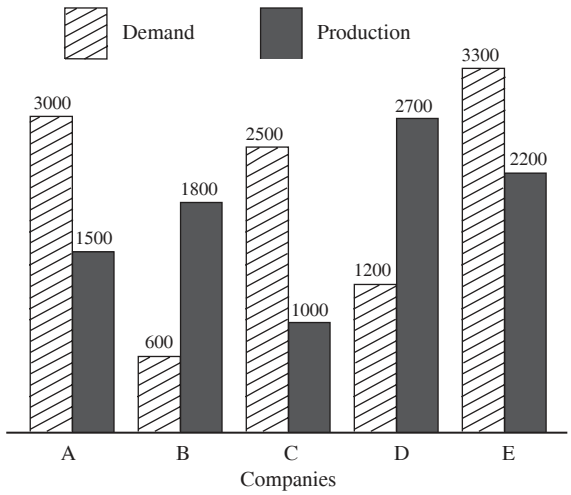
   Clearly in IX standard the result of girls is more than the average result of the boys.

5. (E) Maximum number of girls passed is in IX standard.

   So, the failure of girls is lowest in IX standard.

Q. 6. Study the following graph carefully and answer the questions—

Demand, Production of colour T.Vs. of Five Companies of October 1988



1. What is the ratio of companies having more demand than production to those having more production than demand ?
   (A) 2 : 3 (B) 4 : 1
   (C) 2 : 2 (D) 3 : 2

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2. What is the difference between average demand and average production of the five companies taken together ?
   (A) 1400 (B) 400
   (C) 280 (D) 138
   (E) None of these
3. The production of company D is approximately how many times that of the production of the company A ?
   (A) 1·8 (B) 1·5
   (C) 2·5 (D) 1·11
   (E) None of these
4. The demand for company 'B' is approximately what per cent of the demand for company 'C' ?
   (A) 4 (B) 24
   (C) 20 (D) 60
5. If company 'A' desire to meet the demand by purchasing surplus T. V. sets from a single company, which one of the following companies can meet the need adequately ?
   (A) B (B) C
   (C) D (D) None of these

Answers with Hints

1. (D) The companies having more demand than production are A, C and E *i.e.*, their number is 3.

   The companies having more production than demand are B and D *i.e.*, their number is 2.

   So, the required ratio is 3 : 2.
2. (C) Average demand

   $$= \frac{1}{5}(3000 + 600 + 2500 + 1200 + 3300) = 2120$$

   Average production

   $$= \frac{1}{5}(1500 + 1800 + 1000 + 2700 + 2200) = 1840$$

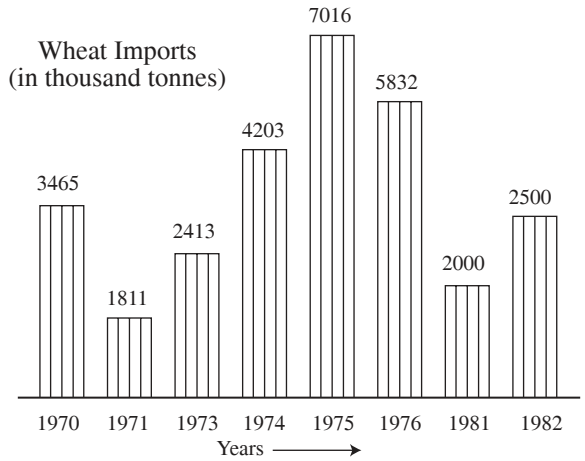
   ∴ Difference between average demand and average production = (2120 – 1840) = 280
3. (A) Let K (1500) = 2700

   or $$K = \frac{2700}{1500} = 1{\cdot}8$$
4. (B) Let x% of (demand for C) = (demand for B)

   i.e., $$\frac{x}{100} \times 2500 = 600$$

   or $$x = \left(\frac{600 \times 100}{2500}\right) = 24\%$$
5. (C) Since company D produces highest number of T. V. sets and company A desires to meet the demand by purchasing surplus T. V. sets from a single company. Clearly, D can meet the demand of A.

Q. 7. Study the graph carefully and answer the questions below it—



1. In which year did the imports register highest increase over its preceding year ?
   (A) 1973 (B) 1974
   (C) 1975 (D) 1982
2. The imports in 1976 was approximately how many times that of the year 1971 ?
   (A) 0·31 (B) 1·68
   (C) 2·41 (D) 3·22
3. What is the ratio of the years which have above average imports to those which have below average imports ?
   (A) 5 : 3 (B) 2 : 6
   (C) 8 : 3 (D) 3 : 8
   (E) None of these
4. The increase in imports in 1982 was what per cent of the imports in 1981 ?
   (A) 25 (B) 5
   (C) 125 (D) 80
5. The imports in 1974 is approximately what per cent of the average imports for the given years ?
   (A) 125 (B) 115
   (C) 190 (D) 85
   (E) 65

Answers with Hints

1. (C) Increase in imports in
   1973 over 1971 is (2413 – 1811)
   = 602 thousand tonnes
   1974 over 1973 is (4203 – 2413)
   = 1790 thousand tonnes
   1975 over 1974 is (7016 – 4203)
   = 2813 thousand tonnes
   1982 over 1981 is (2500 – 2000)
   = 500 thousand tonnes
   ∴ Highest increase over preceding year is in 1975.

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2. (D) Let K (1811) = 5832.

Then, $K = \frac{5832}{1811} = 3{\cdot}22$ thousand tonnes

3. (E) Average of the imports

$= \frac{1}{8}(3465 + 1811 + 2413 + 4203 + 7016 + 5832 + 2000 + 2500) = 3655$

The years in which the imports are above average are 1974, 1975 and 1976 *i.e.*, there are 3 such years.

The years in which the imports are below average are 1970, 1971, 1973, 1981 and 1982 *i.e.*, there are 5 such years

$\therefore$ Required ratio is 3 : 5.

4. (A) Increase in imports in 1982 over 1981

$= \left(\frac{2500 - 2000}{2000} \times 100\right)\% = 25\%.$

5. (B) Average import = 3655 thousand tonnes

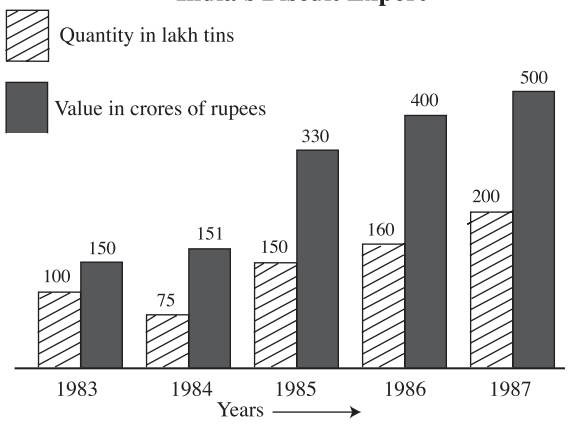
Import in 1974 = 4203 thousand tonnes

Let x% of 3655 = 4203

Then, $x = \left(\frac{4203 \times 100}{3655}\right) = 115\%$

Q. 8. Study the following graph carefully and answer the following questions—

India's Biscuit Export



1. In which year the value per tins was minimum ?
   (A) 1983 (B) 1984
   (C) 1985 (D) 1986
   (E) 1987

2. What was the difference between the tins exported in 1985 and 1986 ?
   (A) 10 (B) 1000
   (C) 100000 (D) 1000000
   (E) None of these

3. What was the approximate per cent increase in export value from 1983 to 1987 ?
   (A) 350 (B) 330
   (C) 43 (D) 2·4
   (E) None of these

4. What was the percentage drop in export quantity from 1983 to 1984 ?
   (A) 75 (B) Nil
   (C) 25 (D) 50
   (E) None of these

5. If in 1986 the tins were exported at the same rate per tin as that in 1985. What would be the value in cross of rupee of export in 1986 ?
   (A) 400 (B) 352
   (C) 375 (D) 330
   (E) None of these

Answers with Hints

1. (A) In 1983, the value of 100 lakh tins

= Rs. 150 crores

$\therefore$ Value of 1 tin = Rs. $\left(\frac{150 \text{ crore}}{100 \text{ lakh}}\right)$

= Rs. $\left(\frac{150}{1{\cdot}00}\right)$ = Rs. 150

Similarly in 1984 the value of 1 tin

= Rs. $\frac{150}{0{\cdot}75}$ = Rs. 200

In 1985, the value of 1 tin

= Rs. $\left(\frac{330}{1{\cdot}50}\right)$ = Rs. 220

In 1986, the value of 1 tin

= Rs. $\left(\frac{400}{1{\cdot}60}\right)$ = Rs. 250

In 1987, the value per tin

= Rs. $\frac{500}{2{\cdot}00}$ = Rs. 250

So, the value per tin is minimum in 1983

2. (D) Difference between the tins exported in 1985 and 1986 is = [(160 lakhs) – (150 lakhs)]

= 10 lakhs = 1000000.

3. (E) Percentage increase in export value from 1983 to 1987

$= \left\{\frac{(500 \text{ crore} - 150 \text{ crores})}{150 \text{ crores}} \times 100\right\}\%$

$= \left\{\frac{(500 - 150)}{150} \times 100\right\}\%$

$= \left(\frac{350}{150} \times 100\right)\% = 233{\cdot}3\%$

4. (C) Percentage drop in export quantity from 1983 to 1984

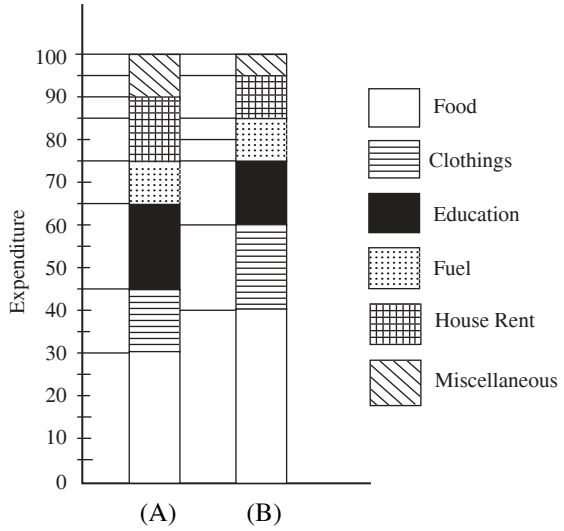
$= \left\{\frac{(100 \text{ lakh tonnes}) - (75 \text{ lakh tonnes})}{100 \text{ lakh tonnes}} \times 100\right\}$

$= \left(\frac{25}{100} \times 100\right)\% = 25\%$

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5. (B) In 1985, the cost of 150 lakh tins
= Rs. 330 crores
∴ In 1985, the cost of 1 tin
= Rs. $\frac{330 \text{ crores}}{150 \text{ lakh}}$
= $\left(\frac{330}{1{\cdot}50}\right)$ = Rs. 220
In 1986, the export value
= Rs. (160 lakh × 220)
= Rs. (1·60 × 220) crores
= Rs. 352 crores

Q. 9. Following bar diagram shows the monthly expenditure of two families on food, clothing, education, fuel, house rent and miscellaneous (in percentage).



Study the above diagram and mark a tick against the correct answer in each question.

1. What fraction of the total expenditure is spent on Education in Family A ?
(A) $\frac{13}{20}$ (B) $\frac{2}{3}$
(C) $\frac{9}{13}$ (D) None of these

2. If the total annual expenditue of family B is Rs. 10,000, then money spent on clothes during the year is—
(A) Rs. 200 (B) Rs. 2,000
(C) Rs. 600 (D) Rs. 6,000

3. If the total annual expenditure of family A is Rs. 30,000, then money spent on food, clothes and house rent is—
(A) Rs. 18,500 (B) Rs. 18,000
(C) Rs. 21,000 (D) Rs. 15,000

4. If both the families have the same expenditure, which one spends more on education and miscellaneous together ?
(A) Family A (B) Family B
(C) None (D) Both equal

5. What percentage is B's expenditure on food over A's expenditure on food ? (Taking equal total expenditure)
(A) 10% (B) 70%
(C) $133\frac{1}{3}\%$ (D) 75%

Answers with Hints

1. (C) In family A, money spent on education
= $20\% = \frac{20}{100}$
= $\frac{1}{5}$ (of total expenditure)

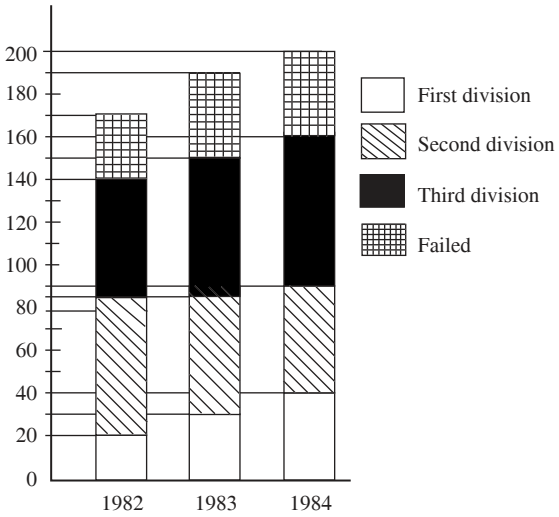
2. (B) In family B, the money spent on clothes
= (20% of total expenditure)
= Rs. $\left(\frac{20}{100} \times 10000\right)$ = Rs. 2000

3. (B) Money spent on food, clothes and house rent in family A
= (30 + 15 + 15) = 60% of total expenditure
= Rs. $\left(\frac{60}{100} \times 30000\right)$ = Rs. 18000

4. (A) Family A spends on education and miscellaneous
= (20 + 10) = 30%
Family B spends on education and miscellaneous
= (15 + 5) = 20%
So, family A spends more on these heads.

5. (C) B's expenditure on food = 40%
A's expenditure on food = 30%
B's percentage over A's = $\left(\frac{40}{30} \times 100\right)$
= $133\frac{1}{3}\%$

Q. 10. The sum-divided bar-diagram given below depicts the result of B.Sc. students of a college for three years.



Study the above bar-diagram and mark a tick against the correct answer in each question.

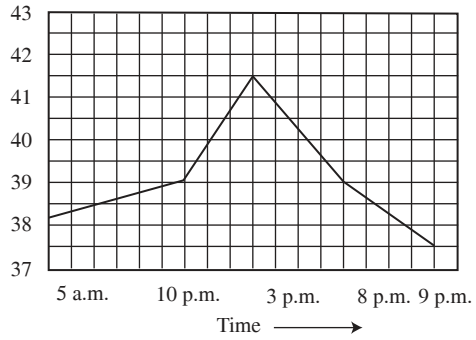
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1. How many per cent passed in Ist division in 1982 ?
   (A) 20% (B) 34%
   (C) $14\frac{2}{7}\%$ (D) $11\frac{13}{17}\%$
2. What was the pass percentage in 1982 ?
   (A) 65% (B) 70%
   (C) 74·6% (D) 88·8%
3. In which year the college had the best result for B. Sc. ?
   (A) 1982 (B) 1983
   (C) 1984 (D) None of these
4. What is the number of third divisioners in 1984 ?
   (A) 165 (B) 75
   (C) 70 (D) 65
5. What is the percentage of students in 1984 over 1982 ?
   (A) 30% (B) $17\frac{11}{17}\%$
   (C) $117\frac{11}{17}\%$ (D) 85%
6. What is the aggregate pass percentage during three years ?
   (A) $51\frac{2}{3}\%$ (B) 82·7%
   (C) 80·4% (D) 77·6%

Answers with Hints

1. (D) Percentage of 1st divisioners
$$= \left(\frac{20}{170} \times 100\right) = 11\frac{13}{17}\%$$
2. (D) Total students passed = 140
Total students appeared = 170
$$\text{Pass percentage} = \left(\frac{140}{170} \times 100\right)\% = 88{\cdot}8\%$$
3. (A) Pass percentage in 1982
$$= \left(\frac{140}{170} \times 100\right)\% = 88{\cdot}8\%$$
Pass percentage in 1983
$$= \left(\frac{150}{195} \times 100\right)\% = 76{\cdot}9\%$$
Pass percentage in 1984
$$= \left(\frac{165}{200} \times 100\right)\% = 82{\cdot}5\%$$
So, the college recorded best result in 1982.
4. (C) Third divisioners in 1984 = (165 – 95) = 70.
5. (C) Students in 1984 = 200
Students in 1982 = 170
$$\text{Required percentage} = \left(\frac{200}{170} \times 100\right)\% = 117\frac{11}{17}\%.$$
6. (C) Total number of students appeared during 3 years
$$= (170 + 195 + 200) = 565$$
Total number of students passed during 3 years
$$= (140 + 150 + 165) = 455$$
$$\text{Aggregate pass percentage} = \left(\frac{455}{565} \times 100\right)\% = 80{\cdot}4\%.$$

Q. 11. The following graph shows the temperature of a patient observed in a hospital at a certain interval of time on a certain day. Starting at 5 A.M.



Scale → 1 division = 1 hour

Scale : {Along OX → 10 small divisions = 15 minutes; Along OY = 10 small divisions = 1°C}

Study the above graph carefully and tick against the correct answer in each of the following questions—

1. What was the temperature of the patient at 2 p. m. ?
   (A) 40·8° C (B) 41·1° C
   (C) 41·5° C (D) 41·9° C
2. The time, when the temperature was recorded 40° C was—
   (A) 11 A. M. (B) 10·30 A. M.
   (C) 11·45 A. M. (D) 11·15 A. M.
3. At what time during the day, the temperature was maximum ?
   (A) 12 P. M. (B) 12·30 P. M.
   (C) 1 P. M. (D) 1·30 P. M.
4. What was the maximum temperature during the day?
   (A) 40·7° C (B) 41·5° C
   (C) 40·8° C (D) 41° C
5. The normal temperature is 37·5° C. At what time was the temperature normal ?
   (A) 5 A. M. (B) 5 P. M.
   (C) 9 P. M. (D) At no time

Answers with Hints

1. (A) Since we have taken origin at 5 A. M. So 2 P. M. is 9 hours beyond this point from this point draw a line parallel to OY to meet the graph at a point. From this point draw a line parallel to OX to meet at a point on OY. This point indicates 40·8°C.
2. (B) Reach a point on OY indicating 40°C. From this point draw a line parallel to OX to meet the graph at

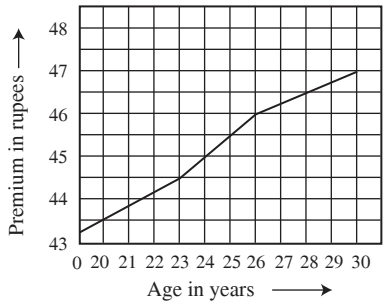
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a point. From this point draw a line parallel to OY to meet a point on OX. This point represents 10·30 A. M. So, this temperature was recorded at 10·30 A. M.

3. (C) From the highest point (along OY) on the graph, draw a line parallel to OY to meet OX at a point which is 8 divisions before a point indicating 1 P. M. So, the highest temperature was recorded at 1 P. M.
4. (B) From the heighest point (along OY) on the graph, draw a line parallel to OX to meet OY at a point indicating 41·5° C. So, the maximum temperature during the day was 41·5°C.
5. (C) We are to find the time when the temperature was 37·5° C. Along OY take the point indicating 37·5° C. From this point, draw a line parallel to OX to meet the graph at a point. From this point, draw a line parallel to OY to meet OX at a point. This point indicates 9 P. M.

   So, the temperature was normal at 9 P. M.

Q. 12. The following graph shows the annual premium of an insurance company. Charged for an insurance of Rs. 1000 for different ages.



Scale : {Along OX → 10 small division = 1 year; Along OY → 1 small division = 5 paise}

1 big division = 10 small divisions (not shown in the fig.)

Study the graph and mark a tick against the correct answer in each of the following questions—

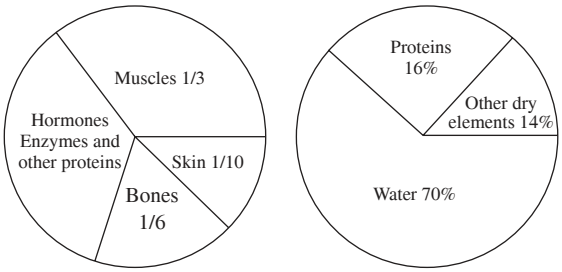
1. The premium for a man aged 26 years for an insurance of Rs. 1000 is—
   (A) Rs. 46 (B) Rs. 45·75
   (C) Rs. 44 (D) Rs. 45
2. What is the age of a person whose premium is Rs. 44·60 for an insurance of Rs. 1000 ?
   (A) 22 years (B) 23 years
   (C) 24 years (D) 25 years
3. The premium for a man aged 22 years for an insurance of Rs. 1000 is—
   (A) Rs. 435 (B) Rs. 440
   (C) Rs. 437·50 (D) Rs. 43·75
4. How much per cent of the premium is increased if a man aged 30 years is insured for Rs. 1000 instead of a man aged 23 years ?
   (A) 4·75% (B) 5·68%
   (C) 6·24% (D) 6%
5. Two members of a family aged 20 years and 25 years are to be insured for Rs. 10000 each. The total annual premium to be paid by them is—
   (A) Rs. 836·75 (B) Rs. 845·50
   (C) Rs. 870·60 (D) Rs. 885
6. Two persons aged 21 years and 23 years respectively are insured for rupees one lakh each. The difference between their premiums is—
   (A) Rs. 100 (B) Rs. 25
   (C) Rs. 50 (D) Rs. 20

Answers with Hints

1. (B) From the point indicating 26 years on OX draw a vertical line parallel to OY to meet some point in the curve. From this point draw a line parallel to OX to meet OY at a point and this point clearly indicates Rs. 45·75
2. (C) Along OY, reach the point indicating Rs. 44·60. From this point draw a line parallel to OX to meet the graph at a point. From this point, draw a line parallel to OY to meet OX at a point indicating 24 years.
3. (C) As indicated by graph, premium at the age of 22 years for an insurance of Rs. 1000 is Rs. 43·75. So for an insurance of Rs. 10000, the premium is Rs. (43·75 × 10) = Rs. 437·50.
4. (B) Premium for Rs. 1000 for a man aged 23 years
   = Rs. 44
   Premium for Rs. 1000 for a man aged 30 years
   = Rs. 46·50
   Increase % in Premium
   $= \left(\frac{2{\cdot}50}{44} \times 100\right)\% = 5{\cdot}68\%$
5. (D) Premium for Rs. 10000 at 20 years
   = Rs. (43·25 × 10) = Rs. 432·50
   Premium for Rs. 10000 at 25 years
   = Rs. (45·25 × 10) = Rs. 452·50
   Total annual premium for both
   = Rs. (432·50 + 452·50) = Rs. 885
6. (C) Premium for Rs. one lakh at 21 years
   = Rs. (100 × 43·50) = Rs. 4350
   Premium for Rs. one lakh at 23 years
   = Rs. (100 × 44) = Rs. 4400
   Difference in premiums
   = Rs. 50

Q. 13. Study the following graphs carefully and answer the questions that follow :

Distribution of proteins in human body



Distribution of elements in human body

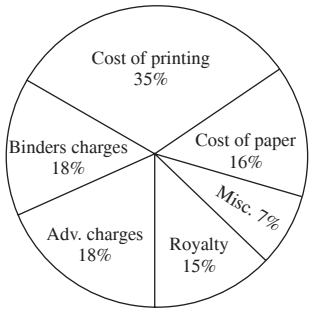
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1. What is the ratio of the distribution of proteins in the muscles to that of the distribution of proteins in the bones ?
   (A) 1 : 2 (B) 2 : 1
   (C) 18 : 1 (D) 1 : 18
2. What per cent of the total weight of the human body is equivalent to the weight of the skin in the human body ?
   (A) ·016
   (B) 1·6
   (C) ·16
   (D) Insufficient information
3. To show the distribution of proteins and other dry elements in the human body, the arc of the circle should subtend at the centre an angle of—
   (A) 126° (B) 54°
   (C) 108° (D) 252°
4. What will be the quantity of water in the body of a person weighing 50 kg ?
   (A) 35 kg (B) 120 kg
   (C) 71·42 kg (D) 20 kg
5. In the human body what is made of neither bones nor skin ?
   (A) $\frac{2}{5}$ (B) $\frac{3}{5}$
   (C) $\frac{1}{40}$ (D) $\frac{3}{80}$

Answers with Hints

1. (B) Required Ratio
$$\frac{1}{3} : \frac{1}{6} = 6 : 3 \text{ or } 2 : 1.$$
2. (B) Weight of skin
$$= \frac{1}{10} \text{ parts of } 16\% \text{ of proteins}$$
$$= \frac{1}{10} \times 16\% = 1{\cdot}6\%.$$
3. (C) Proteins and other dry elements
$$= 30\%$$
$\therefore$ Angle subtended by the required arc
$$= (30\% \text{ of } 360°) = 108°.$$
4. (A) Quantity of water in body of person weighing 50 kg.
$$= 70\% \text{ of } 50 \text{ kg} = \left(\frac{70}{100} \times 50\right) \text{kg}$$
$$= 35 \text{ kg}.$$
5. (A) Part of the body made of neither bones nor skin
$$= 1 - \left(\frac{1}{3} + \frac{1}{10} + \frac{1}{6}\right) = \left(1 - \frac{6}{10}\right) = \frac{2}{5}.$$

Q. 14. Circle graph given above shows the expenditure incurred in bringing out a book, by a publisher.



Study the graph carefully and answer the questions given below it.

1. What should be the central angle of the sector for the cost of the paper ?
   (A) 22·5° (B) 16°
   (C) 54·8° (D) 57·6°
2. If the cost of printing is Rs. 17500, the royalty is—
   (A) Rs. 8750 (B) Rs. 7500
   (C) Rs. 3150 (D) Rs. 6300
3. If the miscellaneous charges are Rs. 6000, the advertisement charges are—
   (A) Rs. 90000 (B) Rs. 1333·33
   (C) Rs. 27000 (D) Rs. 12000
4. If 5500 copies are published, miscellaneous expenditures amount to Rs. 1848 and publisher's profit is 25%, then marked price of each copy is—
   (A) Rs. 8·40 (B) Rs. 12·50
   (C) Rs. 10·50 (D) Rs. 10
5. Royalty on the book is less than the advertisement charges by—
   (A) 3% (B) 20%
   (C) $16\frac{2}{3}\%$ (D) None of these

Answers with Hints

1. (D) Requisite angle
$$= \left(\frac{16}{100} \times 360\right) = 57{\cdot}6°.$$
2. (B) If cost of printing is Rs. 35, royalty is Rs. 15
If cost of printing is Rs. 17500, royalty is
$$= \text{Rs.} \left(\frac{15}{35} \times 17500\right) = \text{Rs. } 7500$$
3. (C) If misc. charges are Rs. 4, advertisement charges
$= \text{Rs. } 18$
If misc. charges are Rs. 6000 advertisement charges
$$= \left(\frac{18}{4} \times 6000\right) = \text{Rs. } 27000$$
4. (C) If misc. charges are Rs. 4 total charges
$= \text{Rs. } 100$
If misc. charges are Rs. 1848, total charges
$$= \text{Rs.} \left(\frac{100}{4} \times 1848\right) = \text{Rs. } 46200$$
Cost price of each copy
$$= \text{Rs.} \left(\frac{46200}{5500}\right) = \text{Rs. } 8{\cdot}40$$
Marked price of each copy
$= 125\% \text{ of Rs. } 8{\cdot}40 = \text{Rs. } 10{\cdot}50$
5. (C) On Rs. 18 it is less by Rs. 3
On Rs. 100 it is less by $\left(\frac{3}{18} \times 100\right) = 16\frac{2}{3}\%$

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Tabulation

Tabulation : In studying problems on statistics, the data collected by the investigator are arranged in a systematic form, called the tabular form. In order to avoid same heads again, we make tables consisting of horizontal lines (called rows) and vertical lines (called columns) with distinctive heads known as captions. Units of measurements are given along with the captions.

Exercise

Q. 1. Following table gives the population of a town from 1988 to 1992

Year	Men	Women	Children	Total	Increase (+) or Decrease (–) over preceding year
1988	65104	60387	—	146947	—
1989	70391	62516	—	—	+ (11630)
1990	—	63143	20314	153922	—
1991	69395	—	21560	—	(– 5337)
1992	71274	—	23789	160998	—

Complete the table and mark a tick against the correct answer in each question—

(i) The number of children in 1988 is—
(A) 31236 (B) 125491
(C) 14546 (D) 21456

(ii) The total population in 1989 is—
(A) 144537 (B) 158577
(C) 146947 (D) 149637

(iii) Number of children in 1989 is—
(A) 25670 (B) 14040
(C) 13970 (D) 15702

(iv) Number of men in 1990 is—
(A) 40645 (B) 60454
(C) 70465 (D) 58835

(v) Number of women in 1991 is—
(A) 57630 (B) 56740
(C) 52297 (D) 62957

(vi) Increase or decrease of population in 1992 over 1991 is—
(A) – (12413) (B) + (12413)
(C) + 155661 (D) + 7086

Q. 2. The following data give yearwise outlay in lakhs of rupees in a certain 5 year plan (1980 – 1985) of a state, under the heads :

Transport & Communication, Education, Health, Housing and Social Welfare respectively.

1st year 56219, 75493, 13537, 9596 and 1985
2nd year 71416, 80691, 15902, 10135 and 2073
3rd year 73520, 61218, 16736, 11000 and 3918
4th year 75104, 73117, 17523, 12038 and 4102
5th year 80216, 90376, 19420, 15946 and 10523

Putting the data in the form of a table, write the total under each head and answer the following questions—

(i) During which year the outlay on Education was maximum ?
(ii) How many times, the outlay on Education was increased over preceding year ?
(iii) What is the percentage increase during 1983-84 over 1982-83 in health outlay ?
(vi) What is total outlay on Social Welfare during the plan period ?
(v) What is the ratio between outlays on Transport & (Communication) and Housing during 1984-85.

Q. 3. The table given below shows the population literates and illiterate in thousands and percentage of literacy in three states in a year—

States	Population	Literates	Illiterates	Percentage of literacy
Chennai	49342	6421	—	—
Mumbai	—	4068	16790	—
Bengal	60314	—	—	16·1

After reading the table, mark a tick against the correct answer in each question given below and hence complete the table—

(i) Percentage of Literacy in Chennai is—
(A) 14·9% (B) 13·01%
(C) 12·61% (D) 15·64%

(ii) Percentage of literacy in Mumbai is—
(A) 19·5% (B) 16·7%
(C) 18·3% (D) 14·6%

(iii) Literates in Bengal are—
(A) 50599 (B) 9715
(C) 7865 (D) 9475

Q. 4. Study the following table carefully and answer the questions given below—

Number of Boys of Standard XI Participating in Different Games

↓Games / Class →	XI A	XI B	XI C	XI D	XI E	Total
Chess	8	8	8	4	4	32
Bedminton	8	12	8	12	12	52
Table Tennis	12	16	12	8	12	60
Hockey	8	4	8	4	8	32
Football	8	8	12	12	12	52
Total no. of boys	44	48	48	40	48	228

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(a) Every student (boy or girl) of each class of standard XI participates in a game.

(b) In each class the number of girls participating in each game is 25% of the number of boys participating in each game.

(c) Each student (boy or girl) participates in one and only one game.

(i) All the boy of class XI D passed at the annual examination but a few girls failed. If all the boys and girls who passed and entered XII D and if in class XII D, the ratio of boys to girls is 5 : 1. What would be the number of girls who failed in class XI D ?

(A) 8 (B) 5

(C) 2 (D) 1

(E) None of these

(ii) Girls playing which of the following games need to be combined to yield a ratio of boys to girls of 4 : 1, if all boys playing Chess and Badminton are combined ?

(A) Table Tennis and Hockey

(B) Badminton and Table Tennis

(C) Chess and Hockey

(D) Hockey and Football

(iii) What should be he total number of students in the school if all the boys of class XI A together with all the girls of class XI B and class XI C were to be equal to 25% of the total number of students ?

(A) 272 (B) 560

(C) 656 (D) 340

(iv) Boys of which of the following classes need to be combined to equal to four times the number of girls in class XI B and class XI C ?

(A) XI D and XI E

(B) XI A and XI B

(C) XI A and XI C

(D) None of these

(v) If boys of class XI E participating in Chess together with girls of class XI B and class XI C participating in Table Tennis and Hockey respectively are selected for a course at the college of sports. What per cent of the students will get this advantage approximately ?

(A) 4·38 (B) 3·51

(C) 10·52 (D) 13·5

(vi) If for social work, every boy of class XI D and class XI C is paired with a girl of the same class, what percentage of the boys of these two classes cannot participate in social work ?

(A) 88 (B) 66

(C) 60 (D) 75

Q. 5. Study the following table carefully and answer the questions given below—

Financial Statement of a Company over the Year

Rs. (in lakh)

Year	Gross Turnover Rs.	Profit before interest and depre-ciation	Interest Rs.	Depre-ciation Rs.	Net Profit Rs.
1980-81	1380·00	380·92	300·25	69·90	10·69
1981-82	1401·00	404·98	315·40	71·12	18·46
1982-83	1540·00	520·03	390·85	80·02	49·16
1983-84	2112·00	599·01	444·44	88·88	65·69
1984-85	2520·00	811·00	505·42	91·91	212·78
1985-86	2758·99	920·00	600·20	99·00	220·80

(i) During which year did the 'Net Profit' exceed Rs. 1 crore for the first time ?

(A) 1985-86 (B) 1984-85

(C) 1983-84 (D) 1982-83

(ii) During which year was the 'Gross Turnover' closest to thrice the 'Profit before Interest and Depreciation' ?

(A) 1985-86 (B) 1984-85

(C) 1983-84 (D) 1982-83

(iii) During which year did the 'Net profit' form the highest proportion of the 'Profit' before Interest and Depreciation ?

(A) 1984-85 (B) 1983-84

(C) 1982-83 (D) 1981-82

(iv) Which of the following registered the lowest increase in terms of rupees from the year 1984-85 to the year 1985-86 ?

(A) Gross turnover

(B) Profit before Interest and Depreciation

(C) Depreciaiton

(D) Interest

(v) The 'Gross Turnover' for 1982-83 is about what per-cent of the 'Gross Turnover' for 1984-85 ?

(A) 61 (B) 163

(C) 0·611 (D) 39

Q. 6. Study the following table carefully and answer the questions given below—

Loan Disbursed by 5 Banks

Banks	Years				
	1982	1983	1984	1985	1986
A	18	23	45	30	70
B	27	33	18	41	37
C	29	29	22	17	11
D	31	16	28	32	43
E	13	19	27	34	42
Total	**118**	**120**	**140**	**154**	**203**

(i) In which year was the disbursement of loans of all the banks put together least compared to the average disbursement of loans over the years ?

(A) 1982 (B) 1983

(C) 1984 (D) 1985

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(ii) What was the percentage increase of disbursement of loans of all banks together from 1984 to 1985 ?

(A) 110% (B) 14%

(C) $90\frac{10}{11}\%$ (D) 10%

(iii) In which year was the total disbursement of loans of banks A and B exactly equal to the total disbursement of banks D and E ?

(A) 1983 (B) 1986

(C) 1984 (D) None of these

(iv) In which of the following banks did the disbursement of loans continuously increase over the years ?

(A) A (B) B

(C) C (D) E

(v) If the minimum target in the preceding years was 20% of the total disbursement of loans, how many banks reached the target in 1983 ?

(A) 1 (B) 3

(C) 2 (D) 4

(vi) In which bank was loan disbursement more than 25% of the disbursement of all banks together in 1986 ?

(A) A (B) B

(C) C (D) D

Q. 7. The following table shows the production of foodgrains in million tonnes in a state for the period from 1988-89 to 1992-93—

Year	Production in Million Tonnes				Total
	Wheat	Rice	Maize	Other cereals	
1988-89	580	170	150	350	1350
1989-90	600	220	234	400	1474
1990-91	560	240	228	420	1538
1991-92	680	300	380	460	1660
1992-93	860	260	340	500	1910
Total	**3280**	**1190**	**1332**	**2130**	**7932**

Read the above table and mark a tick against the correct answer in each of the following questions—

(i) During the period from 1988-89 to 1992-93. What per cent of the total production is the wheat ?

(A) 42·6% (B) 43·1%

(C) 41·3% (D) 40·8%

(ii) During the year 1992-93 the percentage increase in production of wheat over the previous year was—

(A) 26·4% (B) 20·9%

(C) 23·6% (D) 18·7%

(iii) In the year 1991-92 the increase in production was maximum for—

(A) Wheat (B) Rice

(C) Maize (D) Other cereals

(iv) During the year 1990-91, the percentage of decrease in production of maize was—

(A) 2·63% (B) 2·56%

(C) 2·71% (D) 2·47%

(v) The increase in the production of other cereals was minimum during the year—

(A) 1989-90 (B) 1990-91

(C) 1991-92 (D) 1992-93

Answers with Hints

1. (i) (D) Number of children in 1988

= (146947) – (65104 + 60387) = 21456

∴ Answer (D) is correct.

(ii) (B) Total population in 1988 is 146947 and increase in 1989 is 11630.

Therefore, total population in 1989 is

= (146947 + 11630) = 158577.

(iii) (A) Number of children in 1989

= (158577) – (70391 + 62516) = 25670

(iv) (C) Number of men in 1990

= (153922) – (63143 + 20314) = 70465

(v) (A) Total population in 1990 was 153922 and decrease in next year was 5337. So, the total population in 1991

= (153922 – 5337) = 148585

Number of women in 1991

= (148585) – (69395 + 21560)

= 57630

(vi) (B) Total population in 1991 was 148585 and that in 1992 was 160998.

So, Increase = (160998 – 148585) = 12413

∴ Answer (B) is correct.

Also, number of women in 1992

= (160998) – (71274 + 23789)

= 65935

Filling all these entries the complete table is given below—

Year	Men	Women	Children	Total	Increase (+) or Decrease (–) over preceding year
1988	65104	60387	**21456**	14697	—
1989	70391	62516	**25670**	**158577**	+ (11630)
1990	**70465**	63143	20314	153922	**– (4655)**
1991	69395	**57630**	21560	**148585**	(– 5337)
1992	71274	**65935**	23789	160998	**+ (12413)**

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2. The table may be constructed as shown below—

Outlay (in lakh of rupees) of a State in a 5 year plan (1980 to 85)

Year	Transport & Communication	Education	Housing	Health	Social welfare	Total
1980-81	56219	75493	13537	9596	1985	156830
1981-82	71416	80691	15902	10135	2073	180217
1982-83	73520	61218	16736	11000	3918	166392
1983-84	75104	73117	17523	12038	4102	181884
1884-85	80216	90376	19420	15946	10523	21648
Total	**356475**	**380895**	**83118**	**58715**	**22601**	**901804**

As given in the table.

(i) During 1984-85, the outlay on education was maximum.

(ii) Clearly, the outlay on education was increased in 1981-82, over 1980-81, in 1983-84 over 1982-83 and in 1984-85 over 1983-84.

Thus it was increased **three times** during the plan period.

(iii) % increase in 1983-84 over 1982-83 in health

$$= \left(\frac{12038 - 11000}{11000}\right) \times 100\% = 9{\cdot}43\%$$

(iv) Total outlay on social welfare during the plan period is Rs. 22601 lakhs.

(v) Ratio between outlay on (transport and communication) and housing during 1984-85 is

$= 80216 : 19420 = 4{\cdot}13 : 1 = (413 : 100)$

3. (i) (B) Percentage of literacy in Chennai

$$= \left(\frac{6421}{49342} \times 100\right)\% = 13{\cdot}01\%$$

(ii) (A) Population of Mumbai

$= (4068 + 16790)$

$= 20858$ thousands

$\therefore$ Percentage of literacy in Mumbai

$$= \left(\frac{4068}{20858} \times 100\right)\%$$

$= 19{\cdot}5\%$

(iii) (B) Number of literates in Bengal

$$= \left(\frac{16{\cdot}1}{100} \times 60314\right)$$

$= 9715$ thousands

Also, number of illiterates in Bengal

$= (60314 - 9715)$

$= 50599$ thousands

Fillings these entries, the complete table is given further—

States	Population	Literates	Illiterates	Percentage of Literacy
Chennai	49342	6421	**42921**	**13·01%**
Mumbai	**20858**	4068	16790	**19·5%**
Bengal	60314	**9715**	**50599**	16·1%

4. (i) (C) Total number of boys in XI D = 40

Number of girls in XI D = 25% of 40 = 10

Since all boys of XI D passed, so the number of boys in XII D = 40

Ratio of boys and girls in XII D is 5 : 1.

Number of girls in XII D

$$= \left(\frac{1}{5} \times 40\right) = 8$$

So, the number of girls failed in XI D

$= (10 - 8) = 2$

(ii) (D) Total number of boys playing Chess and Badminton $= (32 + 52) = 84$

Number of girls playing Hockey & Football

$= 25\% (32 + 52) = 25\%$ of 84

$$= \left(\frac{1}{4} \times 84\right) = 21.$$

Since 84 : 21 is 4 : 1, so the girls playing Hockey and Football are combined to yield a ratio of boys to girls as 4 : 1.

(iii) (A) Number of boys in XI A

$= 44$

Number of girls in XI B = 25% of 48 = 12

Number of girls in XI C = 25% of 48 = 12

$\therefore \quad (44 + 12 + 12) = 68$

Let x be the total number of students in the school.

Then, 25% of $x = 68$

$$\Rightarrow \quad x = \frac{68 \times 100}{25}$$

$= 272$

$\therefore$ Total number of students in the school

$= 272.$

(iv) (D) 4 times the number of girls in XI B & XI C

$= 4(12 + 12) = 96$

But, none of these pairs of classes from (A) to (C) has this as the number of boys.

(v) (B) Number of boys of XI E playing Chess = 4

Number of girls of XI B playing Table Tennis

= 25% of 16 = 4.

Number of girls of XI C playing Hockey

= 25% of 8 = 2.

$\therefore$ Number of students selected for a course at the college of sports $= (4 + 4 + 2) = 10$

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Total number of students in the school

$= (228 + 25\% \text{ of } 228)$

$= 285$

Let $x\%$ of $285 = 10$

$\therefore \quad x = \left(\frac{10 \times 100}{285}\right)$

$= 3{\cdot}51\%$

(vi) (D) Since the number of girls = 25% of the number of boys, so only 25% of the boys can participate in social work.

$\therefore$ Required % of the boys, who cannot participate in social work $= (100 - 25)\%$

$= 75\%.$

5. (i) (B) Clearly the net profit exceeded Rs. 1 crore in the year 1984-85.

(ii) (A) The ratio of 'Gross turn over' to the profit before interest and depreciation.

In 1980-81 is $\frac{1380}{380{\cdot}92} = 3{\cdot}62$

In 1981-82 is $\frac{1401}{404{\cdot}98} = 3{\cdot}46$

In 1982-83 is $\frac{1540}{520{\cdot}03} = 2{\cdot}96$

In 1983-84 is $\frac{2112}{599{\cdot}01} = 3{\cdot}52$

In 1984-85 is $\frac{2520}{810{\cdot}11} = 3{\cdot}11$

In 1985-86 is $\frac{2758{\cdot}99}{920} = 2{\cdot}999$

(iii) (A) Let net profit = $x\%$ of profit before interest and depreciation.

For 1980-81, we have $x = \frac{10{\cdot}69 \times 100}{380{\cdot}92}$

$= 2{\cdot}80\%$

For 1981-82, we have $x = \frac{18{\cdot}46 \times 100}{404{\cdot}98}$

$= 4{\cdot}56\%$

For 1982-83, we have $x = \frac{49{\cdot}16 \times 100}{520{\cdot}03}$

$= 9{\cdot}45\%$

For 1983-84, we have $x = \frac{65{\cdot}69 \times 100}{599{\cdot}01}$

$= 10{\cdot}97\%$

For 1984-85, we have $x = \frac{212{\cdot}78 \times 100}{810{\cdot}11}$

$= 26{\cdot}269$

$= 26{\cdot}27\%$

For 1985-86, we have $x = \frac{220{\cdot}80 \times 100}{920}$

$= 24\%$

So, in 1984-85, the **'net profit'** forms the highest proportion of **"the profit before interest and depreciation."**

(iv) (C) Increase from the year 1984-85 to 1985-86 in gross turn over is $(2758{\cdot}99 - 2520)$

$= 238{\cdot}99$ lakhs

Profit before interest and depreciation

is $(920 - 810{\cdot}11) = 109{\cdot}89$ lakhs

Interest is $(600{\cdot}20 - 505{\cdot}42) = 94{\cdot}78$ lakhs

Depreciation is $(99 - 91{\cdot}91) = 7{\cdot}09$ lakhs

Net profit is $(220{\cdot}80 - 212{\cdot}78)$

$= 8{\cdot}02$ lakhs

Clearly, the increase is lowest in depreciation.

(v) (A) Let $x\%$ of gross turn over for (1984-85)

= Gross turn over for (1982-83)

$\Rightarrow \quad \frac{x}{100} \times 2520 = 1540$

$\therefore \quad x = \frac{1540 \times 100}{2520} = 61{\cdot}11\% \simeq 61\%.$

6. (i) (A) Average disbursement of loans over the years

$= \frac{1}{5}(118 + 120 + 140 + 154 + 203) = 147$

Clearly, it is least in the year 1982.

(ii) (D) Percentage increase of loans from 1984 to 1985 $= \left(\frac{154 - 140}{140}\right) \times 100\% = 10\%$

(iii) (D) In none of the given years is the sum of loans of A and B is equals to sum of loans of D and E.

(iv) (D) In bank E the disbursement of loans continuously increase over the years.

(v) (C) 20% of total loans disbursed in 1982

$= (20\% \text{ of } 118) = 23{\cdot}6$ crore

Clearly banks B and C reached the target in 1983.

(vi) (A) In 1986, 25% of total disbursement

$= (25\% \text{ of } 203)$ crore $= 50{\cdot}75$ crore

$\therefore$ In bank A, the loan disbursed is more than 25% of the total disbursement of all banks in 1986.

7. (i) (C) Total production during the given period

$= 7932$ million tonnes

Wheat production during the period

$= 3280$ million tonne

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∴ Required percentage of wheat production over total production

$$= \left(\frac{3280}{7932} \times 100\right)\% = 41{\cdot}3\%$$

(ii) (A) Increase in 1992-93 in wheat production over 1991-92

$$= (860 - 680)$$

$$= 180 \text{ million tonnes}$$

Required increase %

$$= \left(\frac{180}{680} \times 100\right)\% = 26{\cdot}4\%$$

(iii) (C) During 1991-92 as read from the table the increase in the production of wheat, rice, maize and other cereals is 120, 60, 152 and 40 millions tonnes respectively. So, increase in maize production is maximum.

(iv) (B) During the year 1990-91, the decrease in production of maize

$$= (234 - 228)$$

$$= 6 \text{ million tonnes}$$

∴ Required decrease %

$$= \left(\frac{6}{234} \times 100\right)\% = 2{\cdot}56\%$$

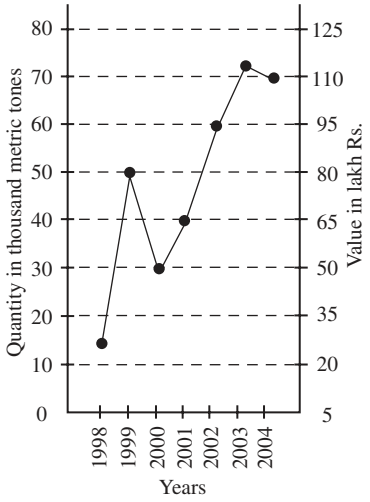
(v) (B) Increase in production of other cereals in 1989-90, 1990-91, 1991-92 and 1992-93 over previous year is 50, 20, 40, 40 million tonnes respectively. So, the increase in the production of other cereals was minimum during the year 1990-91.

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Miscellaneous Exercise – I

Directions : (Q. 1–5) Study the following graph carefully and answer the questions given below—

Quantity and value of production of sugar of a company over the years



1. What was the difference between the average production of sugar during the average production of sugar during the years 1998, 1999, 2000 and 2001 and that of 2001, 2002, 2003 and 2004 in thousand metric tons ?
   (A) 15
   (B) 20
   (C) 25
   (D) None of these

2. In which of the following years was the percentage increase in value of sugar per metric ton from the previous year the maximum ?
   (A) 1999 (B) 2000
   (C) 2001 (D) 2003

3. In which of the following years was the value of sugar per metric ton the highest among the given years ?
   (A) 1999
   (B) 2004
   (C) 2003
   (D) None of these

4. In which of the following years was the value of sugar per metric ton the lowest among the given years ?
   (A) 1998 (B) 1999
   (C) 2001 (D) 2003

5. In which of the pair of years the sum of production is exactly 25% of the production of all the years together ?
   (1) 1998 and 2004
   (2) 1998 and 2003
   (3) 1998 and 2001
   (A) Only (1)
   (B) Only (2)
   (C) Only (3)
   (D) Both (1) and (3)

6. Seven men, five women and eight children were given an assignment of distributing 2000 books to students in a school over a period of three days. All of them distributed books on the first day. On the second day two women and three children remained absent and on the third day three men and five children remained absent. If the ratio of the number of books distributed in a day by a man, a woman and a child was 5 : 4 : 2 respectively, a total of approximately how many books were distributed on the second day ?
   (A) 1000 (B) 800
   (C) 650 (D) 900

7. The present ages of A, B and C are in the ratio of 8 : 14 : 22 respectively. The present ages of B, C and D are in the ratio of 21 : 33 : 44 respectively. Which of the following represents the ratio of the present ages of A, B, C and D respectively ?
   (A) 12 : 21 : 33 : 44
   (B) 12 : 22 : 31 : 44
   (C) 12 : 21 : 36 : 44
   (D) Cannot be determined

8. Mohan distributed his total assets to his wife three sons, two daughters and five grand children in such a way that each grand child got one-eight of each son or one-tenth of each daughter. His wife got 40 per cent of the total share of his sons and daughters together. If each daughter received asset of worth Rs. 1·25 lakh, what was the total worth of the assets received by his wife and the three grand children together ?
   (A) Rs. 32,500
   (B) Rs. 2,57,500
   (C) Rs. 2,82,500
   (D) Cannot be determined

9. In one-day cricket match the captain of one of the teams scored 30 runs more than the average runs scored by the remaining six batsmen of that team who batted in the match. If the total runs scored by all the batsmen of that team were 310, how many runs did the captain score ?
   (A) 60
   (B) 70
   (C) 50
   (D) Cannot be determined

10. The radius of a circle is more than the height of a right angled triangle by 20%. The base of the right angled triangle is equal to the area of the circle, then what is the approximate area of the circle ?
    (A) 72 sq. cm
    (B) 144 sq. cm
    (C) 216 sq. cm
    (D) 128 sq. cm

11. Two third of one fourth of a number is equal to 40% of another number which one of the following statements is true about the numbers ?
    (A) Second number is 2·4 times of the first number
    (B) First number is 2·4 times of the second number
    (C) First number is more than the second number by 40%
    (D) Second number is less than the first number by 60%

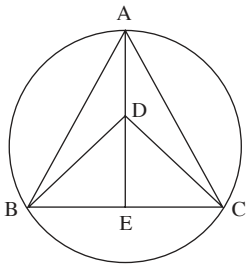
12. A shopkeeper purchased rice of 3 varieties a, b, c which cost Rs. 34.50, Rs. 28.60 and Rs. 32.40 per kg. respectively. In which of the following bargain he will earn the maximum ?
    (A) He purchased (a) and (c) each 20 kg and sold them at Rs. 38.00 and Rs. 36.00 per kg. respectively

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(B) He purchased (a) and (b) 30 kg. and 40 kg respectively and sold them Rs. 37.00 and Rs. 33.00 per kg respectively
(C) He purchased (b) and (c) 20 kg. and 40 kg. respectively and sold them at Rs. 40.00 and Rs. 38.00 per kg. respectively
(D) He purchased (c) and (a) 25 kg. and 30 kg respectively and sold them at Rs. 42.00 and Rs. 38.00 per kg. respectively

13. When an odd number of two digits is divided by an even number of two digits then quotient is 0.625. If the odd number is less than the even number by 5, then what is the ratio between odd number and even number ?
(A) 5 : 8
(B) 8 : 5
(C) 6 : 9
(D) Cannot be determined

14. In the given figure ABC is an equilateral triangle which is inscribed in a circle of radius *r*. Which one of the following is area of the triangle ?



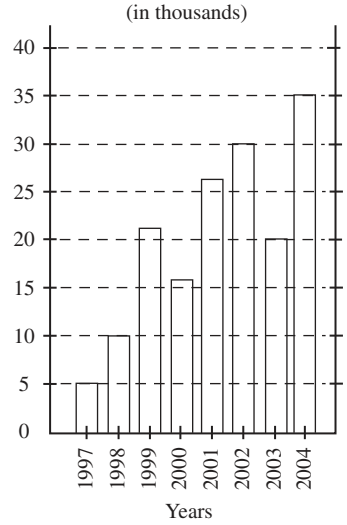
(A) $(r - DE)^{1/2} (r + DE)^2$
(B) $(r - DE)^2 (r + DE)^2$
(C) $(r - DE)^{1/2} (r + DE)^{3/2}$
(D) $(r + DE)^{1/2} (r - DE)^{3/2}$

15. The area of a square of one side 8 cm is equal to the area of a rectangle. Which of the following statements about the rectangle is/are correct ?
(1) The length of the rectangle is 16 times of the breadth
(2) The length of the rectangle is 32 times of the breadth
(3) The breadth of the rectangle is $\frac{1}{6}$ of the length
(4) The breadth of the rectangle is $\frac{1}{9}$ of the length.
(A) Only (1) and (2)
(B) Only (3) and (4)
(C) Either (1) or (2)
(D) Either (3) or (4)

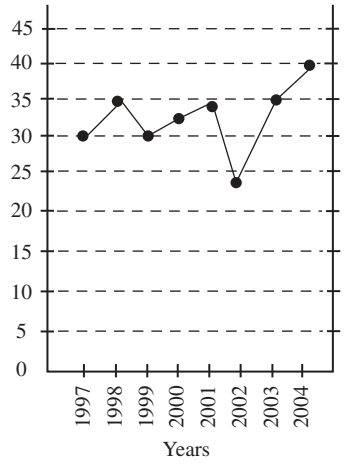
Directions : (Q. 16–20) Study the following graph carefully and answer the questions given below—

Number of candidates appeared (in thousand) and percentage of candidates qualified in a competitive examination over the years.

No. of candidates appeared
(in thousands)



Percentage of candidates qualified



16. What was the ratio between the number of candidates appeared in 1997 and the number of candidates qualified in 2004 ?
(A) 14 : 5
(B) 5 : 14
(C) 3 : 7
(D) Data inadequate

17. In which of the following years was the number of candidates qualified the lowest among the given years ?
(A) 1997 (B) 2002
(C) 2001 (D) 1998

18. What was the percentage drop in the number of candidates appeared from the year 2002 to 2003 ?
(A) $66\frac{2}{3}$ (B) 30
(C) 70 (D) $33\frac{1}{3}$

19. How many candidates qualified in the year 2002 ?
(A) 6750
(B) 13500
(C) 9900
(D) Cannot be determined

20. The number of candidates qualified in 1999 was what percentage of the number of candidates appeared in 1998 ?
(A) 68·5 (B) 70
(C) 32·5 (D) 67·5

Directions : (Q. 21–25) In each of the following questions a number series is given. After the series a number is given followed by (a) (b) (c) (d) and (e). You have to complete the series starting with given number, following the sequence of original series and answer questions that follow the series—

21. 8 4 6 15 52·5 36·25
12 (a) (b) (c) (d) (e)
What will come in place of (c) ?
(A) 18.25 (B) 19
(C) 22.5 (D) 20.75

22. 3 13 37 87 191 401
1 (a) (b) (c) (d) (e)
What will come in place of (d) ?
(A) 169 (B) 161
(C) 171 (D) 159

23. 5 12 4 10 3 8
6 (a) (b) (c) (d) (e)
What will come in place of (d) ?
(A) 3 (B) 5
(C) 4 (D) 7

24. 4 13 40 135 552 2765
2 (a) (b) (c) (d) (e)
What will come in place of (c) ?
(A) 123 (B) 133
(C) 127 (D) 131

25. 3 19 103 439 1381 2887
5 (a) (b) (c) (d) (e)
What will come in place of (b) ?
(A) 139 (B) 163
(C) 161 (D) 157

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Directions : (Q. 26–30) In each of the following questions a series is given. In each one term is wrong. Find out the wrong term—

26. 7, 4, 6, 9, 20, 52·5, 16·5
(A) 6 (B) 4
(C) 20 (D) 9

27. 4, 6, 12, 20, 30, 75, 315, 1260
(A) 315 (B) 75
(C) 12 (D) 6

28. 3, 4, 13, 38, 87, 166, 289
(A) 38 (B) 13
(C) 87 (D) 166

29. 4, 5, 9, 29, 111, 556, 3335
(A) 5 (B) 9
(C) 29 (D) 111

30. 2, 6, 16, 38, 84, 176, 368
(A) 6 (B) 16
(C) 38 (D) 176

31. Average weight of three boys P, T and R is $54\frac{1}{3}$ kg. while the average weight of 3 boys T, F and G is 53 kg. What is the average weight of P, T, R, F and G ?
(A) 53·8 kg
(B) 52·4 kg
(C) 53·2 kg
(D) Data insufficient

32. Two girls and four boys any made to sit in a line in such a way that the girls should not sit together. By how many ways this is possible ?
(A) 720 (B) 480
(C) 360 (D) 240

33. Sunetra started a business of software with Rs. 50,000. After 6 months Nikhil joined her with Rs. 80,000. At the end of 3 years they earned a profit of Rs. 24,500. What is the share of Sunetra in the profit ?
(A) Rs. 14,000
(B) Rs. 9,423
(C) Rs. 10,250
(D) None of these

34. What approximate value should come in place of question mark in the following equation ?
9876 ÷ 24·96 + 215·005 – ? = 309·99
(A) 395 (B) 295
(C) 300 (D) 315

35. A boat can row a distance of 16 km down the stream in 2 hours while up the stream the same distance in 4 hours. What is the speed of the boat in still water ?
(A) 4 km/hr
(B) 6 km/hr
(C) 8 km/hr
(D) Data insufficient

36. The ratio of the earnings of A and B is 4 : 7. If A's earning is in creased 50% and B's earning is decreased by 25%. Then the ratio in their earnings becomes 8 : 7. What is the earning of A ?
(A) Rs. 26,000
(B) Rs. 28,000
(C) Rs. 21,000
(D) Data insufficient

37. Sudhanshu invested Rs. 15000 for a year at 10% p.a. If the interest is compounded half yearly. What amount will Sudhanshu get at the end of the year ?
(A) Rs. 16537.50
(B) Rs. 16500.00
(C) Rs. 16525.50
(D) Rs. 18150.00

38. 405 sweets were distributed equally among children in such a way that each child gets 20% of the total number of children. How many sweets did each child get ?
(A) 15 (B) 45
(C) 9 (D) 18

39. If $2x + 3y + z = 55$, $x + z - y = 4$ and $y - x + z = 12$, what is value of y ?
(A) 7
(B) 8
(C) 12
(D) None of these

40. 10% of wheat sold by a Grocer is of lower quality. How much wheat of good quality should be mixed with 150 kg of wheat of lower quantity so that the wheat of lower quality quantity be 5%?
(A) 150 kg (B) 135 kg
(C) 50 kg (D) 85 kg

41. Present ages of Radha and Sudha are in the ratio of 7 : 9 respectively. Five years ago ratio of their ages that time was 3 : 4. What will be Sudha's age after 3 years from now ?
(A) 48 years (B) 42 years
(C) 43 years (D) 38 years

42. The population of a state is counted after every three years. It is found that population each time is increased by 20% as compared to the previous count. If the population in the year 1998 was 42 lakh. What will be the population in the year 2007 ?
(A) 60.48 lakh
(B) 72.576 lakh
(C) 62.576 lakh
(D) 70.48 lakh

43. The ratio is the salaries of A, B and C is 2 : 3 : 5. If their salaries are increased by 15%, 10% and 20% respectively, then what will be the ratio in their new salaries ?
(A) 3 : 3 : 10
(B) 23 : 33 : 60
(C) 10 : 11 : 20
(D) Can not be found

44. If $3x + 2x = 47$ and $11x = 7y$, what is the value of $x - y$?
(A) 4
(B) 6
(C) 7
(D) None of these

Directions : (Q. 45–49) What will come in place of the question mark (?) in the following questions ?

45. $3 \times ? + 30 = 0$
(A) – 15
(B) 15
(C) 10
(D) None of these

46. $40{\cdot}83 \times 1{\cdot}02 \times 1{\cdot}2 = ?$
(A) 49·97592 (B) 41·64660
(C) 58·7952 (D) 42·479532

47. $3\frac{1}{3} \div 6\frac{3}{7} \times 1\frac{1}{2} \times \frac{22}{7} = ?$
(A) 4·4
(B) $\frac{22}{7}$
(C) $\frac{5}{22}$
(D) None of these

48. $\sqrt{1{\cdot}5625} = ?$
(A) 125 (B) 12·5
(C) 1·05 (D) 1·25

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49. $3978 + 112 \times 2 = ? \div 2$
(A) 8180 (B) 2101
(C) 4090 (D) 8404

50. 4 boys and three girls are to be seated in a row in such a way that no two boys sit adjacent to each other. In how many different ways can it be done ?
(A) 5040 (B) 30
(C) 144 (D) 72

51. What will be the compound interest on a sum of Rs. 25000 after three years at the rate of 12 per cent p.a. ?
(A) Rs. 10123·20
(B) Rs. 9000·30
(C) Rs. 10483·20
(D) Rs. 9720·00

52. What approximate value should come in place of the question mark (?) in the following equation ? $29{\cdot}98 \times 37{\cdot}05 \div ? + 7{\cdot}45 = 100{\cdot}5$
(A) 10 (B) 13
(C) 14·5 (D) 12

53. A committee of 3 members is to be formed out of 3 men and 4 women. In how many different ways can it be done so that at least one number is a woman ?
(A) 34 (B) 12
(C) 30 (D) 36

54. In how many ways can a group of 5 men and 2 women be made out of total of 7 men and 3 women ?
(A) 63 (B) 45
(C) 126 (D) 90

55. 70% of a number is equal to four fifth of another number. If the difference between the two numbers is 100. What is the bigger number ?
(A) 700
(B) 750
(C) 800
(D) Cannot be determined

56. The average of four numbers A, B, C and D is 40. The average of four numbers A, B, E and F is also 40 (A, B are common). Which of the following must be true ?
(A) $(A + B) \neq (C + D)$
(B) $(C + D) = (E + F)$
(C) Either C = E or F and D = F or E
(D) C = E and D = F

57. Mr. 'X' invested certain amounts in two different Scheme 'A' and 'B'. Scheme 'A' offers simple interest @ 12 per cent p.a. and Scheme 'B' offers compound interest @ 10 per cent p.a. Interest accrued on the amount invested in Scheme 'A' in 2 years was Rs. 3600 and the total amount invested was Rs. 35000. What was interest accrued on the amount invested in Scheme 'B' ?
(A) Rs. 4800
(B) Rs. 4200
(C) Rs. 4000
(D) Cannot be determined

58. In how many different ways can the letters of the word CORPORATION be arranged in such a way that the vowels always come together ?
(A) 840
(B) 86400
(C) 8400
(D) None of these

59. If the number obtained by reversing the digits of a two digit number is more than the original number by 18 and the sum of the digits is 8. What is the original number ?
(A) 53
(B) 26
(C) 35
(D) Cannot be determined

60. The digit of a two digit number are in the ratio of 2 : 3 and the number obtained by inter changing the digits is bigger than the original number by 27. What was the original number ?
(A) 64 (B) 46
(C) 96 (D) 69

61. A select group of 4 is to be formed from 8 men and 6 women in such a way that the group must have atleast one woman. In how many different ways can it be done ?
(A) 364 (B) 1001
(C) 728 (D) 931

62. The salary of an employee increase consistently by 50% every year. If his salary today is Rs. 10000, what will be the salary after another 4 years ?
(A) Rs. 62500
(B) Rs. 26500
(C) Rs. 50625
(D) Rs. 33750

63. By how much is three fifth of 350 greater than four-seventh of 210 ?
(A) 120
(B) 210
(C) 95
(D) None of these

64. The inequality $x\ (x + 3) < 10$ proved for what value of x ?
(A) $x > 2, x < -5$
(B) $-5 < x < 2$
(C) $-2 < x < 5$
(D) $x < -2, x > 5$

65. What will come in place of both the question marks (?) in the following equation ?
$$\frac{17 \times 32 \div ? + 12}{6^2 \div 9 \times 4 - ?} = 10$$
(A) 16 (B) 4
(C) 8 (D) 12

66. In a sample, if a person is picked up randomly, the probability that the person is a smoker is $\frac{3}{5}$ and that of the person being male is 1/2. What is the probability that the person is both male as well as a smoker ?
(A) $\frac{10}{11}$
(B) $\frac{1}{5}$
(C) $\frac{3}{5}$
(D) None of these

67. What will come in place of question mark (?) in the following equation ?
$16^{7.5} \div 8^{3.5} \div 2^{7.5} = ?$
(A) 8^4 (B) 16^4
(C) 2^{15} (D) 2^{27}

68. Three men four women and six children can complete a work in 7 days. A woman does double the work a man does and a child does half the work a man does.

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How many women alone can complete this work in 7 days ?

(A) 8

(B) 7

(C) 12

(D) Cannot be determined

69. Four parts out of the five parts lettered (A) (B) (C) (D) and (E) in the following equation are exactly equal. Which one of the given part is not equal to the other four parts ? The letter of that part is the your answer ?

(A) $136 \times 12 \div 9 \times 3$

(B) $= 17 \times 64 \div 6 \times 3$

(C) $= 36 \times 17 + 9 \times 9$

(D) $= 56 \times 8 \div 14 \times 17$

(E) $= 76 \times 6 \div 19 \times 17$

70. In a class of 45 students boys and girls are in the ratio of 5 : 4 respectively. Average marks obtained by boys in Mathematics out of 100 were 76 and that of girls were 78. What are average marks of boys and girls together in Mathematics (rounded off to two decimal points) ?

(A) 76·89 (B) 77

(C) 77·29 (D) 76·98

71. On five chairs arranged in a row, five persons A, B, C, D and E are to be seated in such a way that B and D always sit together (side by side). In how many different ways can it be done ?

(A) 120 (B) 48

(C) 60 (D) 24

72. Present ages of Seema and Naresh are in the respective ratio of 5 : 7. Five years hence the ratio of their ages becomes 3 : 4 respectively. What is Naresh's present age in years ?

(A) 25

(B) 40

(C) 30

(D) Cannot be determined

Directions : (Q. 73–77) for the two given equations I and II—

Give answer (A) if p is greater than q.

Give answer (B) if p is smaller than q.

Give answer (C) if p is equal to q.

Give answer (D) if p is either equal to or smaller than q.

73. (1) $6p^2 + 5p + 1 = 0$

(2) $20q^2 + 9q = -1$

74. (1) $3p^2 + 2p - 1 = 0$

(2) $2q^2 + 7p + 6 = 0$

75. (1) $3p^2 + 15p = -18$

(2) $q^2 + 7q + 12 = 0$

76. (1) $p = \frac{\sqrt{4}}{\sqrt{9}}$

(2) $9q^2 - 12q + 4 = 0$

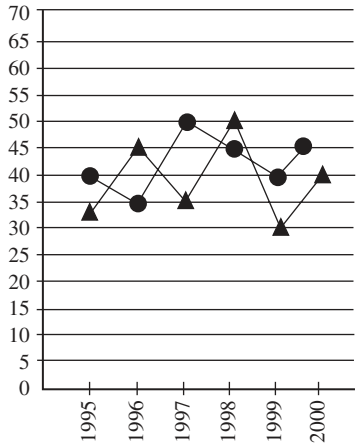
77. (1) $p^2 + 13q + 42 = 0$

(2) $q^2 = 36$

Directions : (Q. 78–81) Study the following graph carefully and answer the questions given below it—

Percentage profit earned by two companies A and B over the given years.

$$\% \text{ Profit/loss} = \frac{\text{Income} - \text{Expenditure}}{\text{Expenditure}} \times 100$$



78. Expenditures of company B in 1996 and 1997 are Rs. 12 lakh and Rs. 14·5 lakh respectively. What was the total income of company B in 1996 and 1997 together (in lakh Rs.) ?

(A) 39·75 (B) 37·95

(C) 38·75 (D) 38·50

79. Ratio of expenditures of companies A and B in 1999 was 3 : 4 respectively. What was the respective ratio of their income in 1999 ?

(A) 21 : 26

(B) 13 : 14

(C) 14 : 13

(D) None of these

80. Total expenditure of company 'A' in all the year together was Rs. 82·5 lakh. What was the total income of the company in all the years together ?

(A) Rs. 1·23 crore

(B) Rs. 98·75 lakh

(C) Rs. 99·85 lakh

(D) Cannot be determined

81. If the expenditures companies A and B in 2000 were equal and the total income of the two companies was Rs. 5·7 lakh, what was the total expenditure of the two companies in 2000 ?

(A) Rs. 4 lakh

(B) Rs. 2 lakh

(C) Rs. 4·2 lakh

(D) Cannot be determined

82. If the incomes of company B in 1997 and 1998 were in the ratio of expenditures of that company in these two years ?

(A) 20 : 29 (B) 9 : 10

(C) 29 : 45 (D) 10 : 29

83. Mr. Nilesh Agarwal opened a workshop investing Rs. 40,000. He invested additional amount of Rs. 10,000 every year. After two years his brother Suresh joined him with an amount of Rs. 85,000. Thereafter Suresh did not invest any additional amount. On completion of four years from the opening of work shop they earned an amount of Rs. 1,95,000. What will be Nilesh's share in the earning ?

(A) Rs. 85,000

(B) Rs. 1,10,000

(C) Rs. 1,35,000

(D) Rs. 95,000

84. The average (Arithmetic Mean) and the Median of a set of numbers is the same which of the following must be true ?

(A) All the numbers are odd in the set

(B) All the numbers are even in the set

(C) All the numbers are consecutive integers in the set

(D) The data set has even numbers of observations

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Directions : (Q. 85–89) Study the following table carefully to answer these questions—

Percentage of marks obtained by six students in six different subjects—

Student	Subjects					
	P (70)	Q (80)	R (120)	S (125)	T (75)	U (150)
A	68	84	77	72	64	82
B	49	79	62	85	56	76
C	56	81	68	60	58	68
D	75	85	82	88	72	78
E	70	66	65	76	77	83
F	72	70	79	68	68	71

Note : Figure into bracket below each subject indicates the maximum marks allotted.

85. What is the average percentage of marks obtained by all students in subject 'T' ?
(A) 65·6
(B) 66·5
(C) 66·8
(D) None of these

86. Marks obtained 'A' in subjects P, Q and R together are approximately what per cent of the marks obtained by F in subjects S, T and U together ?
(A) 80 (B) 75
(C) 85 (D) 105

87. What is the overall percentage of marks obtained by 'B' in all the subjects together (Rounded off to two digits after decimal ?
(A) 70·02 (B) 72·51
(C) 67·83 (D) 71·50

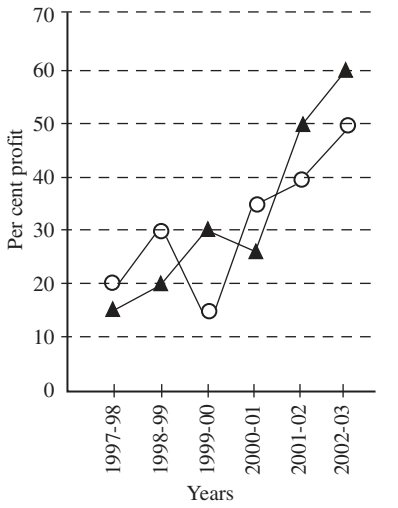
88. What are the total marks obtained by D in all the subjects together ?
(A) 449·8 (B) 499·9
(C) 480 (D) 490

89. What are the average marks obtained out of 80 by all the students together in subjects 'Q' ?
(A) 68 (B) 77·5
(C) 88·57 (D) 62

Directions : (Q. 90–95) Study the following graph to answer the given questions.

Per cent profit earned by two companies over the given years

$$\% \text{ Profit} = \frac{\text{Income} - \text{Expenditure}}{\text{Expenditure}} \times 100$$



90. If the income of Company X in 1998-99 was equal to the expenditure of Company Y in 2001-02. What was the ratio of their respective profits ?
(A) 13 : 15
(B) 15 : 26
(C) 13 : 26
(D) Cannot be determined

91. For Company X its income in 2001-02 was equal to its expenditure in 2002-03. What was the ratio of its respective incomes in these two years ?
(A) 4 : 5
(B) 3 : 4
(C) 2 : 3
(D) Cannot be determined

92. For Company Y, which year is the percent of increase in per cent profit over that of previous year the highest ?
(A) 2002-03
(B) 1999-00
(C) 2001-02
(D) Cannot be determined

93. In 1997-98, the expenditure of Company X was Rs. 40 crores. What was its income in that year ?
(A) Rs. 50 crores
(B) Rs. 48 crores
(C) Rs. 46 crores
(D) Cannot be determined

94. What was the difference in expenditure of the two companies in 1999-2000 ?
(A) 10
(B) 100
(C) 1000
(D) Cannot be determined

95. In 2002-03 the income of Company Y was Rs. 128 crores. What was its expenditure in that year ?
(A) Rs. 76·8 crores
(B) Rs. 64 crores
(C) Rs. 48 crores
(D) None of these

Directions : (Q. 96–100) Study the following table to answer these questions—

Percentage of Marks obtained by seven students in six subjects
(Maximum marks for each subject are shown in bracket)

Subject/Student	History (75)	Geography (60)	Maths (80)	Science (50)	English (40)	Hindi (40)
P	86	82	95	78	66	84
Q	92	78	85	89	72	76
R	76	94	89	75	62	69
T	67	74	74	84	85	82
M	74	86	64	80	78	72
L	88	89	76	88	70	64
N	90	96	86	92	65	66

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96. Approximately what is the over all percentage of marks obtained by 'T' in all the subjects ?
(A) 79 (B) 82
(C) 86 (D) 76

97. What is the percentage of marks obtained by M in all subjects ?
(Answer upto two places of decimal)
(A) 82·74 (B) 84·76
(C) 76·84 (D) 74·87

98. What is average of marks in Geography obtained by all students ?
(Answer upto two places of decimals)
(A) 51·34 (B) 85·57
(C) 52·36 (D) 76·27

99. What is total of marks obtained by 'L' in History, Geography and Maths ?
(A) 221·8
(B) 253
(C) 180·2
(D) 184

100. What is the average of percentage of marks obtained by all students in Mathematics ?
(Answer upto two places of decimal)
(A) 81·92 (B) 81·29
(C) 65·03 (D) 76·23

Answers with Hints

1. (D) Average production of sugar in years 1998, 1999, 2000 and 2001

$$= \frac{15 + 50 + 30 + 35}{4}$$

$$= 32{\cdot}5 \text{ thousands metric tons}$$

and average production of sugar in years 2001, 2002, 2003 and 2004

$$= \frac{35 + 65 + 75 + 70}{4}$$

$$= 61{\cdot}25 \text{ thousands metric tons}$$

$\therefore$ Required difference

$$= 61{\cdot}25 - 32{\cdot}5$$

$$= 28{\cdot}75 \text{ thousands metric tons}$$

2. (A) In 1999 the per cent increase in value from the previous year

$$= \frac{50 - 15}{15} \times 100\% = 233{\cdot}33\%$$

In 2001 per cent increase in value from the previous year

$$= \frac{35 - 30}{30} \times 100\% = 16{\cdot}66\%$$

In 2003 the per cent increase in value from the previous year

$$= \frac{75 - 65}{65} \times 100\% = 15{\cdot}38\%$$

$\therefore$ In the remaining there was decrease

3. (D) In 1998 the value of sugar per metric ton

$$= \frac{55}{2 \times 15} = \text{Rs. } 1{\cdot}833 \text{ lakh}$$

In 1999 the value of sugar per metric ton

$$= \frac{80}{50} = \text{Rs. } 1{\cdot}600 \text{ lakh}$$

In 2000 the value of sugar per metric ton

$$= \frac{50}{30} = \text{Rs. } 1{\cdot}666 \text{ lakh}$$

In 2001 the value of sugar per metric ton

$$= \frac{115}{2 \times 35} = \text{Rs. } 1{\cdot}642 \text{ lakh}$$

In 2002 the value of sugar per metric ton

$$= \frac{102{\cdot}5}{65} = \text{Rs. } 1{\cdot}575 \text{ lakh}$$

In 2003 the value of sugar per metric ton

$$= \frac{235}{2 \times 75} = \text{Rs. } 1{\cdot}566 \text{ lakh}$$

And in 2004 the value of sugar per metric ton

$$= \frac{110}{70} = \text{Rs. } 1{\cdot}571 \text{ lakh}$$

$\therefore$ It is the highest in the year 1998.

4. (D) It is the lowest in the year 2003.

5. (A) 25% of the total production

$$= \frac{25}{100} \times 340$$

$$= 85 \text{ thousand metric tons}$$

And the production of the years 1998 and 2004

$$= 15 + 70$$

$$= 85 \text{ thousand metric tons}$$

6. (C) Let the books distributed by a man, a woman and a child be $5x$, $4x$ and $2x$ respectively

$\therefore$ No. of books distributed in Ist day

$$= 7 \times 5x + 5 \times 4x + 8 \times 2x$$

$$= 71x$$

No. of books distributed in IInd day

$$= 7 \times 5x + 3 \times 4x + 5 \times 2x$$

$$= 57x$$

And no. of books distributed in IIIrd day

$$= 4 \times 5x + 5 \times 4x + 3 \times 2x$$

$$= 46x$$

$\because$ $71x + 57x + 46x = 2000$

$$x = \frac{2000}{174}$$

$$57x = \frac{2000}{174} \times 57 = 650 \text{ (App.)}$$

7. (A) $\because$ A : B : C = 8 : 14 : 22

= 12 : 21 : 33

B : C : D = 21 : 33 : 44

$\therefore$ A : B : C : D = 12 : 21 : 33 : 44

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8. (B) Share of each daughter = Rs. 1·25 lakh

$\therefore$ Share of grand child $= \frac{1}{10} \times 1{\cdot}25$

$= 0{\cdot}125$ lakh

And share of each son $= 0{\cdot}125 \times 8$

$=$ Rs. 1 lakh

$\therefore$ Money received by three sons and two daughters

$= 3 \times 1 + 2 \times 1{\cdot}25$

$=$ Rs. 5·5 lakh

$\therefore$ Money received by his wife $= \frac{40}{100} \times 5{\cdot}5$

$=$ Rs. 2·2 lakh

$\therefore$ Money received by his wife and three grand children

$= 2{\cdot}2 + 3 \times 0{\cdot}125$

$=$ Rs. 257500

9. (B) Let the average of runs made by other 6 batsman be x

$\therefore$ Runs made by the captain $= x + 30$

$\because$ $x + 30 + 6x = 310$

$\Rightarrow$ $7x = 280$

$\therefore$ $x = 40$

$\therefore$ No. of runs scored by the captain

$= 40 + 30 = 70$

10. (A) Let the radius of the circle and the height of the right angled Δ be r and h respectively

$\therefore$ $r = \frac{100 + 20}{100} h$

and area of $\Delta = \frac{1}{2} \times h \times 36 = 18\,h$

$\therefore$ Area of the circle $= 18\,h$

$\because$ $\pi r^2 = 18\,h$

$\Rightarrow$ $\frac{22}{7} r^2 = \frac{18 \times 100 \times r}{120}$

$r = \frac{18 \times 100 \times 7}{120 \times 22} = 4{\cdot}77$

$\therefore$ Area of the circle $= \frac{22}{7} r^2 = \frac{22}{7} \times 4{\cdot}77 \times 4{\cdot}77$

$=$ 72 (App.) sq. cm.

11. (B) Let the first and second numbers be x and y respectively

$\because$ $x \times \frac{1}{4} \times \frac{2}{3} = y \times \frac{40}{100}$

$\therefore$ $x = y \times \frac{40}{100} \times \frac{4 \times 3}{2} = 2{\cdot}4\,y$

12. (C) Profit on each 20 kg of A and C

$= 20\,(38 - 34{\cdot}5) + 20\,(36 - 32{\cdot}4)$

$= 70 + 72 =$ Rs. 142

Profit on 20 kg of B and 40 kg of C

$= 20\,(40 - 28{\cdot}6) + 40\,(38 - 32{\cdot}4)$

$= 228 + 224 =$ Rs. 452

Profit on 25 kg of C and 30 kg of A

$= 25\,(42 - 32{\cdot}4) + 30\,(30 - 34{\cdot}5)$

$= 240 + 105 =$ Rs. 345

Profit on 40 kg of B and 20 kg of A

$= 40\,(37 - 28{\cdot}6) + 20\,(40 - 34{\cdot}5)$

$= 336 + 110 =$ Rs. 446

Hence, he will earn maximum in bargain (C)

13. (A) $\frac{\text{odd number}}{\text{even number}} = 0{\cdot}625 = \frac{5}{8}$

14. (C) Area of the Δ

$= \frac{1}{2} \times AE \times BC$

$= \frac{1}{2} \times 2 \times AE \times BE \left(\text{Because } BE = \frac{1}{2} BC\right)$

$= AE \times BE$

$= (AD + DE) \times \sqrt{BD^2 - DE^2}$

$= (r + DE) \times \sqrt{(r^2 - DE^2)}$

$= (r + DE) \times (r - DE)^{1/2}\,(r + DE)^{1/2}$

$= (r + DE)^{3/2}, (r - DE)^{1/2}$

15. (C) Area of the square $= 8 \times 8$

$= 64$ cm^2

$\therefore$ Area of the rectangle $= 64$ cm^2

$\therefore$ $L \times B = 64$ cm^2

$\therefore$ Length of the rectangle may be 16 times or 32 times of the breadth.

16. (B) Required ratio $= \frac{5000 \times 100}{40 \times 35000} = 5 : 14$

17. (A) In 1997, the number of qualified candidates

$= \frac{32{\cdot}5}{100} \times 5000 = 1625$

In 1998, the number of qualified candidates

$= \frac{37{\cdot}5}{100} \times 10000 = 3750$

In 1999, the number of qualified candidates

$= \frac{30}{100} \times 22500 = 6750$

In 2000, the number of qualified candidates

$= \frac{30}{100} \times 15500 = 46500$

In 2001, the number of qualified candidates

$= \frac{32{\cdot}5}{100} \times 27500$

$= 8937{\cdot}5 = 8938$

In 2002, the number of qualified candidates

$= \frac{22{\cdot}5}{100} \times 30000 = 6750$

In 2003, the number of qualified candidates

$= \frac{35}{100} \times 20000 = 7000$

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And in 2004, the number of qualified candidates

$$= \frac{40}{100} \times 35000 = 14000$$

Hence it is the lowest in 1997.

18. (D) Required percentage

$$= \frac{30000 - 20000}{30000} \times 100\% = 33\frac{1}{3}\%$$

19. (A)

20. (D) Required percentage

$$= \frac{6750 \times 100}{10000}\% = 67{\cdot}50\%$$

21. (C) 8, 4, 6, 15, 52·5, 236·25

$\times\frac{1}{2}$, $\times\frac{3}{2}$, $\times\frac{5}{2}$, $\times\frac{7}{2}$, $\times\frac{9}{2}$

(a), (b), (c)

12, 6, 9, 22·5

$\times\frac{1}{2}$, $\times\frac{3}{2}$, $\times\frac{5}{2}$

Hence 22·5 will come in place of (c)

22. (D) 3, 13, 37, 87, 191, 401

$\times 2 + 7$, $\times 2 + 11$, $\times 2 + 13$, $\times 2 + 17$, $\times 2 + 19$

$\therefore$ (a), (b), (c), (d)

1, 9, 29, 71, 159

$\times 2 + 7$, $\times 2 + 11$, $\times 2 + 13$, $\times 2 + 17$

Hence 159 will come in place of (d)

23. (C) -1, -1

5, 12, 4, 10, 3, 8

$\times 2 + 2$, $\times 2 + 2$, $\times 2 + 2$

-1a, (b), (c) -1, (d)

6, 14, 5, 12, 4, 10

$\times 2 + 2$, $\times 2 + 2$, $\times 2 + 2$

$\therefore$ 4 will come in place of (d)

24. (A) 4, 13, 40, 135, 552, 2765

$\times 1 + 1 \times 9$, $\times 2 + 2 \times 7$, $\times 3 + 3 \times 5$, $\times 4 + 4 \times 3$, $\times 5 + 5 \times 1$

Similarly,

2, (a) = 11, (b) = 36, (c) = 123, (d) = 504, (e) = 2525

$\times 1 + 1 \times 9$, $\times 2 + 2 \times 7$, $\times 3 + 3 \times 5$, $\times 4 + 4 \times 3$, $\times 5 + 5 \times 1$

Hence 123 will come in place of (c)

25. (B) 3, 19, 103, 439, 1381, 2887

$\times 6 + (1)^3$, $\times 6 + (2)^3$, $\times 4 + (3)^3$, $\times 3 + (4)^3$, $\times 2 + (5)^3$

Similarly,

5, (a) = 31, (b) = 163, (c) = 679, (d) = 2101, (e) = 4327

Hence 163 will come in place of (b)

26. (A) 7, 4, 5, (6), 9, 20, 52·5, 160·5

$\times 0{\cdot}5 + 0{\cdot}5$, $\times 1 + 1$, $\times 1{\cdot}5 + 1{\cdot}5$, $\times 2 + 2$, $\times 2 + 2{\cdot}5$, $\times 3 + 3$

27. (B) 4, 6, 12, 30, (90), 75, 315, 1260

$\times 1{\cdot}5$, $\times 2$, $\times 2{\cdot}5$, $\times 3$, $\times 3{\cdot}5$, $\times 4$

28. (D) 3, 4, 13, 38, 87, (168), (166), 289

$+ (1)^2$, $+ (3)^2$, $+ (5)^2$, $+ (7)^2$, $+ (9)^2$, $+ (11)^2$

29. (C) 4, 5, 9, 28, (29), 111, 556, 3335

$\times 1 + 1$, $\times 2 - 1$, $\times 3 + 1$, $\times 4 - 1$, $\times 5 + 1$, $\times 6 - 1$

30. (D) 2, 6, 16, 38, 84, (178), (176), 368

$\times 2 + 2$, $\times 2 + 4$, $\times 2 + 6$, $\times 2 + 8$, $\times 2 + 10$, $\times 2 + 12$

31. (D)

32. (B) No. of arrangements for boys $= \lfloor\!\underline{4} = 24$

Now, after this we have (4 + 1) places in which 2 girls can be arranged

$\therefore$ No. of arrangements by girls $= {}^5P_2$

$$= \frac{\lfloor\!\underline{5}}{\lfloor\!\underline{3}}$$

$= 20$

$\therefore$ Total number of arrangements $= 24 \times 20$

$= 480$

33. (D) Money invested by Sunetra for 1 month

$= 50000 \times 36 = \text{Rs. } 1800000$

And money invested by Nikhil for 1 month

$= 80000 \times 30 = \text{Rs. } 2400000$

$\therefore$ Ratio in their investments

$= 1800000 : 2400000$

$= 3 : 4$

$\therefore$ Share of Sunetra in the profit

$$= \frac{3 \times 24500}{3 + 4} = \text{Rs. } 10500$$

34. (C) $9876 = 9875$ (approximate)

$24{\cdot}96 = 25$ (approximate)

$215{\cdot}005 = 215$ (approximate)

$309{\cdot}99 = 310$ (approximate)

$\therefore \quad ? = 9875 \div 25 + 215 - 310$

$= 300$ (approximate)

35. (B) Let the speed of the boat in still water and the speed of the stream be x km/hr. and y km/hr respectively

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$\therefore \quad x + y = \frac{16}{2} = 8 \quad \ldots(1)$

and, $\quad x - y = \frac{16}{4} = 4 \quad \ldots(2)$

From (1) and (2)

$x = 6, y = 2$

$\therefore \quad x = 6$ km/hr.

36. (D)

37. (A) Rate of interest for 6 months

$= 5\%$ and time

$= 2$ half years

$\therefore$ Amount $= 15000\left(1 + \frac{5}{100}\right)^2$

$= 15000 \times \frac{21}{20} \times \frac{21}{20}$

$=$ Rs. 16537·50

38. (C) Let the number of total children be x

$\therefore$ Sweets obtained by each child $= \frac{x}{5}$

$\therefore \quad x \times \frac{x}{5} = 405$

$\Rightarrow \quad x^2 = 2025$

$\therefore \quad x = 45$

Hence the number of sweets obtained by each child

$= \frac{45}{5} = 9$

39. (D) $\quad 2x + 3y + z = 55 \quad \ldots(1)$

$x - y + z = 4 \quad \ldots(2)$

and $\quad -x + y + z = 12 \quad \ldots(3)$

From equations (2) and (3) $z = 8$

$\therefore \quad 2x + 3y + 8 = 55$

$\Rightarrow \quad 2x + 3y = 47$

and $\quad x - y + 8 = 4$

$\Rightarrow \quad x - y = -4$

$\Rightarrow \quad 2x - 2y = -8$

$\therefore \quad y = 11$

40. (A) Quantity of good quality wheat in 150 kg. of wheat $= \frac{150\,(100 - 10)}{100} = 135$ kg.

And quantity of lower quality in 150 kg of wheat $= 15$ kg

If x kg of good quality wheat is mixed, then

$15 = \frac{(150 + x) \times 5}{100}$

$x = 150$ kg.

41. (A) Let Radha's age $= 7x$ year

And Sudha's age $= 9x$ year

In view of question

$\frac{7x - 5}{9x - 5} = \frac{3}{4}$

Sudha's age after 3 years $= 9x + 3$

$= 9 \times 5 + 3$

$= 48$ years.

42. (B) Population in 2007 $= 42\left(1 + \frac{20}{100}\right)^3$

$= 42\left(\frac{6}{5}\right)^3$

$= 72{\cdot}576$ lakhs

43. (B) Let the salaries of A, B and C be Rs. $2x$, Rs. $3x$ and Rs. $5x$ respectively.

$\therefore$ The salaries of A, B and C after the increase

$=$ Rs. $\frac{2x \times 115}{100}$, Rs. $\frac{3x \times 110}{100}$ and Rs. $\frac{5x \times 120}{100}$ respectively

$\therefore$ Ratio in the new salaries

$= \frac{230x}{100} : \frac{330x}{100} : \frac{600x}{100}$

$= 23 : 33 : 60$

44. (D) $\quad 3x + 2x = 47$

$\therefore \quad x = \frac{47}{5}$

$\because \quad 11x = 7y$

$\therefore \quad y = 11 \times \frac{47}{5} \times \frac{1}{7} = \frac{517}{35}$

$\therefore \quad x - y = \frac{47}{5} - \frac{517}{35} = \frac{329 - 517}{35}$

$= \frac{-188}{35}$

45. (D) $\quad ? \times 3 + 30 = 0$

$? = -\frac{30}{3} = -10$

46. (A) $\quad ? = 40{\cdot}83 \times 1{\cdot}02 \times 1{\cdot}2$

$= 49{\cdot}97592$

47. (D) 48. (D) 49. (D)

50. (C) Reqd. different ways $= \lfloor 3 \times \lfloor 4$

$= 6 \times 24$

$= 144$

51. (A) C. I. $= 25000\left[\left(1 + \frac{12}{100}\right)^3 - 1\right]$

$= 25000\,[(1{\cdot}12)^3 - 1]$

$= 25000\,[1{\cdot}404928 - 1]$

$= 25000 \times 0{\cdot}404928$

$=$ Rs. 10123·20

52. (D)

53. (A) Reqd. different ways $= {}^7C_3 - {}^3C_3$

$= \frac{\lfloor 7}{\lfloor 3 \lfloor 4} - \frac{\lfloor 3}{\lfloor 0 \lfloor 3}$

$= 34$

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Short Method : Reqd. no. of ways

$= {}^3C_2 \times {}^4C_1 + {}^3C_1 \times {}^4C_2 + {}^3C_0 \times {}^4C_3$

$= 3 \times 4 + 3 \times \frac{4 \times 3}{2 \times 1} + 1 \times 4$

$= 12 + 18 + 4 = 34$

54. (A) Reqd. number of groups $= {}^7C_5 \times {}^3C_2$

$= 21 \times 3 = 63$

55. (C) Let the bigger number $= x$

$\therefore$ Smaller number $= (x - 100)$

By question, $x \times \frac{70}{100} = (x - 100) \times \frac{4}{5}$

$\Rightarrow 70x = 80\,(x - 100)$

$70x = 80x - 8000$

$\Rightarrow 10x = 8000$

$\therefore x = 800$

$\therefore$ Bigger number $= 800$

56. (B) $\because$ $A + B + C + D = A + B + E + F$

$\therefore C + D = E + F$

57. (B) Let the money invested by M_{nx} in scheme (A) be Rs. P

$\therefore$ Money invested in (B) $=$ Rs. $(35000 - P)$

$\because \frac{P \times 12 \times 2}{100} = 3600$

$\therefore P = \frac{3600 \times 100}{12 \times 2}$

$= $ Rs. 15000

$\Rightarrow 35000 - P =$ Rs. 20000

$\therefore$ Interest accrued in scheme (B)

$= 20000 \left[\left(1 + \frac{10}{100}\right)^2 - 1\right]$

$= 20000 \times \frac{121 - 100}{100}$

$= $ Rs. 4200

58. (D) Reqd. no. of ways $= \frac{\lfloor 7 \times \lfloor 5}{\lfloor 2 \times \lfloor 3}$

$= 50400$

59. (C) Let the number of two digits be $10x + y$

$\therefore (10y + x) - (10x + y) = 18$

$\Rightarrow 9y - 9x = 18$

$\Rightarrow y - x = 2$

and $y + x = 8$

$\therefore x = 3$ and $y = 5$

$\therefore$ Reqd. no. is 35.

60. (D) Let the unit digit $= 3x$

and the tens digit $= 2x$

Then original number $= 10\,(2x) + 3x$

$= 23x$

The new number obtained on transposing the digits

$= 10\,(3x) + 2x$

$= 32x$

By question $32x - 23x = 27$

$9x = 27$

$\Rightarrow x = 3$

Original no. $= 23x$

$= 23 \times 3$

$= 69$

61. (D)

62. (C) Required salary after another 4 years

$= 10000 \left(1 + \frac{50}{100}\right)^4$

$= 10000 \times \frac{3}{2} \times \frac{3}{2} \times \frac{3}{2} \times \frac{3}{2}$

$= $ Rs. 50625

63. (D) $\left(\frac{3}{5} \text{ of } 350\right) - \left(\frac{4}{7} \text{ of } 210\right)$

$= 210 - 120 = 90$

64. (B) $x\,(x + 3) < 10$

$\Rightarrow x^2 + 3x - 10 < 0$

$\Rightarrow (x - 2)\,(x + 5) < 0$

$-5 < x < 2$

65. (C) $\frac{17 \times \frac{32}{x} + 12}{36 \div 9 \times 4 - x} = 10$

$\Rightarrow \frac{544}{x} + 12 = 10\,(16 - x)$

$\Rightarrow \frac{544}{x} + 12 = 160 - 10x$

$\Rightarrow 10x + \frac{544}{x} = 160 - 12$

$\Rightarrow 10x^2 + 544 - 148x = 0$

$\Rightarrow 5x^2 - 74x + 272 = 0$

$\Rightarrow 5x^2 - 40x - 34x + 272 = 0$

$\Rightarrow 5x\,(x - 8) - 34\,(x - 8) = 0$

$\Rightarrow (x - 8)\,(5x - 34) = 0$

$\therefore x = 8$ and $\frac{34}{5}$

66. (D)

67. (A) $? = 16^{7.5} \div 8^{3.5} \div 2^{7.5}$

$= (2)^{30} \div (2)^{10.5} \div (2)^{7.5}$

$= 2^{30 - 10.5 - 7.5}$

$= 2^{12}$

$= (8)^4$

68. (B) Work of (3 men + 4 women + 6 children)

$= $ work of $\left(\frac{3}{2} \text{ women} + 4 \text{ women} + \frac{6}{4} \text{ women}\right)$

$= $ work of 7 women

$\therefore$ 7 women will complete the work in 7 days.

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69. (D) $136 \times 12 \div 9 \times 3 = 136 \times \frac{12}{9} \times 3 = 544$

$17 \times 64 \div 6 \times 3 = 17 \times \frac{64}{6} \times 3 = 544$

$36 \times 17 \div 9 \times 8 = 36 \times \frac{17}{9} \times 8 = 544$

$56 \times 8 \div 14 \times 17 = 56 \times \frac{8}{14} \times 17 = 544$

$76 \times 6 \div 19 \times 17 = 76 \times \frac{6}{19} \times 17 = 408$

70. (A) No. of boys $= \frac{5}{9} \times 45$

$= 25$

No. of girls $= \frac{4}{9} \times 45$

$= 20$

Reqd. average marks $= \frac{25 \times 76 + 20 \times 78}{(25 + 20)}$

$= \frac{3460}{45}$

$= 76{\cdot}89$

71. (B) Total different ways of sitting $= {}^4P_4 \times {}^2P_2$

$= \lfloor 4 \times \lfloor 2$

$= 48$

72. (D) Let the present ages of Seema and Naresh be $5x$ years and $7x$ years respectively.

$\because \quad \frac{5x + 5}{7x + 5} = \frac{3}{4}$

$\Rightarrow \quad 21x + 15 = 20x + 20$

$\Rightarrow \quad x = 5$

$\therefore$ Present age of Naresh $= 35$ years

73. (B) 1. $6p^2 + 5p + 1 = 0$

$\Rightarrow \quad (2p + 1)(3p + 1) = 0$

$p = -\frac{1}{2}$ or $-\frac{1}{3}$

2. $20q^2 + 9q = -1$

$\Rightarrow \quad 20q^2 + 9q + 1 = 0$

$\Rightarrow \quad (5q + 1)(4q + 1) = 0$

$q = -\frac{1}{5}$ or $-\frac{1}{4}$

Hence $p < q$

74. (B) 1. $3p^2 + 2p - 1 = 0$

$(p + 1)(3p - 1) = 0$

$\therefore \quad p = -1$ or $\frac{1}{3}$

2. $2q^2 + 7p + 6 = 0$

$\Rightarrow \quad 2q^2 + 7\left(-1 \text{ or } \frac{1}{3}\right) + 6 = 0$

Either $2q^2 - 1 = 0$

or $2q^2 + \frac{25}{3} = 0$

Either $q = \pm \frac{1}{\sqrt{2}}$

or, $q = \sqrt{-\frac{25}{6}}$ imaginary

Hence $q > p$

75. (A) 1. $3p^2 + 15p = -18$

$\Rightarrow \quad p^2 + 5p + 6 = 0$

$\Rightarrow \quad (p + 2)(p + 3) = 0$

$\therefore \quad p = -2$ or -3

2. $q^2 + 7q + 12 = 0$

$\Rightarrow \quad (q + 3)(q + 4) = 0$

$\therefore \quad q = -3$ or -4

Hence $p > q$

76. (D) 1. $p = \frac{\sqrt{4}}{\sqrt{9}}$

$p = \pm \frac{2}{3}$

2. $9q^2 - 12q + 4 = 0$

$\Rightarrow \quad (3q - 2)^2 = 0$

$q = \frac{2}{3}$

Hence, $p \leq q$

77. (C) 1. $p^2 + 13q + 42 = 0$

$\Rightarrow \quad p^2 \pm 78 + 42 = 0$

$\Rightarrow \quad p^2 = -120$ or 36

$\therefore \quad p = \pm 6$

2. $q^2 = 36$

$\therefore \quad q = \pm 6$

Hence, $p = q$

78. (B) Let the income of B in 1996 and 1997 be Rs. x and Rs. y respectively

$\therefore \quad \frac{x - 12}{12} \times 100 = 35$

$\Rightarrow \quad x - 12 = 35 \times \frac{12}{100}$

$\Rightarrow \quad x = 12 + \frac{420}{100}$

$= $ Rs. $16{\cdot}2$ lakhs.

and $\frac{y - 14{\cdot}5}{14{\cdot}5} \times 100 = 50$

$\Rightarrow \quad y - 14{\cdot}5 = \frac{50 \times 14{\cdot}5}{100}$

$y = 7{\cdot}25 + 14{\cdot}5$

$= $ Rs. $21{\cdot}75$ lakhs

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$\therefore$ Total income in 1996 and 1997

$= 16{\cdot}2 + 21{\cdot}75$

$=$ Rs. 37·95 lakhs.

79. (D) Let the expenditures of companies A and B in 1999 be Rs. $3x$ lakhs and $4x$ lakhs respectively

Profit of A $= 30\%$

$\therefore \quad 30 = \dfrac{\text{Income} - 3x}{3x} \times 100$

$\therefore$ Income of A in 1999 $=$ Rs. $3{\cdot}9x$ lakhs.

and Profit of B $= 40\%$

$\therefore \quad 40 = \dfrac{\text{Income} - 4x}{4x} \times 100$

$\Rightarrow$ Income of B in 1999 $=$ Rs. $5{\cdot}6x$ lakhs

$\therefore$ Reqd. ratio $= \dfrac{3{\cdot}9x}{5{\cdot}6x} = 39 : 56$

80. (D)

81. (A) Let the expenditures of companies A and B each in 2000 be Rs. x lakhs.

If the income of company A in 2000 be Rs. y lakhs.

Then, income of company B in 2000 = Rs. $(5{\cdot}7 - y)$ lakhs.

$\therefore \quad 40 = \dfrac{y - x}{x} \times 100$

$\Rightarrow \quad y = 1{\cdot}4x$

and $\quad 45 = \dfrac{5{\cdot}7 - y - x}{x} \times 100$

$\Rightarrow \quad 5{\cdot}7 = 2{\cdot}85\,x$

$\therefore \quad 2x = \dfrac{5{\cdot}7 \times 2}{2{\cdot}85} =$ Rs. 4 lakhs.

82. (C) Let the income of company B in 1997 and 1998 be Rs. $2x$ and Rs. $3x$ respectively.

If the expenditures of company B in 1997 and 1998 be Rs. y and Rs. z respectively.

$\therefore \quad 50 = \dfrac{2x - y}{y} \times 100 \qquad \Rightarrow x = \dfrac{3y}{4}$

and $\quad 45 = \dfrac{3x - z}{z} \times 100 \qquad \Rightarrow x = \dfrac{1{\cdot}45\,z}{3}$

$\therefore \quad \dfrac{3y}{4} = \dfrac{1{\cdot}45\,z}{3}$

$\Rightarrow \quad \dfrac{y}{z} = \dfrac{1{\cdot}45}{3} \times \dfrac{4}{3}$

$= \dfrac{5{\cdot}8}{9} = 29 : 45$

83. (B) Capital of Neelesh

$= 40000 \times 1 + 50000 \times 1$

$+ 60000 \times 1 + 70000 \times 1$

$=$ Rs. 220000

Capital of Suresh $= 85000 \times 2$

$=$ Rs. 170000

Ratio of Capitals $= 220000 : 170000$

$= 22 : 17$

Share of Neelesh $= \dfrac{22}{(22 + 17)} \times 195000$

$=$ Rs. 110000

84. (C)

85. (D) Reqd. average percentage of marks

$= \dfrac{64 + 56 + 58 + 72 + 77 + 68}{6}$

$= 65{\cdot}8$

86. (C) Marks obtained by A in P, Q and R together

$= \dfrac{68 \times 70}{100} + \dfrac{84 \times 80}{100} + \dfrac{77 \times 120}{100}$

$= 47{\cdot}6 + 67{\cdot}2 + 92{\cdot}4 = 207{\cdot}2$

Marks obtained by F in S, T and U together

$= \dfrac{68 \times 125}{100} + \dfrac{68 \times 75}{100} + \dfrac{71 \times 150}{100}$

$= 85 + 51 + 106{\cdot}5 = 242{\cdot}5$

$\therefore$ Reqd. percentage $= \dfrac{207{\cdot}2 \times 100}{242{\cdot}5}$

$= 85{\cdot}44\%$

$=$ 85% (Approximate)

87. (A) Per cent of marks obtained by B in all the subject together

$= \dfrac{(49 \times 70 + 79 \times 80 + 62 \times 120 + 85 \times 125 + 56 \times 75 + 76 \times 150)}{70 + 80 + 120 + 125 + 75 + 150}$

$= \dfrac{(3430 + 6320 + 7440 + 10625 + 4200 + 11400)}{620}$

$= \dfrac{43415}{620} = 70{\cdot}02$

88. (B) Total marks obtained by D in all the subjects together

$= \dfrac{70 \times 75}{100} + \dfrac{80 \times 85}{100} + \dfrac{82 \times 120}{100} + \dfrac{88 \times 125}{100} + \dfrac{72 \times 75}{100} + \dfrac{78 \times 150}{100}$

$= 52{\cdot}5 + 68 + 98{\cdot}4 + 110 + 54 + 117$

$= 499{\cdot}9$

89. (D) Average marks obtained out of 80 by all these x students together in subjects

$Q = \dfrac{80}{100 \times 6}(84 + 79 + 81 + 85 + 66 + 70)$

$= \dfrac{80 \times 465}{600} = 62$

90. (D) Let the income and expenditure of the company X in 1998-99 be Rs. P crore and T crore respectively.

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$\therefore \quad 30 = \frac{P - T}{T} \times 100$

$\Rightarrow \quad P = 1{\cdot}3\,T$

$\therefore$ Profit in 1998-99 of company X

$= P - T$

$=$ Rs. 0·3 T crores

If the income of the company Y in 2001-02 be Rs. 1 crore.

Then $\quad 50 = \frac{1 - \square P}{P} \times 100$

$\Rightarrow \quad P = \frac{2}{3} I$

$\therefore \quad$ Profit $= \frac{1}{3} I$

$= \frac{1}{3} \times \frac{3}{2} P = \frac{P}{2} = 0{\cdot}65\,T$

$\therefore$ Reqd. ratio $=$ 0·3 T : 0·65 T

$=$ 6 : 13

91. (C) Let the income of the company X in 2001-02 be Rs. W crore

$\therefore$ Expenditure of the company X in 2002-03

$=$ Rs. W crores

If the income of the company X in 2002-03 be Rs. 1 crore

then $\quad 50 = \frac{1 - W}{W} \times 100$

$\therefore \quad 1 = \frac{3}{2} W$

$\therefore \quad$ Reqd. ratio $= W : \frac{3}{2} W$

$= 2 : 3$

92. (C) For Company Y—

In 1998-99 increase in per cent profit over that of previous year

$= \frac{20 - 15}{15} \times 100 = 33{\cdot}3$

In 1999-2001 increase in per cent profit over that of previous year

$= \frac{30 - 20}{20} \times 100 = 50{\cdot}00$

In 2000-01 increase in per cent profit over that of previous year = 0

In 2001-02 increase in per cent profit over that of previous year

$= \frac{50 - 30}{30} \times 100 = 66{\cdot}66$

In 2002-03 increase in per cent profit over that of previous year

$= \frac{60 - 50}{50} \times 100 = 20{\cdot}00$

$\therefore$ The highest per cent of increase in per cent profit is in 2001-02

93. (B) Let the income of the company X in 1997-98 be Rs. k crores

$20 = \frac{k - 40}{40} \times 100$

$\Rightarrow \quad \frac{20 \times 40}{100} = k - 40$

$\therefore \quad k =$ Rs. 48 crores

94. (D) Since the income of the companies are not known so that answer cannot be determined.

95. (D) Let the expenditure of the company Y in 2002-03 be Rs. x crores

$\therefore \quad 60 = \frac{128 - x}{x} \times 100$

$\Rightarrow \quad 60x = 12800 - 100x$

$\Rightarrow \quad 160x = 12800$

$\therefore \quad x = \frac{12800}{160} =$ Rs. 80 crores

96. (D) Marks obtained by T in all subjects

$= \frac{67 \times 75}{100} + \frac{74 \times 60}{100} + \frac{74 \times 80}{100} + \frac{50 \times 84}{100} + \frac{40 \times 85}{100} + \frac{40 \times 82}{100}$

$= 50{\cdot}25 + 44{\cdot}40 + 59{\cdot}20 + 42{\cdot}00 + 34{\cdot}00 + 32{\cdot}80$

$= 262{\cdot}65$

$\therefore$ Reqd. percentage $= \frac{262{\cdot}65 \times 100}{345}$

$=$ 76 (Approximate)

97. (D) Marks obtained by M in all subjects

$= \frac{74 \times 75}{100} + \frac{86 \times 60}{100} + \frac{80 \times 64}{100} + \frac{50 \times 80}{100} + \frac{40 \times 78}{100} + \frac{40 \times 72}{100}$

$= 55{\cdot}50 + 51{\cdot}60 + 51{\cdot}26 + 40{\cdot}00 + 31{\cdot}20 + 28{\cdot}80$

$= 258{\cdot}30$

$\therefore$ Reqd. percentage $= \frac{258{\cdot}30 \times 100}{345} = 74{\cdot}87$

98. (A) Marks obtained in Geography by all the students

$= 49{\cdot}2 + 46{\cdot}8 + 56{\cdot}4 + 44{\cdot}4 + 51{\cdot}6 + 53{\cdot}4 + 57{\cdot}6$

$= 359{\cdot}4$

$\therefore$ Reqd. average marks $= \frac{395{\cdot}4}{7} = 51{\cdot}34$

99. (C) Total marks obtained by L in History, Geography and Mathematics

$= 66 + 53{\cdot}4 + 60{\cdot}8 = 180{\cdot}2$

100. (B) Reqd. average

$= \frac{95 + 85 + 89 + 74 + 64 + 76 + 86}{7}$

$= \frac{569}{7} = 81{\cdot}29$

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Miscellaneous Exercise – II

Directions : (Q. 1–5) Each of the following questions depends on the table given below—

Distribution of malnutrition in children in percentage in various years

Year	Total surveying number (N)	Degree of malnutrition			
		General	Mild	Moderate	Serious
1998	18,000	3·0	14·0	65·0	18·0
1999	2,410	3·8	21·9	53·8	20·5
2000	1,721	3·4	22·1	52·6	21·8
2001	6,775	10·6	41·1	39·8	8·5
2002	4,713	14·3	42·4	34·9	8·4
2003	4,008	14·8	47·9	32·6	4·7
2004	9,180	16·5	53·4	28	2·1
Total	**46,807**				

1. In which of the following years there was most improvement in degree of malnutrition in comparison of previous year ?
   (A) 2000 (B) 2001
   (C) 2002 (D) 2003
2. How many per cent approximately was mild malnutrition in all the years together ?
   (A) 35 (B) 32
   (C) 42 (D) 46
3. How many were normal in the number of the surveying in all the years ?
   (A) 4439 (B) 7723
   (C) 4681 (D) 4192
4. How many cases were moderate and serious malnutrition together in the surveying in 1998 ?
   (A) 15,000
   (B) 11,700
   (C) 14,220
   (D) None of these
5. What was the approximate percentage decrease in moderate cases from 1998 to 2004 ?
   (A) 57 (B) 38
   (C) 43 (D) $11\frac{2}{3}$

Directions : (Q. 6–10) What approximate value should come in place of the question mark (?) in the following question (?)

(You are not expected to calculate the exact value)

6. $989{\cdot}001 + 1{\cdot}00982 \times 76{\cdot}792 = ?$
   (A) 1000 (B) 1100
   (C) 1065 (D) 110
7. $\sqrt{624{\cdot}9995} + (4{\cdot}9989)^2 = ? \div \frac{1}{4{\cdot}9900865}$
   (A) 6 (B) 50
   (C) 10 (D) 125
8. $6{,}23{,}898 \times 99 = ? \times 60{,}000$
   (A) 1000 (B) 1030
   (C) 1050 (D) 1065
9. $\frac{4}{5} \times \frac{3}{7} \div \frac{6}{7} \div \frac{5}{9} = ?$
   (A) $\frac{9}{17}$ (B) $\frac{20}{49}$
   (C) $\frac{18}{25}$ (D) $\frac{1}{2}$
10. $(399{\cdot}98)^2 = ?$
    (A) 160000 (B) 15999
    (C) 1600 (D) 1599

Directions : (Q. 11–15) In each of the following questions a question is followed by information given in three statements. You have to study the question along with statements and decide the information given in which of the statement(s) is necessary and sufficient to answer the question.

11. What is the volume of the cylindrical tank ?
    (1) Area of the base is x square metres
    (2) Height of the tank is y metres
    (3) Diameter of the base is equal to the height of the tank.
    (A) Only 1 and 2
    (B) Only 2 and 3
    (C) Only 1 and 3
    (D) Any two of three
12. How many children are there in the class ?
    (1) 20% children speak only Hindi
    (2) 44 children can speak languages other than Hindi
    (3) There are 30 boys in the class
    (A) All 1, 2 and 3
    (B) Any two of the three
    (C) 2 and either 1 or 3
    (D) 1 and 2 only
13. What is the speed of the train ?
    (1) Length of the platform is 150% of the length of the train
    (2) The train crosses the platform in 25 seconds
    (3) The train crosses the signal pole in 10 seconds
    (A) All 1, 2 and 3
    (B) 1 and either 2 or 3
    (C) Only 2 and 3
    (D) Question cannot be answered even with the information in all three statements
14. What is the selling price of the T.V. set if no discount is offered ?
    (1) Profit earned was 20%
    (2) Had 10% discount been offered on selling price the profit would have been Rs. 1200
    (3) Cost price is Rs. 15000
    (A) Any two of the three
    (B) Only 1 and 2
    (C) Only 1 and 3
    (D) Only 2 and 3
15. What is the average weight of girls in the class ?
    (1) Average weight of all the 60 students is 42 kg
    (2) Average weight of boys is 43 kg
    (3) Total weight of all the girls together is 1144 kg

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(A) Any two of the three

(B) All 1, 2 and 3

(C) 1 and 2 only

(D) 2 and 3 only

Directions : (Q. 16–21) Study the information given in each of these questions to answer the questions.

16. Cumulative frequency of number of books purchased—

January	150	June	580
February	260	July	780
March	290	August	1010
April	360	September	1120
May	450		

In which month were highest number of books purchased ?

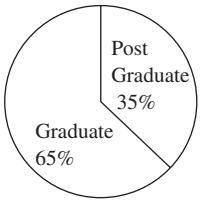
(A) September

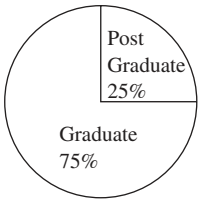
(B) July

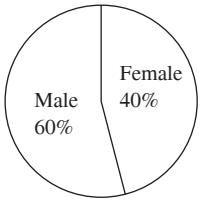
(C) August

(D) Cannot be determined

17. Percentage of sex (male female) and education level (postgraduate or graduate) data of a college







Total N = 2300

Total how many postgraduates are there in the college ?

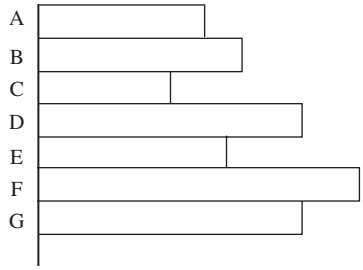
(A) 805

(B) 1380

(C) 690

(D) None of these

18. A Candidate's score (out of 100) in different subjects—



The difference in scores is maximum between which of the two subjects ?

(A) A and F (B) C and F

(C) D and F (D) A and B

19. Caloric value of food per 100 gms.

Food	Value
X	100
Y	29
Z	110
A	70
B	40

Who consumed the most calories ?

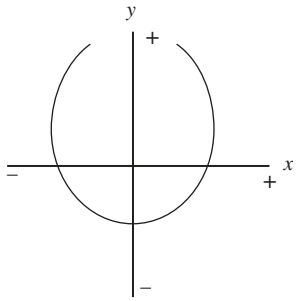
(A) Geeta had 200 gms of X, 50 gms of A and 200 gms of B

(B) Jyoti had 50 gms each of X, Y, Z and B and 250 gms of A

(C) Meera had 300 gms of Z

(D) Surekha had 100 gms of each of food item listed above

20. Study the graph and answer the question given below—



Which of the following is true about the value of x and y in the graph ?

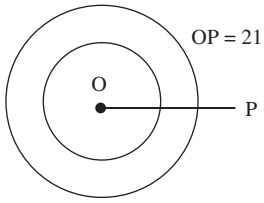
(A) When x is negative, y is also negative

(B) When x is positive, y is negative

(C) For each value of y, there are four corresponding values of x

(D) None of these

21. Population of two states represented by circle is equal to the area of the circle (in lakhs). What is the population of the smaller state ?



(A) 1386 lakhs

(B) 693 lakhs

(C) 132 lakhs

(D) Cannot be determined

22. A 180 metres long train crosses a platform of equal length in 18 seconds. What is the speed of the train ?

(A) 22 metres/seconds

(B) 10 metres/seconds

(C) 15 metres/seconds

(D) None of these

23. What would be the compound interest drawn on an amount of Rs. 18,400 @ 12 per cent p.a. at the end of 3 years ?

(A) Rs. 4680·96

(B) Rs. 7450·6752

(C) Rs. 6235·2143

(D) Rs. 8042·16

24. When an odd number of two digits is divided by an even number of two digits, then quotient is 0·625. If the odd number is less than the even number by 5, then what is the ratio between odd number and even number ?

(A) 5 : 8

(B) 8 : 5

(C) 6 : 9

(D) Cannot be determined

25. A Shopkeeper purchased rice of 3 varieties a, b, c which cost Rs. 34·50, Rs. 28·60 and Rs. 32·40 per kg respectively. In which of the following bargain he will earn the maximum ?

(A) He purchased (A) and (C) each 20 kg and sold them at Rs. 38·00 and Rs. 36·00 per kg respectively

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(B) He purchased (A) and (B) 30 kg and 40 kg respectively and sold them Rs. 37·00 and Rs. 33·00 per kg respectively

(C) He purchased (B) and (C) 20 kg and 40 kg respectively and sold them at Rs. 40·00 and Rs. 38·00 per kg respectively

(D) He purchased (C) and (A) 25 kg and 30 kg respectively and sold them at Rs. 42·00 and Rs. 38·00 per kg respectively

26. What would be the cost of building a 7 metres wide garden around a circular field with diameter equal to 280 metres. If the cost per sq. metre for building the garden is Rs. 21 ?

(A) Rs. 1,56,242

(B) Rs. 2,48,521

(C) Rs. 1,11,624

(D) None of these

27. The simple interest accrued on an amount of Rs. 14,800 at the end of three years is Rs. 6,216. What would be the compound interest accrued on the same amount at the same rate in the same period ?

(A) Rs. 6,986·1142

(B) Rs. 7,042·2014

(C) Rs. 7,126·8512

(D) Rs. 8,321·4166

28. Vipul decided to donates 5% of his salary. On the day of donation he changed his mind and donated Rs. 1687·50. Which was 75% of what he had decided earlier. How much is Vipul's salary ?

(A) Rs. 37,500

(B) Rs. 45,000

(C) Rs. 33,750

(D) Cannot be determined

29. 9 children can complete a piece of work in 360 days, 18 men can complete the same piece of work in 72 days and 12 women can complete the piece of work 162 days. In how many days can 4 man, 12 women and 10 children together complete the piece of work ?

(A) 124 (B) 81

(C) 68 (D) 96

Directions : (Q. 30–34) In each of the following questions there is a question which is followed by three statements. Read the question and all the three statements and then decide which of the statement(s) is/are sufficient to answer the question—

30. What is the area of the hall ?

(1) The cost of the material for the floor is Rs. 250 per square metre

(2) The cost of labour for the floor of the hall is Rs. 3500

(3) Total cost of the floor of the hall is Rs. 14500

(A) Only 1 and 2

(B) Only 2 and 3

(C) 1, 2 and 3

(D) None of these

31. How many per cent was the discount ?

(1) After allowing the discount, the profit on the article sold for Rs. 252 was Rs. 52

(2) If there was no discount then profit was Rs. 80

(3) If there was no discount then profit was 40%

(A) Only 1 and 2

(B) 2 and either 1 or 3

(C) Only 1 and 3

(D) 1 and either 2 or 3

32. What is the speed of the train ?

(1) The train crosses a railway signal pole in 13 seconds

(2) The train passes a platform 250 m long in 27 seconds

(3) The train crosses another train going in the same direction in 32 seconds

(A) Only 1 and 2

(B) Only 1 and 3

(C) Only 2 and 3

(D) Any two out of three

33. What is the population of the state 'A' ?

(1) After the increase of 15% the population of 'A' increases 1·61 lakh

(2) The ratio in the population of the States 'A' and 'B' is 7 : 8

(3) The population of the State 'B' is 1·6 lakh

(A) Only 1

(B) Only 2 and 3

(C) Only 1 and 3

(D) Either 1 or 2 and 3

34. To complete the construction work how many labours are required ?

(1) 8 labours can complete 20% of work in 8 days

(2) 20 labours can complete the work in 16 days

(3) 8 labours can complete the work in 5 days

(A) Only 1 and 3

(B) Only 2 and 3

(C) Only 1

(D) Any one of the three

35. Cost of 25 pencils and 20 sharpeners is Rs. 100. If the cost of a sharpener is more than the cost of a pencil by 50 paise. What is the total cost of 3 pencils and 4 sharpeners ?

(A) Rs. 15

(B) Rs. 25

(C) Rs. 20

(D) None of these

Directions : (Q. 36–40) Two equations 1 and 2 are given in each question. On the basis of these equations you have to decide the relation between p and q and give answer.

(A) If no relation can be decided between p and q

(B) If $p > q$ (C) If $q > p$

(D) If $p = q$ (E) If $p \geq q$.

36. (1) $p^2 + 13p + 40 = 0$

(2) $q^2 + 7q + 12 = 0$

37. (1) $p = (-10)^2$

(2) $q^2 + q - 9900 = 0$

38. (1) $p^2 - 5p + 6 = 0$

(2) $q^2 - 4q + 3 = 0$

39. (1) $p = 10$

(2) $q = \sqrt{100}$

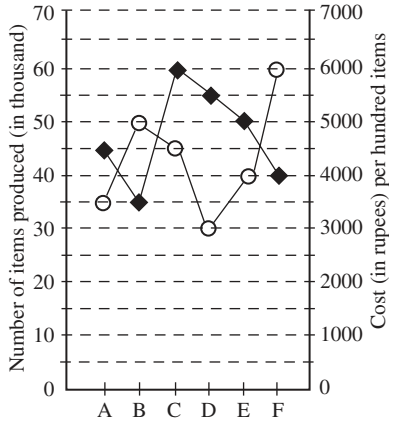
40. (1) $p = \pm 100$

(2) $q = (10000)^{1/2}$

Directions : (Q. 41–45) Study the following graph carefully to answer these questions—

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Number of items produced (in thousands) and cost (in rupees) per hundred items in six companies.



41. What will be the total cost of items produced by company C ?
(A) Rs. 32 lakh
(B) Rs. 24 lakh
(C) Rs. 27 lakh
(D) Rs. 36 lakh

42. What is the average cost per hundred items for all the given companies ?
(A) Rs. $4183\frac{2}{3}$
(B) Rs. $4283\frac{1}{3}$
(C) Rs. $433\frac{2}{3}$
(D) None of these

43. What is the total cost of items produced by companies A and B together ?
(A) Rs. 17·50 lakh
(B) Rs. 33·25 lakh
(C) Rs. 15·75 lakh
(D) Rs. 32·75 lakh

44. What was the total number of items produced by all the companies together ?
(A) 28500
(B) 258000
(C) 25800
(D) None of these

45. If the number of items produced by company 'D' increases by 30%. What will be the total cost of items produced ?
(A) Rs. 21·45 lakhs
(B) Rs. 22·45 lakhs
(C) Rs. 24·25 lakhs
(D) Rs. 22·25 lakhs

46. Two-third of one-fourth of a number is equal to 40% of another number which one of the following statements is true about the numbers ?
(A) Second number is 2·4 times of the first number
(B) First number is 2·4 times of the second number
(C) First number is more than the second number by 40%
(D) Second number is less than the first number by 60%

47. 8 men alone can complete a piece of work in 12 days. 4 women alone can complete the same piece of work in 48 days and 10 children alone can complete the piece of work in 24 days. In how many days can 10 men, 4 women and 10 children together complete the piece of work ?
(A) 5 (B) 15
(C) 28 (D) 6

Directions : (Q. 48–52) Study the following table to answer these questions—

Percentage of Marks obtained by seven students in six subjects
(Maximum marks for each subject are shown in bracket)

Subject / Student	History (75)	Geography (60)	Maths (80)	Science (50)	English (40)	Hindi (40)
P	86	82	95	78	66	84
Q	92	78	85	89	72	76
R	76	94	89	75	62	69
T	67	74	74	84	85	82
M	74	86	64	80	78	72
L	88	89	76	88	70	64
N	90	96	86	92	65	66

48. Approximately what is the overall percentage of marks obtained by T in all the subjects ?
(A) 79 (B) 82
(C) 86 (D) 76

49. What is the percentage of marks obtained by M in all subjects ?
(Answer upto two places of decimal)
(A) 82·74 (B) 84·76
(C) 76·84 (D) 74·87

50. What is average of marks in Geography obtained by all students ?
(A) 51·34 (B) 85·57
(C) 52·36 (D) 76·27

51. What total of marks obtained by 'L' in History, Geography and Maths ?
(A) 221·8 (B) 253
(C) 180·2 (D) 184

52. What is the average of percentage of marks obtained by all students in Mathematics ?
(A) 81·92 (B) 81·29
(C) 65·03 (D) 76·23

53. The area of a circle is seven times its circumference. What is the circumference of the circle ?
(A) 616
(B) 132
(C) 88
(D) Cannot be determined

Directions : (Q. 54–58) Study the following table carefully to answer these questions.

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Number of Articles (in thousands) Manufactured (M) and Defective (D) by 5 units of a company over the years

Year	Units									
	I		II		III		IV		V	
	M	D	M	D	M	D	M	D	M	D
1996	53	21	45	12	76	38	56	21	46	18
1997	29	18	32	10	45	24	63	24	36	14
1998	50	18	48	18	55	16	68	30	34	15
1999	65	20	68	15	57	20	54	19	48	12
2000	70	31	72	13	82	22	48	27	58	10
2001	44	15	56	22	38	32	40	15	60	11

54. What is the ratio between total number of article manufactured by unit III to that by unit V for all the years together ?
(A) 353 : 282 (B) 282 : 353
(C) 457 : 215 (D) 215 : 457

55. What is the average number of defective items from units II for the given years ?
(A) 21,500 (B) 4,000
(C) 12,500 (D) 15,000

56. During which year the largest percentage of articles were defective out of the articles manufactured by unit IV ?
(A) 1996 (B) 1997
(C) 1998 (D) 2000

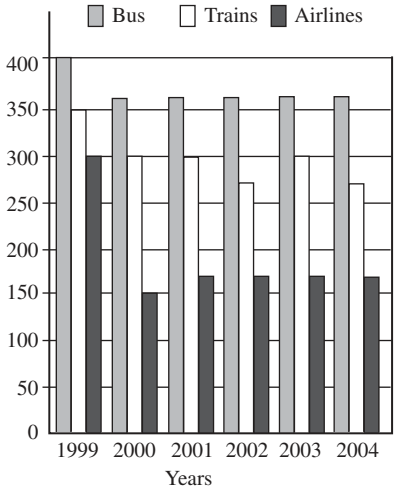
57. What was the percentage (rounded off to nearest integer) of defective articles over the number of articles manufactured by all units together in the year 2001 ?
(A) 42 (B) 40
(C) 37 (D) 33

58. During which year was the percentage increase/decrease in manufacture from the previous year the highest for unit ?
(A) 1998 (B) 2001
(C) 1999 (D) 1997

59. A boat takes 8 hours to cover a distance while travelling up stream whereas while travelling down stream it takes 6 hours. If the speed of the current is 4 km/ph. What is the speed of the boat in still water ?
(A) 12 kmph
(B) 28 kmph
(C) 16 kmph
(D) Cannot be determined

Directions : (Q. 60–64) Study the following graph carefully and answer the question given below.

Preferences of People in Using Different Modes of Transport Over the Year



60. In 2001, the people prefering to travel by bus represented approximately what per cent of the people preferring to travel by buses, trains and airlines together in that year ?
(A) 65% (B) 25%
(C) 55% (D) 45%

61. From 1999 to 2004, the total number of people who preferred to travel by trains, was approximately how many millions ?
(A) 1300 (B) 1800
(C) 1600 (D) 1700

62. What is the respective ratio of the number of people preferring to travel by bus to the number of people prefering to travel by train in the year 2002 ?
(A) 15 : 11 (B) 9 : 7
(C) 7 : 9 (D) 11 : 15

63. In the year 2003. If all the airlines reduced their rates by 50% and 50% of the people who preferred to travel by train, now preferred airlines, approximately how many millions of people prefer to travel by air ?
(A) 290 (B) 308
(C) 330 (D) 325

64. The number of people preferring to travel by train in 2004, was how many millions fewer than the number of people preferring to travel by train in 1999 ?
(A) 70 (B) 4
(C) 75 (D) 50

65. Two cars A and B are running in the same direction. Car 'A' had already covered a distance of 60 km. When car 'B' started running. The cars meet each other in 3 hours after car 'B' started running. What was the speed of car 'A' ?
(A) 40 kmph
(B) 60 kmph
(C) 45 kmph
(D) Cannot be determined

66. The radius of a circle is more than the height of a right angled triangle by 20%. The base of the right angled triangle is 36 cm. If the area of the right angled triangle is equal to the area of the circle, then what is the approximate area of the circle ?
(A) 72 sq cm (B) 144 sq cm
(C) 216 sq cm (D) 128 sq cm

Directions : (Q. 67–71) Study the table carefully to answer the questions that follow—

Sale (in crores) of number of units by six Different Companies over the years

Year → Company ↓	1997	1998	1999	2000	2001	2002
L	107·0	80·0	28·48	38·0	26·5	36·6
M	175·1	76·0	31·38	43·0	27·5	32·8
N	156·6	66·49	43·7	45·2	19·0	40·12
O	112·4	78·24	56·6	35·1	25·1	25·0
P	95·1	111·8	53·2	48·9	22·5	37·0
Q	192·0	72·18	31·04	42·2	17·0	30·0

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67. Which year is the percentage increase/decrease in number of units sold from the previous year the lowest for company L ?
(A) 2000 (B) 2002
(C) 2001 (D) 1998

68. What is the difference between number of units sold by company O in the year 1997 and the year 2000 ?
(A) 7730000000
(B) 773000000
(C) 7030000000
(D) 77300000

69. What is the approximate average number of units sold in the year 1999 ?
(A) 407300000
(B) 4040000
(C) 42740000
(D) 4073000000

70. Number of units sold by company M in the year 2002 is what per cent of the total number of units sold by all the companies together in that year ? (rounded off to two digits after decimal)
(A) 14·16
(B) 21·18
(C) 16·28
(D) None of these

71. Which company has sold the maximum number of units over the years ?
(A) Q
(B) M
(C) N
(D) None of these

72. If the digits of a two digit number are interchanged, the number so obtained is greater than the original number by 27. If the sum of the two digits of the number is 11. What is the original number ?
(A) 47
(B) 38
(C) 74
(D) Cannot be determined

Directions : (Q. 73–77) Each of these questions have a questions followed by information given in three statements (1) (2) and (3). You have to study the question along with the information in three statements and decide that the information in which of the statement(s) is/are necessary to answer the question ?

73. What is the principal amount ?
(1) Difference between simple interest and compound interest for 2 years is Rs. 37·50
(2) Simple interest for 3 year is Rs. 2·250
(3) Simple interest and compound interest for the first year are equal
(A) Only 1
(B) Only 1 and 2
(C) Only 1 and 3
(D) Any two of the three

74. What is the area of the rectangular garden ?
(1) Perimeter of the garden is 220 metres
(2) Length and the breadth of the garden are in the respective ratio of 7 : 4
(3) Length is less than twice the breadth by 30 metres.
(A) Only 1 and 2
(B) Only 1 and 3
(C) 1 and either 2 or 3 only
(D) Only 2 and 3

75. What was the population of State 'A' ?
(1) Males and females were in the ratio of 4 : 5 respectively
(2) 70% of the population was literate
(3) 8 lakh males were literate in the State
(A) Only 1 and 2
(B) Only 2 and 3
(C) Any two of three
(D) Question cannot be answered even with the information in all three statements

76. In how many days can the work be completed by 10 women ?
(1) 5 men can complete the work in 8 days
(2) 6 men and 4 women together can complete the work in 5 days
(3) One man and one woman together can do thrice the work done by a woman in one day
(A) Only 1
(B) Only 2 and 3
(C) Only 1 and 3
(D) Any two of the three

77. What is the speed of the train ?
(1) The train crosses a signal pole in 14 secs.
(2) The train crosses another train in 6 secs.
(3) The train crosses a 200 metres long platform in 24 secs.
(A) Only 1 and 2
(B) Only 1 and 3
(C) Only 2 and 3
(D) Any two of the three

78. Subhash starts a business by investing Rs. 25,000, 6 months later Aditya joins him by investing Rs. 15,000. After another 6 months Aditya invests an additional amount of Rs. 15,000. At the end of 3 years they earn a profit of Rs. 2,47,000. What is Aditya's share in the profit ?
(A) Rs. 1,30,000
(B) Rs. 1,23,000
(C) Rs. 1,05,000
(D) None of these

Directions : (Q. 79–86) What will come in place of the question mark (?) in the following questions ?

79. $1984 + 523 - ? = 1899$
(A) 718 (B) 608
(C) 708 (D) 618

80. $1400 \times ? = 1050$
(A) $\frac{1}{4}$ (B) $\frac{3}{4}$
(C) $\frac{3}{5}$ (D) $\frac{2}{3}$

81. 40% of ? = 240
(A) 60 (B) 6000
(C) 960 (D) 600

82. $(1515)^2 = ? \div 1515$
(A) 3030 (B) 235225
(C) 4485 (D) 5115

83. $35 + 15 \times 1{\cdot}5 = ?$
(A) 75 (B) 5·25
(C) 57·5 (D) 51·5

84. $\sqrt[3]{19683} = ? \times 3$
(A) 90
(B) 7
(C) 3
(D) None of these

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85. $3 + 33 + 333 + 3{\cdot}33 = ?$
(A) 362·3 (B) 372·33
(C) 702·33 (D) 702

86. 60 = ?% of 400
(A) 6 (B) 2
(C) 20 (D) 15

87. The area of a square of one side 8 cm is equal to the area of a rectangle. Which of the following statement about the rectangle is/are correct ?
(1) The length of the rectangle is 16 times of the breadth
(2) The length of the rectangle is 32 times of the breadth
(3) The breadth of the rectangle is $\frac{1}{6}$ of the length
(4) The breadth of the rectangle is $\frac{1}{9}$ of the length
(A) Only (1) and (2)
(B) Only (3) and (4)
(C) Either (1) or (2)
(D) Either (3) or (4)

Directions : (Q. 88–92) What will come in place of the question mark (?) in the following questions ? (a, b, c are integers)

88. $(a)^c \times (b)^a \times ? = 0$
(A) 1 (B) – 1
(C) 0 (D) $(c)^b$

89. $[(a)^2] ? = a^6$
(A) 6 (B) 5
(C) 3 (D) $2a$

90. $? \times (|a| \times |b|) = -ab$
(A) – 1 (B) 1
(C) 0 (D) c

91. $(c)^0 \times b = ?$
(A) 1
(B) 0
(C) cb
(D) None of these

92. $[(a)^b] ? = 1$
(A) 1
(B) c
(C) a
(D) None of these

Directions : (Q. 93–97) What should come in place of the question mark (?) in the following number series ?

93. 13 30 66 140 ? 592
(A) 210 (B) 290
(C) 428 (D) 430

94. 24 ? 109 134 150 159
(A) 71
(B) 65
(C) 86
(D) None of these

95. 3 5 15 ? 1125 84375
(A) 75 (B) 20
(C) 45 (D) 80

96. 3 20 78 332 1680
(A) 8410 (B) 9836
(C) 10098 (D) 1150

97. 17 9 10 ? 35 90
(A) 21 (B) 27·5
(C) 19 (D) 16·5

98. In one-day cricket match the captain of one of teams scored 30 runs more than the average runs scored by the remaining six batsman of that team who batted in the match. If the total runs scored by all the batsman of that team were 310, how many runs did the captain score ?
(A) 60
(B) 70
(C) 50
(D) Cannot be determined

99. The average of four number A, B, C and D is 40. The average of four number A, B, E and F is also 40. (A, B are common) Which of the following must be true ?
(A) $(A + B) \neq (C + D)$
(B) $(C + D) = (E + F)$
(C) Either C = E or F and D = F or E
(D) C = E and D = F

100. Mohan distributed his total assests to his wife, three sons, two daughters and five grand children in such a way that each grand child got one-eight of each son or one-tenth of each daughter. His wife got 40 per cent of the total share of his sons and daughters together. If each daughter received assest of worth Rs. 1·25 lakh, what was the total worth of the assests received by his wife and the three grand children together ?
(A) Rs. 32500
(B) Rs. 257500
(C) Rs. 282500
(D) Cannot be determined

Answers with Hints

1. (B) There was most improvement in degree of mal-nutrition in the year 2001 in comparison of previous year.

2. (A) Required percentage
$$= \frac{14{\cdot}0 + 21{\cdot}9 + 22{\cdot}1 + 41{\cdot}1 + 42{\cdot}4 + 47{\cdot}9 + 53{\cdot}4}{7}$$
$$= \frac{242{\cdot}8}{7}\% = 35\%$$

3. (D) Required number
$$= \frac{3}{100} \times 180 + \frac{3{\cdot}8}{100} \times 2410 + \frac{3{\cdot}4}{100} \times 1721 + \frac{10{\cdot}6}{100} \times 6775 + \frac{14{\cdot}3}{100} \times 4713 + \frac{14{\cdot}8}{100} \times 4008 + \frac{16{\cdot}5}{100} \times 9180$$
$$= 540 + 91{\cdot}58 + 58{\cdot}51 + 718{\cdot}15 + 673{\cdot}95 + 593{\cdot}18 + 1514{\cdot}70$$
$$= 4190{\cdot}07$$
$$= 4192$$

4. (D) Required no. $= \frac{(65 + 18) \times 1800}{100}$
$= 14940$

5. (B) Required percentage $= (65{\cdot}0 - 28)\%$
$= 37\%$
$= 38\%$

6. (C) 7. (B) 8. (B) 9. (C) 10. (A)

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11. (D) From 1 area of the base = x sq. m

From 1 and 2 vol. of the tank = xy m^3

From 1, diameter of the base = $\sqrt{\frac{4x}{\pi}}$

and From 3 height = $\sqrt{\frac{4x}{\pi}}$

$\therefore$ From 1 and 3 vol. of the tank = $x \times \sqrt{\frac{4x}{\pi}}\, m^3$

From 2 and 3 vol. of the tank = $\pi \left(\frac{y}{2}\right)^2 \times y.$

$\therefore$ Any two of the three are sufficient to answer the question.

12. (D) From 1, 20% children speak Hindi only

$\therefore$ 80% children can speak other languages

From 2, 44 children can speak language other than Hindi.

If x is the total number children in the class then

$x \times 80\% = 44$

$\therefore$ For answer 1 and 2 are sufficient.

13. (D) From 1, If length of the train be x metres

Then length of the platform = $\frac{3x}{2}$ metres

From 2, speed of the train = $\frac{x + \frac{3x}{2}}{25}$

From 3, speed of the train = $\frac{x}{10}$

$$\frac{x + \frac{3x}{2}}{25} = \frac{x}{10}$$

as the value of x cannot be found. Hence question cannot be answered even with the information in all three statements.

14. (C) From 1 and 3 S. P. = Rs. $15000 \left(1 + \frac{20}{100}\right)$

Hence 1 and 3 are sufficient to answer the question.

15. (B) From 1, total weight of 60 students

= $60 \times 42 = 2520$ kg

From 3, total weight of all the girls

= 1144 kg

$\therefore$ From 1 and 3, total weight of all the boys

= 2520 – 1144

= 1376 kg

$\therefore$ From 2, average weight of boys = 43 kg

$\therefore$ From 1, 2 and 3 no. of boys = $\frac{1376}{43}$

= 32

$\therefore$ No. of girls = 60 – 32

= 28

$\therefore$ Average weight of girls = $\frac{1144}{28}$ kg

Hence to answer the question all the three statements are necessary.

16. (C)

Months	C.F.	F.
January	150	150
February	260	110
March	290	30
April	360	70
May	450	90
June	580	130
July	780	200
August	1010	230
September	1120	110

$\therefore$ The number of books purchased was the highest in August.

17. (D) No. of male in the college

= $\frac{60}{100} \times 2300 = 1380$

And no. of female in the college

= $\frac{40 \times 2300}{100} = 920$

$\therefore$ No. of post graduate in the college

= $\frac{35}{100} \times 1380 + \frac{25 \times 920}{100}$

= 483 + 230 = 713

18. (B) The difference of marks obtained between

A and F = 2·9

The difference of marks obtained between

C and F = 3·4

The difference of marks obtained between

D and F = 0·4

The difference of marks obtained between

A and B = 0·8

The difference of marks obtained between F and G

$\therefore$ The maximum difference is between C and F

19. (D) The value of food consumed by Geeta

= 200 + 35 + 80 = 315 calorie

The value of food consumed by Jyoti

= 50 + 14·5 + 55 + 20 + 175

= 314·5 calorie

The value of food consumed by Meera

= 330 calorie

The value of food consumed by Surekha

= 80 + 140 = 220 calorie

And the value of food consumed by Sehnaz

= 100 + 29 + 110 + 70 + 40

= 349 calorie

20. (D)

21. (D) Population of the smaller State cannot be determined as radius of the small circle is not known.

22. (D) Speed of the train = $\frac{180 + 180}{18} = 20$ m/sec.

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23. (B) C. I. $= 18400\left[\left(1+\frac{12}{100}\right)^3-1\right]$

$= 18400\left(\frac{28\times28\times28-25\times25\times25}{25\times25\times25}\right)$

$= \frac{18400\times6327}{15625}$

$=$ Rs. 7450·6752

24. (A) $\frac{\text{Odd number}}{\text{Even number}} = 0{\cdot}65$

$= \frac{5}{8}$

25. (C) Profit on each 20 kg of A and C

$= 20\,(38-34{\cdot}5)+20\,(36-32{\cdot}4)$

$= 70+72$

$=$ Rs. 142

Profit on 30 kg of A and 40 kg of B

$= 30\times(37-34{\cdot}5)+40\,(33-28{\cdot}6)$

$=$ Rs. 251

Profit on 20 kg of B and 40 kg of C

$= 20\,(40-28{\cdot}6)+40\,(38-32{\cdot}4)$

$= 228+224$

$=$ Rs. 452

Profit on 25 kg of C and 30 kg of A

$= 25\,(42-32{\cdot}4)+30\,(38-34{\cdot}5)$

$= 240+105$

$=$ Rs. 345

Profit on 40 kg of B and 20 kg of A

$= 40\,(37-28{\cdot}6)+20\,(40-34{\cdot}5)$

$= 336+110$

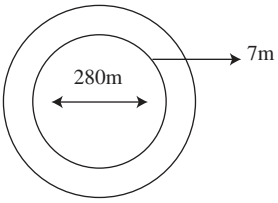
$=$ Rs. 446

Hence, he will earn maximum in bargain (C).

26. (D) Area of the garden

$= \frac{22}{7}[(140+7)^2-(140)^2]$

$= \frac{22}{7}\times7\times287 = 6314\ \text{m}^2$



$\therefore$ Required cost $= 6314\times21$

$=$ Rs. 132594

27. (C) Rate $= \frac{6216\times100}{14800\times3} = 14\%$

$\therefore$ C. I. $= 14800\left[\left(1+\frac{14}{100}\right)^3-1\right]$

$= 14800\,\frac{(57\times57\times57-50\times50\times50)}{50\times50\times50}$

$= \frac{14800\times60193}{125000}$

$=$ Rs. 7126·8512

28. (B) Let the salary of Vipul be Rs. x

$\because \quad \frac{5x}{100}\times\frac{75}{100} =$ Rs. 1687·50

$\therefore \quad x = \frac{1687{\cdot}50\times100\times100}{5\times75}$

$=$ Rs. 45000

29. (B) $\because$ A piece work is done in 360 days by 9 children

$\therefore$ A piece work is done $= 9\times360$ children

Similarly in one day the work will be done by 18×72 men and one day the work will be done by 162×12 women.

$\therefore \quad 18\times72$ men $= 9\times360$ children

$\therefore \quad 4$ men $= \frac{9\times360\times4}{18\times72}$

$= 10$ children

And 162×12 women $= 9\times360$ children

$\therefore \quad 12$ women $= \frac{9\times360\times12}{162\times12}$

$= 12$ children

$\therefore$ 4 men + 12 women + 10 children

$= (10+20+10)$

$= 40$ children

$\because$ 9 children do a piece of work in 360 days

$\therefore$ 40 children do a piece of work in

$= \frac{360\times9}{40} = 81$ days

30. (C) From the statements 2 and 3 cost of material for the hall

$= 14500-3500 =$ Rs. 11000

And from statement 1 Area of the hall

$= \frac{11000}{250} = 44\ \text{m}^2$

31. (D) From 1 C. P. of the article $= 252-52$

$=$ Rs. 200

From 2 M.P. of the article $= 200+80$

$=$ Rs. 280

$\because$ Discount on Rs. 280 $=$ Rs. 28

$\therefore$ Rate of discount $= \frac{28\times100}{280}$

$= 10\%$

and from 3 M.P. of the article $= \frac{200\,(100+40)}{200}$

$=$ Rs. 280

$\therefore$ Rate of discount $= \frac{28\times100}{280} = 10\%$

32. (A) Let the speed of the train be x m/sec.

$\therefore$ Length of the train from 1 $= x\times13$

$= 13x$ m

and from 2, $13x+250 = 27x$

$\therefore \quad x = \frac{250}{14}$ m/sec.

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33. (D) From 1 population of the State A

$$= 1{\cdot}61 \times \frac{100}{15} \text{ lakh}$$

If the population of A be x lakh, then

From 2 and 3, $\frac{x}{1{\cdot}6} = \frac{7}{8}$

Hence either 1 or 2 and 3 are necessary.

34. (D) From 1, 20% of work is done in 8 days by 8 labours.

$\therefore$ 100% of work is done in 10 days by 8 labours

$$= \frac{8 \times 100}{20} \times \frac{8}{10}$$

From 2 in 16 days the work is done by 20 labours

$\therefore$ In 10 days the work will be done by labours

$$= \frac{20 \times 16}{10}$$

From 3 in 5 days the work is done by 8 labours.

$\therefore$ In 10 days the work is done by labours

$$= \frac{8 \times 5}{10}$$

Hence any one of the three statements is necessary.

35. (D) Let the price of 1 pencil = Rs. x

Then, the cost of 1 sharpner = Rs. $(x + 0{\cdot}50)$

By question, $25x + 20\,(x + 0{\cdot}50) = 100$

$\Rightarrow \quad 25x + 20x + 10 = 100$

$\Rightarrow \quad 45x = 90$

$\Rightarrow \quad x = 2$

Therefore, the required price $3x + 4\,(x + 0{\cdot}50)$

$= 3 \times 2 + 4\,(2 + 0{\cdot}50)$

= Rs. 16

36. (C) 37. (B) 38. (D)

39. (D) From 1 $p = 10$

From 2 $q = \pm 10$

$p \geq q$

40. (D) From 1 $p = \pm 100$

From 2 $q = \pm 100$

$\therefore \quad p = q$

41. (C) Reqd. total cost = 45000×60

= Rs. 27 lakhs

42. (D) Required average cost

$$= \frac{4500 + 3500 + 6000 + 5500 + 5000 + 4000}{6}$$

= Rs. 4750

43. (B) Total cost of the items produced by companies A and B together

$= 35000 \times 45 + 50000 \times 35$

$= 1575000 + 1750000$

= Rs. 33·25 lakhs

44. (D) Reqd. no. = $35000 + 50000 + 45000 + 30000 + 40000 + 60000$

= 260000

45. (A) No. of items produced by D

$$= \frac{30000 \times 130}{100} = 39000$$

$\therefore$ Total cost of items produced by D

$= 39000 \times 55$

= Rs. 21·45 lakhs

46. (B) Let the first and second number be x and y respectively

$\because \quad x \times \frac{1}{4} \times \frac{2}{3} = y \times \frac{40}{100}$

$\therefore \quad x = y \times \frac{40}{100} \times \frac{4 \times 3}{2}$

$= 2{\cdot}4y$

47. (D) Work is completed in 1 day by

$= 12 \times 8 = 96$ men

Work is completed in 1 day by

$= 48 \times 4 = 192$ women

And work is completed in 1 day by

$= 24 \times 10 = 240$ children

$\because \quad 96$ men = 240 children

$\therefore \quad 10$ men $= \frac{240 \times 10}{96} = 25$ children

$\because \quad 192$ women = 240 children

$\therefore \quad 4$ women $= \frac{240}{192} \times 4$

= 5 children

$\therefore$ (10 men + 4 women + 0 children)

$= (25 + 5 + 10)$

= 40 children

$\because$ 10 children complete one work in 24 days

$\therefore$ 40 children complete one work in

$= \frac{24 \times 10}{40} = 6$ days.

48. (D) Marks obtained by T in all subjects

$$= \frac{67 \times 75}{100} + \frac{74 \times 60}{100} + \frac{74 \times 80}{100} + \frac{50 \times 84}{100} + \frac{40 \times 85}{100} + \frac{40 \times 82}{100}$$

$= 50{\cdot}25 + 44{\cdot}40 + 59{\cdot}20 + 42{\cdot}00 + 34{\cdot}00 + 32{\cdot}80$

$= 262{\cdot}65$

$\therefore$ Reqd. percentage $= \frac{262{\cdot}65 \times 100}{345}$

= 76 (Approximate)

49. (D) Marks obtained by M in all subjects.

$$= \frac{74 \times 75}{100} + \frac{86 \times 60}{100} + \frac{80 \times 64}{100} + \frac{50 \times 80}{100} + \frac{40 \times 78}{100} + \frac{40 \times 72}{100}$$

$= 55{\cdot}50 + 51{\cdot}60 + 51{\cdot}26 + 40{\cdot}00 + 31{\cdot}20 + 28{\cdot}80$

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$= 258{\cdot}30$

Reqd. percentage $= \dfrac{258{\cdot}30 \times 100}{345} = 74{\cdot}87$

50. (A) Marks obtained in Geography by all the students
$= 49{\cdot}2 + 46{\cdot}8 + 56{\cdot}4 + 44{\cdot}4 + 51{\cdot}6 + 53{\cdot}4 + 57{\cdot}6$
$= 359{\cdot}4$

Reqd. average marks $= \dfrac{359{\cdot}4}{7} = 51{\cdot}34$

51. (C) Total marks obtained by L in History, Geography and Mathematics
$= 66 + 53{\cdot}4 + 60{\cdot}8 = 180{\cdot}2$

52. (B) Reqd. average
$= \dfrac{95 + 85 + 89 + 74 + 64 + 76 + 86}{7}$
$= \dfrac{567}{7} = 81{\cdot}29$

53. (C) $\because \quad \pi r^2 = 7 \times 2\pi r$
$\therefore \quad r = 14$
$\therefore$ Circumference of the circle
$= 2 \times \dfrac{22}{7} \times 14 = 88$

54. (A) Reqd. ratio $= \dfrac{76 + 45 + 55 + 57 + 82 + 38}{46 + 36 + 34 + 48 + 58 + 60}$
$= \dfrac{353}{282}$

55. (D) Reqd. average $= \dfrac{12 + 10 + 18 + 15 + 13 + 22}{6}$
$= \dfrac{90}{6}$ thousands $= 15{,}000$

56. (D) % of defective article in 1996
$= \dfrac{21}{56} \times 100 = 37{\cdot}5\%$
% of defective article in 1997
$= \dfrac{24}{63} \times 100 = 38{\cdot}1\%$
% of defective articles in 1998
$= \dfrac{30 \times 100}{68} = 44{\cdot}1\%$
% of defective article in 1999
$= \dfrac{19 \times 100}{54} = 35{\cdot}2\%$
% of defective article in 2000
$= \dfrac{27 \times 100}{48} = 56{\cdot}3\%$
$\therefore$ The largest % of articles were defective in 2000.

57. (B) Reqd. percentage $= \dfrac{95 \times 100}{238} = 40\%$

58. (A) Reqd. % in 1997 $= \dfrac{53 - 29}{53} \times 100 = 45{\cdot}3\%$
Read. % in 1998 $= \dfrac{50 - 29}{29} \times 100 = 72{\cdot}4\%$
Reqd. % in 1999 $= \dfrac{65 - 50}{50} \times 100 = 30\%$
Reqd. % in 2000 $= \dfrac{70 - 65}{65} \times 100 = 7{\cdot}6\%$
and Reqd. % in 2001 $= \dfrac{70 - 44}{70} \times 100 = 37\%$
$\therefore$ It is the highest % in 1998.

59. (B) Speed of the boat in still water
$= \dfrac{v\,(t_1 + t_2)}{t_2 - t_1}$
[Here $v = 4$, $t_1 = 6$ and $t_2 = 8$]
$= \dfrac{4\,(6 + 8)}{8 - 6} = 28$ km/hr.

60. (D) Reqd. percentage $= \dfrac{375 \times 100}{(375 + 300 + 175)}$
$= 45\%$

61. (B) Reqd. number $= 350 + 300 + 300 + 275 + 300 + 275$
$= 1800$

62. (A) Reqd. ratio $= \dfrac{375}{275} = 15 : 11$

63. (D) Reqd. number $= 175 + \dfrac{1}{2} \times 300$
$= 175 + 150 = 325$

64. (C) Reqd. number $= 350 - 275$
$= 75$ millions

65. (D)

66. (A) Let the radius of the circle and the height of the right angled Δ be r and h respectively.
$r = \dfrac{(100 + 20)}{100} h$
and area of $\Delta = \dfrac{1}{2} \times h \times 36$
$= 18\,h$
$\therefore$ Area of the circle $= 18\,h$
$\pi r^2 = 18\,h$
$\Rightarrow \quad \dfrac{22}{7} r^2 = \dfrac{18 \times 100 \times r}{120}$
$r = \dfrac{18 \times 100 \times 7}{120 \times 22}$
$= 4{\cdot}77$
$\therefore$ Area of the circle $= \dfrac{22}{7} r^2$
$= \dfrac{22}{7} \times 4{\cdot}77 \times 4{\cdot}77$
$= 72$ sq. cm.

67. (D) % Decrease from the year in 1998
$= \dfrac{107 - 80}{107} \times 100 = 25{\cdot}23\%$
% Decrease from the year in 1999
$= \dfrac{80 - 28{\cdot}48}{80} \times 100 = 64{\cdot}40\%$

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% Increase from the year in 2000

$$= \frac{38 - 28{\cdot}48}{28{\cdot}48} \times 100 = 33{\cdot}42\%$$

% Decrease from the year in 2001

$$= \frac{38 - 26{\cdot}5}{38} \times 100 = 30{\cdot}26\%$$

and % increase from the year in 2002

$$= \frac{36{\cdot}6 - 26{\cdot}5}{26{\cdot}5} \times 100 = 38{\cdot}11\%$$

$\therefore$ Reqd. year is 1998.

68. (B) Reqd. difference = (112·4 – 35·1) crores
= 77·3 crores
= 773000000

69. (A) Reqd. average

$$= \frac{28{\cdot}48 + 31{\cdot}38 + 43{\cdot}7 + 56{\cdot}6 + 53{\cdot}2 + 31{\cdot}04}{6}$$

$$= \frac{244{\cdot}4}{6} \text{ crores}$$

= 407300000

70. (C) Reqd. percentage $= \frac{32{\cdot}8 \times 100}{201{\cdot}52} = 16{\cdot}28\%$

71. (B) No. of units sold by company L over the years
= 107 + 80 + 28·48 + 38 + 26·5 + 36·6
= 316·58
No. of units sold by company M over the years
= 175·1 + 76 + 31·38 + 43 + 27·5 + 32·8
= 385·78
No. of units sold by company N over the years
= 156·6 + 66·49 + 43·7 + 45·2 + 19 + 40·12
= 371·11
No. of units sold by company O over the years
= 112·4 + 78·24 + 56·6 + 35·1 + 25·1 + 25
= 332·44
No. of units sold by company P over the years
= 95·1 + 111·8 + 53·2 + 48·9 + 22·5 + 37
= 368·5
No. of units sold by company Q over the years
= 192 + 72·18 + 31·04 + 42·2 + 17 + 30
= 382·42
$\therefore$ Max. no. of units is sold by company M.

72. (A) Let the original no. = $10x + y$
and $x + y = 1$ …(1)
and $(10y + x) - (10x + 4) = 27$
$y - x = 3$ …(2)
From equation (1) and (2)
$x = 4$ and $y = 7$
$\therefore$ Required no. = 47

73. (D) From statement (1) $37{\cdot}50 = \frac{Pr^2}{100 \times 100}$
$\therefore$ $Pr^2 = 375000$ …(1)
From statement (2) $2250 = \frac{P \times r \times 3}{100}$
$\therefore$ $Pr = 75000$ …(2)
From statement (3)

$$\frac{P \times r \times 1}{100} = P\left[\left(1 + \frac{r}{100}\right) - 1\right] \quad \ldots(3)$$

So, the principal can be found out by either two of the aforesaid three statements.

74. (C) From statement 1 $2(L + b) = 220$
$\Rightarrow$ $L + b = 110$
From statement 2
Let the length of garden L = $7x$
and breadth $b = 4x$
or From statement 3 $L = 2b - 30$

75. (D) The question cannot be answered despite the knowledge of the three statements.

76. (D)

77. (B) From statement 1
Length of train = Speed × 14 …(1)
From statement 3
Length of train = Speed × 24 – 200 …(2)
Therefore, we can determine the speed of the train from statement 1 and 3.

78. (D) $\because$ Investment of Subhash for 3 years
= Rs. 25,000
$\therefore$ Investment of Subhash for 1 month
= 25,000 × 36
= Rs. 9,00,000
And investment of Aditya for 1 month
= 15,000 × 30 + 15,000 × 24
= Rs. 8,10,000
$\therefore$ Ratio in their investments
= 9,00,000 : 8,10,000
= 10 : 9
$\therefore$ Aditya's share in the profit

$$= \frac{9}{19} \times 2{,}47{,}000$$

= Rs. 1,17,000.

79. (B) 80. (B) 81. (D) 82. (D) 83. (C)
84. (D) 85. (B) 86. (D)

87. (C) Area of the square = $8 \times 8 = 64$ cm^2
$\therefore$ Area of the rectangle = 64 cm^2
$\therefore$ L × B = 64 cm^2
$\therefore$ Length of the rectangle may be 16 times or 32 times of the breadth.

88. (C) $\because$ $(a)^c \times (b)^a \times ? = 0$
$\therefore$ $? = 0$

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89. (C) $[(a^2)]\ ? = a^6$

$\therefore \quad a^2 \times ? = a^6$

$\therefore \quad ? = \frac{6}{2} = 3$

90. (A) $\because \quad ? \times (|a| \times |b|) = -ab$

$\Rightarrow \quad ? \times a \times b = -ab$

$\therefore \quad ? = -1$

91. (D) $? = (c)^0 \times b$

$= 1 \times b = b$

92. (D) $\because \quad [(a)^b]\ ? = 1$

$\Rightarrow \quad (a)^b \times ? = a^0$

$\therefore \quad ? = 0$

93. (B)

13 $\xrightarrow{\times 2 + 4}$ 30 $\xrightarrow{\times 2 + 6}$ 66 $\xrightarrow{\times 2 + 8}$ 140 $\xrightarrow{\times 2 + 10}$ [290] ? $\xrightarrow{\times 2 + 12}$ 592

94. (D)

24 $\xrightarrow{+ (7)^2}$ [73] ? $\xrightarrow{+ (6)^2}$ 109 $\xrightarrow{+ (5)^2}$ 134 $\xrightarrow{+ (4)^2}$ 150 $\xrightarrow{+ (3)^2}$ 159

95. (A)

$3 \times 5 = 15$

$5 \times 15 = (75)$

$15 \times 75 = 1125$

$75 \times 1125 = 84375$

96. (C)

3 $\xrightarrow{(+7) \times 2}$ 20 $\xrightarrow{(+6) \times 3}$ 78 $\xrightarrow{(+5) \times 4}$ 332 $\xrightarrow{(+4) \times 5}$ 1680 $\xrightarrow{(+3) \times 6}$ [10098] ?

97. (D)

17 $\xrightarrow{(+1) \times \frac{1}{2}}$ 9 $\xrightarrow{(+1) \times 1}$ 10 $\xrightarrow{(+1) \times 1{\cdot}5}$ [16·5] ? $\xrightarrow{(+1) \times 2}$ 35 $\xrightarrow{(+1) \times 2{\cdot}5}$ 90

98. (B) Let the average of runs made by other 6 batsmen be x

$\therefore$ Runs made by the Captain $= x + 30$

$\because \quad x + 30 + 6x = 310$

$\Rightarrow \quad 7x = 280$

$\therefore \quad x = 40$

$\therefore$ No. of runs scored by the Captain $= 40 + 30$

$= 70$

99. (B) $\because \quad A + B + C + D = A + B + E + F$

$\therefore \quad C + D = E + F$

100. (B) Share of each daughter = Rs. 1·25 lakh

$\therefore$ Share of grand child $= \frac{1}{10} \times 1{\cdot}25$

$= 0{\cdot}125$ lakh

And share of each son $= 0{\cdot}125 \times 8$

$=$ Rs. 1 lakh

$\therefore$ Money received by three sons and two daughters

$= 3 \times 1 + 2 \times 1{\cdot}25$

$=$ Rs. 5·5 lakh

$\therefore$ Money received by his wife $= \frac{40}{100} \times 5{\cdot}5$

$=$ Rs. 2·2 lakh

$\therefore$ Money received by his wife and three grand children $= 2{\cdot}2 + 3 \times 0{\cdot}125$

$=$ Rs. 257500

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Miscellaneous Exercise – III

Directions : (Q. 1–5) In each of the following questions, a is followed by information given in three statements. You have to decide the information given in which of the statements is necessary and sufficient to answer the question.

1. The company earned how much profit in the year 2002 ?
   (1) In 2001 the company earned 40% more profit which earned in the year 2003
   (2) The company earned the profit of 20 crores together in the year 2001 and 2002
   (3) The company earned in 2003, 80% profit which was earned in the year 2002
   (A) Any two of (1), (2) and (3) are sufficient
   (B) Either (1) and (2) or (2) and (3) are sufficient
   (C) (1) and (2) or (3) are sufficient
   (D) (1), (2) and (3) all the three are necessary to answer
2. What is monthly salary of an assistant of company in which managers, supervisors and assistants are appointed ?
   (1) Each supervisor gets more than an assistant by Rs. 12000 per month
   (2) Total salary of a supervisor and an assistant is Rs. 32000 per month
   (3) Total salary of a manager and a supervisor is Rs. 57000 per month
   (A) Either (1) or (2) and (3)
   (B) Only (1) and (2)
   (C) Any two of (1), (2) and (3)
   (D) (1), (2) and (3) all the three are necessary
3. What is the measurement of perimeter of a semicircle in cm ?
   (1) Area of the semicircle is equal to the area of the parallelogram
   (2) Length of the parallelogram is 1·5 times of the radius of the semicircle
   (3) The difference of the length and breadth of a parallelogram is 8 cm
   (A) Only (2) and (3) are sufficient
   (B) Only (1) and (3) are sufficient
   (C) Only (1) and (2) are sufficient
   (D) (1), (2) and (3) together are not sufficient to answer the question.
4. In a business of A, B and C together, what profit B earned in 2 years—
   (1) A and B started a business with the capital in the ratio of 3 : 5 respectively
   (2) C joined them after 6 months with a capital of Rs. 4 lakh
   (3) At the end of 2 years the share of A in the profit was Rs. 60,000
   (A) Only (1) and (3) are sufficient
   (B) Only (2) and (3) are sufficient
   (C) Either (1) or (2) and (3) are sufficient
   (D) All the three are necessary to answer the question
5. How many students secured at least per cent marks in Mathematics in a class of 240 students ?
   (1) 20 per cent of the students in the class secured 80 per cent and above marks in Mathematics
   (2) 80 students have secured more than 50 per cent but less than 60 per cent marks in Mathematics
   (3) The number of students who secured marks between 60 and 79 per cent was equal to the number of students who secured less than 50 per cent marks in Mathematics
   (A) All (1) and (3) are necessary to answer the question
   (B) Only (1) and (3) are sufficient
   (C) Only (2) and (3) are sufficient
   (D) The question cannot be answered even with all (1), (2) and (3)

Directions : (Q. 6–10) In each of these questions two equations 1 and 2 are given. You have to solve both the equations and give answer—

(A) If $a < b$
(B) If $a > b$
(C) If relationship between a and b cannot be established
(D) If $a \geq b$
(E) If $a \leq b$

6. (1) $4a^2 - 20a + 21 = 0$
   (2) $2b^2 - 5b + 3 = 0$
7. (1) $6a^2 - 25a + 25 = 0$
   (2) $15b^2 - 16b + 4 = 0$
8. (1) $a^2 = 4$
   (2) $b^2 = 9$
9. (1) $2a^2 + 3a + 1 = 0$
   (2) $12b^2 + 7b + 1 = 0$
10. (1) $a^2 + 5a + 6 = 0$
    (2) $b^2 + 3b + 2 = 0$

Directions : (Q. 11–16) In each of the following number series, a wrong number is given, find out the wrong number—

11. 2 3 6 18 109 1944 209952
    (A) 3 (B) 6
    (C) 18 (D) 109
12. 1 3 6 11 20 39 70
    (A) 3 (B) 39
    (C) 11 (D) 20
13. 2 13 27 113 561 3369 23581
    (A) 13 (B) 27
    (C) 113 (D) 561
14. 50 51 47 56 42 65 29
    (A) 51 (B) 47
    (C) 56 (D) 42
15. 3 9 23 99 479 2881 20159
    (A) 9 (B) 23
    (C) 99 (D) 479
16. 2 4 5 8 13 21 34
    (A) 4 (B) 5
    (C) 8 (D) 13

Directions : (Q. 17–21) Study the following table carefully to answer these questions—

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Number of students appeared and passed over the years in various state

Year / State	1995		1996		1997		1998		1999	
	Present	Passed	Present	Passed	Present	Passed	Present	Passed	Present	Passed
A	15250	1800	17800	1750	14500	1350	15400	1640	16300	1725
B	12500	1100	15400	1480	13800	1420	14000	1525	14550	1500
C	14000	1550	16200	1640	15500	1480	17500	1880	15800	1620
D	17600	1640	16500	1560	14800	1575	15600	1480	17200	1750
E	16400	1480	14700	1820	17000	1600	16400	1500	18000	1950
F	14500	1250	16800	1780	17200	1780	15200	1450	16800	1725
G	15000	1400	15200	1650	16400	1840	17200	1820	17000	1850
Total	**107250**	**10220**	**112600**	**11680**	**109200**	**11045**	**111300**	**11295**	**115650**	**12170**

17. What is the percentage of passed candidates to the appeared students in 1998 and 1999 together of all the states ? (Answer upto two places of decimal)
(A) 10·84 (B) 10·32
(C) 10·62 (D) 10·34

18. In which state the percentage of passed students to the appeared students in 1995 is the least ?
(A) A (B) F
(C) B (D) D

19. What is the percentage of passed students to the appeared students in 1997 of the states C and D together ?
(A) 10 (B) 12·5
(C) 15 (D) 20

20. What is the average approximate number of passed students in 1998 all states ?
(A) 1630 (B) 1516
(C) 1615 (D) 1545

21. What is the average number of students appeared in B for all years ?
(A) 15850
(B) 14550
(C) 15050
(D) None of these

22. A right circular cylindrical tank has the storage capacity of 38808 ml. If the radius of the base of the cylinder is three fourth of the height. What is the diameter of the base ?
(A) 28 cm (B) 56 cm
(C) 21 cm (D) 42 cm

23. The present ages of A, B and C are in the ratio of 8 : 14 : 22 respectively. The present ages of B, C and D are in the ratio of 21 : 33 : 44 respectively. Which of the following represents the ratio of the present ages of A, B, C and D respectively ?
(A) 12 : 21 : 33 : 44
(B) 12 : 22 : 31 : 44
(C) 12 : 21 : 36 : 44
(D) None of these

Directions : (Q. 24–28) What approximate value should come in place of the question mark (?) in the following questions ? (You are not expected to calculate the exact value)

24. $12 \times 958 \div 17 = ?$
(A) 532 (B) 676
(C) 765 (D) 483

25. $15{\cdot}002 \times ? \times 25{\cdot}0210 = 7113{\cdot}918$
(A) 19 (B) 26
(C) 11 (D) 31

26. $8^{1{\cdot}38} \times 8^{1{\cdot}63} = ?$
(A) 680 (B) 218
(C) 726 (D) 512

27. $\sqrt{1000} = ?$
(A) 10 (B) 24
(C) 45 (D) 32

28. 59·99% of 255·012 + 22·98% of 182·005 = ?
(A) 162 (B) 146
(C) 195 (D) 225

Directions : (Q. 29–35) What will come in place of the question mark (?) in the following numbers ?

29. 1 ? 27 64 125
(A) 8 (B) 4
(C) 6 (D) 9

30. 25 16 ? 4 1
(A) 3 (B) 6
(C) 12 (D) 9

31. 1 6 36 240 1960 ?
(A) 19660 (B) 3680
(C) 36800 (D) 19600

32. 12 14 17 13 8 14 21 13 4 ?
(A) 14 (B) 13
(C) 15 (D) 2

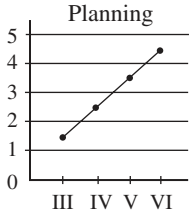
33. 25 7 12 19 31 50 ?
(A) 53
(B) 81
(C) 69
(D) None of these

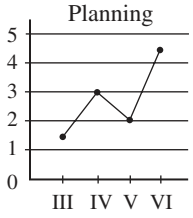
34. 15 12 17 10 ? 8 25 6
(A) 3 (B) 17
(C) 21 (D) 19

35. 4 6 12 30 90 315 ?
(A) 945 (B) 102
(C) 1260 (D) 1417·5

Directions : (Q. 36–40) Each of the questions is based on the table given below—

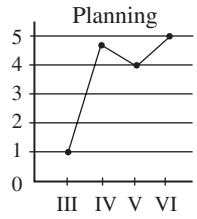
36. Which of the following graphs well illustrates expenditure for water supply and cleaning in the ratio of expenditure in public sector under various plannings ?

(A)


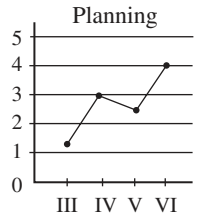
(B)


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(C)



(D)



37. For which planning the expenditure of social services in ratio of expenditure of public service sector is maximum ?
(A) (I) (B) (VI)
(C) (V) (D) (II)

38. In which sector there is a continuous decrease in expenditure in ratio of expenditure in public sector in successive planning ?
(A) Not in any sector
(B) Health
(C) Education
(D) Social Services

39. In VI planning, how many per cent expenditure of public sector planning is for housing and city services ?
(A) 0·35 (B) 25
(C) 25·5 (D) 2·5

40. What was the total difference of expenditure in Education and Health for all planning ?
(A) Rs. 220400000
(B) Rs. 224000000
(C) Rs. 22040000000
(D) Rs. 220400000000

Directions : (Q. 41–43) What approximate value will come in place of the question mark (?) in the following equations ?

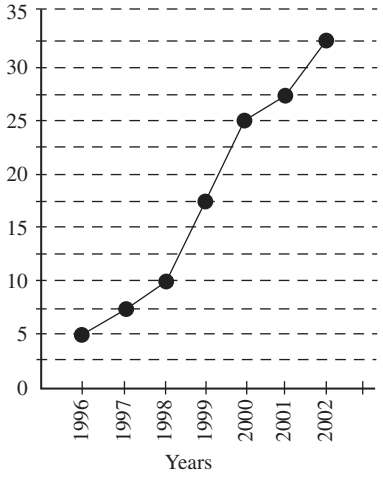
41. 125% of 4875 + 88·005 × 14·995 = ?
(A) 7395 (B) 7485
(C) 7514 (D) 7415

42. 1010 ÷ 36 + 187 × 20·05 = ?
(A) 3650 (B) 3770
(C) 3825 (D) 3800

43. 127·001 × 7·998 + 6·05 × 4·001 = ?
(A) 1440 (B) 1400
(C) 1000 (D) 1040

Directions : (Q. 44–47) Study the following graph to answer the given questions—

Production of a company (in Lakh Units) over the given years



44. The production in 2002 is what per cent of production in 1996 ?
(A) 650 (B) 550
(C) 325 (D) 320

45. What is the approximate average production (in lakhs) for the given years ?
(A) 18 (B) 19
(C) 20 (D) 18·5

46. Which of the following is the highest difference in production between two adjacent years ?
(A) 5 lakhs (B) 10 lakhs
(C) 9 lakhs (D) 7·5 lakhs

47. Which year had the highest per cent increase in production over the previous year ?
(A) 2000 (B) 1999
(C) 2002 (D) 1997

Directions : (Q. 48–52) In each of the following questions a pair of equations is given. You have to find out the value of x and y and give answer—
(A) If $x < y$ (B) If $x \le y$
(C) If $x = y$ (D) If $x > y$
(E) If $x \ge y$

48. (1) $2x^2 - 7x + 6 = 0$
(2) $4y^2 = 9$

49. (1) $4x^2 - 4x - 3 = 0$
(2) $4y^2 + 12y + 5 = 0$

50. (1) $4x^2 = 49$
(2) $9y^2 - 66y + 121 = 0$

51. (1) $x^2 + 9x + 14 = 0$
(2) $y^2 + y - 2 = 0$

52. (1) $9x^2 - 18x + 5 = 0$
(2) $2y^2 - 9y + 10 = 0$

53. A committee of 6 members is to be selected from a group of 8 men and 6 women in such a way that at least 3 men are there in the committee. In how many different ways can it be done ?
(A) 2506 (B) 2534
(C) 1120 (D) 1050

Directions : (Q. 54–58) In each of the following questions a question is followed by information given in three statements. You have to study the question alongwith the statement and decide the information given in which of the statement(s) is necessary to answer the question.

54. In how many days can 16 men and 8 women together complete the piece of work ?
(1) 8 men complete the piece of work in 10 days
(2) 16 women complete the piece of work in 10 days
(3) 5 women take 32 days to complete the piece of work
(A) Only (1) and (2)
(B) Only (2) and (3)
(C) Only (1) and (3)
(D) Only (1) and either (2) or (3)

55. What is the speed of the train ?
(1) Train crosses a pole in 10 seconds
(2) Length of the train is 240 metres
(3) Train crosses a platform of equal length in 20 seconds
(A) Only (1) and (2)
(B) Only (2) and (3)
(C) All (1), (2) and (3)
(D) Any two of the three

56. What is the area of the square ?
(1) Measure of diagonal of the square is given

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(2) Measure of one side of square is given

(3) Perimeter of the square is given

(A) Only (2)

(B) Only (3)

(C) Only (1) and (3)

(D) Only (2) and (3)

57. What is the two digit number ?

(1) The number obtained by interchanging the digits of the number is greater than the original number by 18

(2) Sum of the two digits of the number in 14

(3) Difference between the two digits of the number is 2

(A) Any two of the three

(B) Only (1) and (2)

(C) (2) and either (1) or (3)

(D) All the three

58. What is the rate of interest p.c.p.a. ?

(1) Simple interest earned per annum is Rs. 5,300

(2) The difference between the compound and simple interest on an amount is Rs. 1,060 at the end of 2 years

(3) An amount doubles itself in 5 years with simple interest

(A) All the three

(B) Only (3)

(C) Either (2) or (3)

(D) Only (3) or (1) and (2)

Directions : (Q. 59–63) What should come in place of the question mark (?) in the following questions ?

59. $1\frac{4}{7} + 1\frac{3}{5} + 1\frac{1}{3} = ?$

(A) $5\frac{47}{105}$ (B) $4\frac{58}{105}$

(C) $4\frac{53}{105}$ (D) $5\frac{43}{105}$

60. $8{\cdot}88 \times 88{\cdot}8 \times 88 = ?$

(A) 68301·142

(B) 79391·642

(C) 65365·824

(D) None of these

61. $\sqrt{\sqrt{2500} + \sqrt{961}} = (?)^2$

(A) 81 (B) 3

(C) 6561 (D) 9

62. $\frac{9 \div 2 \times 27 \div 9}{18 \div 7{\cdot}5 \times 5 \div 4} = ?$

(A) 4·5 (B) 5·7

(C) 2·5 (D) 6·8

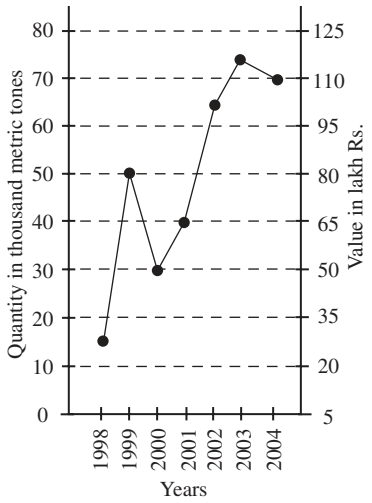
63. ? % of 280 + 18% of 550 = 143·8

(A) 11 (B) 18

(C) 21 (D) 16

Directions : (Q. 64–68) Study the following graph carefully and answer the question given below—

Quantity and value of production of sugar of a company over the years



64. What was the difference between the average production of sugar during the years 1998, 1999, 2000 and 2001 and that of 2001, 2002, 2003 and 2004 in thousand metric tons ?

(A) 15

(B) 20

(C) 25

(D) None of these

65. In which of the following years was the percentage increase in value of sugar per metric ton from the previous year the maximum ?

(A) 1999 (B) 2000

(C) 2001 (D) 2003

66. In which of the following years was the value of sugar per metric ton the highest among the given years ?

(A) 1999

(B) 2004

(C) 2003

(D) None of these

67. In which of the following years was the value of sugar per metric ton the lowest among the given years ?

(A) 1998 (B) 1999

(C) 2001 (D) 2003

68. In which of the pair of years the sum of production is exactly 25% of the production of all the years together ?

(1) 1998 and 2004

(2) 1998 and 2003

(3) 1998 and 2001

(A) Only (1)

(B) Only (2)

(C) Only (3)

(D) Only (1) and (3)

(E) (1), (2) and (3)

Directions : (Q. 69–73) Study the following table carefully to answer these questions—

Sales of a product (in million tons) for six states over the years

Years	States					
	A	B	C	D	E	F
1998	25	45	38	52	47	55
1999	32	39	40	55	46	67
2000	41	50	43	57	39	64
2001	37	48	43	58	32	72
2002	28	53	46	62	37	58
2003	43	55	49	63	42	62

69. If the cost of product per thousand tons in 1998 was Rs. 1·8 lakh. What was the cost of average sales for the given states in that year ?

(A) Rs. 786000 lakhs

(B) Rs. 786 lakhs

(C) Rs. 7860 lakhs

(D) Rs. 78600 lakhs

70. Total sales in year 2000 were what per cent of the total sales in year 2003 ? (Rounded off to two digits after decimal)

(A) 93·63 (B) 92·65

(C) 106·80 (D) 93·23

71. What was the percentage increase in total sales in 2003 from 1998 ?

(Rounded off to nearest integer)

(A) 19 (B) 20

(C) 16 (D) 17

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72. Approximately what was the ratio between average sales of states B and C respectively ?
(A) 31 : 25 (B) 26 : 31
(C) 29 : 24 (D) 29 : 26

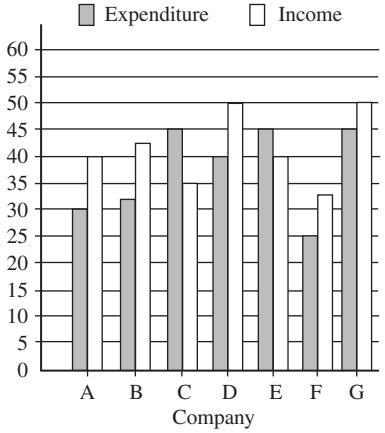
73. For which of the following years the percentage increase/decrease in sales from the previous years was highest for state 'E' ?
(A) 1999 (B) 2000
(C) 2001 (D) 2002

Directions : (Q. 74–78) Study the following graph carefully and answer the question given below it.

Account of Income and Expenditure (in crore Rs.) of seven companies in the year 2000

% Profit/loss

$$= \frac{\text{Income} - \text{Expenditure}}{\text{Expenditure}} \times 100$$



74. Approximately what is the percentage of profit/loss that companies C and D had together ?
(A) 10% profit
(B) 12% profit
(C) 10% loss
(D) There was no loss or profit

75. If the income of company A had increased by 10% in year 2000 from year 1999 and profit earned in 1999 was 20%. What was its expenditure in 1999 ? (In crore Rs. rounded off to two decimal places)
(A) 36·36
(B) 32·32
(C) 30·30
(D) Cannot be determined

76. If the expenditure of company G in 2000 was 20% more than its expenditure in the year 1999 and the company had earned a profit of 10% in 1999. What was the company's income in 1999 in crore Rs. ?
(A) 37·5
(B) 41·25
(C) 34·09
(D) Cannot be determined

77. Which of the following companies had the highest percentage of profit/loss in year 2000 ?
(A) B (B) C
(C) F (D) A

78. What is the approximate percentage of profit earned by all the companies together in the year 2000 ?
(A) 11 (B) 11·5
(C) 10·5 (D) 12

79. In how many different ways can the letters of the word ADJUST be arranged so that the vowels never come together ?
(A) 720 (B) 120
(C) 240 (D) 480

80. For which of the following values of x the inequality $3(x^2 - 4x + 4) < x$ gets satisfied ?
(A) $x > 3, x < \frac{4}{3}$
(B) $x > -3, x < -\frac{4}{3}$
(C) $\frac{4}{3} < x < 3$
(D) $\frac{4}{3} \le x \le 3$

81. Abhishek invested an amount of Rs. 29,000 in two parts under two different schemes A and B and earned a total interest of Rs. 3,840. Schemes A and B offered 15% and 12% interest respectively. What was the amount invested in scheme 'A' ?
(A) Rs. 17,000
(B) Rs. 12,000
(C) Rs. 14,000
(D) Data inadequate

82. What approximate value should come in place of the question mark (?) in the following equation ? 695·95 ÷ 29·07 × ? + 40·25 = 399·99—
(A) 14 (B) 17
(C) 12 (D) 15

83. If the numerator of a fraction is increased by 40% and the denominator is doubled the new fraction obtained is $\frac{7}{16}$. What was the original fraction ?
(A) $\frac{5}{8}$
(B) $\frac{3}{8}$
(C) $\frac{7}{8}$
(D) Cannot be determined

Directions : (Q. 84–88) Study the table carefully to answer the following questions—

Number of cars (in thousands) manufactured and sold by six companies over the year

Company	A		B		C		D		E		F	
Year	Manufactured	Sold	Manufactured	Sold	Manufactured	Sold	Manufactured	Sold	Manufactured	Sold	Manufactured	Sold
2000	2·58	1·96	1·98	1·62	1·97	1·53	2·46	2·11	2·35	2·16	1·88	1·50
2001	2·34	1·98	2·15	2·00	2·20	2·03	2·46	2·14	2·45	2·20	1·95	1·62
2002	2·85	2·05	2·35	1·99	2·18	1·87	2·55	2·23	2·60	2·13	2·25	1·93
2003	2·87	2·11	2·62	2·01	2·25	1·95	2·62	2·30	2·79	2·31	2·39	2·08
2004	2·91	2·22	2·71	2·12	2·68	2·32	2·71	2·19	2·88	2·19	2·58	2·10
2005	2·94	2·25	2·84	2·15	2·86	2·36	2·76	2·28	2·90	2·32	2·67	2·30

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84. What is the total number of cars sold by company C in all the year together ?
(A) 120600 (B) 14205
(C) 12060 (D) 142050

85. What is the approximate per cent increase in the number of cars sold by company F in the year 2004 from the previous year ?
(A) 13 (B) 19
(C) 0·96 (D) 8

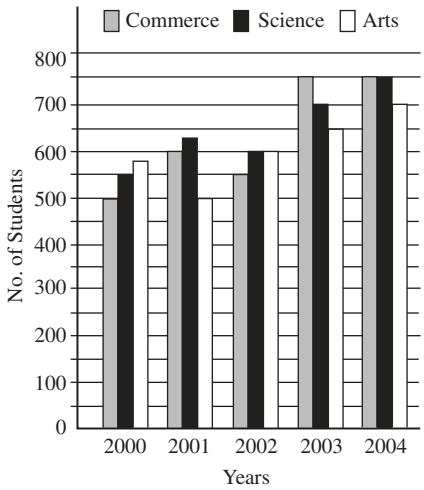
86. What is respective ratio of total number of cars manufactured by companies A, B and C together in the year 2001 to those manufactured by companies D, E and F together in the year 2003 ?
(A) 164 : 217 (B) 223 : 260
(C) 260 : 223 (D) 217 : 164

87. What is the percentage of number of cars sold by company D in the year 2002 to those manufactured by it in that year ? (rounded off to two digits after decimal)
(A) 87·45 (B) 77·28
(C) 92·54 (D) 79·65

88. In which year were the maximum number of cars manufactured by all companies together ?
(A) 2001
(B) 2002
(C) 2003
(D) None of these

Directions : (Q. 89–93) Study the following graph carefully to answer the questions that follow—

Number of students studying different disciplines in a college over the year



89. Number of students studying Commerce in the year 2004 forms approximately what per cent of the total number of students studying Commerce in all the years together ?
(A) 13 (B) 20
(C) 29 (D) 33

90. What is the total number of students studying Arts in all the years together ?
(A) 3700
(B) 2750
(C) 3500
(D) None of these

91. Number of students studying Science in the year 2001 forms what per cent of total number of students studying all the disciplines together in that year ? (rounded off to two digits after decimal)
(A) 46·24 (B) 23·51
(C) 37·14 (D) 40·15

92. What is the respective ratio of total number of students studying Arts, Commerce and Science in all the years together ?
(A) 77 : 75 : 76
(B) 76 : 75 : 77
(C) 76 : 77 : 75
(D) 75 : 77 : 76

93. What is the respective ratio of total number of students studying Commerce in the years 2000 and 2002 together to those studying Arts in the years 2003 and 2005 together ?
(A) 3 : 4 (B) 7 : 9
(C) 4 : 3 (D) 9 : 7

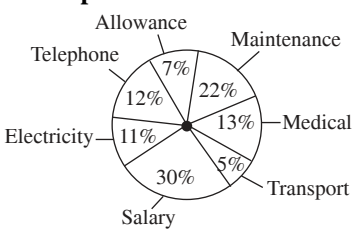
Directions : (Q. 94–98) Study the following graph carefully to answer these questions—

Details about the distribution of employees and expenditure of an organization.

(Distributed proportionately across the departments)

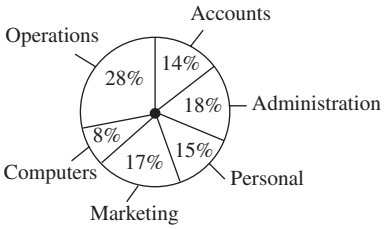
Annual expenditure on different items

Total expenditure = Rs. 12 crores



Departmentwise distribution of employees

Total number of employees = 1200



94. What was the total expenditure on accounts department ?
(A) Rs. 16·8 lakh
(B) Rs. 1680 lakh
(C) Rs. 18·6 million
(D) Rs. 16·8 million

95. What was per employee expenditure on medical ?
(A) Rs. 12000
(B) Rs. 13000
(C) Rs. 12500
(D) Rs. 13500

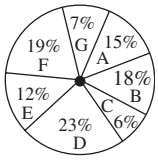
96. What was the total expenditure on salary of employees in marketing department ?
(A) Rs. 6·12 lakh
(B) Rs. 61·2 million
(C) Rs. 6·12 million
(D) Rs. 176 lakh

97. What was the amount spent on electricity ?
(A) Rs. 132 million
(B) Rs. 13·2 lakh
(C) Rs. 126 million
(D) None of these

98. What was the expenditure on telephone for employees in computer department ?
(A) Rs. 11·52 lakh
(B) Rs. 11·52 million
(C) Rs. 10·72 lakh
(D) Rs. 10·72 million

Directions : (Q. 99–105) Study the following graph and table carefully and answer the questions given below it.

Distribution of candidates appeared in a Competitive Examination from seven states



Total candidates appeared = 3 lakh

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Statewise percentage and ratio of male and female qualified candidates

State	% qualified over appeared from State	Ratio of qualified candidates
		Male : Female
A	49	4 : 5
B	61	6 : 4
C	54	7 : 8
D	45	3 : 2
E	65	7 : 6
F	57	11 : 8
G	48	9 : 11

99. What is the number of male candidates qualified from State 'G' ?
(A) 4568 (B) 5454
(C) 5544 (D) 4536

100. What is the total number of female candidates qualified from States 'A' and 'B' together ?
(A) 26526 (B) 25426
(C) 26426 (D) 24526

101. Which of the following pair of States have equal number of qualified male candidates ?
(A) B and F (B) C and G
(C) C and E (D) A and E

102. What is the percentage of candidates qualified from States 'A' and 'C' together, rounded off to two decimal points ?
(A) 49·93 (B) 51·26
(C) 50·43 (D) 50·93

103. What is the total number of candidates qualified from States 'E' and 'D' together ?
(A) 54450 (B) 45540
(C) 54540 (D) 54410

104. How many male candidates have appeared from State 'D' ?
(A) 41400
(B) 27600
(C) 32400
(D) Cannot be determined

105. How many female candidates have qualified from State 'F' ?
(A) 32490
(B) 18810
(C) 13810
(D) None of these

Answers with Hints

1. (D) Let the profit earned by the company in the year 2002 be Rs. x crores

$\therefore$ From 2 Profit earned in 2001

$\Rightarrow$ Rs. $(20 - x)$ crores

And from 1 Profit earned in 2003.

$\Rightarrow$ Rs. $(20 - x) \times \frac{140}{100}$ crores

$\because$ From 3

$$(20 - x) \times \frac{140}{100} = \frac{80x}{100}$$

$$\Rightarrow \quad 280 - 14x = 8x$$

$$x = \frac{140}{11}$$

$$\therefore \quad x = \text{Rs. } 12{\cdot}727 \text{ crores}$$

2. (B) Let the monthly salary of an assistant of the company be Rs. x

$\therefore$ From 1, monthly salary of a supervisor

$$= \text{Rs. } (x + 12000)$$

And From 2,

$\because \quad x + x + 12000 = 32000$

$\therefore \quad x = \text{Rs. } 10000$

3. (D) Area of the parallelogram cannot be found. Hence answer of the question cannot be found even from 1, 2 and 3 together

4. (A) From 1 and 3 the profit earned by B

$$= \frac{5}{3} \times 60000$$

$$= \text{Rs. } 1 \text{ lakh}$$

Hence, only 1 and 3 are sufficient.

5. (D) From (1) No. of candidates who get marks 80% and above

$$= 20\% \text{ of } 240$$

$$= 48$$

From 3 if the no. of candidates who secured marks between 60% and 79% be x.

Then no. of candidates who secured marks below 50% = x.

From 2 no. of candidates who secured marks more than 50% but less than 60%

$$= 80$$

Since the number of candidates who secured marks between 60% and 79% is not known

Hence, answer cannot be obtained from any of these.

6. (D) From 1 $\quad 4a^2 - 20a + 21 = 0$

$$\Rightarrow \quad (2a - 3)(2a - 7) = 0$$

$$\Rightarrow \quad a = \frac{3}{2} \text{ or } \frac{7}{2}$$

From 2, $\quad 2b^2 - 5b + 3 = 0$

$$\Rightarrow \quad (b - 1)(2b - 3) = 0$$

$$\Rightarrow \quad b = 1 \text{ or } \frac{3}{2}$$

$$a \geq b$$

7. (B) From 1, $\quad 6a^2 - 25a + 25 = 0$

$$\Rightarrow \quad (2a - 5)(3a - 5) = 0$$

$$\Rightarrow \quad a = \frac{5}{2} \text{ or } \frac{5}{3}$$

From 2, $\quad 15b^2 - 16b + 4 = 0$

$$\Rightarrow \quad (3b - 2)(5b - 2) = 0$$

$$\Rightarrow \quad b = \frac{2}{3} \text{ or } \frac{2}{5}$$

$$\therefore \quad a > b$$

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8. (C) From 1, $a^2 = 4$

$\Rightarrow a = \pm 2$

From 2, $b^2 = 9$

$\Rightarrow b = \pm 3$

$\therefore$ The relationship between a and b cannot be established

9. (A) From 1, $2a^2 + 3a + 1 = 0$

$\Rightarrow (2a + 1)(a + 1) = 0$

$\Rightarrow a = -\frac{1}{2}$ or -1

From 2, $12b^2 + 7b + 1 = 0$

$\Rightarrow (4b + 1)(3b + 1) = 0$

$\Rightarrow b = -\frac{1}{4}$ or $-\frac{1}{3}$

$\therefore a < b$

10. (D) From 1, $a^2 + 5a + 6 = 0$

$\Rightarrow (a + 2)(a + 3) = 0$

$\Rightarrow a = -2$ or -3

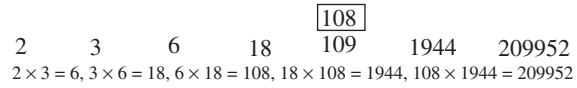
From 2, $b^2 + 3b + 2 = 0$

$\Rightarrow (b + 1)(b + 2) = 0$

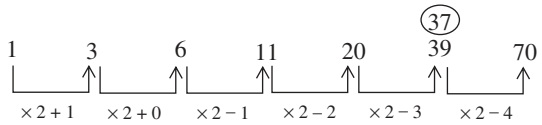
$\Rightarrow b = -1$ or -2

$\therefore a \leq b$

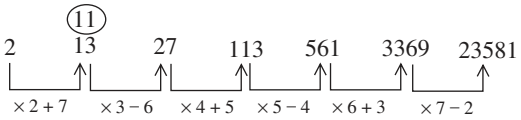
11. (D)



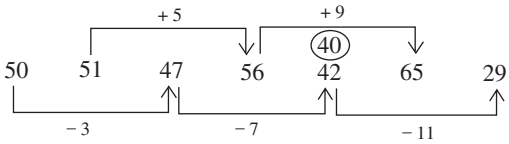
12. (B)



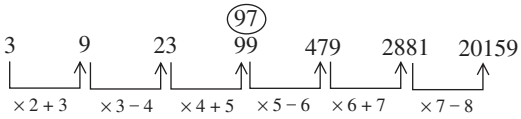
13. (A)



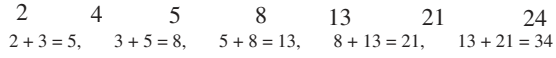
14. (D)



15. (C)



16. (A)



17. (D) Reqd. percentage

$= \left(\frac{11295 + 12170}{111300 + 115650}\right) \times 100$

$= \frac{23465 \times 100}{226950} = 10{\cdot}34$

18. (A) % of A $= \frac{1800 \times 100}{15250} = 11{\cdot}8$

% of B $= \frac{1100 \times 100}{12500} = 8{\cdot}8$

% of C $= \frac{1550 \times 100}{14000} = 11{\cdot}07$

% of D $= \frac{1640 \times 100}{17600} = 9{\cdot}31$

% of E $= \frac{1480 \times 100}{16400} = 9{\cdot}02$

% of F $= \frac{1250 \times 100}{14500} = 8{\cdot}62$

and % of G $= \frac{1400 \times 100}{15000} = 9{\cdot}33$

$\therefore$ Least percentage is of F.

19. (A) Reqd. percentage

$= \left(\frac{1480 + 1575}{15500 + 14800}\right) \times 100$

$= \frac{3055 \times 100}{30300} = 10$ (App.)

20. (C) Average number $= \frac{11295}{7} = 1615$

21. (D) Average number

$= \frac{12500 + 15400 + 13800 + 14000 + 14550}{5}$

$= \frac{70250}{5} = 14050$

22. (D) $\because$ V = 38808 ml

= 38808 c.c. ...(1)

$\because r = \frac{3}{4}h$

$\Rightarrow h = \frac{4r}{3}$ ...(2)

Volume of cylindrical tank (V)

$= \pi r^2 h$

$388808 = \frac{22}{7} \times r^2 \times \frac{4r}{3}$

$\Rightarrow r^3 = \frac{38808 \times 7 \times 3}{22 \times 4}$

$\Rightarrow r^3 = 9261$

$\therefore r = 21$

Diameter of base $= 2r$

$= 2 \times 21$

$= 42$ cm.

23. (A) A : B : C = 8 : 14 : 22

= 12 : 21 : 33

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B : C : D = 21 : 33 : 44

∴ A : B : C : D = 12 : 21 : 33 : 44

24. (B) $? = 12 \times 958 \div 17$

$= 12 \times \frac{958}{17} = 676{\cdot}23$

$\simeq 676$

25. (A) 26. (D) 27. (D) 28. (C)

29. (A)

	(8)			
1	?	27	64	125
↓				
$(1)^3$	$(2)^3$	$(3)^3$	$(4)^3$	$(5)^3$

30. (D)

	(9)			
25	16	?	4	1
$(5)^2$	$(4)^2$	$(3)^2$	$(2)^2$	$(1)^2$

31. (A)

				(19660)	
1	6	36	240	1960	?
	$\times 2 + (2 \times 2)$	$\times 4 + (4 \times 3)$	$\times 6 + (6 \times 4)$	$\times 8 + (8 \times 5)$	$\times 10 + (10 \times 6)$

32. (A)

12	
	+ 2
14	
	+ 3
17	
	− 4
13	
	− 5
8	
	+ 6
14	
	+ 7
21	
	− 8
13	
	− 9
4	
	+ 10
14	?

33. (B)

34. (D)

	− 2		− 2		− 2		
15	12	17	10	?	8	25	6
	+ 2		+ 3		+ 5		

35. (C)

							(1260)
4	6	12	30	90	315	?	
	×1·5	×2	×2·5	×3	×3·5	×4	

36. (A) 37. (A)

38. (A) Not in any sector

39. (D) Required percentage $= \frac{24880 \times 100}{975000}\%$

$= 2{\cdot}5\%$

40. (C) Total expenditure on education

= Rs. 556610 million

Total expenditure on health

= Rs. 34570 million

∴ Required difference = Rs. (56610 – 34570)

= Rs. 22040 million

= Rs. 22040000000

41. (D) $? = \frac{4875 \times 125}{100} + 88 \times 15$

$= 6093 + 1320 = 7415$

42. (B) $? = \frac{1010}{36} + 187 \times 20$

$= 28 + 3740 = 3770$

43. (D) $? = 127 \times 8 + 6 \times 4$

$= 1016 + 24 = 1040$

44. (A) Required percentage $= \frac{32{\cdot}5 \times 100}{5} = 650$

45. (A) Approximate average production

$= \frac{5 + 7{\cdot}5 + 10 + 17{\cdot}5 + 25 + 27{\cdot}5 + 32{\cdot}5}{7}$

$= \frac{125}{7} = 17{\cdot}86 = 18$ lakh

46. (D) ∵ $(17{\cdot}5 - 10) = (25 - 17{\cdot}5) = 7{\cdot}5$

47. (B) Per cent increase in production over the previous year in 1997

$= \frac{7{\cdot}5 - 5{\cdot}0}{5{\cdot}0} \times 100 = 50\%$

Per cent increase in production over the previous year in 1998

$= \frac{10 - 7{\cdot}5}{7{\cdot}5} \times 100 = 33{\cdot}33\%$

Per cent increase in production over the previous year in 1999

$= \frac{17{\cdot}5 - 10}{10} \times 100 = 75\%$

Per cent increase in production over the previous year in 2000

$= \frac{25 - 17{\cdot}5}{17{\cdot}5} \times 100 = 42{\cdot}86\%$

Per cent increase in production over the previous year in 2001

$= \frac{27{\cdot}5 - 25}{25} \times 100 = 10\%$

Per cent increase in production over the previous year in 2002

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$$= \frac{32{\cdot}5 - 27{\cdot}5}{27{\cdot}5} \times 100 = 18{\cdot}18\%$$

$\therefore$ Highest per cent increase in production over the previous year is in 1999

48. (E) $2x^2 - 7x + 6 = 0$

$\Rightarrow (x - 2)(2x - 3) = 0$

$\Rightarrow x = 2 \text{ or } \frac{3}{2}$

and, $4y^2 = 9 \rightarrow y$

$= \pm \frac{3}{2}$

$\therefore x \geq y$

49. (E) $4x^2 - 4x - 3 = 0$

$\Rightarrow (2x - 3)(2x + 1) = 0$

$\Rightarrow x = \frac{3}{2} \text{ or } \frac{-1}{2}$

and $4y^2 + 12y + 5 = 0$

$\Rightarrow (2y + 5)(2y + 1) = 0$

$\Rightarrow y = \frac{-5}{2} \text{ or } \frac{-1}{2}$

$\therefore x \geq y$

$\Rightarrow (2y + 5)(2y + 1) = 0$

$\Rightarrow y = \frac{-5}{2} \text{ or } \frac{-1}{2}$

$\therefore x \geq y$

50. (A) $4x^2 = 49$

$\Rightarrow \pm \frac{7}{2}$

and $9y^2 - 66y + 121 = 0$

$\Rightarrow (3y - 11)^2 = 0$

$y = \frac{11}{3}$

$\therefore x < y$

51. (B) $x^2 + 9x + 14 = 0$

$\Rightarrow (x + 2)(x + 7) = 0$

$\Rightarrow x = -2 \text{ or } -7$

and $y^2 + y - 2 = 0$

$\Rightarrow (y - 2)(y - 1) = 0$

$y = -2 \text{ or } 1$

$\therefore x \leq y$

52. (A) $9x^2 - 18x + 5 = 0$

$\Rightarrow (3x - 5)(3x - 1) = 0$

$x = \frac{5}{3} \text{ or } \frac{1}{3}$

and $2y^2 - 9y + 10 = 0$

$\Rightarrow (2y - 5)(y - 2) = 0$

$\Rightarrow y = \frac{5}{2} \text{ or } 2$

$\therefore x < y$

53. (B) As per the given condition a committee out of 8 men and 6 women can be formed in the following manner :

(1) With 3 men and 3 women the selection may be done in ${}^8C_3 \times {}^6C_3$ ways

(2) With 4 men and 2 women, the selection may be made in ${}^8C_4 \times {}^6C_2$ ways

(3) With 5 men and 1 women, the solution may be made in ${}^8C_5 \times {}^6C_1$ ways

(4) With 6 men and 0 woman

Therefore, the required number

$= ({}^8C_3 \times {}^6C_3) + ({}^8C_4 \times {}^6C_2) + ({}^8C_5 \times {}^6C_1) + {}^8C_6\ {}^6C_0$

$= \left(\frac{8{\cdot}7{\cdot}6}{1{\cdot}2{\cdot}3} \times \frac{6{\cdot}5{\cdot}4}{1{\cdot}2{\cdot}3}\right) + \left(\frac{8{\cdot}7{\cdot}6{\cdot}5}{1{\cdot}2{\cdot}3{\cdot}4} \times \frac{6{\cdot}5}{1{\cdot}2}\right) + \left(\frac{8{\cdot}7{\cdot}6{\cdot}5{\cdot}4}{1{\cdot}2{\cdot}3{\cdot}4{\cdot}5} \times \frac{6}{1}\right) + \left(\frac{8{\cdot}7{\cdot}6{\cdot}5{\cdot}4{\cdot}3}{1{\cdot}2{\cdot}3{\cdot}4{\cdot}5{\cdot}6}\right)$

$= (56 \times 20) + (70 \times 15) + (56 \times 6) + 28 \times 1$

$= 1120 + 1050 + 336 + 28 = 2534$

54. (D) From I and II or III

Work of 1 man = work of 2 women

$\therefore$ 16 men + 8 women = 32 + 8 = 40 women

Now from II or III 40 women will complete 1 work in 4 days

55. (D) From 1 and 2

Speed of the train $= \frac{240}{10} = 24$ m/sec

From 2 and 3

Speed of the train $= \frac{240 + 240}{20} = 24$ m/sec

56. (D) From 1 area of the square

$= \frac{1}{2}(\text{Diagonal})^2$

From 2 area of the square $= (\text{side})^2$

From 3 Area of the square $= \left(\frac{\text{Perimeter}}{4}\right)^2$

57. (C) Let the two digit number be $10x + y$

From 1 or from 3

$(10y + x) - (10x + y) = 18$

$\Rightarrow y - x = 2$ ...(1)

From (2) $x + y = 14$ ...(2)

$\therefore x = 6$

and $y = 8$

$\therefore$ Number = 68

58. (B) Amount doubles itself in 5 years with S.I.

$\therefore$ If P = Rs. 100

then S.I. = Rs. 100

Rate $= \frac{100 \times 100}{100 \times 5} = 20\%$ p.a.

59. (C) 60. (D) 61. (B) 62. (A)

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63. (D) ∵ ? % of 280 + 18% of 550

$$= 143{\cdot}8$$

$$\Rightarrow \frac{? \times 280}{100} + \frac{550 \times 18}{100} = 143{\cdot}8$$

$$\Rightarrow 2{\cdot}8 \times ? + 99 = 143{\cdot}8$$

$$? = \frac{143{\cdot}8 - 99}{2{\cdot}8}$$

$$= \frac{44{\cdot}8}{2{\cdot}8} = 16$$

64. (D) Average production of sugar in years 1998, 1999, 2000 and 2001

$$= \frac{15 + 50 + 30 + 35}{4}$$

$$= 32{\cdot}5 \text{ thousands metric tons}$$

And average production of sugar in years 2001, 2002, 2003 and 2004

$$= \frac{35 + 65 + 75 + 70}{4}$$

$$= 61{\cdot}25 \text{ thousands metric tons}$$

∴ Required difference

$$= 61{\cdot}25 - 32{\cdot}5$$

$$= 28{\cdot}75 \text{ thousands metric tons}$$

65. (A) In 1999 the per cent increase in value from the previous year

$$= \frac{50 - 15}{15} \times 100\%$$

$$= 233{\cdot}33\%$$

In 2001 the per cent increase in value from the previous year

$$= \frac{35 - 30}{30} \times 100\%$$

$$= 16{\cdot}66\%$$

In 2003 the per cent increase in value from the previous year

$$= \frac{75 - 65}{65} \times 100\%$$

$$= 15{\cdot}38\%$$

∴ In the remaining there was decrease

66. (D) In 1998 the value of sugar per metric ton

$$= \frac{55}{2 \times 15} = \text{Rs. } 1{\cdot}833 \text{ lakh}$$

In 1999 the value of sugar per metric ton

$$= \frac{80}{50} = \text{Rs. } 1{\cdot}600 \text{ lakh}$$

In 2000 the value of sugar per metric ton

$$= \frac{50}{30} = \text{Rs. } 1{\cdot}666 \text{ lakh}$$

In 2001 the value of sugar per metric ton

$$= \frac{115}{2 \times 35} = \text{Rs. } 1{\cdot}642 \text{ lakh}$$

In 2002 the value of sugar per metric ton

$$= \frac{102{\cdot}5}{65} = \text{Rs. } 1{\cdot}575 \text{ lakh}$$

In 2003 the value of sugar per metric ton

$$= \frac{235}{2 \times 75} = \text{Rs. } 1{\cdot}566 \text{ lakh}$$

And in 2004 the value of sugar per metric ton

$$= \frac{110}{70} = \text{Rs. } 1{\cdot}571 \text{ lakh}$$

∴ It is the highest in the year 1998

67. (D) It is lowest in the year 2003

68. (A) 25% of the total production

$$= \frac{25}{100} \times 340$$

$$= 85 \text{ thousand metric tons}$$

And the production of the year 1998 and 2004

$$= 15 + 70$$

$$= 85 \text{ thousand metric tons}$$

69. (D) Reqd. cost of average sales

$$= \frac{(25 + 45 + 38 + 52 + 47 + 55)}{6} \times 1000 \times 1{\cdot}8$$

$$= \text{Rs. } 78600 \text{ lakh}$$

70. (C) Total sale in 2003

$$= 43 + 55 + 49 + 63 + 42 + 62$$

$$= 314 \text{ lakh tonnes}$$

And total sale in 2000

$$= 41 + 50 + 43 + 57 + 39 + 64$$

$$= 294 \text{ lakh tonnes}$$

∴ Required percentage $= \frac{314 \times 100}{294}\%$

$$= 106{\cdot}80\%$$

71. (B) Percentage increase in sales in 2003 from 1998

$$= \frac{314 - 262}{262} \times 100\%$$

$$= 19{\cdot}847\%$$

$$= 20\%$$

72. (D) Average of B $= \frac{45 + 39 + 50 + 48 + 53 + 55}{6}$

$$= 48{\cdot}3 \text{ lakh tonnes}$$

and average sale of C

$$= \frac{38 + 40 + 43 + 43 + 46 + 49}{6}$$

$$= 43{\cdot}16 \text{ lakh tonnes}$$

∴ Reqd. ratio $= 48{\cdot}3 : 43{\cdot}16$

$$= 29 : 26$$

73. (C) % of decrease in sales in 1999 of E from previous year

$$= \frac{47 - 46}{47} \times 100 = 2{\cdot}13\%$$

% of decrease in sales in 2000 of E from previous year

$$= \frac{46 - 39}{46} \times 100 = 15{\cdot}22\%$$

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% of decrease in sales in 2001 of E from previous year

$$= \frac{39-32}{39} \times 100 = 17{\cdot}95\%$$

% of increase in sales in 2002 of E from previous year

$$= \frac{37-32}{32} \times 100 = 15{\cdot}63\%$$

% of decrease in sales in 2003 of E from previous year

$$= \frac{42-37}{37} \times 100 = 13{\cdot}51\%$$

$\therefore$ Max. % decrease is in the year 2001

74. (D) Expenditure of companies C and D

$= 40 + 45$

$=$ Rs. 85 crore

and income of companies C and D

$= 35 + 50$

$=$ Rs. 85 crore

$\therefore$ There was no loss or profit

75. (C) Income of company A in 1999

$$= \frac{100 \times 40}{110}$$

$$= \text{Rs. } \frac{400}{11} \text{ crore}$$

If the expenditure of company A in 1999 be Rs. x

then, $$20 = \frac{\frac{400}{11} - x}{x} \times 100$$

$\Rightarrow$ $x =$ Rs. 30·30 crore

76. (B) Expenditure of company G in 1999

$$= \frac{100 \times 45}{100 + 20} = \text{Rs. } 37{\cdot}5 \text{ crore}$$

If the income of G in 1999 be Rs. x

then $$10 = \frac{x - 37{\cdot}50}{37{\cdot}50} \times 100$$

$\therefore$ $x =$ Rs. 41·25 crore

77. (D) % of profit of A in 2000

$$= \left(\frac{40-30}{30}\right) \times 100$$

$= 33{\cdot}33$

% of profit of B in 2000

$$= \frac{42{\cdot}50 - 32{\cdot}50}{32{\cdot}50} \times 100$$

$= 30{\cdot}77$

% of loss of C in 2000

$$= \frac{45-35}{45} \times 100 = 22{\cdot}22$$

% of profit of D in 2000

$$= \frac{50-40}{40} \times 100 = 25$$

% of loss of E in 2000

$$= \frac{45-40}{45} \times 100 = 11{\cdot}11$$

% of profit of F in 2000

$$= \frac{32{\cdot}5 - 25}{25} \times 100 = 30{\cdot}00$$

% of profit of G in 2000

$$= \frac{50-45}{45} \times 100 = 11{\cdot}11$$

% Highest percentage of profit in 2000 is of the company A

78. (C) Total income of all companies

$= 40 + 42{\cdot}5 + 35 + 50 + 40 + 32{\cdot}5 + 50$

$=$ Rs. 290 crore

And total expenditure of all companies

$= 30 + 32{\cdot}5 + 45 + 40 + 45 + 25 + 45$

$=$ Rs. 262·5 crore

$\therefore$ Required % profit

$$= \frac{290 - 262{\cdot}5}{262{\cdot}5} \times 100 = 10{\cdot}5$$

79. (D) There are 6 different letters in the word ADJUST with two vowels (A, U) and four consonants (D, J, S, T). The vowels (A, U) put together may be deemed as a single letter. In this condition there are in all (1 + 4) *i.e*; 5 letters. The numbers comprising these 5 letters are $\lfloor 5$ but the vowels (A, U) can be arranged in $\lfloor 2$ ways. So putting both the vowels together

Number of words $= \lfloor 5 \times \lfloor 2$

Number of words when the two vowels do not occur together

$= \lfloor 6 - \lfloor 5 \times \lfloor 2$

$= 720 - 240$

$= 480$

80. (C) $3x^2 - 12x + 12 < x$

$3x^2 - 13x + 12 < 0$

$(x-3)(3x-4) < 0$

$$(x-3)\left(x - \frac{4}{3}\right) < 0$$

$$+ \quad - \quad +$$

$$-\infty \quad \frac{4}{3} \quad 3 \quad +\infty$$

$$\frac{4}{3} \le x \le 3$$

81. (D) If the period is not known, we cannot ascertain the amount invested under scheme A.

82. (D)

83. (A) Let the original fraction be $\frac{x}{y}$

By question, $$\frac{1{\cdot}4x}{2y} = \frac{7}{16}$$

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$\Rightarrow \quad 1{\cdot}4x \times 16 = 2y \times 7$

$\Rightarrow \quad \frac{x}{y} = \frac{2 \times 7}{1{\cdot}4 \times 16}$

$\therefore \quad \frac{x}{y} = \frac{5}{8}$

84. (C) Reqd. number
$= 1{\cdot}53 + 2{\cdot}03 + 1{\cdot}87 + 1{\cdot}95 + 2{\cdot}32 + 2{\cdot}36$
$= 12{\cdot}06$ thousand $= 12060$

85. (C) Reqd. per cent increase
$= \frac{2{\cdot}10 - 2{\cdot}08}{2{\cdot}08} \times 100$
$= \frac{0{\cdot}02 \times 100}{2{\cdot}08}$
$= \frac{2}{2{\cdot}08} = 0{\cdot}96\%$

86. (B) Reqd. ratio $= \frac{2{\cdot}34 + 2{\cdot}15 + 2{\cdot}20}{2{\cdot}62 + 2{\cdot}79 + 2{\cdot}39}$
$= \frac{6{\cdot}69}{7{\cdot}80} = 223 : 260$

87. (A) Reqd. per cent $= \frac{2{\cdot}23}{2{\cdot}55} \times 100 = 87{\cdot}45$

88. (D) In 2000, no. of cars manufactured by all companies
$= 2{\cdot}58 + 1{\cdot}98 + 1{\cdot}97 + 2{\cdot}46 + 2{\cdot}35 + 1{\cdot}88$
$= 13{\cdot}22$ thousand
In 2001, no. of cars manufactured by all companies
$= 2{\cdot}34 + 2{\cdot}15 + 2{\cdot}20 + 2{\cdot}46 + 2{\cdot}45 + 1{\cdot}95$
$= 13{\cdot}55$ thousand
In 2002, no. of cars manufactured by all companies
$= 2{\cdot}85 + 2{\cdot}35 + 2{\cdot}18 + 2{\cdot}55 + 2{\cdot}60 + 2{\cdot}25$
$= 14{\cdot}78$ thousand
In 2003, no. of cars manufactured by all companies
$= 2{\cdot}87 + 2{\cdot}62 + 2{\cdot}25 + 2{\cdot}62 + 2{\cdot}79 + 2{\cdot}39$
$= 15{\cdot}54$ thousand
In 2004, no. of cars manufactured by all companies
$= 2{\cdot}91 + 2{\cdot}71 + 2{\cdot}68 + 2{\cdot}71 + 2{\cdot}88 + 2{\cdot}58$
$= 16{\cdot}47$ thousand
and in 2005, no. of cars manufactured by all companies
$= 2{\cdot}94 + 2{\cdot}84 + 2{\cdot}86 + 2{\cdot}76 + 2{\cdot}90 + 2{\cdot}67$
$= 16{\cdot}97$ thousand

89. (B) Reqd. per cent $= \frac{750 \times 100}{3800}$
$= 19{\cdot}74\%$
$= 20\%$

90. (D) Reqd. no. $= 3750$

91. (C) Reqd. percentage $= \frac{650 \times 100}{(600 + 650 + 500)}$
$= \frac{65000}{1750} = 37{\cdot}14\%$

92. (D) Reqd. ratio $= 550 + 500 + 600 + 650 + 700 + 750) : (450 + 650 + 600 + 700 + 750 + 700) : (500 + 600 + 550 + 750 + 750 + 650)$
$= 3750 : 3850 : 3800$
$= 75 : 77 : 76$

93. (A) Reqd. ratio $= (500 + 550) : (650 + 750)$
$= 1050 : 1400$
$= 3 : 4$

94. (D) Total expenditure on accounts deptt.
$= \frac{120000000 \times 168}{1200}$
$= 120000000 \times \frac{14}{100}$
$=$ Rs. 16·8 million

95. (B) Per employee expenditure on medical
$= 120000000 \times \frac{13}{100} \times \frac{1}{1200}$
$= 13000$

96. (C) Total expenditure on salary of employees in marketing deptt.
$= \frac{30}{100} \times 120000000 \times \frac{17}{100}$
$=$ Rs. 6·12 millions

97. (D) Amount spent on electricity
$= 120000000 \times \frac{11}{100}$
$=$ Rs. 13200000

98. (A) Expenditure on telephone for employees in computer deptt.
$= 120000000 \times \frac{12}{100} \times \frac{8}{100}$
$=$ Rs. 11·52 lakh

99. (D) Total candidates $= 300000$
Candidates joining in state G $= 300000 \times \frac{7}{100}$
$= 2100$
No. of candidates passed in state G
$= 210 \times \frac{48}{100}$
$= 10080$
No. of male candidates passed in State G
$= \frac{9}{9 + 11} \times 10080$
$= 4536$

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100. (B) No. of candidates passed in State A

$$= 300000 \times \frac{15}{100} \times \frac{49}{100}$$

$$= 22050$$

No. of female candidates passed in State A

$$= \frac{5}{9} \times 22050$$

$$= 12250$$

Similarly,

No. of total candidates passed in State B

$$= 300000 \times \frac{18}{100} \times \frac{61}{100}$$

$$= 32940$$

No. of female candidates passed in State B

$$= \frac{4}{10} \times 32940$$

$$= 13176$$

No. of total female candidates passed

$$= 12250 + 13176$$

$$= 25426$$

101. (B) No. of candidates passed in State A

$$= 300000 \times \frac{15}{100} \times \frac{49}{100}$$

$$= 22050$$

No. of male candidates passed in State A

$$= \frac{4}{9} \times 22050$$

$$= 9800$$

No. of candidates passed in State B

$$= 300000 \times \frac{18}{100} \times \frac{61}{100}$$

$$= 32940$$

No. of male candidates passed in State B

$$= \frac{6}{10} \times 32940$$

$$= 19764$$

No. of candidates passed in State C

$$= 300000 \times \frac{6}{100} \times \frac{54}{100}$$

$$= 9720$$

No. of male candidates passed in State C

$$= \frac{7}{15} \times 9720$$

$$= 4536$$

No. of male candidates passed in State G

$$= 4536$$

Obviously, the no. of male candidates passed in State C and G in the same

102. (C) No. of candidates passed in State A

$$= 22050$$

No. of candidates passed in State C

$$= 9720$$

No. of candidates passed in State A and C

$$= 22050 + 9720$$

$$= 31770$$

No. of candidates joining in State A

$$= 300000 \times \frac{15}{100}$$

$$= 45000$$

No. of candidates joining in State C

$$= 300000 \times \frac{6}{100}$$

$$= 18000$$

No. of total candidates joining in State A and C

$$= 45000 + 18000$$

$$= 63000$$

$$\text{Reqd. percentage} = \frac{31770}{63000} \times 100$$

$$= 50{\cdot}43$$

103. (A) No. of total candidates passed in State E and D

$$= \left(300000 \times \frac{12}{100} \times \frac{65}{100}\right) + \left(300000 \times \frac{23}{100} \times \frac{45}{100}\right)$$

$$= 23400 + 31050$$

$$= 54450$$

104. (D) Male-female ratio of candidates failing in State D has not been given. Therefore the male candidates who joined cannot be ascertained.

105. (D) Number of candidates passed in State F

$$= 300000 \times \frac{19}{100} \times \frac{57}{100}$$

$$= 32490$$

Number of female candidates passed in State F

$$= \frac{8}{19} \times 32490$$

$$= 13680$$

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Miscellaneous Exercise – IV

1. The highest common factor of 70 and 245 is—
   (A) 35 (B) 55
   (C) 45 (D) 65

2. The average of the fractions $1\frac{1}{2}$, $2\frac{1}{3}$, $3\frac{1}{3}$, $4\frac{5}{6}$ is—
   (A) 2 (B) $2\frac{1}{2}$
   (C) 3 (D) 4

3. $\left(\frac{?}{31}\right) \times \left(\frac{?}{279}\right) = 1$
   (A) 31 (B) 93
   (C) 217 (D) 8649

4. A number exceeds its four seventh by 18. What is the number ?
   (A) 36
   (B) 49
   (C) 63
   (D) None of these

5. The ratio $\frac{1}{2} : \frac{1}{3} : \frac{1}{5}$ is the same as—
   (A) 2 : 3 : 5
   (B) 5 : 3 : 2
   (C) 15 : 10 : 6
   (D) 6 : 10 : 15

6. $\sqrt[3]{1 - \frac{91}{216}}$ is equal to—
   (A) $\frac{1}{6}$
   (B) $\frac{5}{6}$
   (C) $1 - \frac{\sqrt[3]{91}}{6}$
   (D) None of these

7. The value of $(1502)^2 - (1498)^2$ is—
   (A) 12000 (B) 16000
   (C) 2256004 (D) 22560

8. $1 + \cfrac{1}{1 + \cfrac{1}{1 - \frac{1}{6}}} = ?$
   (A) $\frac{6}{11}$ (B) $\frac{16}{11}$
   (C) $\frac{7}{6}$ (D) $\frac{1}{6}$

9. Which is the biggest of the following fractions ?
   (A) $\frac{3}{4}$ (B) $\frac{4}{5}$
   (C) $\frac{5}{6}$ (D) $\frac{6}{7}$

10. $\frac{1}{7} + \left[\frac{7}{9} - \left(\frac{3}{9} + \frac{2}{9}\right) - \frac{2}{9}\right]$ is equal to—
    (A) $\frac{1}{7}$ (B) $\frac{1}{9}$
    (C) $\frac{2}{9}$ (D) $\frac{3}{7}$

11. $5{\cdot}75 - \frac{3}{7} \times 15\frac{3}{4} + 2\frac{2}{35} \div 1{\cdot}44 = ?$
    (A) $\frac{2}{5}$ (B) $\frac{3}{7}$
    (C) $\frac{4}{11}$ (D) $\frac{2}{9}$

12. $12\frac{1}{2} \times 3\frac{3}{5} \div 1\frac{4}{5} = ?$
    (A) 45
    (B) 81
    (C) 405
    (D) None of these

13. ?% of 250 + 25% of 68 = 67
    (A) 10 (B) 15
    (C) 20 (D) 25

14. $\sqrt{\frac{?}{289}} = \frac{54}{51}$
    (A) 108 (B) 324
    (C) 2916 (D) 6800

15. In a garden there are 10 rows and 12 columns of mango trees. The distance between each tree is of 2 metres and a distance of one metre is left from all sides of the boundary of the garden. The length of the garden is—
    (A) 20 metres (B) 22 metres
    (C) 24 metres (D) 26 metres

16. An increase of Rs. 60 in the monthly salary of Madan made it 50% of the monthly salary of Kamal. What is Madan's present monthly salary ?
    (A) Rs. 180
    (B) Rs. 240
    (C) Rs. 300
    (D) Data inadequate

17. 18 persons can finish a work in 36 days. How much time will 12 persons take to finish the same work ?
    (A) 18 days (B) 24 days
    (C) 54 days (D) 72 days

18. A and B finish a job in 12 days. While A, B and C can finish it in 8 days. C alone will finish the job in—
    (A) 14 days (B) 16 days
    (C) 20 days (D) 24 days

19. The smallest number which when subtracted from sum of squares of 11 and 13 gives a perfect square, is—
    (A) 1 (B) 4
    (C) 5 (D) 9

20. The sum of any seven consecutive whole numbers is always divisible by—
    (A) 2 (B) 3
    (C) 7 (D) 11

21. In an examination 35% of the total student failed in Hindi. 45% failed in English and 20% in both. Percentage of total students passed in both the subjects is—
    (A) 10 (B) 20
    (C) 30 (D) 40

22. The least square number exactly divisible by 8, 12, 15 and 20 is—
    (A) 900 (B) 1200
    (C) 3600 (D) 14400

23. If the price of some commodity is reduced from Rs. 16 to Rs. 12·25 then on purchasing four such commodities how much percentage can one save ?
    (A) 15 (B) 49
    (C) $23\frac{7}{16}$ (D) $\frac{4900}{64}$

24. The smallest number, which must be added to 1000 to make it a perfect square is—
    (A) 12 (B) 20
    (C) 24 (D) 25

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25. Two consecutive multiples of a certain number add upto 184. The number is—
(A) 4 (B) 8
(C) 23 (D) 46

26. The positions of the digits of a two digit number are interchanged. If the sum of the original number and the number obtained by interchanging the digits is 44. What is the sum of digits of that number ?
(A) 2
(B) 4
(C) 11
(D) Cannot be determined

27. The least number, which 715 must be multiplied with in order to get a multiple of 825 is—
(A) 10 (B) 12
(C) 15 (D) 35

28. The difference of two numbers is 11 and $\frac{1}{5}$th of their sum is 9. The number are—
(A) 31, 20 (B) 30, 19
(C) 29, 18 (D) 28, 17

29. Kavita has one quarter more money than Nitin. Nitin has two-third money as of Pravin. If Pravin has Rs. 876 with him. How much money Kavita has ?
(A) Rs. 365 (B) Rs. 467·20
(C) Rs. 730 (D) Rs. 760

30. $\frac{1}{4}$th of Nikhil's money is equal to $\frac{1}{6}$th of Yogesh's money. If both together have Rs. 600, the difference between their amounts is—
(A) Rs. 50 (B) Rs. 120
(C) Rs. 240 (D) Rs. 360

31. A number when divided by 123 leaves remainder 83. If the same number is divided by 41, the remainder will be—
(A) 0 (B) 1
(C) 40 (D) 83

32. One fourth of a two digit number is two less than one-third of the same number. What is the sum of the digits of the number ?
(A) 6
(B) 8
(C) 9
(D) None of these

33. If 5 poles are erected at equal distances between two points 20 metres apart. What is the distance between any two poles ?
(A) 2 metres (B) 3 metres
(C) 4 metres (D) 5 metres

34. Which of the following has the fraction in the ascending order ?
(A) $\frac{2}{7}, \frac{3}{10}, \frac{4}{13}$ (B) $\frac{4}{13}, \frac{3}{10}, \frac{2}{7}$
(C) $\frac{3}{10}, \frac{2}{7}, \frac{4}{13}$ (D) $\frac{4}{13}, \frac{2}{7}, \frac{3}{10}$

35. Dhawan bought 10 chairs for Rs. 500. He got them repaired and sold them at Rs. 500 per pair. He got a profit of Rs. 100 per chair. How much did he spend on the repair of the chairs ?
(A) Rs. 250 (B) Rs. 500
(C) Rs. 1000 (D) Rs. 1500

36. Deepak has Rs. 5130 in the form of 1, 2 and 5 rupee notes. If these notes be in the ratio 3 : 7 : 8, the number of five rupee notes he has is—
(A) 340 (B) 672
(C) 720 (D) 768

37. At the election involving two candidates only 68 votes are declared as invalid. The winning candidates scores 52% and wins by 98 votes. The total number of votes polled is—
(A) 2382
(B) 2450
(C) 2518
(D) None of these

38. Two different natural numbers are such that their product is less than their sum. One of the numbers must be—
(A) 1
(B) 2
(C) 3
(D) None of these

39. The price of an article was increased by P%. Later the new price was decreased by P%. If the latest price was Re. 1, the original price was—
(A) Re. 1
(B) Rs. $\frac{1 - P^2}{100}$
(C) Rs. $\left(\frac{10000}{10000 - P^2}\right)$
(D) Rs. $\frac{\sqrt{1 - P^2}}{100}$

40. A boy was asked to multiply a certain number by 25. He multiplied it by 52 and got his answer more than the correct one by 324. The number to be multiplied was—
(A) 12 (B) 15
(C) 25 (D) 52

41. The difference between the simple interest and the compound interest at the same rate of interest on a sum of money at the end of the second year will be Rs. 4·00. If the rate of interest is 5% per annum, what is the sum ?
(A) Rs. 1200
(B) Rs. 1600
(C) Rs. 2000
(D) None of these

42. If the price of one dozen of mangoes is Rs. 49·75, what will be the approximate value of 291 mangoes ?
(A) Rs. 1000 (B) Rs. 1200
(C) Rs. 1500 (D) Rs. 1800

43. The square root of 824464 is—
(A) 686
(B) 868
(C) 908
(D) None of these

44. A trader lists his articles 20% above C.P. and allows a discount of 10% on cash payment, this gain per cent is—
(A) 5% (B) 6%
(C) 8% (D) 10%

45. 10% of 24·2 will be how much more than 10% of 24·02 ?
(A) 0·02 (B) 0·18
(C) 0·018 (D) 0·002

46. For the theatre the cost of a child ticket is $\frac{1}{3}$ of the cost of an adult ticket. If the cost of tickets for 3 adults and 3 children is Rs. 60, the cost of an adult ticket is—
(A) Rs. 12 (B) Rs. 15
(C) Rs. 18 (D) Rs. 20

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47. The sum of two numbers is 104 and their difference is 30. The difference of their squares is—
(A) 74 (B) 2160
(C) 2320 (D) 3120

48. B is twice as fast as A and C is three times as fast as A. If B alone can complete a job in 12 days, how long will A, B and C take to complete the same job together ?
(A) 3 days
(B) 4 days
(C) 6 days
(D) None of these

49. The average of marks obtained by Aakash in seven subjects is 68. His average in six subjects excluding Mathematics is 70. How many marks did he get in Mathematics ?
(A) 56 (B) 60
(C) 68 (D) 82

50. The L.C.M. of two numbers is 2310 and their H.C.F. is 30. If one number is 210, the other number is—
(A) 330 (B) 1470
(C) 2100 (D) 16170

51. A man donated 5% of his income to a charitable organisation and deposited 20% of the remainder in a bank. If he now has Rs. 1919 left, his income is—
(A) Rs. 2300 (B) Rs. 2500
(C) Rs. 2525 (D) Rs. 2558·60

52. A sum of Rs. 45 is made up of 100 coins of 50 paise and spaise. How many of them are 55 paise coins ?
(A) 40 (B) 50
(C) 75 (D) 80

53. If the area of an equilateral triangle is $36\sqrt{3}$ cm^2 the perimeter of the triangle is—
(A) 18 cm (B) 24 cm
(C) 30 cm (D) 36 cm

54. A fruit vender has 24 kg of apples. He sells a part of these at 20% gain and the balance at a loss of 5%. If on the whole he earns a profit of 10% the amount of apples sold at a loss is—
(A) 6 kg (B) 4·6 kg
(C) 9·6 kg (D) 11·4 kg

55. Monika deposits Rs. 8000 partly at 10% and partly at 15% interest for one year in a bank. If she gets an interest of Rs. 950 at the end of one year the amount deposited at 15% is—
(A) Rs. 2000 less than deposited at 10%
(B) Rs. 1250 less than deposited at 10%
(C) Rs. 500 less than deposited at 10%
(D) Rs. 1500 less than deposited at 10%

56. 12 buckets of water fill a tank when the capacity of each bucket is 13·5 litres. How many buckets will be needed to fill the same tank if the capacity of each bucket is 9 litres ?
(A) 8
(B) 16
(C) 18
(D) None of these

57. Rs. 1200 amounts to Rs. 1632 in four years at a certain rate of simple interest. If the rate of interest is increased by 1%, it would amount to how much ?
(A) Rs. 1635 (B) Rs. 1644
(C) Rs. 1670 (D) Rs. 1680

58. Jayant started a business investing Rs. 6000. Six months later Madhu joined him investing Rs. 4000. If they make a profit of Rs. 5200 at the end of the year, how much should be the share of Madhu ?
(A) Rs. 1300 (B) Rs. 1732
(C) Rs. 3466 (D) Rs. 3900

59. The compound interest on Rs. 6000 for $1\frac{1}{2}$ years at 10% per annum, the interest being paid half yearly, will be—
(A) Rs. 912·75
(B) Rs. 930
(C) Rs. 932·50
(D) Rs. 945·75

60. What number must be added to the numbers 3, 7 and 13 so that they are in a continued proportion ?
(A) 5 (B) 6
(C) 8 (D) 9

61. The charges of hired car are Rs. 4 per km for the first 60 km, Rs. 5 km for the next 60 km and Rs. 8 for every 5 km for the further journey. If the balance amount left over with Ajit is $\frac{1}{4}$ less that what he paid towards the charges of the hired car for travelling 320 km. How much money did he have initially with him ?
(A) Rs. 1032
(B) Rs. 1253
(C) Rs. 1548
(D) None of these

62. A 63 cm long wire is to be cut into two pieces such that one piece will be $\frac{2}{5}$ as long as the other. How many centimetres will the shorter piece be ?
(A) 9 (B) 18
(C) 36 (D) 45

63. A bus goes from A to B at the rate of 30 kmph and from B to A at the rate of 60 kmph. The average speed of the bus is—
(A) 40 kmph
(B) 45 kmph
(C) 47·5 kmph
(D) 52·5 kmph

64. A class starts at 10 A.M. and lasts till 1·27 p.m. Four periods are held during this interval. After every period, 5 minutes are given free to the students. The exact duration of each period is—
(A) 42 minutes
(B) 48 minutes
(C) 51 minutes
(D) 53 minutes

65. The average of first nine multiples of 3 is—
(A) 12·0 (B) 12·5
(C) 15·0 (D) 18·5

66. The mean proportional of 0·32 and 0·02 is—
(A) 0·08 (B) 0·16
(C) 0·30 (D) 0·34

67. One third of Vinod's mark in Mathematics exceeds a half of his marks in social studies by 30. If he got 240 marks in the two subjects together how many

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marks did he get in social studies ?
(A) 40 (B) 60
(C) 80 (D) 90

68. There are 20 students with an average height of 125 cm in a class. 5 students with an average height of 116 cm leave the class. What is average height of the class now ?
(A) 118 cm (B) 120 cm
(C) 128 cm (D) 130 cm

69. The smallest number which when divided by 10, 15, 20 and 35 leaves 6, 11, 16 and 31 as remainder is—
(A) 416
(B) 424
(C) 436
(D) None of these

70. One third of the boys and one half of the girls of a college participate in a social work project. If the number of participating students is 300 out of which 100 are boys. What is the total number of students in the college ?
(A) 500 (B) 600
(C) 700 (D) 800

71. A jar full of whisky contains 40% of alcohol. A part of this whisky is replaced by another containing 19% alcohol and now the percentage of alcohol was found to be 26. The quantity of whisky replaced is—
(A) $\frac{1}{3}$ (B) $\frac{2}{3}$
(C) $\frac{2}{5}$ (D) $\frac{3}{5}$

72. 60% of the length of a pole is painted red, 40% of the rest is painted green and 50% of the balance is painted blue. The remaining unpainted length of the pole is 30 cm. The length of the pole is—
(A) 2·5 m (B) 3·2 m
(C) 4·8 m (D) 5·6 m

73. A train X starts from Meerut at 4 p.m. and reaches Ghaziabad at 5 p.m. while another train Y starts from Ghaziabad at 4 p.m. and reaches Meerut at 5·30 p.m. The two trains will cross each other at—
(A) 4·36 p.m. (B) 4·42 p.m.
(C) 4·48 p.m. (D) 4·50 p.m.

74. A person gave Rs. 2500 to his eldest son, $\frac{5}{12}$ of the whole property to the second son and to the youngest as much as to the first and the second son together. How much did the youngest son get ?
(A) Rs. 10000
(B) Rs. 15000
(C) Rs. 20000
(D) Rs. 25000

75. Twenty litres of a mixture contain milk and water in the ratio 5 : 3. If 4 litres of this mixture are replaced by 4 litres of milk, the ratio of milk to water in the new mixture will become—
(A) 2 : 1 (B) 6 : 5
(C) $7\frac{1}{8} : 3$ (D) 8 : 3

76. A milkman procures milk at the rate of Rs. 4·50 per litre and sells it to his customers at the same rate. If he makes a profit of $12\frac{1}{2}\%$ the quantity of water he mixes for every litre of milk is—
(A) 50 ml (B) 100 ml
(C) 125 ml (D) 175 ml

77. A man distributed Rs. 100 equally among his friends. If there had been five more friends, each would have received one rupee less. How many friends had he ?
(A) 20 (B) 25
(C) 30 (D) 35

78. A car complete a certain journey in 8 hours. It covers half the distance at 40 kmph and the rest at 60 kmph, the length of the journey is—
(A) 350 km (B) 384 km
(C) 400 km (D) 420 km

79. The ratio between a two digit number and the sum of the digits of that number is 7 : 1. If the digit in the tenth place is one more than the digit in the unit place. What is the number ?
(A) 21
(B) 32
(C) 43
(D) None of these

80. A train covers four successive two km streches at speeds of 10 kmph, 20 kmph, 30 kmph and 60 kmph respectively. Its average speed over this distance—
(A) 20 kmph (B) 24 kmph
(C) 30 kmph (D) 32 kmph

81. A sum of money deposited at compound interest amounts to Rs. 6690 after 3 years and Rs. 10,035 after 6 years. The sum is—
(A) Rs. 4400 (B) Rs. 4445
(C) Rs. 4460 (D) Rs. 4520

82. In a competitive examination, a student scores 4 marks for every correct answer and looses 1 mark for every wrong answer. If he attempts all 75 questions and secure 125 marks the number of questions he attempts correctly is—
(A) 35 (B) 40
(C) 42 (D) 46

83. The average of three numbers is 20. If two of the numbers are 16 and 22, the third is—
(A) 18 (B) 19
(C) 20 (D) 22

84. A student who secure 20% marks in an examination fails by 30 marks. Another student who secure 32% marks gets 42 marks more than those required to pass. Per cent of mark required to pass is—
(A) 20 (B) 25
(C) 28 (D) 30

85. If the L.C.M. of x and y is z their H.C.F. is—
(A) $\frac{xy}{z}$ (B) xyz
(C) $\frac{x+y}{z}$ (D) $\frac{z}{xy}$

86. Kasim can do a piece of work in $7\frac{1}{2}$ hours and Sunil can finish it in 10 hours. If Kasim works at it for 3 hour and Sunil for 4 hours the amount of work left unfinished is—
(A) $\frac{1}{5}$ (B) $\frac{2}{5}$
(C) $\frac{1}{4}$ (D) $\frac{2}{7}$

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87. Two numbers are in the ratio 3 : 4 and the product of their L.C.M. and H.C.F. is 10,800. The sum of the numbers is—
(A) 180 (B) 210
(C) 225 (D) 240

88. Pratap bought a radio with 25% discount on the original price. He got Rs. 40 more than the original price by selling it at 140% of the price at which he bought. At what price did he buy the radio ?
(A) Rs. 600 (B) Rs. 700
(C) Rs. 800 (D) Rs. 900

89. Four different bells ring at intervals of 5, 6, 8 and 10 minutes respectively. If they ring together at 4 p.m. they will ring together again at—
(A) 5·30 p.m. (B) 6·00 p.m.
(C) 7·00 p.m. (D) 8·10 p.m.

90. The average of marks obtained by Sunil in History and Mathematics is 60%. If he got 90 marks out of 150 in Mathematics, how much did he get in History out of 100 ?
(A) 1 (B) 6
(C) 8 (D) 12

91. If $\frac{a}{3} = \frac{b}{4} = \frac{c}{7}$, the value of $\frac{a+b+c}{c}$ is—
(A) $\frac{1}{2}$ (B) $\frac{1}{7}$
(C) 2 (D) 7

92. 15 persons can fill 35 boxes in 7 days. How many Persons can fill 65 boxes in 5 days ?
(A) 13 (B) 39
(C) 45 (D) 65

93. A man drives 4 km distance to go around a rectangular park. If the area of the rectangle is 0·75 sq km the difference between the length—
(A) 0·5 km (B) 1 km
(C) 2·75 km (D) 10·25 km

94. The difference between the simple interest and the compound interest earned on a sum of money at the end of four years at the rate of 10% p.a. is Rs. 256·40. What is the sum ?
(A) Rs. 4000 (B) Rs. 4500
(C) Rs. 5000 (D) Rs. 6000

95. A sum of Rs. 65000 was divided into 3 parts so that they yielded the same interest when they were lent for 2, 3 and 4 years at 8% simple interest at the end of these periods. The ratio between these parts is—
(A) 2 : 3 : 4 (B) 4 : 3 : 2
(C) 6 : 4 : 3 (D) 3 : 4 : 6

96. Rs. 6450 is divided between Rajan and Suresh so that for every Rs. 8 that Rajan gets, Suresh Rs. 7, their shares difference by—
(A) Rs. 390 (B) Rs. 430
(C) Rs. 442 (D) Rs. 464

97. A's money is to B's money as 4 : 5 and B's money is to C's money as 2 : 3. If A has Rs. 800 C has—
(A) Rs. 1000 (B) Rs. 1200
(C) Rs. 1500 (D) Rs. 2000

98. If a man walks at 5 km/hr he reaches the bus stop 5 minutes too late and if he walks at 6 km/hr he reaches the bus stop 5 minutes too early. The bus stop is at a distance of—
(A) 3 km (B) 5 km
(C) 6 km (D) 10 km

99. In a division sum, the divisor is twelve times the quotient and five times the remainder. If the remainder be 48, then the dividend is—
(A) 240 (B) 576
(C) 4800 (D) 4848

100. A and B can complete a piece of work in 8 days. B and C in 12 days while C and A in 16 days. They work together for 3 days when A leaves off. In how many days more will B and C finish the remaining work ?
(A) $1\frac{1}{2}$ days (B) $2\frac{1}{4}$ days
(C) $7\frac{1}{8}$ days (D) $4\frac{1}{2}$ days

Answers with Hints

1. (A)
$$\begin{array}{r} 70)\ 245\ (3 \\ \underline{210} \\ 35)\ 70\ (2 \\ \underline{70} \\ \times \end{array}$$
$\therefore$ H.C.F. = 35

2. (C) Average $= \frac{1}{4}\left(\frac{3}{2}+\frac{7}{3}+\frac{10}{3}+\frac{29}{6}\right)$
$= \left(\frac{9+14+20+29}{24}\right) = \frac{72}{24} = 3$

3. (B) Let $\frac{x}{31} \times \frac{x}{279} = 1$
Then, $x^2 = 31 \times 279 = (31 \times 31 \times 3 \times 3)$
$\therefore$ $x = 31 \times 3 = 93$

4. (D) $x - \frac{4}{7}x = 18$
$\Rightarrow$ $7x - 4x = 126$
or $x = 42$

5. (C) $\frac{1}{2} : \frac{1}{3} : \frac{1}{5} = 15 : 10 : 6$

6. (B) $\sqrt[3]{1-\frac{91}{216}} = \left(\frac{216-91}{216}\right)^{1/3}$
$= \left(\frac{125}{216}\right)^{1/3} = \left(\frac{5\times5\times5}{6\times6\times6}\right)^{1/3} = \frac{5}{6}$

7. (A) $(1502)^2 - (1498)^2 = (1502 - 1498)$ (1502 + 1498)
$= 4 \times 3000 = 12000$

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8. (B) Given expression $= 1 + \dfrac{1}{1 + \dfrac{1}{\dfrac{5}{6}}} = 1 + \dfrac{1}{1 + \dfrac{6}{5}}$

$= 1 + \dfrac{5}{11} = \dfrac{16}{11}$

9. (D) $\dfrac{3}{4} = 0{\cdot}75$

$\dfrac{4}{5} = 0{\cdot}8$

$\dfrac{5}{6} = 0{\cdot}833$

and $\dfrac{6}{7} = 0{\cdot}857$

10. (A) Given expression $= \dfrac{1}{7} + \left[\dfrac{7}{9} - \dfrac{5}{9} - \dfrac{2}{9}\right]$

$= \dfrac{1}{7} + 0 = \dfrac{1}{7}$

11. (B) Given expression $= \dfrac{575}{100} - \dfrac{3}{7} \times \dfrac{63}{4} + \dfrac{72}{35} \times \dfrac{100}{144}$

$= \dfrac{23}{4} - \dfrac{27}{4} + \dfrac{10}{7}$

$= -1 + \dfrac{10}{7} = \dfrac{3}{7}$

12. (D) Given expression $= \left(\dfrac{25}{2} \times \dfrac{18}{5} \times \dfrac{5}{9}\right) = 25$

13. (C) $\dfrac{x}{100} \times 250 + \dfrac{25}{100} \times 68 = 67$

$\Rightarrow \quad \dfrac{5x}{2} = (67 - 17) = 50$

$\therefore \quad x = \left(50 \times \dfrac{2}{5}\right) = 20$

14. (B) Let $\sqrt{\dfrac{x}{289}} = \dfrac{54}{51}$

Then, $\dfrac{x}{289} = \dfrac{54}{51} \times \dfrac{54}{51}$

$\therefore \quad x = \left(\dfrac{54}{51} \times \dfrac{54}{51} \times 289\right) = 324$

15. (C) Lengthwise there are 12 trees

Total distance between them $= (11 \times 2)$ m $= 22$ m

$\therefore$ Length $= (1 + 22 + 1) = 24$ m

16. (D) Data inadequate

17. (C) Less persons more days 12 : 18 : : 36 : x

$\therefore \quad x = \dfrac{18 \times 36}{12} = 54$

18. (D) C's 1 day's work $= \left(\dfrac{1}{8} - \dfrac{1}{12}\right) = \dfrac{1}{24}$

$\therefore$ C alone can finish the job in 24 days

19. (A) $(13)^2 + (11)^2 = 169 + 121 = 290$

$\therefore$ Least number to be subtracted = 1

20. (C) $1 + 2 + 3 + 4 + 5 + 6 + 7 = 28$

which is divisible by 7

21. (D) Failed in Hindi only $= (35 - 20) = 15\%$

Failed in English only $= (45 - 20) = 25\%$

Failed in both $= 20\%$

Failed in one or both $= (15 + 25 + 20)\%$

$= 60\%$

Passed in both $= 40\%$

22. (C) L.C.M. of 8, 12, 15, 20 $= 2 \times 3 \times 2 \times 5 \times 2$

$\therefore$ Least square number divisible by 8, 12, 15, 20

$= 2 \times 2 \times 3 \times 3 \times 5 \times 5 \times 2 \times 2 = 3600$

23. (D) C.P. of 4 commodities $=$ Rs. 64

Reduced price of 4 commodities $=$ Rs. 52

Saving % $= \left(\dfrac{12}{64} \times 100\right)\%$

$= 18\dfrac{3}{4}\%$

24. (C)

3	$\overline{10}\,\overline{00}$	(31
	9	
61	100	
	61	
	39	

Number to be added $= (32)^2 - 1000$

$= (1024 - 1000) = 24$

25. (B) $184 = 2 \times 2 \times 2 \times 23$

$mx + m(x + 1) = 184$

So, $m[2x + 1] = 184$

or $2x + 1 = \dfrac{184}{m}$

By hit and trial $m = 8$

and $x = 11$

So the number $= 8$

26. (B) Let ten's digit $= x$ and unit's digit $= y$

Then, $(10x + y) + (10y + x) = 44$

$\Rightarrow \quad 11(x + y) = 44$

or $x + y = 4$

27. (C) $715 = 5 \times 11 \times 13$

and $825 = 5 \times 5 \times 11 \times 3$

The least number is 5×3 by which 715 must be multiplied to obtain a multiple of 825

28. (D) Let the number be x and $x - 11$

$\dfrac{1}{5}(x + x - 11) = 9$

or $2x - 11 = 45$

or $x = 28$

$\therefore$ The numbers are 28, 17.

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29. (C) $N = \frac{2}{3}P, K = \left(\frac{2}{3}P + \frac{1}{4} \times \frac{2}{3}P\right) = \frac{5P}{6}$

$\text{Ratio} = \frac{2}{3}P : \frac{5}{6}P : P = \frac{2}{3} : \frac{5}{6} : 1 = 4 : 5 : 6$

If Pravin has Rs. 6 Kavita has Rs. 5

If Pravin has Rs. 876, Kavita has Rs. $\left(\frac{5}{6} \times 876\right)$

= Rs. 730

30. (B) $\frac{N}{4} = \frac{4}{6}$

$\Rightarrow \quad 6N - 4Y = 0$

or $\quad 3N - 2Y = 0$

Also $\quad N + Y = 600$

Solving we get $N = 240$ only $Y = 360$

$\therefore$ Difference $= (360 - 240) = 120$

31. (B) $N = 123, Q = 83 = (41 \times 3)Q + (82 + 1)$

$= 41 \times (3Q + 2) + 1$

$\therefore$ Required remainder $= 1$

32. (A) Let unit's digit $= x$ and ten's digit $= y$

$\frac{1}{3}(10y + x) - \frac{1}{4}(10y + x) = 2$

$\left(\frac{1}{3} - \frac{1}{4}\right)(10y + x) = 2$

or $\quad 10y + x = 24$

$\therefore$ Number $= 24$

Sum of the digits $= 6$

33. (D) Distance between two poles $= \frac{20}{(5 - 1)}$

$= 5$ metres

34. (A) $\frac{2}{7} = 0{\cdot}285, \frac{3}{10} = 0{\cdot}3$ and $\frac{4}{13} = 0{\cdot}307$

$\therefore$ Fraction in ascending order are $\frac{2}{7}, \frac{3}{10}$ and $\frac{4}{13}$

35. (C) $2500 - 1000 = 500 + x$

or $\quad x = 1000$

So, he spent Rs. 1000 on repairs

36. (C) Let these notes be $3x$, $7x$ and $8x$

Ratio of their values $= 3x \times 1 : 7x \times 2 : 8x \times 5$

$= 3x : 14x : 40x$

$= 3 : 14 : 40$

Value of 5 rupee notes $=$ Rs. $\left(5130 \times \frac{40}{57}\right)$

$=$ Rs. 3600

Number of these notes $= \frac{3600}{5} = 720$

37. (D) Let total votes polled $= x$, then

52% of x + (52% of $x - 98$) + 68 $= x$

$2 \times \frac{52}{100}x - x = 30$

or $\quad x = (30 \times 25)$

$= 750$

38. (A) Clearly $1x < 1 + x$

So, one of the numbers must be 1

39. (C) Let original price $=$ Rs. x

Increased price $= \left(\frac{100 + P}{100}\right)x$

Reduced price $= \frac{(100 - P)}{100} \times \frac{100 + P}{100}x$

$\therefore \quad \frac{(100)^2 - P^2}{(100)^2}x = 1$

or $\quad x = \frac{10000}{(10000 - P^2)}$

40. (A) $52x - 25x = 324$

$\Rightarrow \quad 27x = 324$

$\Rightarrow \quad x = 12$

41. (B) Let sum $=$ Rs. P

Then, S.I. $= \frac{P \times 2 \times 5}{100} = \frac{P}{10}$

C.I. $= \left[P\left(1 + \frac{5}{100}\right)^2 - P\right]$

$= \frac{40}{400}P$

$\frac{41}{400}P - \frac{1}{10}P = 4$

or $\quad P\left(\frac{41}{400} - \frac{1}{10}\right) = 4$

$\therefore \quad P = (400 \times 4) = \text{Rs. } 1600$

42. (B) Cost of 291 mangoes $=$ Rs. $\left(\frac{49{\cdot}75}{12} \times 291\right)$

$=$ Rs. 1200 approx.

43. (C) Do yourself.

44. (C) Let C.P. $=$ Rs. 100

Then, list price $=$ Rs. 120

S.P. $=$ 90% of Rs. 120 $=$ Rs. 108

Gain $= 8\%$

45. (C) It is more by $\left(\frac{10}{100} \times 24{\cdot}2 \frac{10}{100} \times 24{\cdot}02\right)$

$= 2{\cdot}42 - 2{\cdot}402 = 0{\cdot}018$

46. (B) $3x + 3\frac{1}{3}x = 60$

or $\quad x = 15$

$\therefore$ Cost of an adult ticket $=$ Rs. 15

47. (D) $x + y = 104$ and $x - y = 30$

$\therefore \quad (x^2 - y^2) = (x + y)(x - y)$

$= 104 \times 30 = 3120$

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48. (B) B completes in 12 days, A will take 24 days and C will take 8 days

$$(A + B + C)\text{'s 1 day's work} = \left(\frac{1}{24}+\frac{1}{12}+\frac{1}{8}\right)$$
$$= \frac{6}{24}=\frac{1}{4}$$

So, all together will complete the job in 4 days.

49. (A) Marks in Mathematics $= (68 \times 7 - 70 \times 6)$
$= (476 - 420) = 56$

50. (A) Other number $= \frac{2310 \times 30}{210} = 330$

51. (C) Let income = Rs. x

Then, $\frac{5}{100}x + \frac{20}{100}\left(x - \frac{5}{100}x\right) + 1919 = x$

$$\frac{x}{20}+\frac{19x}{100}+1919 = x$$

or $5x + 19x + 191900 = 100x$

$\therefore$ $76x = 191900$

or $x = \frac{191900}{76}$

$= 2525$

52. (D) Let the number of these coins be x and $(100 - x)$

$$\frac{1}{2}x+\frac{100-x}{4} = 45$$

$\Rightarrow$ $2x + 100 - x = 180$

or $x = 80$

$\therefore$ Number of 50 paise coins = 80

53. (D) $\frac{\sqrt{3}}{4}a^2 = 36\sqrt{3}$

$\Rightarrow$ $a^2 = 144$

or $a = 12$ cm

$\therefore$ perimeter = 36 cm

54. (C) Let C.P. of apples = Re. 1 per kg

CP = Rs. 245, P = 110% of Rs. 24 = Rs. 26·40

Suppose he sold x kg at a loss of 5%

Then, $\frac{95}{100}x + \frac{120}{100}(24 - x) = 26{\cdot}40$

$\therefore$ $95x + 2880 - 120x = 2640$

or $25x = 240$

or $x = 9{\cdot}6$ kg

55. (A) Let amount at 15% be Rs. x

$$\frac{x \times 15 \times 1}{100}+\frac{(8000-x)\times 10\times 1}{100} = 950$$

or $15x + 8000 - 10x = 95000$

$5x = 15000$

or $x = 3000$

Amount at 15% = Rs. 3000

Amount at 10% = Rs. 5000

56. (C) Capacity of tank $= (12 \times 13{\cdot}5)$ litres
$= 162$ litres

Number of new buckets $= \left(\frac{162}{9}\right) = 18$

57. (D) Rate $= \frac{100 \times 432}{1200 \times 4} = 9\%$

New rate = 10%

New interest = Rs. $\left(\frac{1200 \times 10 \times 4}{100}\right)$

= Rs. 480

Amount = Rs. 1680

58. (A) Jayant Madhu $= (6000 \times 12 : 4000 \times 6)$
$= 3 : 1$

Madhu's Share = Rs. $\left(5200 \times \frac{1}{4}\right)$

= Rs. 1300

59. (D) C.I. = Rs. $\left[6000 \times \left(1+\frac{5}{100}\right)^3 - 6000\right]$

= Rs. $\left[6000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20} - 6000\right]$

= Rs. 945·75

60. (A) $\frac{3+x}{7+x} = \frac{7+x}{13+x}$

$\Rightarrow$ $(3 + x)(13 + x) = (7 + x)^2$

or $x^2 + 16x + 39 = x^2 + 14x + 49$

or $x = 5$

61. (D) Charges for 320 km

$= 60 \times 4 + 60 \times 5 + 8 \times \left(\frac{200}{5}\right)$

= Rs. (240 + 300 + 320)

= Rs. 860

Balance = Rs. $\left(860 - \frac{1}{4} \times 860\right)$

= Rs. (860 – 215) = Rs. 645

Total amount with Ajit

= Rs. (860 + 645) = Rs. 1505

62. (B) $x + \frac{2}{5}x = 63$

$\Rightarrow$ $7x = 63 \times 5$

or $x = 45$ cm

Shorter piece = $\left(\frac{2}{5} \times 45\right)$ cm = 18 cm

63. (A) Average speed = $\left(\frac{2 \times 30 \times 60}{30 + 60}\right)$ km/hr

= 40 km/hr.

64. (B) Total time = (180 + 27) min.

or = 207 min.

Free time = 15 min

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Used time = (207 – 15) min
= 192 min

Duration of each period = $\frac{192}{4}$ = 48 min

65. (C) Average
$= \frac{3\,(1+2+3+4+5+6+7+8+9)}{9} = 15$

66. (A) Mean proportion = $\sqrt{0{\cdot}32 \times 0{\cdot}02}$
$= \sqrt{0{\cdot}0064} = 0{\cdot}08$

67. (B) $\frac{M}{3} - \frac{S}{2} = 30$
$\Rightarrow$ $2M - 3S = 180$
Also, $M + S = 240$
Solving $2M - 3S = 180$
and $M + S = 240$
we get = 60

68. (C) Average now = $\left(\frac{20 \times 125 - 5 \times 116}{15}\right)$ cm
= 128 cm.

69. (A) Required number
= (1 cm of 10, 15, 20, 35) – 4
= 416

70. (C) Let the number of girls = x
and number of boys = y
Then, $\frac{1}{3}y = 100$
or $y = 300$
Now, $\frac{x}{2} + 100 = 300$
or $x = 400$
$\therefore$ Total number of students = (300 + 400) = 700

71. (B) Alcohol in first mix = 40 litres, water in it = 60 litres.
Let x litres be replaced
Alcohol in (100 – x) litres = $\frac{40}{100}(100 - x)$ litres
Alcohol in new x litres = $\left(\frac{19}{100}x\right)$
Total alcohol now $\frac{2}{5}(100 - x) + \frac{19x}{100}$
$\therefore$ $\frac{2}{5}(100 - x) + \frac{19x}{100} = 26$
or $4000 - 40x + 19x = 2600$
or $x = \frac{1400}{21} = \frac{200}{3}$
$\therefore$ Part replaced = $\frac{x}{100} = \frac{200}{3 \times 100} = \frac{2}{3}$

72. (A) Let total length = 100 m
Then, Painted red = 60 m
Balance = 40 m
Painted green = 16 m
Balance = 24 m
Painted blue = 12 m
Balance = 12 m
If balance is 12 m total length = 100 m
If balance is $\frac{30}{100}$ m, total length = $\left(\frac{100}{12} \times \frac{30}{100}\right)$ m
= 2·5 m

73. (A) Suppose total distance = x km
Then, X's speed = x km/hr
and Y's speed = $\left(\frac{2x}{3}\right)$ km/hr
Let them meet after y hours
Then, $xy + \frac{2x\,y}{3} = x$
or $y\left(1 + \frac{2}{3}\right) = 1$
or $y = \frac{3}{5}$ hr.
$= \left(\frac{3}{5} \times 60\right)$ min.
= 36 min.
So, they cross each other at 4·36 p.m.

74. (B) $2\left(2500 + \frac{5}{12}x\right) = x$
or $30000 + 5x = 6x$
or $x = 30000$
Share of youngest son = $\frac{x}{2}$
= Rs. 15000

75. (C) Milk in 20 litres = $\left(20 \times \frac{5}{8}\right)$ litres
= 12·5 litres
Milk in 4 litres = $\left(4 \times \frac{5}{8}\right)$ litres
= 2·5 litres
$\therefore$ Milk in new mix = (12·5 – 2·5 + 4) litres
= 14 litres
Water in it = 6 litres
$\therefore$ Ratio of milk and water in new mix = 14 : 6 = 7 : 3

76. (C) C.P. = Rs. 45
S.P. = 112 $\frac{1}{2}$% of Rs. 4·50
= Rs. $\left(\frac{225}{2 \times 100} \times 4{\cdot}50\right)$
= Rs. $\left(\frac{20{\cdot}25}{4}\right)$
Rs. 4·50 is the cost of 1 litre
Rs. $\frac{20{\cdot}25}{4}$ is the cost of $\left(\frac{1}{4{\cdot}50} \times \frac{20{\cdot}25}{4}\right) = \frac{9}{8}$ litres

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$\therefore$ Water added to each litre $= \frac{1}{8}$ litre

$= \left(\frac{1}{8} \times 1000\right)$ ml = 125 ml.

77. (A) Suppose he had x friends

$$\frac{100}{x} - \frac{100}{x+5} = 1$$

$\Rightarrow$ $100(x+5) - 100x = x(x+5)$

$\therefore$ $x^2 + 5x - 500 - 0$

or $(x+25)(x-20) = 0$

Hence $x = 20$

78. (B) $\frac{x}{2(40)} + \frac{x}{2(60)} = 8$

$\Rightarrow$ $\frac{x}{80} + \frac{x}{120} = 8$

$\therefore$ $3x + 2x = 240 \times 8$

or $x = 384$ km

79. (A) Let number $= 7x$

and sum of digits $= x$

Let unit digit be y. Then, ten's digit $= x - y$

Now, $x - y - y = 1$

or $x - 2y = 1$

$10x - 10y + y = 7x$

or $x = 3y$

Solving $x - 2y = 1$

and $x = 3y$

We get $y = 1$

and $x = 3$

$\therefore$ Number $= 21$

80. (A) Total time taken to cover 8 km

$$\left(\frac{2}{10} + \frac{2}{20} + \frac{2}{30} + \frac{2}{60}\right) = \frac{24}{60} = \frac{2}{5} \text{ hours}$$

$\therefore$ Average speed $= \left(8 \times \frac{5}{2}\right)$ km/hr

$= 20$ km/hr

81. (C) $P\left(1 + \frac{R}{100}\right)^3 = 6690$

and $P\left(1 + \frac{R}{100}\right)^6 = 10035$

On dividing, we get $\left(1 + \frac{R}{100}\right)^3 = \frac{10035}{6690}$

$\therefore$ $P = \frac{6690}{\left(1 + \frac{R}{100}\right)^3} = \frac{6690}{\frac{10035}{6690}}$

$= \frac{6690 \times 6690}{10035} = 4460$

82. (B) Suppose the number of correct answers $= x$

wrong answers $= (75 - x)$

$\therefore$ $(4x - 75 + x) = 125$

$\Rightarrow$ $5x = 200$

or $x = 40$

83. (D) $\frac{16 + 22 + x}{3} = 20$

$\Rightarrow$ $38 + x = 60$

or $x = 22$

84. (B) Let total marks $= x$

Then, $\left(\frac{20}{100}x + 30\right) = \left(\frac{32}{100}x - 42\right)$

or $\frac{3x}{25} = 72$

$\therefore$ $\left(\frac{72 \times 25}{3}\right) = 600$

Pass marks $= \left(\frac{20}{100}x + 30\right)$

$= \left(\frac{20}{100} \times 600 + 30\right) = 150$

Pass percentage $= \left(\frac{150}{600} \times 100\right)\% = 25\%$

85. (A) H.C.F. $= \frac{\text{Product of numbers}}{\text{Their L.C.M.}} = \frac{xy}{z}$

86. (A) Total work done $= \left(3 \times \frac{2}{15} + 4 \times \frac{1}{10} \times \frac{1}{10}\right)$

$= \left(\frac{2}{5} + \frac{2}{5}\right) = \frac{4}{5}$

Work unfinished $= \left(1 - \frac{4}{5}\right) = \frac{1}{5}$

87. (B) Let the number be $3x$ and $4x$

Then, their, H.C.F. $= x$

and their L.C.M. $= 12x$

$\therefore$ $12x \times x = 10800$

or $x^2 = 900$

or $x = 30$

So, the numbers are 90 and 120

The sum of the numbers $= 210$

88. (A) Suppose he bought the radio for Rs. x

If C.P. is Rs. 75 original price $=$ Rs. 100

If C.P. is Rs. x, original price $=$ Rs. $\left(\frac{100}{75} \times x\right)$

$=$ Rs. $\left(\frac{4x}{3}\right)$

$\frac{140}{100}x = \frac{4x}{3} + 40$

or $420x = 400x + 12000$

or $x = 600$

89. (B) L.C.M. of 5, 6, 8, 10

$= 2 \times 5 \times 3 \times 4 = 120$

So, they will ring together again after 2 hours, *i.e.*, at 6 p.m.

2	5, 6, 8, 10
5	5, 3, 4, 5
	1, 3, 4, 1

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90. (A) Total marks obtained by Sunil = 60% of (150 + 100) = 150

$\therefore$ Marks obtained in History = (150 – 90) = 60

91. (C) Let $\frac{a}{3}=\frac{b}{4}=\frac{c}{7}=x$

Then, $a = 3x, b = 4x$ and $c = 7x$

$\therefore \quad \frac{a+b+c}{c}=\frac{3x+4x+7x}{7x}=\frac{14x}{7x}=2$

92. (B) More boxes, More persons, Less days, More persons

$\therefore \quad \left.\begin{matrix}35:65\\5:7\end{matrix}\right\}::15:x$

or $x = \frac{65\times7\times15}{35\times5}=39$

93. (B) $2(x+y) = 4$

or $x + y = 2$

Also, $xy = 0{\cdot}75$

Now, $x-y=\sqrt{(x+y)^2-4xy}$

$=\sqrt{4-4\times0{\cdot}75}=1$ km

94. (A) Let sum = Rs. x

S.I. $=\frac{x\times4\times10}{100}=\text{Rs.}\left(\frac{2x}{5}\right)$

C.I. $=\left[x\left(1+\frac{10}{100}\right)^4-x\right]$

$=\frac{4641}{10000}x$

$\therefore \quad \frac{4641}{10000}x-\frac{2x}{5}=256{\cdot}40$

or $641x = 2564000$

or $x = 4000$

95. (C) $\frac{A\times2\times8}{100}=\frac{B\times3\times8}{100}=\frac{C\times4\times8}{100}=x$

$A=\frac{25}{4}x, B=\frac{25}{6}x$ and $C=\frac{25}{8}x$

$\therefore \quad A:B:C=\frac{25}{4}:\frac{25}{6}:\frac{25}{8}=6:4:3$

96. (B) Rajan's Share = Rs. $\left(6450\times\frac{8}{15}\right)$

= Rs. 3440

Suresh's Share = Rs. (6450 – 3440)

= Rs. 3010

Difference = Rs. (3440 – 3010)

= Rs. 430

97. (C) A : B = 4 : 5

and B : C = 2 : 3

$\therefore \quad \frac{A}{C}=\frac{A}{B}\times\frac{B}{C}=\frac{4}{5}\times\frac{2}{3}=\frac{8}{15}$

Thus A : C = 8 : 15

If A has Rs. 8, C has Rs. 15

If A has Rs. 800, C has Rs. $\left(\frac{15}{8}\times800\right)$ = Rs. 1500

98. (B) Let required distance = x km

$\frac{x}{5}-\frac{x}{6}=\frac{10}{60}$

or $\frac{6x-5x}{30}=\frac{1}{6}$

or $6x = 30$

or $x = 5$ km

99. (D) Divisor = 12Q = 5R = 5 × 48 = 240

So Q = 20

Dividend = (240 × 20 + 48) = 4848

100. (C) 2 (A + B + C)'s 1 day's work $=\left(\frac{1}{8}+\frac{1}{12}+\frac{1}{16}\right)$

$=\frac{13}{48}$

(A + B + C)'s 3 day's work $=\left(3\times\frac{13}{96}\right)$

$=\frac{13}{32}$

Remaining work $=\left(1-\frac{13}{32}\right)=\frac{19}{32}$

$\because \frac{1}{12}$ work is done by B and C in 1 day

$\therefore \frac{19}{32}$ work will be done by them in $\left(\frac{19}{32}\times12\right)$ days

$=7\frac{1}{8}$ days.

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Miscellaneous Exercise – V

Against each of the questions suggested answers are given. Find out the correct answer and mark it by putting a tick mark in the place holders.

1. In an election one of the two candidates gets 40% votes and loses by 100 votes. Total number of votes is—
   (A) 500 (B) 400
   (C) 600 (D) 1000

2. 2 of $\frac{3}{4} \div \frac{3}{4} + \frac{1}{4} = ?$
   (A) $\frac{3}{2}$
   (B) $\frac{9}{4}$
   (C) $\frac{1}{4}$
   (D) None of these

3. The value of $\frac{(2{\cdot}3)^3 - {\cdot}027}{(2{\cdot}3)^2 + {\cdot}69 + {\cdot}09}$ is—
   (A) 2
   (B) 2·273
   (C) 2·327
   (D) None of these

4. 0·144 ÷ 0·012 = ?
   (A) ·12 (B) 1·2
   (C) 12 (D) ·012

5. In a fort there were provisions for 45 days for 150 men. After 10 days 25 men left over. The food would new last long for—
   (A) 36 days (B) 40 days
   (C) 42 days (D) 50 days

6. A candidate needs 35% marks to pass. If he gets 96 marks and fails by 16 marks, then the maximum marks are—
   (A) 250 (B) 320
   (C) 300 (D) 425

7. A man travels a certain distance at the rate of 12 km/hr and returns back to the starting point at the rate of 15 km/hr. His average speed during the whole journey is—
   (A) 13·5 km/hr
   (B) $13\frac{1}{3}$ km/hr
   (C) $12\frac{2}{3}$ km/hr
   (D) 14 km/hr

8. What per cent of 1 kg is 5 gms ?
   (A) ·4% (B) ·5%
   (C) ·05% (D) ·005%

9. Five bells begin to toll together and toll respectively at intervals of 6, 7, 8, 9 and 12 seconds. After how many seconds will they toll together again ?
   (A) 72 sec. (B) 612 sec.
   (C) 504 sec. (D) 318 sec.

10. The lowest fraction in $\frac{1}{2}, \frac{3}{4}, \frac{5}{6}, \frac{7}{12}, \frac{2}{5}$ is—
    (A) $\frac{1}{2}$ (B) $\frac{7}{12}$
    (C) $\frac{5}{6}$ (D) $\frac{2}{5}$

11. The H.C.F. of $\frac{1}{2}, \frac{3}{4}, \frac{5}{6}, \frac{7}{8}, \frac{9}{10}$ is—
    (A) $\frac{1}{2}$ (B) $\frac{1}{10}$
    (C) $\frac{9}{120}$ (D) $\frac{1}{120}$

12. The value of 3755 × 9999 is—
    (A) 37556245
    (B) 38297255
    (C) 37546245
    (D) 34657245

13. The value of $\sqrt{({\cdot}121)}$ is—
    (A) ·11
    (B) 1·1
    (C) ·347
    (D) None of these

14. $\frac{561}{748}$ when reduced to the lowest terms is—
    (A) $\frac{13}{14}$ (B) $\frac{3}{4}$
    (C) $\frac{11}{14}$ (D) $\frac{23}{24}$

15. 133% can be written as—
    (A) 1·33
    (B) ·133
    (C) ·0133
    (D) None of these

16. If the cost price of 21 copies of a book are the same as the selling price of 18 copies of the book, then gain per cent is—
    (A) $14\frac{2}{7}\%$ (B) $16\frac{2}{3}\%$
    (C) $33\frac{1}{3}\%$ (D) $23\frac{1}{3}\%$

17. The length of a given rectangle is increased by 20% and the breadth of the rectangle is decreased by 20%. Then, the new area—
    (A) Remains the same
    (B) Is increased by 4%
    (C) Is increased by 5%
    (D) Is decreased by 4%

18. A 200 metres long train, running at a speed of 60 km/hr passes a bridge in 1 minute. The length of the bridge is—
    (A) 1200 metres
    (B) 900 metres
    (C) 800 metres
    (D) 600 metres

19. The sum of the digits of a two digit number is 8. If the digits are reversed the number is decreased by 54. The number is—
    (A) 62 (B) 71
    (C) 53 (D) 80

20. A mixture contains alcohol and water in the ratio 4 : 3. If 7 litres of water is added to the mixture, the ratio of alcohol and water becomes 3 : 4. The quantity of alcohol in the mixture is—
    (A) 10 litres (B) 12 litres
    (C) 32 litres (D) 48 litres

21. A series discount of 20%, 10% is equivalent to a single discount of—
    (A) 30% (B) $28\frac{2}{3}\%$
    (C) 28% (D) 27%

22. Bananas are bought at 15 for a rupee and sold at the rate of 9 for a rupee. The gain per cent is—
    (A) 30% (B) 60%
    (C) $66\frac{2}{3}\%$ (D) $33\frac{1}{3}\%$

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23. If A : B = 2 : 3 and B : C = 7 : 8, then A : C is—
(A) 9 : 11
(B) 7 : 12
(C) 16 : 21
(D) None of these

24. If 28 men working 8 hours per day can finish a piece of work in 10 days. How many hours per day 40 men must work to complete the same work in 8 days ?
(A) 6 hours (B) $6\frac{1}{2}$ hours
(C) 7 hours (D) 9 hours

25. A man spends 76% of his income. This income increases by 20% and he increased his expenditure by 15%. This savings are then increased by—
(A) 35% (B) $33\frac{1}{3}\%$
(C) 40% (D) 33%

26. 70201·002 + ? = 756 × 8 + 9·007—
(A) 65143·995
(B) – 64143·995
(C) 64143·995
(D) 15143·995

27. 140% of ? = 13 × 400 – 780—
(A) 3157 (B) 3157·14
(C) 3517 (D) 3715

28. 11882 ÷ 42 ÷ 7 ÷ ? = 20—
(A) 202 (B) 201
(C) 203 (D) 102

29. 820 × 739 ÷ 739 × 20 of 232 = ?
(A) 2804800 (B) 3804800
(C) 5804800 (D) 1804800

30. $40932 \div ? + 20 = \sqrt{15876 + 39}$
(A) $282\frac{42}{145}$ (B) $280\frac{42}{145}$
(C) $281\frac{42}{145}$ (D) 283

31. $2\frac{7}{9} + 9\frac{11}{12} \div 12\frac{17}{18} = ?$
(A) 2
(B) 3
(C) 4
(D) None of these

32. $\left(\frac{0{\cdot}8 \times 0{\cdot}8 - 0{\cdot}9 \times 0{\cdot}9}{0{\cdot}8 \times 1 - 0{\cdot}9 \times 1}\right) = ?$
(A) 1·4 (B) 1·17
(C) 2 (D) 1·7

33. $7\frac{5}{32} + 23\frac{1}{3} - 12\frac{1}{8} = ?$
(A) $18\frac{35}{69}$ (B) $17\frac{35}{96}$
(C) $18\frac{35}{96}$ (D) $5\frac{7}{48}$

34. $7\frac{3}{7}$ of 1386 + $\frac{4}{9}$ of 837 = 27 + $(?)^2$
(A) 103·6 (B) 103·16
(C) 130·16 (D) 203·16

35. 17298 + 13232 – 28989 = ?
(A) 1541 (B) 1441
(C) 1641 (D) 1451

36. $664\sqrt{15 + 75{\cdot}086} = ?$
(A) 2900 (B) 3500
(C) 4000 (D) 2700

37. 20% of 3375 of 25·003 = ?
(A) 2800 (B) 2900
(C) 16900 (D) 2700

38. 87300 + 99700 + 29000 = ?
(A) 218000 (B) 217000
(C) 216000 (D) 215000

39. $237\frac{2}{23} \times 2\frac{4}{21} \div \frac{2}{3}$ of 3·001 = ?
(A) 270 (B) 260
(C) 250 (D) 280

40. 537·07 × 238·06 – 5·56 ÷ 6·006 = ?
(A) 127805 (B) 21000
(C) 21100 (D) 21200

41. Among the following fractions which one is the largest fraction ?
(A) $\frac{21}{22}$ (B) $\frac{22}{23}$
(C) $\frac{23}{24}$ (D) $\frac{25}{26}$

42. 1447, 1422, 1395, 1390, 1366, 1335, 1302—
(A) 1422 (B) 1390
(C) 1366 (D) 1335

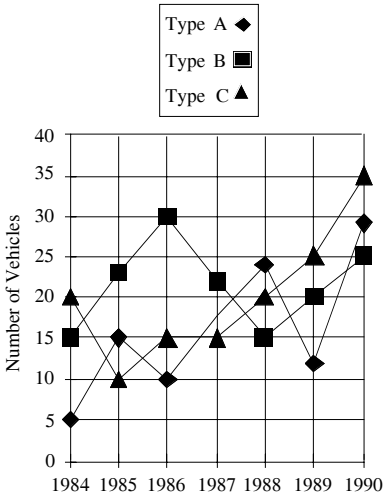
43. 27, 28, 37, 60, 111, 192—
(A) 60
(B) 28
(C) 111
(D) Series is wrong

44. 39, 38, 34, 24, 9—
(A) 9 (B) 34
(C) 24 (D) 38

45. 669, 568, 366, 263, 159—
(A) 468 (B) 263
(C) 366 (D) 568

46. 6, 3, 3, 4·0, 9, 22·5—
(A) 4·0 (B) 3
(C) 9 (D) 22·5

For Questions 47–50—



47. What was the percentage increase in production of C type vehicles from 1985 to 1986 ?
(A) 10
(B) 5
(C) 20
(D) None of these

48. The number of A type vehicles produced in 1986 was that per cent of the number of C type vehicles produced in 1988 ?
(A) $33\frac{1}{3}$ (B) 40
(C) 50 (D) 15

49. In how many years was the production of A type vehicles less than its average production over the given years ?
(A) 2 (B) 4
(C) 3 (D) 1

50. What was the average number of B type vehicles produced by the company over the years ?
(A) 20000
(B) 25000
(C) 15000
(D) None of these

Directions—(Q. 51-52) What approximate value should come in

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place of question mark (?) in each of the following questions ?

51. $40\sqrt{2} + 15\%$ of $962 = ?$
(A) 400 (B) 500
(C) 200 (D) 300

52. $33\frac{1}{3}\%$ of $33\frac{1}{3}\%$ of $8979 = ?$
(A) 1000 (B) 1100
(C) 900 (D) 2200

53. If the sum of the digits of a two-digit number is 9 while their product is 14. What is the number ?
(A) 36 (B) 63
(C) 54 (D) 72

54. A trade man defrauds by means of a false to 10% in buying and to the, same extent in selling goods. What per cent does he gain on his outlay by defraud ?
(A) 21% (B) $22\frac{2}{9}\%$
(C) $20\frac{2}{9}\%$ (D) $21\frac{2}{7}\%$

55. If 10 boys and 12 girls together complete a work in 10 days while 8 boys and 12 girls together can complete the same work in 12 days one boy's work is equal to the work of how many girls ?
(A) 4 (B) 5
(C) 6 (D) 7

Directions—(Q. 56–60) Answer
(a) If I alone is sufficient.
(b) If II alone is sufficient.
(c) I and II together are not sufficient.
(d) Neither I is needed nor II is needed.
(e) I and II together are needed.

56. 15 article were bought for some money and 10 article were sold for the same amount. What is necessary to know the gain per cent ?
(A) Cost of 15 articles
(B) Selling price of 10 articles

57. A man is standing at a place. How much time will a bus take to cross him ? What is necessary to know the answer the question ?
(A) Speed of the bus
(B) Length of the bus

58. If a man walks to his office at $\frac{3}{5}$th of his original speed. He reaches there 10 minutes late. How much will he take to reach his office if he walks at his original speed ? What is necessary to know the answer of the question ?
(A) The distance of his office
(B) His original speed

59. A shopkeeper sells some toys at Rs. 250 each. To find out what per cent profit he makes. Which of the following informations is/are necessary ?
(A) Number of toys sold
(B) Cost price of each toy

60. The total monthly salary of all the employees in a company is Rs. 75000. To determine what is the total number of employees in that company ? Which of the following information given in (A) and (B) is/are sufficient ?
(A) 40 employees get Rs. 1000 per month
(B) 20% of the employees get Rs. 2000 per month

61. Ram started a business investing Rs. 45000. Three months after he started, Anil joined him with Rs. 60000. If at the end of the year the total profit in the business is Rs. 26000, what would be the share of Anil in the profit ?
(A) Rs. 10000
(B) Rs. 14000
(C) Rs. 13000
(D) Rs. 16000

Directions—(Q. 62–64) What should come in place of question mark (?) in the equation of each question ?

62. $847{\cdot}56 + 34{\cdot}84 - ? = 582{\cdot}83$—
(A) 298·57
(B) 300·67
(C) 299·47
(D) None of these

63. 30% of $? = 312 - 216$.
(A) 320 (B) 420
(C) 380 (D) 1318

64. $\dfrac{47{\cdot}53 \times 47{\cdot}53 + 2 \times 47{\cdot}53 \times 42{\cdot}47 + 42{\cdot}4 \times 42{\cdot}47}{38{\cdot}25 \times 38{\cdot}25 + 138{\cdot}25 \times 138{\cdot}25 - 2 \times 38{\cdot}25 \times 138{\cdot}25} = ?$
(A) 0·81 (B) 8·1
(C) 81 (D) 18

65. If the price of an article is increased by 25% the number of articles sold is reduced by 22%. What will be the effect on revenue ?
(A) 2·5% increase
(B) 2·5% decrease
(C) 1·5% increase
(D) 1·5% decrease

Directions—(Q. 66–67) Three of the four parts are exactly equal. Which of the parts is not equal to other three ?

66. (A) $(6^2 + 2^2) \div 2^2 - 17$
(B) $116 \times 2 + 27 - 266$
(C) $(62 \times 9) \div 2\sqrt{49}$
(D) None of these

67. (A) 20% of 40% of 50
(B) 60% of 50
(C) $\frac{100}{3}\%$ of 90
(D) $(8^2 - 7^2) + 15$
(E) None of these

Directions—(Q. 68–69) What approximate value should come in place of question mark (?) in the equation in each of the following questions ?

68. $\sqrt{441}$ of $15 \div 3 + 4 = ?$
(A) 107 (B) 113
(C) 119 (D) 229

69. $2{\cdot}301 \times 4{\cdot}7 + 15 = ?$
(A) 10 (B) 13
(C) 17 (D) 29

70. Which number in the following series is wrong ?
574 286 142 72 34 16 7
(A) 286 (B) 142
(C) 72 (D) 34

71. What will be the difference between the simple interest and compound interest of Rs. 4400 for 2 years at 5% per annum ?
(A) Rs. 55 (B) Rs. 507
(C) Rs. 403 (D) Rs. 44

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72. Total number of mangoes available were consumed by 8 families sharing equal mangoes. Had the mangoes been shared by 10 families per family consumption would have reduced by 8 mangoes. What was the total number of mangoes ?

(A) Data inadequate

(B) 320

(C) 160

(D) 240

73. The ratio between the length and breadth of a rectangular field is 3 : 2. If only the length is increased by 5 metres, the new length of the field will be 2600 sq. metres. What is the breadth of the rectangular field ?

(A) 40 m

(B) 60 m

(C) 65 m

(D) Cannot be determined

Directions—(Q. 74–76) In each question what will come in place of question mark ?

74. $\frac{6\times7-7\times3}{1{\cdot}5+1{\cdot}5}+\frac{15}{3}\div\frac{5}{3}=?$

(A) 56

(B) 9·33

(C) 21

(D) None of these

75. $\frac{\sqrt{169}}{42}\times\frac{\sqrt{441}}{26}\times\frac{16}{\sqrt{225}}=?$

(A) $\frac{4}{5}$

(B) $\frac{9}{15}$

(C) $\frac{57}{29}$

(D) None of these

76. $470\times40\div5+57-3=?$

(A) 3503 (B) 3760

(C) 1889 (D) 3814

Answers with Hints

1. (A) Out of 100 difference in votes

$= (60-40) = 20$

If difference is 20 total votes = 100

If difference is 100 total votes = $\left(\frac{100}{20}\times100\right) = 500$

2. (B) $2 \text{ of } \frac{3}{4}\div\frac{3}{4}+\frac{1}{4} = \frac{3}{2}\times\frac{4}{3}+\frac{1}{4}$

$= 2+\frac{1}{4}=\frac{9}{4}$

3. (A) Given expression $= \frac{a^3-b^3}{a^2+ab+b^2}$

$= a-b = 2{\cdot}3-{\cdot}3$

$= 2$

4. (C) $\frac{0{\cdot}144}{0{\cdot}012} = \frac{144}{12} = 12$

5. (C) Remaining days = 35 Remaining men = 125

Now, 150 men have provisions for 35 days.

125 men will have it for $\frac{35\times150}{125} = 42$ days

6. (B) 35% of x = 96 + 16 = 112

or $\frac{135}{100}\times x = 112$

or $x = \frac{112\times100}{35} = 320$

7. (B) Let that distance be x km

Time taken to cover $2x$ km $= \frac{x}{12}+\frac{x}{15}=\frac{9x}{60}$ hrs

Average speed $= \frac{2x\times60}{9x}$ km/hr

$= 13\frac{1}{3}$ km/hr.

8. (B) Fraction $= \frac{5}{1000}=\frac{1}{200}$

Required percentage $= \left(\frac{1}{200}\times100\right)\% = {\cdot}5\%$

9. (C) L.C.M. of 6, 7, 8, 9, 12 is 504.

10. (D) L.C.M. of denominators = 60

$\therefore \quad \frac{1}{2} = \frac{30}{60}, \frac{3}{4}=\frac{45}{60}, \frac{5}{6}=\frac{50}{60}, \frac{7}{12}=\frac{35}{60}, \frac{2}{5}=\frac{24}{60}$

So, $\left(\frac{2}{5}\right)$ is least.

11. (D) H.C.F. of 1, 3, 5, 7, 9 is 1 and L.C.M. of given fractions = $\frac{1}{120}$.

12. (C) $3755\times9999 = 3755\times(10^4-1)$

$= 37550000 - 3755 = 37546245$

13. (C) $\sqrt{{\cdot}121} = \sqrt{\left(\frac{1210}{10000}\right)}=\frac{\sqrt{(1210)}}{100}$

$= \frac{34{\cdot}7}{100} = {\cdot}347$

14. (B) H.C.F. of 561, 748 is 187.

Dividing Nr. and Dr. by 187 the fraction is $\frac{3}{4}$.

15. (A) 133% $= \frac{133}{100} = 1{\cdot}33$

16. (B) Let C.P. of each book be Re. 1.

C.P. of 21 books = Rs. 21

$\therefore$ S.P. of 18 books = Rs. 21

S.P. of 1 book = Rs. $\frac{21}{18}$

Gain on Re. 1 = Rs. $\left(\frac{21}{18}-1\right)$ = Re. $\frac{1}{6}$

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$$\text{Gain} = \left(\frac{1}{6}\times 100\right)\% = 16\frac{2}{3}\%$$

17. (D) Area $= 1 \times b = A$ (say)

$$\text{New area} = \left(\frac{120}{100}l \times \frac{80}{100}b\right) = \frac{24}{25}1b = \frac{24}{25}A$$

$$\text{Decrease on A} = \left(A - \frac{24}{25}A\right) = \frac{A}{25}$$

$$\text{Decrease \%} = \left(\frac{A}{25A}\times 100\right) = 4\%$$

18. (C) Distance covered by the train in /min.

$$= \frac{60 \times 1000}{60} = 1000 \text{ metres}$$

$\therefore$ 200 + (length of bridge) = 1000

or length of bridge = 800 metres.

19. (B) Let the tens and units places be x and y respectively.

Then, $x + y = 8$ and $(10x + y) - (10y + x) = 54$

or $x + y = 8$ and $x - y = 6$

$\therefore$ $x = 7$, $y = 1$, so the number is 71.

20. (B) Let alcohol and water be $4x$ and $3x$ litres respectively. Then

$$\frac{4x}{3x+7} = \frac{3}{4} \text{ or } x = 3$$

$\therefore$ Alcohol = 12 litres

21. (C) Let C.P. be Rs. 100

$$\text{S.P.} = \text{Rs.}\left(\frac{90}{100}\times 80\right) = \text{Rs. } 72$$

$\therefore$ Discount = Rs. (100 – 72) = 28%

So, answer (C) is correct.

22. (C) Let bananas bought (15×9)

Then, C.P. = Rs. 9 S.P. = Rs. 15

$$\text{Gain \%} = \left(\frac{6}{9}\times 100\right)\% = 66\frac{2}{3}\%$$

23. (B) $\frac{A}{B} = \frac{2}{3}$ and $\frac{B}{C} = \frac{7}{8}$

$$\therefore \frac{A}{C} = \frac{A}{B}\times\frac{B}{C} = \frac{2}{3}\times\frac{7}{8} = \frac{14}{24} = \frac{7}{12}$$

24. (C) More men less hours per day indirect.

Less days more hours per day (indirect)

$$\left.\begin{matrix}40 : 28\\ 8 : 10\end{matrix}\right\} :: 8 : x$$

$$\therefore \quad x = \frac{28\times 10\times 8}{8\times 40} = 7 \text{ hrs.}$$

25. (A) Let income be Rs. 100.

Then, expenditure = Rs. 75 saving = Rs. 25

Now, income = Rs. 120

$$\text{New expenditure} = \text{Rs.}\left(\frac{115}{100}\times 75\right) = \text{Rs. } \frac{345}{4}$$

$$\text{Now saving} = \text{Rs.}\left(120 - \frac{345}{4}\right) = \text{Rs. } \frac{135}{4}$$

$$\text{Increase \% in saving} = \left(\frac{35}{4\times 25}\times 100\right) = 35\%$$

26. (B) 27. (B) 28. (A) 29. (B) 30. (A)

31. (D) 32. (D)

33. (C) $7\frac{5}{32} + 23\frac{1}{3} - 12\frac{1}{8} = ?$

$$\therefore \quad ? = (7 + 23 - 12) + \left(\frac{5}{32} + \frac{1}{3} - \frac{1}{8}\right)$$

$$= 18 + \left(\frac{15+n}{96}\right)$$

$$= 18 + \frac{35}{96} = 18\frac{35}{96}$$

34. (B) $7\frac{3}{7}$ of $1386 + \frac{4}{9}$ of $837 = 27 + (?)^2$

$$\Rightarrow \quad 1386\times\frac{52}{7} + 837\times\frac{4}{9} = 27 + (?)^2$$

$$\therefore \quad (?)^2 = 10668 - 27 = 10641$$

$$\therefore \quad ? = 103{\cdot}16$$

35. (A) $17298 + 13232 - 28989 = ?$

$$? = 30530 - 28989 = 1541$$

36. (D) $664\sqrt{15} + 75{\cdot}086 = ?$

$$? = 664 \times 4 + 75 = 2731 = 2700 \text{ (App.)}$$

37. (C) 20% of 3375 of 25·003 = ?

$$? = 3375\times\frac{20}{100}\times 25{\cdot}003 = 3380\times\frac{20}{100}\times 25 = 16900 \text{ (App.)}$$

38. (C) $87300 + 99700 + 29000 = ?$

$$? = 216000$$

39. (B) $237\frac{2}{23}\times 2\frac{4}{21}\div\frac{2}{3}$ of $3{\cdot}001 = ?$

$$? = 237 \times 2{\cdot}2 \div 3\frac{2}{3} = 521{\cdot}4 \div 2 = 260{\cdot}7 = 260 \text{ (App.)}$$

40. (A) $? = 537{\cdot}07 \times 2378{\cdot}06 - 5{\cdot}56 \div 6{\cdot}006$

$$? = 537 \times 238 - \frac{5{\cdot}50}{6} = 127806 - 0{\cdot}917 = 127805 \text{ (App.)}$$

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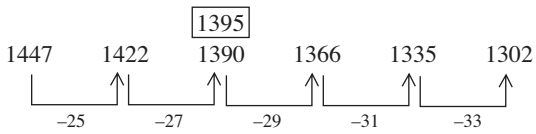
41. (D) $\because \quad \frac{21}{22} = 0{\cdot}955, \frac{22}{23} = 0{\cdot}957$

$\frac{23}{24} = 0{\cdot}958, \frac{24}{25} = 0{\cdot}960$

$\frac{25}{20} = 0{\cdot}962$

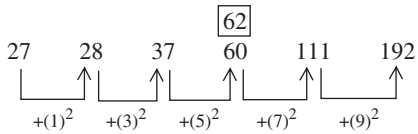
$\therefore$ The largest fraction is $\frac{25}{26}$.

42. (B)



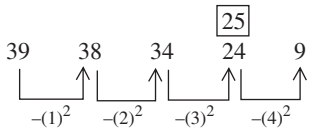
Hence, it is clear that instead of 1390, 1395 will come.

43. (A)



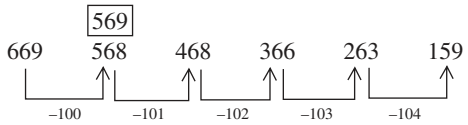
Hence, it is clear that instead of 60, 62 will come.

44. (C) The order of the given number series is in this way—



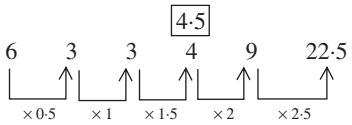
Hence, it is clear that instead of 24, 25 will come.

45. (D)



Hence, it is clear that instead of 568, 569 will come.

46. (A)



Hence, it is clear that instead of 4, 4·5 will come.

47. (D) Required percentage of increase

$$= \frac{(15{\cdot}10) \times 100}{10} = 50\%$$

48. (C) $\frac{10}{20} \times 100 = 50\%$

49. (B) In 4 years there is less production in the vehicle that the average production.

50. (D) Average number of B types vehicles produced over the years

$$= \frac{15 + 22{\cdot}5 + 30 + 22{\cdot}5 + 15 + 20 + 25}{7}$$

$$= \frac{150}{7} = 21{\cdot}428 \text{ thousand}$$

51. (C) $? = 40 \times 1{\cdot}4 + 960 \times \frac{15}{100} = 200$

52. (A) $? = 8979 \times \frac{100}{300} \times \frac{100}{300} = 998$

$= 1000$

53. (D) Let the number be $10x + y$

$\therefore \quad x + y = 9$

and $\quad xy = 14$

$\therefore \quad (x - y)^2 = (x + y)^2 - 4xy$

$= (9)^2 - 4 \times 14$

$= 87 - 56 - 25$

$x - y = 57$

$\therefore \quad x = 7$

and $\quad y = 2$

$\therefore \quad$ Number $= 72$

54. (B) Gain % $= \frac{2x \times 100}{100 - x}$ where $x = 10$

$= \frac{2 \times 10 \times 100}{100 - 10} = \frac{2000}{90}$

$= 22\frac{2}{9}\%$

55. (C) In 10 days the work is completed by 10 boys + 12 girls

$\therefore$ In 1 day the work is completed

$=$ 100 boys + 120 girls

Similarly in 12 days the work is completed

$=$ 8 boys + 12 girls

$\therefore$ In 1 day work is completed

$=$ 96 boys and 144 girls

or Work of 4 boys = work of 24 girls

$\therefore$ Work of 1 boy = work of 6 girls.

56. (D) Let the cost of 15 articles be Rs. x

$\therefore$ C.P. of 1 article $= \frac{2}{15}$

and S.P. of 1 article $= \frac{x}{10}$

$\therefore$ Gain per cent $= \frac{\frac{x}{10} - \frac{x}{15}}{\frac{x}{15}} \times 100$

$= \frac{x \times 15}{30 \times x} \times 100$

$= 50\%$

Hence, without knowing I or II gain % can be calculated.

57. (D) Since time $= \frac{\text{Distance}}{\text{Speed}}$

$\therefore$ Both I and II are needed.

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58. (D) Time $= \dfrac{x \times t}{y - x}$

or Time $= \dfrac{\frac{x}{y}t}{1 - \frac{x}{y}} = \dfrac{\frac{3}{5} \times 10}{1 - \frac{3}{5}} = \dfrac{6 \times 5}{2} = 15$ min.

Neither, I is needed nor II is needed.

59. (C) If S.P. of each toy is not known, per cent profit cannot be calculated. Hence, I and II together are not sufficient.

60. (C) I and II together are not sufficient.

61. (C) Investment of Ram for 1 month
$= 45000 \times 12$
$=$ Rs. 540000

and investment of Anil for 1 month
$= 60000 \times 9$
$=$ Rs. 540000

$\therefore$ Ratio in their investments $= 1 : 1$

$\therefore$ Share of Anil in the profit $= \dfrac{1}{2} \times 26000$

$=$ Rs. 13000

62. (D) ? $= 847{\cdot}56 + 34{\cdot}84 - 582{\cdot}83 = 299{\cdot}57$

63. (A) 30% of ? $= 312 - 216$

or $\dfrac{30 \times ?}{100} = 96$

$\therefore$ $? = \dfrac{96 \times 100}{30} = 320$

64. (A) $? = \dfrac{(47{\cdot}53)^2 + 2 \times 47{\cdot}53 \times 42{\cdot}47 + (42{\cdot}47)^2}{(38{\cdot}25)^2 - 2 \times 38{\cdot}25 \times 138{\cdot}25 + (138{\cdot}25)^2}$

$= \dfrac{(47{\cdot}53 + 42{\cdot}47)^2}{(38{\cdot}25 - 138{\cdot}25)^2} = \dfrac{(90)^2}{(100)^2} = 0{\cdot}81$

65. (B) % effect on revenue
$=$ Increase % value – decrease % value
$= \dfrac{\text{Increase \% value} \times \text{decrease \% value}}{100}$
$= 25 - 22 - \dfrac{25 \times 22}{100} = 3 - 5{\cdot}5 = -2{\cdot}5$
$= 2{\cdot}5\%$ decrease

66. (C) (A) $= (6^2 + 2^2) \div 2^2 - 17$
$= 40 \div 7 - 17 = -7$

(B) $= 116 \times 2 + 27 - 266$
$= 232 + 27 - 266$
$= -7$

(C) $= (62 \times 9) \div 2\sqrt{49}$
$= 558 \div 14 = \dfrac{229}{7}$

(D) $= 343 \div 49 - 14$
$= 7 - 14 = -7$

67. (A) (A) $=$ 20% of 40% of 50
$= \dfrac{20}{100} \times \dfrac{40}{100} \times 50 = 4$

(B) $=$ 60% of 50
$= \dfrac{60 \times 50}{100} = 30$

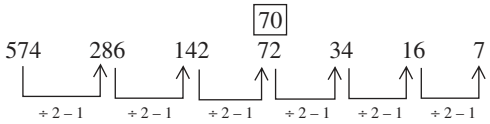
(C) $= \dfrac{100}{3 \times 100} \times 90$
$= 30$

(D) $= (8^2 - 7^2) + 15$
$= (64 - 49) + 15 = 30$

68. (A) $? = 15 \times 21 \div 3 + 4$
$= 15 \times 7 + 4 = 109 = 107$

69. (D) $? = 2{\cdot}301 \times 4{\cdot}7 + 15$
$= 2{\cdot}3 \times 4{\cdot}7 + 15$
$= 10{\cdot}8 + 15 = 26 = 29$

70. (C)



Hence, there should be 70 in place of 72.

71. (D)

72. (B) Let the total number of mangoes be x

Then, $\dfrac{x}{8} - \dfrac{x}{10} = 8$

or $\dfrac{5x - 4x}{40} = 8$

or $\dfrac{x}{40} = 8$

$\therefore$ $x = 8 \times 40 = 320$

73. (A) Let the length of the field be $3x$ metres
Its breadth $= 2x$ metres
$(3x + 5) \times 2x = 2600$
or $6x^2 + 10x - 2600 = 0$
or $3x^2 + 5x - 1300 = 0$
or $3x^2 + 65x - 60x - 1300 = 0$
or $x(3x + 65) - 20(3x + 65) = 0$
or $(3x + 65)(x - 20) = 0$
$\therefore$ $x = 20$
$\therefore$ Breadth $= 2 \times 20 = 40$ cm

74. (D) $? = \dfrac{42 - 21}{3} + \dfrac{15}{3} \times \dfrac{3}{5}$
$= 7 + 3 = 10$

75. (D) $? = \dfrac{13}{42} \times \dfrac{21}{26} \times \dfrac{16}{15}$
$= \dfrac{1}{2} \times \dfrac{1}{2} \times \dfrac{16}{15} = \dfrac{4}{15}$

76. (D) $? = 470 \times 8 + 54$
$= 3760 + 54 = 3814$

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Miscellaneous Exercise – VI

1. The length of the longest pole that can be put in a room (25 metres × 12 metres × 8 metres) is—
   (A) 25 metres
   (B) 45 metres
   (C) 27·7 metres
   (D) 28·8 metres

2. Circumference of a circle is 132 cm. The area of the circle is—
   (A) 792 sq. cm
   (B) 1056 sq. cm
   (C) 1386 sq. cm
   (D) 924 sq. cm

3. The diagonal of a square field is 25 metres. The area of the field is—
   (A) 625 sq. metres
   (B) 312·5 sq. metres
   (C) 156·25 sq. metres
   (D) $\frac{625}{\sqrt{2}}$ sq. metres

4. A takes thrice as long to do a piece of work as B takes. A and B together can finish a piece of work in 15 days. A alone can do it in—
   (A) 30 days (B) 45 days
   (C) 60 days (D) 120 days

5. A monkey ascends a greased pole 36 metres high. He ascends 3 metres in first minute and descends 1 metre in second minute. He again ascends 3 metres in third minute and descends 1 metre in fourth minute and so on. In what time he reaches the top ?
   (A) 36 minutes
   (B) 33 minutes
   (C) $33\frac{5}{6}$ minutes
   (D) $34\frac{2}{3}$ minutes

6. A sum of money at S.I. doubles in 7 years. It will become four times in—
   (A) 14 years (B) 21 years
   (C) 28 years (D) 35 years

7. Insert the missing number—
   5, 12, 9, 16, 13, 20……
   (A) 27
   (B) 23
   (C) 17
   (D) None of these

8. If the numerator of a fraction be increased by 12% and its denominator decreased by 2% the value of the fraction becomes $\left(\frac{6}{7}\right)$. The original fraction is—
   (A) $\left(\frac{3}{4}\right)$ (B) $\left(\frac{3}{5}\right)$
   (C) $\left(\frac{2}{3}\right)$ (D) $\left(\frac{2}{5}\right)$

9. A and B enter into partnership with capitals as 4 : 5. At the end of 9 months A withdraws. If the shares of annual profits be in the ratio 9 : 10, then money of B remained invested for—
   (A) 10 months
   (B) 8 months
   (C) 6 months
   (D) 7 months

10. The value of $\sqrt{\left(\frac{47}{5}\right)}$ is—
    (A) ·32
    (B) 3·17
    (C) 3·06
    (D) None of these

11. If $\frac{13}{15}$ of an estate be worth Rs. 390, then $\frac{3}{5}$ of it is—
    (A) Rs. 320 (B) Rs. 270
    (C) Rs. 450 (D) Rs. 324

12. By selling a radio for Rs. 240 I lose 20%. What per cent shall I gain by selling it for Rs. 320 ?
    (A) $6\frac{2}{3}\%$ (B) $8\frac{1}{3}\%$
    (C) $16\frac{2}{3}\%$ (D) 5%

13. The price of sugar increased by 12%. To maintain previous budget, the consumption should be reduced by—
    (A) 12% (B) 18%
    (C) $11\frac{2}{3}\%$ (D) $10\frac{5}{7}\%$

14. $\sqrt{\{(65)^2 - (16)^2\}}$ = ?
    (A) 43 (B) 47
    (C) 63 (D) 67

15. A watch is bought for Rs. 200 and sold the same day for Rs. 242 at a credit of 2 years. If the rate of interest is 10% compounded annually then there is—
    (A) A gain of 1%
    (B) A gain of 2%
    (C) Neither gain nor loss
    (D) A loss of 1%

16. What is the S.P. of a 7% stock in which an income of Rs. 250 is derived by investing Rs. 3500, brokerage being $\left(\frac{1}{8}\right)\%$?
    (A) Rs. $98\frac{1}{8}$ (B) Rs. $97\frac{7}{8}$
    (C) Rs. 98 (D) Rs. $107\frac{1}{8}$

17. The population of a town is decreasing at a uniform rate of 10% per annum for the last 3 years. If the present population of the town is 137700, what it was 2 years ago ?
    (A) 152847 (B) 160000
    (C) 170000 (D) 163657

18. The edge of a cube is increased by 100%. The surface area of the cube is increased by—
    (A) 100% (B) 200%
    (C) 300% (D) 400%

19. If the time period of a bill is doubled, then the true discount on the bill is—
    (A) Doubled
    (B) Halved
    (C) Becomes $\left(\frac{3}{2}\right)$ times
    (D) None of these

Directions—The following table gives the plan outlay for 1987-88 for

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three states A, B and C under the major heads (in lakhs of rupees)—

States	A	B	C	Total
Agriculture	1203·64	916·88	378·54	2499·06
Rural Development	925·46	741·34	217·62	1884·42
Irrigation & Flood Control	85·34	72·20	40·36	197·90
Energy	2713·57	1015·65	617·42	4346·64
Industries	1056·28	9000·00	136·46	2092·74
Education	336·86	432·39	186·54	955·79
Social Services	100·97	118·42	31·41	250·80
Communication	81·23	100·20	0·82	182·25
Total	**6503·35**	**4297·08**	**1609·17**	**12409·60**

Study the table and mark a tick (√) against the correct answer in each questions given below—

20. Which area received minimum consideration in state A ?
    (A) Irrigation and Flood control
    (B) Communication
    (C) Social Services
    (D) Rural Development

21. The total plan outlay for A and C is in the ratio—
    (A) 19 : 50 (B) 101 : 25
    (C) 3 : 2 (D) 65 : 16

22. Which area received maximum consideration in all the states ?
    (A) Agriculture
    (B) Rural Development
    (C) Energy
    (D) Industries

23. Which is the most appropriate statement ?
    (A) Outlay for B is 6% more than that of C
    (B) Outlay for B is 160% more than that of C
    (C) None of these

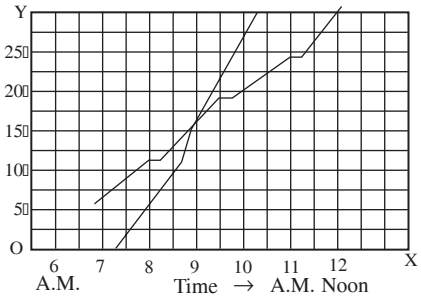
A man starting at 6 AM walks at the uniform rate of 6 km/hr resting of 10 minutes at the end of every hour. A cyclist, starting from the same place at 7·30 AM travels in the same direction at a uniform rate of 12 km/hr. The following graph depicts the distance covered by the man and the cyclist at various interval of time.

Scale—

Along OX → 1 div. = 30 mts.

Along OY → 1 div. = 2·5 km

Study the graph and mark a tick (√) against the correct answer in each of the following questions—



24. At what time will the cyclist pass the man ?
    (A) 9·20 AM (B) 8·50 AM
    (C) 7·50 AM (D) 9 AM

25. At what distance from the starting point will the cyclist pass the man ?
    (A) 12 km (B) 13·5 km
    (C) 12·6 km (D) 15 km

26. If the length of the rectangular plot is increased by 50% then how many per cent should its breadth be increased so that its new area is 75% more than its original area ?
    (A) 20% (B) $17\frac{1}{4}\%$
    (C) 16% (D) $16\frac{2}{3}\%$

27. A certain sum of money was distributed amongst P, R and S in the ratio 5 : 7 : 9 respectively. If the difference between the distributed money of P and S is Rs. 2500. What is that certain sum of money ?
    (A) Rs. 1312
    (B) Rs. 13525
    (C) Rs. 13125
    (D) Rs. 23125

28. In a school there are 40 students in class 8th, 80% of them passed and there are 60 students in class 9th, 60% of them passed. What is the total pass percentage of both the classes ?
    (A) 74% (B) 68%
    (C) 72% (D) 77%

29. Some passengers travel in a train. $\frac{1}{3}$rd of the passengers stepped down on the first station and 560 passengers entered the train, half of the total passengers stepped down on the second station and 24 more passengers entered in the train and on the third station all 496 passengers stepped down. How many passengers were travelling in the train in the beginning ?
    (A) 529 (B) 576
    (C) 626 (D) 625

30. The age of the father 2 years ago was 6 times the age of his son. If 18 years hence his age will be 2 times that of his son, what are their present ages ?
    (A) 34 years, 9 years
    (B) 36 years, 11 years
    (C) 35 years, 7 years
    (D) Data inadequate

31. Which one of the following products is equal to 2·74 × 0·174 × 0·65 ?
    (A) 2·74 × 4·74 × 0·650
    (B) 274 × 0·714 × 0·0065
    (C) 27·4 × 1·74 × 0·650
    (D) 2·74 × 0·074 × 0·650

32. Which one of the following groups is in descending order ?
    (A) $\frac{19}{21}, \frac{16}{19}, \frac{11}{14}$
    (B) $\frac{11}{14}, \frac{19}{21}, \frac{16}{19}$
    (C) $\frac{19}{21}, \frac{11}{14}, \frac{16}{19}$
    (D) $\frac{11}{14}, \frac{16}{19}, \frac{19}{21}$

33. How many numbers from the following are such that they are divisible by 113 ?
    226, 339, 452, 566, 677, 791, 904, 1017 and 1121.
    (A) 3 (B) 4
    (C) 5 (D) 6

34. If a number is divided by 119, the remainder is 19, what will be the remainder if the same number is divided by 17 ?
    (A) 5 (B) 0
    (C) 2 (D) 9

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35. $1524 + 2890 - 40\sqrt{?} = \frac{2}{5}$ of 6410.

(A) 2323 (B) 2026
(C) 2213 (D) 2116

36. $1900 + 3\frac{4}{7}$ of 1484 – ?% of 1200 = 6000.

(A) 100 (B) 115
(C) 117 (D) 122

37. $10570 - ? = 18\frac{2}{3}$ of 480 – 3960 + 15.

(A) 5600 (B) 5450
(C) 5555 (D) 1550

Directions—(Q. 38 to 42) In each of the following questions, a number series is given after the series, below it a number is given followed by (a) (b) (c) (d). You have to complete the series starting with the number given following the squence of the given series.

38. 3 14 44 112 256 35 (a) (b) (c) (d) (e)
Which of the following number will come in place of (d) ?
(A) 368 (B) 768
(C) 572 (D) 472

39. 4 27 160 797 3184 9547 12 (a) (b) (c) (d) (e)
Which of the following number will come in place of (b) ?
(A) 506 (B) 496
(C) 498 (D) 360

40. 4 21 120 595 2376 7125 7 (a) (b) (c) (d) (e)
Which of the following number will come in place of (c) ?
(A) 1775 (B) 1725
(C) 1230 (D) 1225

41. 43 78 114 280 548 49·25 (a) (b) (c) (d) (e)
Which of the following number will come in place of (e) ?
(A) 1296 (B) 1371
(C) 1386 (D) 1288

42. 17 73 214 1080 3230 14 (a) (b) (c) (d)
Which of the following number will come in place of (b) ?
(A) 178 (B) 183
(C) 293 (D) 283

Directions—(Q. 43 to 47) Three of the four parts lettered (A) (B) (C) and (D) are exactly equal. You have to find that part which is not equal to the other three. If all the four parts are equal, then the answer is (E).

43. 38% of 25 + 50 = 8 × 19 – 57 =
(A) (B)
64 × 12 – 673 = 20 × 7 – 15 × 3.
(C) (D)

44. 230% of 280 + 56 = 6·5 × 240
(A)
– 2·5 × 344 = 280% of 280 – 104
(B) (C)
= 2816 – 1876 – 240.
(D)

45. 60 × 15 + 33 × 32 = 16 × 66 + 30
(A) (B)
× 30 = 49·5 × 40 – 120% of 20 =
(C)
22 × 60 + 12 × 53.
(D)

46. 80% of 56 + 240% of 48 = 120%
(A)
of 120 + 320% of 50 = 62·5% of
(B)
160 + 30% of 200 = 50% of 240
(C)
+ 160% of 25.
(D)

47. $\frac{2}{5} + \frac{7}{5} + 2\frac{2}{5} + 3\frac{1}{5} + 1\frac{3}{5} = \frac{4}{6} + 1\frac{1}{3} +$
(A) (B)
$2\frac{2}{3} + \frac{5}{6} = \frac{6}{7} + \frac{3}{7} - \frac{1}{7} + \frac{2}{7} + \frac{6}{7} + 6\frac{5}{7}$
(C)
$= 1\frac{1}{3} + 6\frac{2}{3} - 4\frac{1}{3} + 5 + \frac{1}{3}$.
(D)

Directions—(Q. 48 to 50) What will come in the place of question mark (?) in each of the following questions ?

48. $\left(0\cdot\bar{6} + 0\cdot\bar{7} + 0\cdot\bar{5} + 0\cdot\bar{4}\right) = ?$

(A) $4\frac{1}{4}$ (B) $\frac{3}{9}$
(C) 2 (D) $2\frac{4}{9}$

49. $\frac{1\cdot1 \times 1\cdot1 \times 1\cdot1 - 0\cdot01 \times 0\cdot01 \times 0\cdot01}{1\cdot1 \times 1\cdot1 - 0\cdot01 \times 0\cdot01 + 1\cdot1 \times 0\cdot01} = ?$

(A) 2 (B) 2·09
(C) 2·05 (D) 1·09

50. 15% of 3016 + 2148 × $\frac{5}{1074}$ + 39 × $\frac{1}{3}$ of 130 = ?

(A) 2152·40 (B) 2253·4
(C) 2253 (D) 3125·5

Directions—(Q. 51–54) In each of the following questions and equation is presented in four parts with = sign in between parts. The four parts of the equation are lettered (A) (B) (C) and (D). One of these parts in the equation may be wrong and there by may not yield the same result as the other three parts do. Find out the wrong part. If there is any. If all the four parts are correctly equated and all of them yield the same result, the answer is (E) *i.e.*, 'No, error'.

51. 10% of 0·12 = 12% of 0·1 = 1%
(A) (B)
of (12 × 0·1) = 100% of (120 ×
(C) (D)
0·00001). No error
(E)

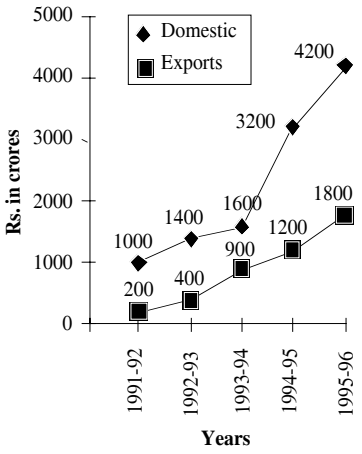
52. $8^2 \div 4^3 \times 10^2 - 8 = \sqrt{2} \times \sqrt{32} \times 9$
(A) (B)
+ 20 = $4^2 \times 4 + 2^3 \times 3 = 10^2 - 2^3$.
(C) (D)
No error
(E)

53. $\frac{3 \times 4}{24} + \frac{7}{12} = \frac{2}{2 \times 3} + \frac{4}{3 \times 4} +$
(A) (B)
$\frac{10}{2 \times 3 \times 4} = \frac{3 \times 4 + 2 \times 4 + 2 \times 3}{2 \times 3 \times 4}$
(C)
$= \frac{1}{2} + \frac{1}{3} + \frac{1}{4}$. No error
(D) (E)

54. 2·2 ÷ 0·01 × 0·001 = 2·2 × 0·0001
(A) (B)
÷ 0·0001 = 0·022 × ·01 ÷ 0·001 =
(C)
2·2 ÷ 0·001 × 0·001. No error
(D) (E)

Directions—(Q. 55–60) Study the following graph carefully and answer the questions given below—

Sale of Hardware by the Computer Industry over the years



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55. What was the difference in sale of hardware between domestic and exports in 1993-94 ?
(A) Rs. 1000 crore
(B) Rs. 500 crore
(C) Rs. 1200 crore
(D) Rs. 700 crore

56. In which of the following years was the percentage increase in sale of hardware in domestic sector maximum over the preceding year ?
(A) 1992-93
(B) 1993-94
(C) 1994-95
(D) 1992-93 and 1993-94

57. What was the difference between the total hardware sale in export sector in 1992-93 and 1993-94 together and hardware sale in domestic sector in 1993-94 ?
(A) Rs. 300 crore
(B) Rs. 200 crore
(C) Rs. 400 crore
(D) Rs. 150 crore

58. Approximately what was the percentage increase in the sale of hardware in domestic sector from 1994-95 to 1995-96 ?
(A) 40 (B) 35
(C) 25 (D) 30

59. What was the difference in the average sale of hardware between the domestic and exports sector ?
(A) Rs. 900 crore
(B) Rs. 1380 crore
(C) Rs. 1560 crore
(D) Rs. 600 crore

Directions—(Q. 60–64) Study the following table carefully and answer the questions given below it—

Subscription to different Schemes of a Mutual Fund Company over the Months

(Rupee in crores)

Scheme / Months	V	W	X	Y	Z	Total
September	200	70	30	290	10	600
October	120	130	70	150	290	760
November	45	35	25	125	160	390
December	160	110	40	115	130	555
January	80	90	70	100	140	480
February	130	150	30	40	390	740

60. What is the difference in the subscription of V scheme between December and January ?
(A) 80 lacs (B) 8 crore
(C) 240 crore (D) 240 lacs

61. If the subscription to a scheme is the criterion of popularity, which of the scheme can be termed as most popular over the months ?
(A) V (B) W
(C) X (D) Z

62. In which of the following months the total subscription to W and X scheme was equal to subscription to W scheme in February ?
(A) September
(B) October
(C) November
(D) December

63. For which of the following type of schemes was there continuous decrease over the months ?
(A) V (B) W
(C) X (D) Y

64. What is the percentage increase in the subscription to Z scheme from January to February ?
(A) 130
(B) 260
(C) 200
(D) None of these

Directions—(Q. 65–68) In each of the following questions a number series is given. After the series, a number is given followed by (a), (b), (c), (d) and (e). You have to complete the series starting with the number given following the sequence of the given series. Then answer the given questions.

65. 80 50 130 100 180 150 230 900 (a) (b) (c) (d) (e)
Which of the following number will come in place of (e) ?
(A) 1050
(B) 970
(C) 100
(D) 950
(E) None of these

66. 60 121 131 264 284 571 601 120 (a) (b) (c) (d) (e)
Which of the following numbers will come in place (d) ?
(A) 524
(B) 1011
(C) 1010
(D) 514
(E) None of these

67. 2 4 9 20 43 90 3 (a) (b) (c) (d) (e)
Which of the following numbers will come in place of (d) ?
(A) 58
(B) 99
(C) 48
(D) 59
(E) None of these

68. 200 184 193 157 182 118 167 150 (a) (b) (c) (d) (e)
Which of the following numbers will come in place of (e) ?
(A) 132
(B) 115
(C) 68
(D) 117
(E) None of these

69. A second hand VCR when sold for Rs. 8600 earns a profit. Which is double the amount of loss when the same is sold for Rs. 6500. What is the purchase price of the VCR ?
(A) Rs. 7600
(B) Rs. 7100
(C) Rs. 7200
(D) Cannot be determined
(E) None of these

70. What will come in place of question mark(?) in the following equation ?
$48{\cdot}48 \div 1{\cdot}2 + 0{\cdot}8 = ?$
(A) 41 (B) 41·2
(C) 24·24 (D) 4·84

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Answers with Hints

1. (D) Length of longest pole
$= \sqrt{\{(25)^2 + (12)^2 + (8)^2\}}$
$= 28{\cdot}8$ metres

2. (C) $2\pi r = 132$
So, $r = \frac{132 \times 7}{2 \times 22} = 21$ cm
Area $= \pi r^2 = \left(\frac{22}{7} \times 21 \times 21\right)$
$= 1386$ sq. cms.

3. (B) Area $= \frac{\text{Diagonal}}{2}$
$= \frac{25 \times 25}{2}$
$= 312{\cdot}5$ sq. metres

4. (C) The ratio between time taken by A and B to finish work $= 3 : 1$
Ratio of the rates of doing work $= \frac{1}{3} : 1 = 1 : 3$
(A + B)'s 1 day's work $= \frac{1}{15}$
$\therefore$ A's 1 day's work $= \frac{1}{15} \times \frac{1}{4} = \frac{1}{60}$
$\left[\text{divide } \frac{1}{15} \text{ in the ratio } 1 : 3\right]$
So, A can finish the work in 60 days.

5. (D) It is clear that the monkeys is capable of covering 2 metres in 2 minutes. So, in 34 minutes he is able to cover 34 metres. Rest of 2 metres he covers in $\left(\frac{2}{3}\right)$ minute. So, total time taken by him to reach the top is $34\frac{2}{3}$ minutes.

6. (B) Rs. P is S.I. on Rs. P for 7 years.
Rs. 3 P is S.I. on Rs. P for $\left(\frac{7}{P} \times 3P\right) = 21$ years.

7. (C) Numbers alternately increase by seven and decrease by 3.
So, missing number is 17.

8. (A) $\frac{3}{4}$.

9. (B) Ratio of capital $= 4 : 5$
Let B invested his money for x months.
Ratio of equivalent capital for 1 month
$= 4 \times 9 : 5 \times x = 36 : 5x$
$\therefore \quad \frac{36}{5x} = \frac{9}{10}$
or $x = \left(\frac{36 \times 10}{5 \times 9}\right)$
$= 8$ months

10. (C) $\sqrt{\frac{47}{5}} = \frac{\sqrt{(47)}}{\sqrt{(5)}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{\sqrt{235}}{5} = \frac{15{\cdot}32}{5} = 3{\cdot}06$

11. (B) $\frac{13}{15} \times x = 390$
or $x = \left(\frac{390 \times 15}{13}\right) = 450$
$\frac{3}{5}$ of $450 = 270$

12. (A) 80% of C.P. $=$ Rs. 240
or C.P. $= \frac{240 \times 100}{80} =$ Rs. 300
Now, C.P. $=$ Rs. 300, S.P. $=$ Rs. 320
Gain % $= \left(\frac{20}{300} \times 100\right)\%$
$= 6\frac{2}{3}\%$

13. (D) If first expenditure is Rs. 100 then it is increased to Rs. 112. So, consumption of Rs. 12 should be reduced out of Rs. 112.
$\therefore$ Reduction % $= \left(\frac{12}{112} \times 100\right)$
$= 10\frac{5}{7}\%$

14. (C) $\sqrt{[(65)^2 - (16)^2]} = \sqrt{[(65 - 16)\,(65 + 16)]}$
$= \sqrt{[(49)\,(81)]} = 7 \times 9 = 63$

15. (C) P.W. of Rs. 242 due 2 years hence
$= \text{Rs.} \left[\frac{242}{\left(1 + \frac{10}{100}\right)^2}\right]$
$= \text{Rs.} \left(\frac{242 \times 10 \times 10}{11 \times 11}\right)$
$= \text{Rs. } 200$
$\therefore$ There is neither gain nor loss.

16. (B) To obtain an income of Rs. 7 investment
$= \text{Rs.} \left(\frac{3500}{250} \times 7\right) = \text{Rs. } 98$
$\therefore$ S.P. $= \text{Rs.} \left(98 - \frac{1}{8}\right) = \text{Rs. } 97\frac{7}{8}$

17. (C) $P\left(1 - \frac{10}{100}\right)^2 = 137700$
or $P = \frac{137700 \times 10 \times 10}{9 \times 9} = 170000$

18. (C) Area $= 6 \times L^2 = 6A$ (say)
New area $= 6 \times (2L)^2 = 24$ A
Increase % $= \left(\frac{18A}{6A} \times 100\right)\%$
$= 300\%$

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19. (D) There is no uniform pattern for the true discount and the time of the bill. So, (D) is correct.

20. (B) Communication.

21. (B) Ratio of outlay for A and C
$= (6503{\cdot}35) : (1609{\cdot}17)$
$= (4{\cdot}04) : (1)$
$= (404 : 100) = (101 : 25)$

22. (C) The allocation for energy is maximum in each state.

23. (B) (Outlay for B) – (Outlay for C)
$= (4297{\cdot}08 - 1609{\cdot}17)$
$= 2687{\cdot}91$
$\therefore$ Excess of B over A $= \left(\frac{2687{\cdot}91}{1690{\cdot}17} \times 100\right)\%$
$= 160\%$

24. (B) At the point of intersection of the graphs, the cyclist passes the man drop a line parallel to OY. It meets OX at a point to indicate 8·50 AM.

25. (D) From the point of intersection of the graphs draw a line parallel to OX to meet OY at a point respresenting 15 km.

26. (D) Let the original length and breadth of the plot be x and y respectively.
$\therefore$ Area of the original plot $= xy$
and area after the increase of 75%
$= xy + \frac{3}{4}xy = \frac{7}{4}xy$
$\left(x + \frac{x}{2}\right) \times \left(y + \frac{?}{100}y\right) = \frac{7}{4}xy$
or $\frac{3x}{2} \times 4\left(1 + \frac{?}{100}\right) = \frac{7}{4}xy$
or $(100 + ?) \times 6 = 700$
$? = 16\frac{2}{3}\%$

27. (C) Let the share of P, R and S be $5x$, $7x$ and $9x$ respectively
$9x - 5x =$ Rs. 2500
$x =$ Rs. 625
Total sum of money $= 5x + 7x + 9x$
$= 21x = 21 \times 625$
$=$ Rs. 13125

28. (A) Number of students passed in class 8th
$= 8\%$ of $40 = 32$
Number of students passed in class 9th
$= 70\%$ of $60 = 42$
$\therefore$ Total number of students who passed in both the classes $= 74$
Total number of students of both the classes
$= 40 + 60 = 100$
$\therefore$ Total pass percentage of both the classes
$= \frac{74}{100} \times 100 = 74\%$

29. (B) Let the total number of the passengers in the beginning be x then no. of passengers after crossing the first station
$= x - \frac{x}{3} + 560$
$= \frac{2x}{3} + 560$
No. of passengers after crossing the second station
$= \frac{1}{2}\left(\frac{2x}{3} + 560\right) + 24$
$= \frac{1}{2}\left(\frac{2x}{3} + 560\right) + 24 = 496$
or $\frac{x}{3} = 192$
Hence, the total number of passengers in the beginning $\Rightarrow x = 576$.

30. (D) Let the age of the son two years ago was x years.
Then the age of the father $= 6x$ years
Hence, present age of the son $= x + 2$ years
Present age of the father $= 6x + 2$ years
$(6x + 2 + 18) = 2(x + 2 + 18)$
or $x = 5$ years
$\therefore$ Present age of the father $= 6x + 2$
$= 32$ years
and present age of the son $= x + 2$
$= 7$ years.

31. (B) $274 \times 0{\cdot}714 \times 0{\cdot}0065$

32. (A) $\frac{19}{21}, \frac{16}{19}, \frac{11}{14}$.

33. (D) From the given numbers following are the numbers which are divisible by 113 :
226, 339, 452, 791, 904 and 1017.

34. (C) Number $= 119\,K + 19$
$= 17 \times 7\,K + (17 + 2)$
$= 17(7\,K + 1) + 2$
$\therefore$ Remainder when the number is divided by 17 is 2.

35. (D) $1524 + 2890 - 40\sqrt{x} = 1282 \times 2$
or $40\sqrt{x} = 4414 - 2564$
or $\sqrt{x} = \frac{1850}{40} = 46{\cdot}25$
$\therefore$ $x = (46)^2 = 2116$

36. (A) $1900 + 212 \times 25 - 1200 \times \frac{x}{100} = 6000$
or $1900 + 5300 - 6000 = 12x$
$x = \frac{1200}{12}$
$= 100$

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37. (C) $10570x = 480 \times \frac{56}{3} - 3945$

or $x = 10570 + 3945 - 8960$

or $x = 5555.$

38. (B) 3 14 44 112 256

$+4\times2$ $+8\times2$ $+12\times2$ $+16\times2$

(A) (B) (C) (D)

$\therefore$ 35 78 172 368 768

39. (B) 4 27 160 797 3184 9547

$\times7-1$ $\times6-2$ $\times5-3$ $\times4-4$ $\times3-5$

(A) (B)

$\therefore$ 12 83 496

$\times7-1$ $\times6-2$

40. (D) 4 21 120 595 2376 7125

$\times7-7$ $\times6-6$ $\times5-5$ $\times4-4$ $\times3-3$

$\therefore$ 4 42 246 1225

$\times7-7$ $\times6-6$ $\times5-5$

41. (D) 43 78 144 280 548

$\times2-8$ $\times2-12$ $\times2-8$ $\times2-12$

(A) (B) (C) (D) (E)

$\therefore$ 49·25 90·50 169 330 648 1288

$\times2-8$ $\times2-12$ $\times2-8$ $\times2-12$ $\times2-8$

42. (A) 17 73 214 1080 3230

$\times4+5$ $\times3-5$ $\times5+10$ $\times3-10$

(A) (B)

$\therefore$ 14 61 178

$\times4+5$ $\times3-5$

43. (B) Excluding (A) the value of all three parts are equal.

44. (B) Excluding (C) the value of all three parts are equal.

45. (A) The value of all the four parts are equal.

46. (D) Excluding (B) the value of all the three parts are equal.

47. (B) Excluding (B) the value of the three parts are equals.

48. (D) $0{\cdot}6 + 0{\cdot}7 + 0{\cdot}5 + 0{\cdot}4 = \frac{6}{9} + \frac{7}{9} + \frac{5}{9} + \frac{4}{9}$

$= \frac{22}{9} = 2\frac{4}{9}.$

49. (D) $\frac{1{\cdot}1 \times 1{\cdot}1 \times 1{\cdot}1 - 0{\cdot}01 \times 0{\cdot}01 \times 0{\cdot}01}{1{\cdot}1 \times 1{\cdot}1 + 0{\cdot}01 \times 0{\cdot}01 + 1{\cdot}1 \times 0{\cdot}01}$

$= \frac{(1{\cdot}1)^3 - (0{\cdot}01)^3}{(1{\cdot}1)^2 + (0{\cdot}01)^2 + (1{\cdot}1 \times 0{\cdot}01)}$

$= (1{\cdot}1) - (0{\cdot}01) = 1{\cdot}09$

50. (A) $3016 \times \frac{15}{100} + 2 \times 5 + 130 \times 13$

$= 3016 \times \frac{3}{20} + 10 + 1690$

$= 452{\cdot}40 + 1700$

$= 2152{\cdot}40$

51. (D) (A) $= 10\%$ of $0{\cdot}12 = \frac{10}{100} \times 0{\cdot}12$

$= 0{\cdot}012$

(B) $= 12\%$ of $0{\cdot}1 = \frac{12}{100} \times 0{\cdot}1$

$= 0{\cdot}012$

(C) $= 1\%$ of $(12 \times 0{\cdot}1)$

$= \frac{1}{100} \times 1{\cdot}2 = 0{\cdot}012$

(D) $= 100\%$ of $(120 \times 0{\cdot}00001)$

$= \frac{100}{100} \times 0{\cdot}00012 = 0{\cdot}00012$

52. (C) (A) $= 8^2 \div 4^3 \times 10^2 - 8$

$= 68 \div 64 \times 10^2 - 8 = 92$

(B) $= \sqrt{2} \times \sqrt{32} \times 9 + 20$

$= 8 \times 9 + 20 = 92$

(C) $= 4^2 \times 4 + 2^3 \times 3 = 64 \times 4 + 8 \times 3$

$= 256 + 24 = 280$

(D) $= 10^2 - 2^3 = 100 - 8 = 92$

53. (C) (A) $= \frac{3 \times 4}{24} + \frac{7}{12} = \frac{1}{2} + \frac{7}{12} = \frac{13}{12}$

(B) $= \frac{2}{2 \times 3} + \frac{4}{3 \times 4} + \frac{10}{2 \times 3 \times 4}$

$= \frac{1}{3} + \frac{1}{3} + \frac{5}{12} = \frac{13}{12}$

(C) $= \frac{3 \times 4 + 2 \times 4 + 2 \times 3}{2 \times 3 \times 4} = \frac{12 + 8 + 6}{24} = 1$

(D) $= \frac{1}{2} + \frac{1}{3} + \frac{1}{4} = \frac{6 + 4 + 3}{12} = \frac{13}{12}$

54. (B) (A) $= 22 \div 0{\cdot}01 \times 0{\cdot}001 = \frac{22}{{\cdot}01} \times {\cdot}001 = 2{\cdot}2$

(B) $= 2{\cdot}2 \times 0{\cdot}001 \div 0{\cdot}0001 = 2{\cdot}2 \times 1 = 2{\cdot}2$

(C) $= 0{\cdot}022 \times 0{\cdot}01 \div 0{\cdot}001 = \frac{{\cdot}022 \times 0{\cdot}01}{{\cdot}001}$

$= {\cdot}22$

(D) $= 2{\cdot}2 \div 0{\cdot}001 \times 0{\cdot}001$

$= \frac{2{\cdot}2}{0{\cdot}001} \times 0{\cdot}001 = 2{\cdot}2$

55. (D) Reqd. difference $= 1600 - 900$

$=$ Rs. 700 crore

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56. (C) Reqd. percentage in 1992-93

$$= \frac{1400 - 1000}{1000} \times 100$$

$$= 40$$

Reqd. percentage in 1993-94

$$= \frac{1600 - 1400}{1400} \times 100$$

$$= 14{\cdot}29$$

Reqd. percentage in 1994-95

$$= \frac{3200 - 1600}{1600} \times 100$$

$$= 100$$

Reqd. percentage in 1995-96

$$= \frac{4200 - 3200}{3200} \times 100$$

$$= 31{\cdot}25$$

Hence, it is maximum in 1994-95.

57. (A) Reqd. difference = 1600 – (400 + 900)
= Rs. 300 crore

58. (D) Reqd. percentage increase

$$= \frac{(4200 - 3200) \times 100}{3200}$$

$$= 31{\cdot}25 = 30 \text{ (Approx.)}$$

59. (B) Average sale of hardware in domestic sector

$$= \frac{1000 + 1400 + 1600 + 3200 + 4200}{5}$$

= Rs. 2280 crore

Average sale of hardware in exports sector

$$= \frac{200 + 400 + 900 + 1200 + 1800}{5}$$

= Rs. 900 crore

∴ Reqd. difference
= 2280 – 900 = Rs. 1380 crore

60. (A) Reqd. difference = 160 – 80 = Rs. 80 lacs

61. (D) Total subscription of scheme V over the months
= Rs. 735 crore

Total subscription of scheme W over the months
= Rs. 585 crore

Total subscription of scheme X over the months
= Rs. 265 crore

Total subscription of scheme Y over the months
= Rs. 820 crore

and total subscription of scheme Z over the months
= Rs. 1120 crore

∴ Scheme Z is most popular.

62. (D) Subscription to W scheme in February
= Rs. 150 crore

and total subscription to W and X schemes in December = Rs. (110 + 40) crore
= Rs. 150 crore

63. (D)

64. (D) Reqd. percentage $= \frac{(390 - 140) \times 100}{140}$

$$= 178{\cdot}57$$

65. (B) 80 50 130 100 180 150 230
(– 30, + 80, – 30, + 80, – 30, + 80)

Similarly,

900 870 930 920 1000 970
(– 30, + 80, – 30, + 80, – 30)
(a) (b) (c) (d) (e)

66. (E) 60 121 131 264 284 571 601
(× 2 + 1, + 10, × 2 + 2, + 20, × 2 + 3, + 30)

Similarly,

120 241 251 504 524 1051 1081
(× 2 + 1, + 10, × 2 + 2, + 20, × 2 + 3, + 30)
(a) (b) (c) (d) (e)

67. (D) 2 4 9 20 43 90
(× 2, × 2 + 1, × 2 + 2, × 2 + 3, × 2 + 4)

Similarly,

3 6 13 28 59
(× 2, × 2 + 1, × 2 + 2, × 2 + 3)
(a) (b) (c) (d)

68. (D) 200 184 193 157 182 118 167
($-(4)^2$, $+(3)^2$, $-(6)^2$, $+(5)^2$, $-(8)^2$, $+(7)^2$)

Similarly,

150 134 143 107 132 68 117
($-(4)^2$, $+(3)^2$, $-(6)^2$, $+(5)^2$, $-(8)^2$, $+(7)^2$)
(a) (b) (c) (d) (e)

69. (C) Let the purchased price of the VCR be Rs. x.

∴ Profit in I case = Rs. $(8600 - x)$
and loss in II case = Rs. $(x - 6500)$
∴ $(8600 - x) = 2(x - 6500)$
or $8600 - x = 2x - 13000$
or $3x = 21600$
∴ $8x = \frac{21600}{3}$

= Rs. 7200

70. (B) ? = 48·48 ÷ 1·2 + 0·8

$$= \frac{48{\cdot}48}{1{\cdot}2} + 0{\cdot}8$$

$$= 40{\cdot}4 + 0{\cdot}8$$

$$= 41{\cdot}2$$

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Miscellaneous Exercise – VII

1. Find out the wrong number in the following sequence of numbers
   4, 13, 17, 26, 30, 38, 43.
   (A) 13 (B) 26
   (C) 38 (D) 43

2. Find out the wrong number in the sequence
   1, 18, 27, 84, 125, 216, 343.
   (A) 1 (B) 27
   (C) 84 (D) 216

3. A is 5 times as old as his son B. Four years hence the sum of their ages will be 50 years. B's age now is—
   (A) 8 years (B) 6 years
   (C) 7 years (D) 5 years

4. The diameter of a cylindrical tower is 10 metres and its height is 14 metres. The cost of painting the carved surface of the cylinder at 75 paise per square metre is—
   (A) Rs. 105 (B) Rs. 330
   (C) Rs. 220 (D) Rs. 440

5. The dimensions of an open box are 52 cms, 40 cms and 26 cms. Its thickness is 1 cm. If 1 cubic cm of the metal used in the box weights 1 gm, then he weight of the box is—
   (A) 8·48 kg (B) 6·58 kg
   (C) 7·28 kg (D) 658 gms

6. Four-fifth of a number is 10 more than two-third of the number. The number is—
   (A) 55 (B) 65
   (C) 75 (D) 80

7. A, B, C hired a Taxi for Rs. 3840 and used it separately for 72 hours 108 hours an 252 hours respectively. The amount paid by C is—
   (A) Rs. 960 (B) Rs. 2880
   (C) Rs. 1920 (D) Rs. 2240

8. When the price of a TV was increased by 15% the number of TV's sold by a company decreases by 15%. What was the net effect on the sale ?
   (A) No effect
   (B) 1·5% increase
   (C) 2·25% decrease
   (D) 2·25% increase

9. $37{\cdot}09 \times ? = (41 - {\cdot}291)$—
   (A) ·11 (B) 1·1
   (C) 11·1 (D) 9·1

10. Which number will replace both the question mark in $\left(\frac{361}{?} = \frac{?}{81}\right)$?
   (A) 191
   (B) 931
   (C) 171
   (D) None of these

11. The value of the expression 1014×986 is—
   (A) 998924 (B) 999864
   (C) 999804 (D) 996724

12. $({\cdot}98 \times {\cdot}98 - {\cdot}98 \times 1{\cdot}52 + {\cdot}76 \times {\cdot}76) = ?$
   (A) ·0484 (B) ·2684
   (C) ·3164 (D) ·1562

13. $\sqrt{\left(\frac{0{\cdot}324}{10}\right)} = ?$
   (A) ·18 (B) 0·1
   (C) ·0018 (D) 2·8

14. Which of the following is in descending order ?
   (A) $\frac{3}{8}, \frac{8}{15}, \frac{11}{23}, \frac{25}{81}$
   (B) $\frac{26}{81}, \frac{11}{23}, \frac{8}{15}, \frac{3}{8}$
   (C) $\frac{8}{15}, \frac{11}{23}, \frac{3}{8}, \frac{26}{81}$
   (D) $\frac{3}{8}, \frac{11}{23}, \frac{8}{15}, \frac{26}{81}$

15. Two towns X and Y are some distance apart. A man cycle from X to Y at a speed of 10 km/hr and then back from Y to X at the rate of 15 km/hr. The average speed during the whole journey is—
   (A) 12·5 km
   (B) 12 km
   (C) The data is inadequate
   (D) 13 km/hr

16. Two taps can separately fill a cistern in 10 minutes and 15 minutes respectively and when the waste pipe is open they can together fill it in 18 minutes. The waste pipe can empty the full cistern in—
   (A) 7 min. (B) 9 min.
   (C) 13 min. (D) 23 min.

17. If twice A is three times B and 5 times B is equal to 6 times C, then A : C is—
   (A) 4 : 5 (B) 5 : 9
   (C) 9 : 5 (D) 5 : 4

18. Suresh and Jagdish start a business investing Rs. 15000 and Rs. 22000 respectively. After 4 months Suresh puts in Rs. 4000 more and Jagdish withdraws Rs. 2000. At the end of year total profit was Rs. 11500. What is the share of Jagdish in it ?
   (A) Rs. 6900 (B) Rs. 5300
   (C) Rs. 6200 (D) Rs. 4600

19. If 20 typists can type 480 pages in 6 hours. How many pages will be typed by 25 typists in 4 hours ?
   (A) 256 (B) 576
   (C) 900 (D) 400

20. A trader allows two successive discount of 20% and 10%. If he gets Rs. 108 for an article, then its marked price is—
   (A) Rs. 142·56
   (B) Rs. 140·40
   (C) Rs. 160
   (D) Rs. 150

21. The compound interest on Rs. 2800 for $1\frac{1}{2}$ years at 10% per annum compounded annually is—
   (A) Rs. 441·35
   (B) Rs. 3234
   (C) Rs. 420
   (D) Rs. 436·75

22. What decimal fraction is 20 mm of a metre ?
   (A) ·02 (B) ·2
   (C) ·05 (D) ·002

23. Deepak is twice as old as Vikas was 3 years ago when Deepak was as old as Vikas today. If the difference between their ages

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today be 5 years. What is the present age of Deepak ?

(A) 12 years (B) 16 years

(C) 18 years (D) 14 years

24. The average age of the husband and wife at the time of their marriage 6 years ago was 28 years 6 months. Now the average of the husband, wife and a child is 24 years. How old is the child ?

(A) $2\frac{1}{2}$ years (B) 3 years

(C) $3\frac{1}{2}$ years (D) 4 years

25. The length of the diagonal of a square is $4\sqrt{2}$ cms. Its area is—

(A) 32 cm^2 (B) 16 cm^2

(C) 8 cm^2 (D) 36 cm^2

Directions—(Q. 26 to 29) Study the table and answer the questions given below—

Carbon Emission from Fossil Fuel Burning, 1994

Country	Total Emissions (Millions Tonnes)	Emissions Per Person (Tonnes)	Emissions growth per person (1990-94) (per cent)
Russia	597	5·26	–44·0
U.S.A.	1289	0·71	13·0
China	954	3·08	24·1
India	356	2·39	21·6
U.K.	123	0·24	–23·5
Japan	285	2·62	–0·3
Mexico	90	0·96	7·1

26. Which was the country amongst the given countries which has maximum emission per person in 1990 ?

(A) India (B) Russia

(C) U.S.A. (D) Mexico

27. Which country will stand at second position if arranged in descending order of population in 1994 ?

(A) China (B) Japan

(C) U.S.A. (D) U.K.

28. What was the approximate sum of the population of U.K. and Japan in 1994 ?

(A) 340 million

(B) 370 million

(C) 450 million

(D) 410 million

29. In 1994 emissions in India were approximately what per cent of the total emissions in all the given countries together ?

(A) 8 (B) 10

(C) 12 (D) 6

Directions—(Q. 30 to 32) In each of the following question a question is asked followed by three informations. You have to decide weather the question can be answered with any one or two or all the three informations.

Answers—

(A) If the informations (I) and (II) are necessary.

(B) If the informations (II) and (III) are necessary.

(C) If the informations (I), (II) and (III) are necessary.

(D) If the informations (I), (II) and (III) together are not sufficient.

(E) None of these

30. Pappu and Munna are the drivers of two different buses. They are travelling in opposite directions and crosses one another in 27 seconds. What is the speed of Pappu's bus ?

Informations—

(I) The length of Pappu's bus

(II) Speed of Munna's bus

(III) The length of Munna's bus

31. A sum of money of Rs. 1600 is to be distributed among P, Q and R. How many rupees will be given top ?

Informations—

(I) R gets Rs. 180 more than P

(II) Q gets the double amount of that of R

(III) Q gets Rs. 240 more than the average amount of all the three

32. A train moving with a uniform speed crosses a standing bus in 20 seconds. What is the speed of the train ?

Informations—

(I) Length of the train

(II) Length of the bus

(III) Speed of the bus

33. Rs. 6200 amounts to Rs. 9176 in four years at simple interest. If the interest rate is increased by 3%. It would amount to how much ?

(A) Rs. 8432

(B) Rs. 9920

(C) Rs. 10920

(D) None of these

34. The inner radius of a same spherical utensil is 12 cm. This utensil is filled with the help of small cylindrical bottles. If the radius of the base of the bottle be $\frac{3}{2}$ cm and height by 4 cm. How many each bottles are required to fill it ?

(A) 272 (B) 64

(C) 128 (D) 136

35. The area of rhombus is 169 cm^2. If its one diagonal is double the other. What are the length of these diagonals ?

(A) 39 cm, 19·5 cm

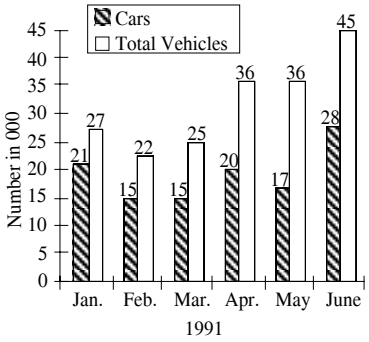
(B) 26 cm, 13 cm

(C) 36 cm, 18 cm

(D) 40 cm, 20 cm

Directions—(Q. 36 to 40) Study the following graph carefully and answer the questions given below it—

Registration of New Vehicles in Delhi



36. What was the difference between the numbers of cars registered in January and those registered in June ?

(A) 2000

(B) 6000

(C) 500

(D) None of these

37. What was the number of vehicles other than cars registered in March 1991 ?

(A) 5000 (B) 10000

(C) 40000 (D) 37000

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38. What was the percentage increase in registration of cars from February to March 1991 ?
(A) 0% (B) 1%
(C) 2% (D) 2·5%

39. What was the increase in registration of vehicles other than cars from January to April 1991 ?
(A) 5000 (B) 10000
(C) 15000 (D) No increase

40. In which of the following month was the registration of vehicles other than cars maximum ?
(A) April (B) June
(C) May (D) March

41. The serial number of each player of a team of volleyball of 8 players is according the marks obtained in their display. The best player got 85 marks. If he had gotten 92 marks, then the average marks obtained by the whole team would be 84. Find the total marks obtained by the whole team.
(A) 666
(B) 672
(C) 588
(D) None of these

42. Ram was asked to multiply a number by 31 by mistake he muliplied that number by 13 and so the answer calculated by him was 342 less than the correct answer. What was that number ?
(A) 191 (B) 17
(C) 19 (D) 18

43. Praveen spends 30% of his monthly income on filling the petrol in the car he spends $\frac{1}{4}$th of the remaining income on house rent and he spends his remaining income on children's education and food. If he spends Rs. 3000 on petrol, what sum of money does he spend on house rent ?
(A) Rs. 1375 (B) Rs. 1750
(C) Rs. 3400 (D) Rs. 1500

44. In the following number of series a wrong number is given. Find out the wrong number.
3, 4, 10, 30, 136, 685, 4116
(A) 685 (B) 30
(C) 4 (D) 136

45. When a amount was distributed equally among 12 boys. Each of them got Rs. 60 more than the amount received by each boy when the same amount was distributed equally to 20 boys. What is the amount ?
(A) Rs. 1800
(B) Rs. 1440
(C) Rs. 1600
(D) Data inadequate

46. Radha borrowed a certain sum of simple interest from Laxmi incurring 6% interest per annum for first 3 years, 8% interest for the period next 5 years. If he paid Rs. 10080 as interest for a total period of 8 years. What sum had he borrowed ?
(A) Rs. 18000
(B) Rs. 14000
(C) Rs. 20160
(D) None of these

47. The ratio between the present ages of Omkar and Ram Kishan is 4 : 5. Seven years ago, the ratio of their ages was 3 : 4. What is the present age of Ram Krishan ?
(A) 28 years
(B) 35 years
(C) 21 years
(D) Data inadequate

48. The length of a plot of land is four times its breadth. A playground measuring 1200 sq. metres occupies one-third of the total area of the plot. What is the length of the plot in metres ?
(A) 90
(B) 30
(C) 20
(D) None of these

49. Arti purchased three sarees with a discount of 15% each on the listed price. She sold one saree earning 20% profit and another saree earning 15% on the price she had purchased. If the listed price of each saree is Rs. 1000 how much profit did she earn by selling two sarees ?
(A) Rs. 397·50
(B) Rs. 1700
(C) Rs. 200
(D) None of these

50. The difference between the cost price of table and chair is Rs. 1800. Assuming that the percentage profit is same for the table and the chair. What will be the profit of selling six such tables and four such chairs ? To find the answer, which of the following informations given in statements (P) and Q is/are sufficient ?
(P) The cost price of a table is Rs. 4000.
(Q) The percentage profit is 25.
(A) Only (P) alone is sufficient
(B) Only (Q) alone is sufficient
(C) Either (P) or (Q) is sufficient
(D) Both (P) and (Q) together are not sufficient
(E) Both P and Q are needed.

Directions—(Q. 51–55) What approximate value should come in place of question mark (?) in the equation in each of the following questions ?

51. $4242 \times 42 = ?$
(A) 168100 (B) 178100
(C) 179100 (D) 135700

52. $777 \times 404 = ?$
(A) 313000 (B) 313500
(C) 213900 (D) 314000

53. $8746 + 5827 + 47 = ?$
(A) 14500 (B) 13600
(C) 14600 (D) 14700

54. 310% of 2800 = ?
(A) 8650 (B) 8400
(C) 8500 (D) 10500

55. $7500 \times 0{\cdot}7 = ?$
(A) 5100 (B) 10714
(C) 5200 (D) 10500

Directions—(Q. 56–70) In each question, what will come in place of question mark ?

56. $14{\cdot}14 \times 2{\cdot}40 + 6{\cdot}064 = ?$
(A) 33·396 (B) 40·000
(C) 34·064 (D) 34·000

57. 40% of 120 = ?% of 96
(A) 24
(B) 36
(C) 48
(D) None of these

58. $7333 + ? - 4548 = 3602$
(A) 707 (B) 807
(C) 827 (D) 817

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59. $5678 + 3569 + 918 = ?$
(A) 10165 (B) 10255
(C) 11965 (D) 10145

60. $9865 - 5134 + 786 = ?$
(A) 4617 (B) 5517
(C) 4731 (D) 5607

61. $5\frac{1}{4} \times 0{\cdot}20 + 0{\cdot}80 - 0{\cdot}65 = ?$
(A) 1·85 (B) 1·20
(C) 1·65 (D) 1·8375

62. $12\frac{2}{3} - 5\frac{1}{3} \div 6\frac{2}{3} = ?$
(A) 8
(B) $6\frac{1}{3}$
(C) $5\frac{2}{3}$
(D) None of these

63. $2548 \div 26 + 13 = ?$
(A) $65\frac{1}{3}$ (B) 111
(C) 85 (D) 98

64. $5794 + 8326 + 785 = ?$
(A) 15085 (B) 14905
(C) 14815 (D) 14995

65. $195{\cdot}84 \div 12{\cdot}24 + 4{\cdot}02 = ?$
(A) 12·00 (B) 16·00
(C) 20·02 (D) 12·02

66. $\frac{24 \times 3 - 18 \times 3}{8 \times 7 - 23{\cdot}5 \times 2} = ?$
(A) 2 (B) 1
(C) $\frac{1}{2}$ (D) 6

67. $4\frac{1}{2} + 2\frac{1}{4} \div \frac{3}{4} \times 4\frac{2}{3} = ?$
(A) 9
(B) 7
(C) $1\frac{2}{7}$
(D) None of these

68. $209 \times 33 + 21 = ?$
(A) 6897
(B) 6928
(C) 6908
(D) None of these

69. $\sqrt{?} + 720 \div 12 = 8 \times 10 - 16$
(A) 4
(B) 12
(C) 16
(D) None of these

70. $286{\cdot}3154 + 87{\cdot}596 + 673{\cdot}49 = ?$
(A) 1047·315
(B) 1046·9604
(C) 1046·424
(D) None of these

71. 765 chairs are to be arranged in columns in such a way that there should be as many chairs in each columns. In order to follow this arrangement how many chairs should be removed ?
(A) 6 (B) 36
(C) 19 (D) 27

72. 20 buckets each of capacity 13·5 litres completely fills the tank. How many buckets each of capacity 9 litres will completely fill the tank ?
(A) 30
(B) 32
(C) 60
(D) Data inadequate

73. Machine A can print 100000 books in 8 hours, machine B can print the same number of books in 10 hours and machine C can print the same number of books in 12 hours. All the three machines began to work at 9·00 AM. At 11 AM the machine A stops to work while the other two continued their work. At what time approximately the work will be complete ?
(A) 12·00 Noon
(B) 12·30 PM
(C) 1·00 PM
(D) 11·30 AM

74. Two students fought a college election. The winning student got 60% of the total votes and won the election by 144 votes. What was the total number of votes polled ?
(A) 720 (B) 360
(C) 480 (D) 240

75. In a factory there are some supervisors and some labourers. On their silver jubilee function, 2 shirts to each labour and one shirt and one pant to each supervisor are distributed. If in all 220 shirts and 20 pants are distributed, what is the total number of workmen in the factory ?
(A) 100
(B) 110
(C) 120
(D) Cannot be determined

Answers with Hints

1. (C) The numbers successively increase by 9 and 4 respectively. So, 38 is wrong. It must be 39.

2. (C) The number must be $1^3, 2^3, 3^3, 4^3, 5^3, 6^3, 7^3$.
So, instead of $4^3 = 64$ it is 84.

3. (C) Let B's age be x. Then A's age = $5x$
$\because \quad (x + 4) + (5x + 4) = 50$
or $\quad x = 7$

4. (B) Area of the curved surface
$= 2\pi h = 2 \times \frac{22}{7} \times 5 \times 14$
$= 440$ sq. m.
$\therefore$ Cost of painting = Rs. $\left(440 \times \frac{3}{4}\right)$
= Rs. 330

5. (B) Volume of metal
$= (52 \times 40 \times 26 - 50 \times 38 \times 25)$ cu. cm.
$= (54080 - 47500)$ cu. cm.
$= 6580$ cu. cm.
$\therefore$ Weight of metal = 6·58 kg

6. (C) $\frac{4}{5}x - \frac{2}{3}x = 10$
or $\frac{12x - 10x}{15} = 10$

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or $2x = 150$

or $x = 75$

7. (D) The amounts paid by them are in the ratio 72 : 108 : 252 *i.e.*, 2 : 3 : 7.

$\therefore$ C's share = Rs. $\left(\frac{3840 \times 7}{12}\right)$

= Rs. 2240

8. (D) Let the S.P. of a T.V. be Rs. x and number sold be y.

Then, total sale = Rs. (xy)

Total sale after increase in price

$= \left(\frac{115}{100}x\right)\left(\frac{85}{100}y\right)$

$= (1{\cdot}15 \times 0{\cdot}85)xy$

$= 0{\cdot}9775xy$

$\therefore$ Decrease in sale = $\left(\frac{{\cdot}0225}{1} \times 100\right)\%$

= $2{\cdot}25\%$

9. (B) 10. (C) 11. (C) 12. (A) 13. (A)

14. (C) 15. (B) 16. (B)

17. (C) $2A = 3B$ and $5B = 6C$

$\therefore \frac{A}{B} = \frac{3}{2}$ and $\frac{B}{C} = \frac{6}{5}$

So, $\frac{A}{C} = \frac{A}{B} \times \frac{B}{C} = \frac{3}{2} \times \frac{6}{5} = \frac{9}{5}$.

18. (C) Ratio of their shares

$= (15000 \times 4 + 19000 \times 8) :$
$(22000 \times 4 + 20000 \times 8)$

$= 21000 : 24800 = 53 : 62$

$\therefore$ Jagdish's share = Rs. $\left(\frac{11500 \times 62}{115}\right)$

= Rs. 6200

19. (D) $\left.\begin{matrix}20 : 25\\6 : 4\end{matrix}\right\} :: 480 : x$

$\therefore x = \frac{25 \times 4 \times 480}{20 \times 6} = 400$

20. (D) Let the market price be Rs. 100

Price after 1st discount = Rs. 80

Price after 2nd discount = Rs. (80 – 8) = Rs. 72

$\therefore 72 : 100 = 108 : x$

or $x = \frac{100 \times 108}{72}$

$= 150$

So, the marked price = Rs. 150

21. (B) Amount = $2800 \times \left(1 + \frac{10}{100}\right)\left(1 + \frac{5}{100}\right)$

= Rs. 3234

22. (A) Required fraction = $\left(\frac{20}{1 \times 100 \times 10}\right) = {\cdot}02$

23. (B) Let the age of Vikas 3 years ago be x years.

Deepak's age today = $2x$ years

Vikas's age today = $(x + 3)$ years

$\therefore 2x - (x + 3) = 500x = 8$

So, Deepak's age today = 16 years

24. (B) The total age of husband and wife 6 years ago

= $\left(28\frac{1}{2} \times 2\right)$ years

= 57 years

The total age of husband and wife now

= (57 + 12) years = 69 years

Total age of husband, wife and child now

= (24 × 3) years = 72 years

Age of the child = (72 – 69) years = 3 years

25. (B) Area = $\frac{1}{2} \times (\text{diagonal})^2$

$= \frac{1}{2} \times \left(4\sqrt{2}\right)$

$= 16 \text{ cm}^2$

26. (B)

27. (A) On arranging the population in descending order we get 1289, 954, 597, 356, 285, 123, 90.

$\therefore$ China stands at the second position.

28. (D) The sum of the population of U.K. and Japan in

1994 = 123 + 285

= 408

= 410 millions (app.)

29. (B) Total emission of all the given countries in 1994

= 597 + 1289 + 954 + 356
+ 123 + 285 + 90

= 3694 millions

$\therefore$ Required percentage = $\frac{356}{3694} \times 100 = 9{\cdot}6$

30. (C) In order to determine the speed of Pappu's bus we should know the relative speed as well as the length of both the buses.

$\therefore$ All the three statements are necessary.

31. (A) Let P's share be Rs. x

Then, R's share = $180 + x$

Then, Q's share = $360 + 2x$

$360 + 2x = \frac{4x + 540 + 240}{3}$

$2x = 180$

$x = 90$

Hence, all the three statements are necessary to answer the question.

32. (A) Speed of the train

= $\left(\frac{\text{Length of the train + Length of the bus}}{20}\right)$ m/sec.

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33. (B) $\text{S.I.} = \frac{P \times R \times T}{100}$

$9176 - 6200 = \frac{6200 \times R \times 4}{100}$

or $R = 12$

New rate $= 12 + 3 = 15$

New amount $= 6200 + \frac{6200 \times 15 \times 4}{100}$

$= \text{Rs. } 9920$

34. (C) Volume of the utensil

$= \left(\frac{2}{3}\pi \times 12 \times 12 \times 12\right)\text{cm}^3$

$= 1152\ \pi\ \text{cm}^3$

Volume of 1 bottle $= \left(\pi \times \frac{3}{2} \times \frac{3}{2}\pi^4\right)\text{cm}^3$

$= 9\ \pi\ \text{cm}^3$

$\therefore$ Number of bottle $= \frac{1152\ \pi}{9\ \pi} = 128$

35. (B) Let the length of diagonal be $2x$ cm

$\therefore$ The length of 2nd diagonal $= x$ cm

$\therefore \quad \frac{1}{2} \times x \times 2x = 169$ cm

or $x = 13$ cm

$\therefore$ Length of 1st and 2nd diagonal is 26 cm and 13 cm respectively.

36. (D) $28000 - 21000 = 7000$

37. (B) $25000 - 15000 = 10000$

38. (A) $\frac{15 - 15}{15} \times 100 = \frac{0}{15} \times 100 = 0\%$

39. (B) January $= 27000 - 21000 = 6000$

April $= 36000 - 20000 = 16000$

$\therefore$ Increase $= 16000 - 6000 = 10000$

40. (C) $36000 - 17000 = 19000 = \text{May}$

41. (D) Let the total marks obtained by the whole team be x

then $\frac{x + 92 - 85}{8} = 84$

$\therefore \quad x = 84 \times 8 - 7 = 665$

42. (C) Let the required number be x

then, $31x - 13x = 342$

or $18x = 342$

or $x = 19$

43. (B) Praveen spends 30% of his income that is Rs. 3000 on petrol.

Hence, Praveen's income is 100%

$= \text{Rs. } 10000$

Money left after he has spend it on petrol

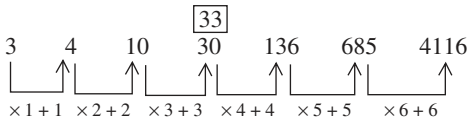
$= 10000 - 3000 = \text{Rs. } 7000$

$\therefore$ Money spent on house rent

$= \frac{1}{4}$th of 7000

$= \text{Rs. } 1750$

44. (B)



$\therefore$ The wrong number is 30.

45. (A) Let the amount be Rs. x.

$\therefore \quad \frac{x}{12} - \frac{x}{20} = 60$

or $\frac{5x - 3x}{60} = 60$

or $x = \frac{60 \times 60}{2}$

$= \text{Rs. } 1800$

46. (D) Let the sum borrowed be Rs. x.

$\therefore \quad \text{S.I.} = \frac{x \times 6 \times 3}{100} + \frac{x \times 8 \times 2}{100} + \frac{x + 12 \times 3}{100}$

or $10080 = \frac{18x}{100} + \frac{16x}{100} + \frac{36x}{100}$

or $10080 = \frac{70x}{100}$

$\therefore \quad x = \frac{10080 \times 100}{70} = \text{Rs. } 14400$

47. (B) Let the present age of Omkar and Ram Kishan be $4x$ years and $5x$ years respectively.

$\therefore \quad \frac{4x - 7}{5x - 7} = \frac{3}{4}$

or $16x - 28 = 15x - 21$

or $x = 7$

$\therefore$ Present age of Ram Kishan

$= 5 \times 7 = 35$ years

48. (D) Let the breadth of the plot be x m

$\therefore \quad$ Ist length $= 4x$ m

$\therefore \quad \frac{1}{3} \times 4x \times x = 1200$

or $x^2 = \frac{1200 \times 3}{4} = 900$

$\therefore \quad x = 30$

$\therefore$ Length of the plot $= 4 \times 30 = 120$ metres

49. (D) Discount on 1st saree $= 15\%$ of $1000 = \text{Rs. } 150$

$\therefore$ Cost price of the 1st saree

$= 1000 - 150 = \text{Rs. } 850$

$\therefore$ Cost price of 2nd saree $= \text{Rs. } 850$

Profit on 1st saree $= 20\%$ of $850 = \text{Rs. } 170$

and profit on 2nd saree $= 15\%$ of 850

$= \text{Rs. } 127{\cdot}50$

Total profit on two sarees $= 170 + 127{\cdot}50$

$= \text{Rs. } 297{\cdot}50$

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50. (E) Cost price of one table = Rs. 4000
(from statement P)
∴ Cost price of six tables = 4000×6 = Rs. 24000
∴ Cost price of one chair = $4000 - 1800$
= Rs. 2200
∴ Cost price of four chairs = 2200×4 = Rs. 8800
∴ Total cost of six tables and four chairs
= $24000 + 8800$
= Rs. 32800
Percentage profit on each is 25 (from statement Q)
∴ Total profit = $\frac{32800 \times 25}{100}$
= Rs. 8200
∴ To find the answer both the statements P and Q are needed.

51. (B) 52. (D) 53. (C) 54. (A) 55. (C)
56. (B) 57. (D) 58. (D) 59. (A) 60. (B)
61. (B)

62. (D) $12\frac{2}{3} - 5\frac{1}{3} \div 6\frac{2}{3} = ?$

$? = \frac{38}{3} - \frac{16}{3} \div \frac{20}{3}$

$= \frac{38}{3} - \frac{16}{3} \times \frac{3}{20}$

$= \frac{38}{3} - \frac{4}{5} = \frac{190 - 12}{15}$

$= \frac{178}{15} = 11\frac{13}{15}$

63. (B) 64. (B) 65. (C)

66. (A) $\frac{24 \times 3 - 18 \times 3}{8 \times 7 - 23{\cdot}5 \times 2} = ?$

$? = \frac{3(24 - 18)}{56 - 47} = \frac{18}{9}$

$= 2$

67. (D) $4\frac{1}{2} + 2\frac{1}{4} \div \frac{3}{4} \times 4\frac{2}{3} = ?$

$? = \frac{9}{2} \times \frac{9}{4} \times \frac{4}{3} \times \frac{14}{3}$

$= \frac{9}{2} + 14 = \frac{9 + 28}{2} = \frac{37}{2}$

$= 18\frac{1}{2}$

68. (D)

69. (C) $\sqrt{?} + 720 \div 12 = 8 \times 10 - 16$

$\sqrt{?} + 60 = 80 - 16$

$\sqrt{?} + 60 = 64$

$\sqrt{?} = 64 - 60 = 4$

$? = (4)^2 = 16$

70. (D) 286·3154 + 87·596 + 673·49 = 1047·4014.

71. (B)

	27
2	765
	4
47	365
	329
	36

∴ No. of chairs to be removed = 36.

72. (A) No. of buckets each of capacity 13·5 litre required to fill the tank = 20
∴ No. of buckets each of capacity 1 litre required to fill the tank = $20 \times 13{\cdot}5$
∴ No. of buckets each of capacity 9 litre required to fill the tank = $\frac{20 \times 13{\cdot}5}{9} = 30$

73. (C) Total work of all the three machines for 1 hour

$= \frac{1}{8} + \frac{1}{10} + \frac{1}{12} = \frac{37}{120}$

∴ Total work of all the three machines for 2 hours

$= 2 \times \frac{37}{120} = \frac{37}{60}$

Remaining work $= 1 - \frac{37}{60} = \frac{23}{60}$

Total work B and C for 1 hour

$= \frac{1}{10} + \frac{1}{12} = \frac{11}{60}$

∴ Time taken by B and C machines to complete the remaining work $= \frac{23}{60} \div \frac{11}{60} = \frac{23}{11}$ hours
= 2 hours (approx.)

74. (A) Let the total number of votes polled be x.
∴ No. of votes obtained by winner

$= \frac{60x}{100} = \frac{3x}{5}$

∴ No. of votes obtained by other

$= x - \frac{3x}{5} = \frac{2x}{5}$

∴ $\frac{3x}{5} - \frac{2x}{5} = 144$

or $\frac{x}{5} = 144$

∴ $x = 144 \times 5$
$= 720$

75. (C) Let the number of supervisor be x and the number of labourers be y.

$x + 2y = 220$

and $x = 20$

On solving we get $y = 100$

∴ Total number of workmen in the factory

$= x + y = 20 + 100$

$= 120.$

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Miscellaneous Exercise – VIII

1. The sum of two digits of a number is 9. If 9 is subtracted from the number, then the digits are reversed. What is the number ?
   (A) 36 (B) 45
   (C) 54 (D) 72

2. An article is sold for Rs. 240. If the profit is one-fourth of the cost price, what is the cost price ?
   (A) Rs. 180 (B) Rs. 164
   (C) Rs. 192 (D) Rs. 196

3. Lemons are bought at 5 for a rupee and sold at 8 for three rupees. What is gain or loss per cent in the transaction ?
   (A) $37\frac{1}{2}\%$ (B) $57\frac{1}{2}\%$
   (C) 6% (D) $87\frac{1}{2}\%$

4. A can run 1 km in 3 min. 10 sec. and B in 3 min. 20 sec. By what distance can A beat B ?
   (A) 36 metres (B) 50 metres
   (C) 40 metres (D) 60 metres

5. The average score of a cricketer for 10 matches is 38·9 runs. If the average for the first 6 matches is 41, what is the average for last 4 matches ?
   (A) 36·25 (B) 34·25
   (C) 35·75 (D) 32·85

6. $\frac{1}{\sqrt{3}} = ?$
   (A) 0·632 (B) ·517
   (C) ·527 (D) ·577

7. $\frac{\sqrt{1008}}{\sqrt{7}} = ?$
   (A) 12·75 (B) 11·68
   (C) 12 (D) 13·26

8. $3\cdot\overline{57}$ in fractional form is—
   (A) $\frac{357}{99}$ (B) $\frac{354}{99}$
   (C) $\frac{357}{90}$ (D) $\frac{354}{90}$

9. The greatest number of 4 digits, which is a perfect square, is—
   (A) 9981 (B) 9891
   (C) 9902 (D) 9801

10. A can do a piece of work in 20 days, B can do it in 25 days. They work together for 5 days and then B goes away. In how many days will A finish the work ?
    (A) $17\frac{1}{2}$ days (B) 11 days
    (C) $8\frac{4}{7}$ days (D) 10 days

11. A lead pipe is 35 cm long its external diameter is 2·4 cm and its thickness is 2 mm. If 1 cubic cm of lead weighs 5 gms. The weight of the pipe is—
    (A) 220 gms (B) 242 gms
    (C) 420 gms (D) 484 gms

12. A company declares a dividend of 12% on Rs. 100 shares. A man buys such shares and gets 15% on his investment. At what price he bought the shares ?
    (A) Rs. 125 (B) Rs. 85
    (C) Rs. 80 (D) Rs. 76

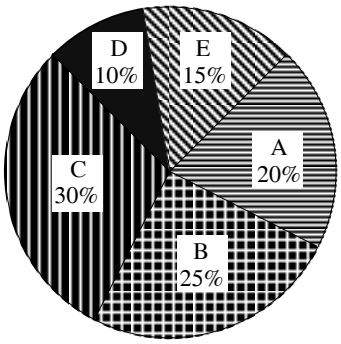
13. $\left(\frac{\cdot86\times\cdot86\times\cdot86-\cdot14\times\cdot14\times\cdot14}{\cdot86\times\cdot86+\cdot86\times\cdot14+\cdot14\times\cdot14}\right) = ?$
    (A) ·72 (B) ·1
    (C) ·32 (D) ·26

14. The cost making an article is divided between materials, labour and overheads in the ratio 3 : 4 : 1. If the materials cost Rs. 11·25. The cost of article is—
    (A) Rs. 33·75 (B) Rs. 45
    (C) Rs. 9·80 (D) Rs. 30

15. A man can row 5 km/hr in still water. If the river is running at 1 km/hr, it takes him 1 hour to row to a place and back. How far is the place ?
    (A) 2·5 km (B) 2·4 km
    (C) 3 km (D) 3·6 km

Directions—(Q. 16 to 19) The following pie-diagram shows the expenditure incurred on the preparation of a book by a publisher under various heads—

(A) Paper 20%
(B) Printing 35%
(C) Binding, Canvassing, Designing etc. 30%
(D) Miscellaneous 10%
(E) Royalty 15%.



Look at the diagram carefully and answer questions.

16. The production of A during the given period is less than that of B by—
    (A) 6·3% (B) 5·9%
    (C) 7·2% (D) 4·8%

17. What is the angle of pie-diagram showing the expenditure incurred on paying the royalty ?
    (A) 24° (B) 48°
    (C) 54° (D) 15°

18. The marked price of a book is 20% more than the C.P. If the marked price of the book be Rs. 30. What is the cost of paper used in a single copy of the book ?
    (A) Rs. 6 (B) Rs. 25
    (C) Rs. 4·50 (D) Rs. 6·50

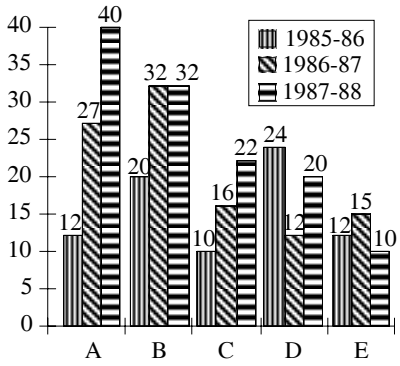
19. Which two expenditures together will form an angle of 108° at the centre of the pie-diagram ?
    (A) A & E (B) B & E
    (C) A & D (D) D & E

20. If the difference between two expenditures be represented by 18° in the pie-diagram these expenditures are—
    (A) B & E
    (B) A & C
    (C) B & D
    (D) None of these

Directions—Examine the following graph carefully and answer

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questions 21 and 22 based on the information given in it.



21. What is the average production (in lakh bales) of these states during 1987-88 ?
(A) 15·6 (B) 24·8
(C) 20·4 (D) 26·5

22. How many states showing below average production in 1985-86 showed above average production in 1986-87 ?
(A) 4 (B) 3
(C) 2 (D) 1

23. Which of the following is a true statements ?
(A) State (A) has produced maximum cotton during the given period
(B) There was no consistent progress shown by C
(C) States A and B showed a steady progress in the production of cotton during the given period
(D) There is no downfall in the production shown by State B

24. The production of A during the given period is less than that of B by—
(A) 6·3% (B) 5·9%
(C) 7·2% (D) 4·8%

25. Admission to a course is increased by 15% every year. If the number of students in this course in 1988 is 1600. What is the expected number of students in 1990 ?
(A) 2080 (B) 2116
(C) 2356 (D) 1960

26. The surface area of a cube is 216 cm^2. What is its volume ?
(A) 1296 cm^3 (B) 648 cm^3
(C) 864 cm^3 (D) 216 cm^3

27. A park square in shape was a 3 metre wide road inside it running along its sides. The area occupied by the road in 1764 square metres what is the perimeter along the outer edge of the road ?
(A) 576 metres
(B) 640 metres
(C) 600 metres
(D) Data inadequate

28. Four of five parts lettered (A), (B), (C), (D) and (E) are exactly equal. Which of the parts is not equal to the other four ? The letter of that part is the answer—
(A) $4\frac{2}{5}$ of 140 + 334 =
(B) 95% of 500 + 50% of 900 =
(C) 1860 + 380 – 1290 =
(D) $2\frac{1}{3}$ of 330 + 180 =
(E) 6·5 × 120 + 2·5 × 80 – 30

29. In the following number series a wrong number is given. Find out that wrong number.
10, 11, 24, 75, 303, 1525, 9156
(A) 24 (B) 1525
(C) 75 (D) 303

30. Three-fifth of two-third of one-sixth of a number is 40, what is thirty per cent of that number ?
(A) 180 (B) 240
(C) 480 (D) 160

31. What approximate value should come in place of the question mark (?) in the following equation ?
137% of 6984 + 2·35 of 140·79 + 1138·65 = ?
(A) 10800 (B) 11000
(C) 9800 (D) 11500

32. What should come in place of question mark (?) in the following equation ?
5·8 × 2·5 + 0·6 × 6·75 + 139·25 = ?
(A) 157·30 (B) 160·30
(C) 157·50 (D) 158·40

33. If 20 men complete a work in 56 days by working 10 hours a day. How many days will 40 men take to complete the same work by working 8 hours a day ?
(A) 30 (B) 25
(C) 48 (D) 35

34. The length of a rectangular plot is sixty per cent more than its breadth. If the difference between the length and breadth of that rectangle is 24 cms, what is the area of that rectangle ?
(A) 2400 sq. cm.
(B) 2560 sq. cm.
(C) 2480 sq. cm.
(D) Data inadequate

35. When the numerator of a certain fraction is increased by 2 and denominator by 1, its value changes to $\frac{1}{2}$, but when the numerator is increased by 3 and denominator by 5, its value then equals to $\frac{2}{5}$. What is the original fraction ?
(A) $\frac{1}{6}$ (B) $\frac{1}{4}$
(C) $\frac{1}{3}$ (D) $\frac{1}{5}$

36. How many different combinations of four letters beginnings with E can be formed from the letters of the word equation ?
(A) 630 (B) 360
(C) 210 (D) 336

37. What will be the ratio of simple interest earned by a certain amount at the same rate of interest for 6 years and that for 9 years ?
(A) 2 : 3
(B) 1 : 4
(C) 1 : 3
(D) Data inadequate

38. The product of two fractions is $\frac{3}{5}$ and the quotient is $\frac{5}{12}$. If the denominator of one is $\frac{1}{3}$ of the other's numerator, which of the following is that pair of fractions ?
(A) $\frac{1}{3}, \frac{9}{5}$
(B) $\frac{1}{2}, \frac{6}{7}$
(C) $\frac{1}{2}, \frac{6}{5}$
(D) Data inadequate

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39. Four of the five parts lettered (A), (B), (C), (D) and (E) in the following equations are exactly equal. Which of the part is not equal to the other four ? The letter of that part is the answer—

(A) $9387 - 7284 + 1125 =$

(B) $286 \times 18 - 1680 - 240 =$

(C) $1640 \times 8{\cdot}5 - 90 \times 140 + 1888 =$

(D) $1864 + 1058 + 306 =$

(E) 150% of 10801510 = 108 =

40. At what price should shopkeeper mark a radio that costs him Rs. 1200 in order that he may offer a discount of 20% on the marked price and still make a profit of 25% ?

(A) Rs. 1675 (B) Rs. 1875

(C) Rs. 2025 (D) Rs. 1900

41. A box contains two white balls, three black balls and four red balls. In how many ways can three balls be drawn from the box of atleast one black ball is to be included in the draw ?

(A) 64 (B) 32

(C) 48 (D) 96

42. In the following number series a wrong number is given. Find out that wrong number.

11 207 36 157 57 138 74

(A) 138 (B) 157

(C) 36 (D) 207

43. Jayesh purchased a machine for Rs. 80000 and sent Rs. 5000 to repair and Rs. 1000 on transport and sold it with 25 per cent profit. At what price did he sell the machine ?

(A) Rs. 117500

(B) Rs. 107500

(C) Rs. 106250

(D) Rs. 105100

44. The sum of the digits of a two digit number is one-fourth of the number and the difference between the digits is one-third of the sum of the digits. What is number ?

(A) 36

(B) 48

(C) 54

(D) Data inadequate

45. P can complete a work in 15 days. Q can complete the same work in 10 days. P started working and after 5 days Q joined him. How many days more will they take to complete the remaining work ?

(A) 1 day (B) 2 days

(C) 3 days (D) 4 days

46. The sum of two numbers is three times the smaller number and the difference between them is equal to the smaller number. What is difinitely the bigger number ?

(A) 28

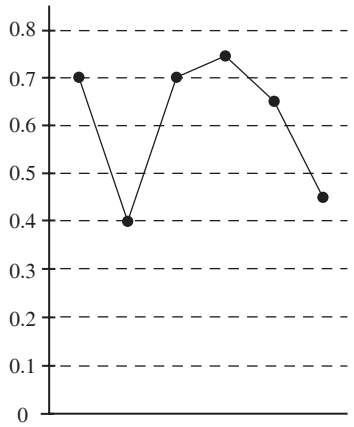
(B) 36

(C) 39

(D) Data inadequate

Directions—(Q. 47–51) Study the following graph carefully and answer the questions given below—

Ratio of Expenditure to Income of a Company over the years



47. If the total expenditure in 1994 and 1995 together was 28 lakhs. What was the total income in these two years ?

(A) 42 lakhs

(B) 36 lakhs

(C) 38 lakhs

(D) Data inadequate

48. In which of the following years was the expenditure minimum with reference to the income in the given years ?

(A) 1996 (B) 1997

(C) 1992 (D) 1995

49. If the expenditure in 1995 was 26 lakhs and income in 1996 was 50 lakhs. What was the difference between the expenditure of these two years ?

(A) 1 lakh

(B) 2 lakhs

(C) 3 lakhs

(D) None of these

50. If the income in 1993 was Rs. 14 lakhs. What was the expenditure in that year ?

(A) 9·8 lakhs

(B) 9·1 lakhs

(C) 8·4 lakhs

(D) Data inadequate

51. What was the percentage increase in income from 1992 to 1993 ?

(A) 30

(B) 75

(C) 70

(D) Data inadequate

Directions—(Q. 52 to 62) Find the approximate value which should replace the question mark (?) in each of the following question.

52. $6{\cdot}595 \times 1084 + 2568{\cdot}34 - 1708{\cdot}34 = ?$

(A) 6000 (B) 12000

(C) 10000 (D) 8000

53. Four-fifth of three-eight of a number is 24. What is 250 per cent of that number ?

(A) 100 (B) 160

(C) 120 (D) 200

54. The average of 17 numbers is 45. The average of first 9 of these numbers is 51 and the last 9 of these numbers is 36. What is the ninth number ?

(A) 14

(B) 16

(C) 22

(D) None of these

55. Four of five parts lettered (A), (B), (C), (D) and (E) are exactly equal. Which of the parts is not equal to the other four ? The letter of that part is the answer.

(A) $16{\cdot}80 \times 4{\cdot}50 + 44 =$

(B) $1600 \div 40 + 16 \times 2{\cdot}5 =$

(C) $5{\cdot}5 \times 8{\cdot}4 + 34{\cdot}6 =$

(D) $1620 \div 20 - 1 =$

(E) $1856{\cdot}95 - 1680 - 65 - 96{\cdot}3 =$

56. Arun borrowed a sum of money from Jayant at the rate of 8

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p.c.p.a. simple interest of the first four years. 10 p.c.p.a. for the next six years and 12 p.c.p.a. for the period beyond ten years. If he pays a total of Rs. 12160 as interest only at the end of 15 years, how much money did he borrow ?

(A) Rs. 8000

(B) Rs. 10000

(C) Rs. 12000

(D) Rs. 9000

57. Four of the five parts lettered (A), (B), (C), (D) and (E) are exactly equal. Which of the parts is not equal to the other four ? The letter of the part is the answer.

$$\frac{(a+b)(a-2b)}{A} = \frac{a^2-b(a+2b)}{B}$$

$$= \frac{a^2b^2-ab-3b^2}{C} = \frac{(a+b)(a-b)+ab}{D}$$

$$= \frac{(a-b)^2\, b\,(a+3b)}{E}$$

58. The average age of 24 students and the class teacher is 16 years. If the class teacher's age is excluded the average reduces by one year. What is the age of the class teacher ?

(A) 50 years

(B) 45 years

(C) 40 years

(D) Data inadequate

59. What should come in place of the question mark (?) in the following equation ?

5679 + 1438 – 2015 = ?

(A) 5192 (B) 5012

(C) 5102 (D) 5002

60. The ratio between the length and breadth of rectangular plot is 7 : 5. If the perimeter of the plot is 144 metres. What is its area ?

(A) 1320 sq. metres

(B) 1260 sq. metres

(C) 1280 sq. metres

(D) 1380 sq. metres

61. What approximate value should come in place of the question mark (?) in the following question ?

159% of 6531·8 + 5·5 × 1015·2 = ? = 5964·9

(A) 10000 (B) 10900

(C) 11000 (D) 10600

Directions—(Q. 62 to 66) In each of the following question a number series is given. After the series below it a number is given followed by a, b, c, d and e. You have to complete the series starting with the number given following the sequence of the given series. Then answer the question given below it.

62. 11 15 38 126

7 a b c d e

Which of the following will come in place of (c) ?

(A) 102 (B) 30

(C) 2140 (D) 80

63. 2 3 8 27

5 (a) (b) (c) (d) (e)

Which of the following will come in place of (e) ?

(A) 184 (B) 6

(C) 925 (D) 45

(E) 14

64. 2 3 9 40·5

4 (a) (b) (c) (d) (e)

Which of the following will come in place of (b) ?

(A) 486 (B) 81

(C) 3645 (D) 18

(E) 6

65. 12 28 64 140

37 (a) (b) (c) (d) (e)

Which of the following will come in place of (e) ?

(A) 1412 (B) 164

(C) 696 (D) 78

(E) 340

66. 5 12 60 340

7 (a) (b) (c) (d) (e)

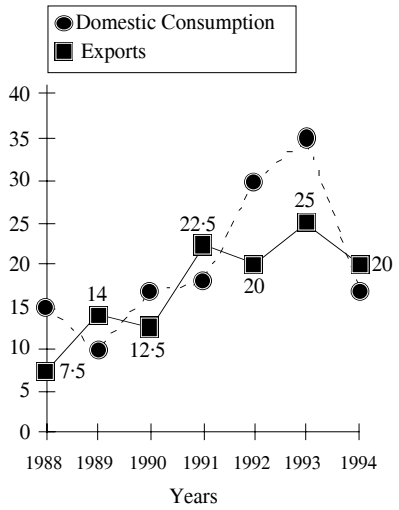
Which of the following will come in place of (d) ?

(A) 172 (B) 3222

(C) 1012 (D) 20164

(E) 28

Directions—(Q. 67 to 71) Study the following graph carefully and answer the questions given above—



67. In which of the following years was the total of the exports and domestic consumption highest among the given years ?

(A) 1991 (B) 1993

(C) 1994 (D) 1992

68. The difference between the domestic consumption between 1990 and 1991 was exactly equal to the difference in exports between which of the following pairs of years ?

(A) 1991 and 1992

(B) 1989 and 1991

(C) 1988 and 1990

(D) 1991 and 1993

69. If there was 40 per cent increase in the domestic consumption from 1994 to 1995. What would have been the difference between the domestic consumption and exports in 1995 ?

(A) 5000 tonnes

(B) 7000 tonnes

(C) 8500 tonnes

(D) Data inadequate

70. In which of the following years was the percentage fluctuation (increase/decrease) in exports the maximum from the previous year ?

(A) 1989 (B) 1991

(C) 1994 (D) 1992

71. What was the difference between the average domestic consumption and the average exports of the given years ?

(A) 2000 tonnes

(B) 3000 tonnes

(C) 2500 tonnes

(D) None of these

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Directions—(Q. 72–75) Study the following table carefully and answer the question given below—

Subjects							
Student Sub.	**History**	**Science**	**Geography**	**English**	**Hindi**	**Maths**	**Total**
Total Marks	**150**	**200**	**150**	**200**	**100**	**200**	**1000**
A	75	110	90	140	75	170	**660**
B	105	130	75	130	85	140	**660**
C	95	105	80	150	90	160	**680**
D	85	115	95	125	65	135	**620**
E	115	135	110	145	70	125	**700**
F	120	160	96	110	55	145	**686**

72. What was the difference between the percentage of marks obtained by student B in History and the percentage of marks obtained by student C in Hindi ?
(A) 25 (B) 20
(C) 35 (D) 30

73. The marks obtained by student A in Maths were how many times the percentage of marks obtained by student F in Science ?
(A) 2·5 (B) 4·125
(C) 1·125 (D) 21·25

74. What was the difference between the percentage of marks obtained by student C in English and average percentage of marks of all the six subjects ?
(A) 82 (B) $38\frac{1}{3}$
(C) 7 (D) 14

75. In how many of the given subjects did students D get marks more than seventy per cent ?
(A) None (B) One
(C) Two (D) Three

76. Approximately what was the average percentage of marks obtained by the six students in English ?
(A) 67
(B) 72
(C) 80
(D) Data inadequate

77. Four of the five parts lettered (A), (B), (C), (D) and (E) are exactly equal. Which of the parts is not equal to the other four ? The letter of that part is the answer.

$$\frac{40\% \text{ of } 160 + \frac{1}{3} \text{ of } 240}{A} = \frac{120\% \text{ of } 1200}{B}$$

$$= \frac{38 \times 12 - 39 \times 8}{C}$$

$$= \frac{1648 - 938 - 566}{D}$$

$$= \frac{6\frac{1}{2} \text{ of } 140 - 2{\cdot}5 \times 306{\cdot}4}{E}$$

78. Assuming A, B and C are different single digit numerical values other than. What is already used in following equation ? What number C definitely cannot be ?
8A2 + 3B5 + C4 = 1271
(A) 7
(B) 9
(C) Either 7 or 9
(D) 6

79. The difference between the digits of a two digit number is one-ninth of the difference between the original number and the number obtained by interchanging the position of the digits. What is definitely the sum of the digits of that number ?
(A) 5
(B) 14
(C) 12
(D) Data inadequate

80. When 35 per cent of a number is added to another number the second number increases by its 20 per cent. What is the ratio between the second number and the first number ?
(A) 4 : 7
(B) 7 : 4
(C) 8 : 5
(D) Data inadequate

81. The sum of three consecutive even numbers is 14 less than one-fourth of 176. What is the middle number ?
(A) 8
(B) 10
(C) 6
(D) Data inadequate

82. The ratio between the per cent age of P and Q is 5 : 8. After four years the ratio between their age will be 2 : 3. What is Q's age at present ?
(A) 36 years
(B) 20 years
(C) 24 years
(D) None of these

83. Two-fifth of thirty per cent of one-fourth of a number is 15. What is 20 per cent of that number ?
(A) 90 (B) 150
(C) 100 (D) 120

84. The price of four tables and seven chairs is Rs. 12090. Approximately what will be the price of such twelve tables and twenty one such chairs ?
(A) Rs. 32000
(B) Rs. 46000
(C) Rs. 38000
(D) Rs. 36000

85. If the price of 253 pencils is Rs. 4263·05. What will be the approximate value of 39 such pencils ?
(A) Rs. 650 (B) Rs. 550
(C) Rs. 450 (D) Rs. 700

86. The perimeter of a rectangle is equal to the perimeter of a right angle triangle of height 12 cm. If the base of the triangle is equal to the breadth of the rectangle. What is the length of the rectangle ?
(A) 18 cms
(B) 24 cms
(C) 22 cms
(D) Data inadequate

87. What should come in place of the question mark (?) in the following equation ?
$18\frac{2}{5}$ of 150·8 + ? = 8697·32 – 3058·16
(A) 2764·44
(B) 2864·34

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(C) 1864·44

(D) None of these

88. The squared value of the diagonal of a rectangle $(64 + x^2)$ sq. cm. where x is less than 8 cm. What is the length of that rectangle ?

(A) 6 cms

(B) 10 cms

(C) 8 cms

(D) Data inadequate

89. Jaydeep purchased 25 kg of rice at the rate of Rs. 16·50 per kg and 35 kg of rice at the rate of Rs. 24·50 per kg. He mixed the two and sold the mixture. Approximately at what price per kg did he sell the mixture to make 25 per cent profit ?

(A) Rs. 26·50 (B) Rs. 27·50

(C) Rs. 28·50 (D) Rs. 30·00

90. In the following number series a wrong number is given. Find out that wrong number.

8, 14, 26, 48, 98, 194, 386

(A) 194 (B) 98

(C) 14 (D) 48

91. What approximate value should come in place of the question mark (?) in the following equation ?

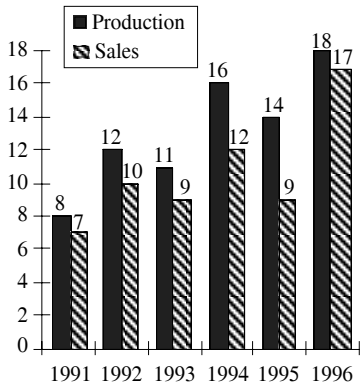
$3\frac{3}{5}$ of 157·85 + 39% of 1847 = ? – 447·30

(A) 1200 (B) 1500

(C) 1600 (D) 1800

Directions—(Q. 92–96) Study the following graph carefully and answer the question given below. (in lakh tonnes)

Amount of production and sales by a company over the years



92. What was the difference between the sales of 1992 and 1995 ?

(A) 10 lakh tonnes

(B) 50 thousand tonnes

(C) 1 lakh tonnes

(D) 75 thousand tonnes

93. The total sales of 1991 and 1992 together were approximately what percentage of the sales in 1994 ?

(A) 140 (B) 120

(C) 160 (D) 130

94. What was the approximate percentage increase in production from 1993 to 1994 ?

(A) 6 (B) 45

(C) 35 (D) 40

95. The percentage of sales to production was maximum in which of the following years ?

(A) 1992 (B) 1994

(C) 1996 (D) 1991

96. What was the percentage drop in sales from 1992 to 1993 ?

(A) 1 (B) 10

(C) 20 (D) 15

97. The ratio between the ages of Rati and Madhuri is 4 : 5 and the ratio between the ages of Madhuri and Kajri is 5 : 6. If the sum of their ages is 60 years, what is the age of Kajri ?

(A) 20 years (B) 16 years

(C) 28 years (D) 24 years

98. $\frac{1}{5}$ of boys and $\frac{1}{4}$ of girls of a class participated in swimming while $\frac{2}{3}$ of boys and $\frac{3}{5}$ of girls participated in sports. If total number of students in the class was 65, how many girls participated in sports ?

(A) 12

(B) 4

(C) 16

(D) Data inadequate

99. If $\frac{1}{14}$ of a number is 12. What will be 150% of the same number ?

(A) 180

(B) 252

(C) 420

(D) Data inadequate

100. What should be added to 20272 so that the result may be divisible by 13 ?

(A) 8 (B) 9

(C) 11 (D) 13

Answers with Hints

1. (C) Let the ten's digit be x and the unit digit by y.

Then, $x + y = 9$ and $10x + y - 9 = 10y + x$

Solving, $x + y = 9$ and $x - y = 1$

We get $x = 5$ and $y = 4$

The no. $10x + y = 10 \times 5 + 4 = 54$.

2. (C) Let the C.P. be Rs. x

Then, $x + \frac{1}{4}x = 240$

or $x = \left(\frac{240 \times 4}{5}\right) = \text{Rs. } 192$

3. (D) Suppose (8×5) *i.e.*, 40 lemons be bought.

Then, C.P. = Rs. 8 and S.P. = Rs. $\left(\frac{3}{8} \times 40\right)$

= Rs. 15

$\therefore$ Gain % = $\left(\frac{7}{8} \times 100\right)\%$

= $87\frac{1}{2}\%$

4. (B) A beats B by 10 sec.

Distance covered by B in 10 sec. $\left(\frac{1000}{200} \times 10\right)$

= 50 metres

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5. (B) $(6 \times 42) + 4 \times x = (38{\cdot}9 \times 10)$

or $x = 34{\cdot}25.$

6. (D) $\frac{1}{\sqrt{3}} = \frac{1}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{3}}{3} = \frac{1{\cdot}732}{3} = 0{\cdot}577$

7. (C) $\frac{\sqrt{1008}}{7} = \sqrt{\left(\frac{1008}{7}\right)} = \sqrt{144} = 12.$

8. (B) $3{\cdot}\overline{57} = 3\frac{57}{99} = \frac{354}{99}$

9. (D) Clearly $[(99)^2 - 9999] = 198$

$\therefore$ Required number $= (9999 - 198) = 9801$

10. (B) Work done in 5 days $= 5\left(\frac{1}{20} + \frac{1}{25}\right) = \frac{9}{20}$

Remaining work $= \left(1 - \frac{9}{20}\right) = \frac{11}{20}$

This work will be finished by A in $\left(\frac{11}{20} \times 20\right)$

$= 11$ days

11. (B) Volume of lead $= \pi h\,(R^2 - 1^2)$

$= \frac{22}{7} \times 35 \times [(1{\cdot}2)^2 - (1)^2]$

$= 48{\cdot}4$ cu. cm.

$\therefore$ Weight of lead $= (48{\cdot}4 \times 5)$ gms $= 242$ gms

12. (C) Let the price of Rs. 100 share be Rs. x.

Then income on Rs. x = Rs. 12.

Income on an investment of Rs. 100

$= \left(\frac{12}{x} \times 100\right)\%$

$\therefore$ $\frac{1200}{x} = 15$

or $x = 80$

13. (A) Given expression $= \frac{a^3 - b^3}{(a^2 + ab + b^2)} = (a - b)$

$= (0{\cdot}86 - 0{\cdot}14) = 0{\cdot}72$

14. (D) Ratio of materials and total cost = 3 : 8

$\therefore$ 3 : 8 :: 11·25 : x

or $x = \frac{8 \times 11{\cdot}25}{3}$

$=$ Rs. 30

15. (B) Man's rate down stream = 6 km/hr

Man's rate upstream = 4 km/hr

Let the distance be x km.

Then $\frac{x}{6} + \frac{x}{4} = 100\ x = 2{\cdot}4$ km

16. (B) Required percentage $= \left(\frac{5}{84} \times 100\right)\%$

$= 5{\cdot}9\%.$

17. (C) Required angle $= \left(\frac{15}{100} \times 360°\right) = 54°.$

18. (B) Let the C.P. of the book be Rs. x.

Then 120 : 100 = 30 : x

$\therefore$ $x = \frac{100 \times 30}{120} =$ Rs. 25

Thus, C.P. of the book = Rs. 25

$\therefore$ Cost of paper used = (20% of Rs. 25) = Rs. 5.

19. (C) $108° = \left(\frac{108}{360} \times 100\right)\%$

$= 30\%$

So, A and D together will form an angle of 108°.

20. (D) $18° = \left(\frac{18}{36} \times 100\right)\%$

$= 5\%.$

21. (B) Average production in 1987-88

$= \frac{40 + 32 + 22 + 20 + 10}{5} = 24{\cdot}8$ lakh bales.

22. (D) Average production in 1985-86 is 15·6.

Average production in 1986-87 is 20·4.

States showing below average production in 1986-87 are A, C and E.

States showing above average production in 1986-87 are A and B.

So, the required type of states is A only.

23. (D) Production by A is 79 lakh bales while production by B during this period is 84 lakh bales. So (A) is false. Statements (B) and (C) are clearly false.

Also, (D) is clearly true.

24. (B) Required percentage $= \left(\frac{5}{84} \times 100\right)\%$

$= 5{\cdot}9\%.$

25. (D) $6a^2 = 226$

or $a^2 = 36$

or $a = 6$

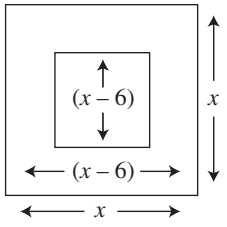
$\therefore$ Volume of the cube $= (6)^3$ cm^3 $= 216$ cm^3

26. (B) Required number of students

$= 1600 \times \left(1 + \frac{15}{100}\right)^2$

$= \left(1600 \times \frac{23}{20} \times \frac{23}{20}\right) = 2116$

27. (C)



$\therefore$ $2 \times (x \times 3) + 2 \times (x - 6) \times 3 = 1764$

or $6x + 6x - 36 = 1764$

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or $12x = 1800$

$\therefore \quad x = \frac{1800}{12} = 150$

$\therefore$ Perimeter $= 4 \times x$

$= 4 \times 150$

$= 600$

28. (B) (A) $= 4\frac{2}{5}$ of $140 = 334$

$= \frac{22}{5} \times 140 + 334 = 950$

(B) $=$ 95% of 500 + 50% of 900

$= \frac{95 \times 500}{100} + \frac{50 + 900}{100}$

$= 475 + 450 = 925$

(C) $= 1860 + 380 - 1290 = 950$

(D) $= 2\frac{1}{3}$ of $330 + 180$

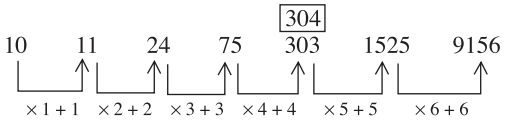
$= \frac{7}{3} \times 330 + 180$

$= 770 + 180 = 950$

(E) $= 6{\cdot}5 \times 120 + 2{\cdot}5 \times 80 - 30$

$= 780 + 200 - 30 = 950$

29. (D)



$\therefore$ The wrong number is 303.

30. (A) Let the number be x.

$\therefore \quad \frac{3}{5}$ of $\frac{2}{3}$ of $\frac{1}{6}$ of $x = 40$

or $x = 40 \times 15 = 600$

$\therefore \quad 30\%$ of $600 = \frac{30}{100} \times 600 = 180$

31. (B) ? $=$ 137% of 6984 + 2·35 of 140·79 + 1138·65

$=$ 9568·08 + 330·8565 + 1138·65

$=$ 11037·5865 = 11000 (Approx.)

32. (C) ? $= 5{\cdot}8 \times 2{\cdot}5 + 0{\cdot}6 \times 6{\cdot}75 + 139{\cdot}25$

$= 14{\cdot}5 + 4{\cdot}05 + 139{\cdot}25 = 157{\cdot}5$

33. (D) If 20 men working 10 hours a day complete a work in 56 days.

$\therefore$ 1 man working 1 hour a day complete a work

$= 56 \times 20 \times 10$

$\therefore$ 40 men working 8 hours a day complete a work

$= \frac{56 \times 20 \times 10}{40 \times 8} = 35$ days

34. (B) Let the breadth of the plot be x metres.

$\therefore \quad$ Length $= x \times \frac{(100 + 60)}{100} = \frac{8}{5}x$ metres

$\therefore \quad \frac{8x}{5} - x = 24$

or $\frac{3x}{5} = 24$

$\therefore \quad x = 24 \times \frac{5}{3} = 40$ cm

and $\frac{8x}{5} = \frac{8 \times 40}{5} = 64$ cm

$\therefore$ Area $= 64 \times 40 = 2560$ cm^2

35. (D) Let the fraction be $\frac{x}{y}$.

$\therefore \quad \frac{x+2}{y+1} = \frac{1}{2}$

or $2x + 4 = y + 1$

or $2x - y = 3$ …(i)

and $\frac{x+3}{y+5} = \frac{2}{5}$

or $5x + 15 = 2y + 10$

or $5x - 2y = -5$ …(ii)

On solving equations (i) and (ii), we get

$x = 1$

and $y = 5$

$\therefore$ Reqd. fraction is $= \frac{1}{5}$.

36. (C) Reqd. number of combinations

$= {}^{7}p_{4} = 7 \times 6 \times 5 = 210$

37. (A) S.I. for years $= \frac{p \times 6 \times r}{100}$

and S.I. for a years $= \frac{p \times 9 \times r}{100}$

$\therefore$ Reqd. ratio $= \frac{p \times 6 \times r}{100} \times \frac{100}{p \times 9 \times r} = 2 : 3$

38. (C)

39. (D) (A) $= 9387 - 7284 + 1125 = 3228$

(B) $= 286 \times 18 - 1680 - 240 = 3228$

(C) $= 1640 \times 8{\cdot}5 - 90 \times 140 + 1888 = 3228$

(D) $= 1864 + 1058 + 306 = 3228$

(E) $=$ 150% of 1080 + 1510 + 108 = 3238

40. (B) C.P. of the radio $=$ Rs. 1200

and Profit $=$ 25%

S.P. $= 1200\left(\frac{100 + 25}{100}\right)$

$=$ Rs. 1500

If M.P. be Rs. 100 then, S.P. after discount

$= 100 - 20 =$ Rs. 80

If Rs. 80 is S.P. then M.P. $=$ Rs. 100

$\therefore$ If Rs. 1500 S.P. the, M.P. $= \frac{100 \times 1500}{80}$

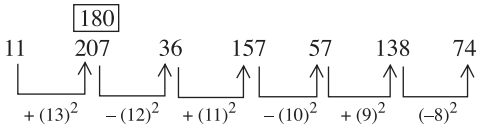
$=$ Rs. 1875

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41. (A) The reqd. number of ways

$$= {}^3C_1 \times {}^6C_2 + {}^3C_2 \times {}^6C_1 + {}^3C_3$$
$$= 3 \times 15 + 3 \times 6 + 1$$
$$= 45 + 18 + 1 = 64$$

42. (D)



Therefore, the number 207 is wrong and it should be replaced by 180.

43. (B) Total cost of machine

$$= \text{Rs. } 80000 + \text{Rs. } 5000 + \text{Rs. } 1000$$
$$= \text{Rs. } 86000$$

$\therefore$ S.P. of machine

$$= \text{Rs. } 86000 \times 1{\cdot}25$$
$$= \text{Rs. } 107500$$

44. (D) Let the number be $10x + y$.

$\therefore$ According to question,

$$(10x + y) = \frac{(10x + y)}{4} = \frac{10x - y}{3}$$

or
$$10x + y = \frac{30x + 3y + 40x - 4y}{12}$$
$$10x + y = \frac{70x - y}{12}$$
$$120x + 12y = 70x - y$$
$$50x + 13y = 0$$

45. (D)
$$\text{P's one day work} = \frac{1}{15}$$
$$\text{Q's one day work} = \frac{1}{10}$$
$\therefore$
$$\text{P's five day work} = \frac{5}{15} = \frac{1}{3}$$
$\therefore$
$$\text{Remaining work} = 1 - \frac{1}{3} = \frac{2}{3}$$
$\therefore$
$$\text{(P + Q)'s one day work} = \frac{1}{15} + \frac{1}{10}$$
$$= \frac{2+3}{30} = \frac{5}{30} = \frac{1}{6}$$

$\therefore$ Remaining work can be completed by both in

$$\frac{2}{3} \times \frac{6}{1} = 4 \text{ days}$$

46. (D) Let the smaller number be x and the bigger number be y, then

$$x + y = 3x$$
$$y - x = x$$

Therefore,
$$y = 3x$$

and so the value of x and cannot be calculated. Hence, the data is inadequate.

47. (D) Since the expenditure of each year that is 1994 and 1995 is not given separately. Hence, their income cannot be calculated as the data is inadequate.

48. (C) The expenditure was minimum with the income in 1992.

49. (D)
$$\text{Expenditure in 1995} = 26 \text{ lakhs}$$
$$\text{Expenditure in 1996} = (50 \times 0{\cdot}55) \text{ lakhs}$$
$$= 27{\cdot}5 \text{ lakhs}$$
$\therefore$
$$\text{Required difference} = (27{\cdot}5 - 26) \text{ lakhs}$$
$$= 1{\cdot}5 \text{ lakhs}$$

50. (A)
$$\text{Income in 1993} = 14 \text{ lakhs}$$
$$\frac{\text{Expenditure}}{\text{Income}} = 0{\cdot}7$$
$\therefore$
$$\text{Required expenditure} = 14 \times 0{\cdot}7 = 9{\cdot}8 \text{ lakhs}$$

51. (D) Since in the graph only ratio of expenditure to income is given so the data is inadequate to answer the question.

52. (D)
$$6{\cdot}595 \times 1084 + 2568{\cdot}34 - 1708{\cdot}34 = ?$$
$$7148{\cdot}98 + 2568{\cdot}34 - 1708{\cdot}34 = ?$$
$$? = 7148{\cdot}98 + 2568{\cdot}34 - 1708{\cdot}34$$
$$? = 7150 + 2568 - 1708$$
$$= 9718 - 1708 = 8010 = 8000$$

53. (D) Let the number be x.

$$\frac{4}{5} \text{ of } \frac{3}{8} \text{ of } x = 24$$

or
$$\frac{4}{5} \times \frac{3}{8} \times x = 24$$

or
$$3x = 24 \times 10$$
$$x = \frac{24 \times 10}{3} = 80$$

$\therefore$
$$250\% \text{ of } x = 250\% \text{ of } 80$$
$$= \frac{250 \times 80}{100} = 200$$

54. (D)
$$\text{Total sum of 17 numbers} = 45 \times 17 = 765$$
$$\text{Total sum of Ist 9 numbers} = 9 \times 51 = 459$$
$$\text{Total sum of last 9 numbers} = 9 \times 36 = 324$$
$\therefore$
$$\text{Required number} = (459 + 324) - 765$$
$$= 783 - 765 = 18$$

55. (C)
(A) $16{\cdot}80 \times 4{\cdot}50 + 4{\cdot}4 = 80$
(B) $1600 \div 40 + 16 \times 2{\cdot}5 = 80$
(C) $5{\cdot}5 \times 8{\cdot}4 + 34{\cdot}6 = 80{\cdot}8$
(D) $16{\cdot}20 \div 20 - 1 = 80$
(E) $1856{\cdot}95 - 1680{\cdot}65 - 96{\cdot}3 = 80$

Therefore, the required answer is part C.

56. (A) Let the principal amount be Rs. P.

$$\frac{P \times 8 \times 4}{100} + \frac{P \times 10 \times 6}{100} + \frac{P \times 12 \times 5}{100} = 12160$$
$$\frac{32P}{100} + \frac{60P}{100} + \frac{60P}{100} = 12160$$
$$152\,P = 1216000$$
$$P = \frac{1216000}{152}$$
$$= \text{Rs. } 8000$$

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57. (D) (A) $(a + b)(a - 2b) = a^2 - ab - 2b^2$

(B) $a^2 - b(a + 2b) = a^2 - ab - 2b^2$

(C) $a^2 + b^2 - ab - 3b^2 = a^2 - ab - 2b^2$

(D) $(a + b)(a - b) + ab = a^2 - b^2 + ab$

(E) $(a - b)^2 - b(a - 3b) = a^2 - ab - 2b^2$

Therefore, the required answer is part D.

58. (C) Total age of 24 students and the class teacher

$= 16 \times 25 = 400$ years

Total age of 24 students $= 24 \times (16 - 1)$

$= 24 \times 15 = 360$ years

$\therefore$ Age of the class teacher $= 400 - 360$

$= 40$ years

59. (C) $? = 5679 + 1438 - 2015$

$? = 7117 - 2015$

$? = 5102$

60. (B) Let the length and breadth of the rectangular plot be $7x$ m and $5x$ m respectively.

Perimeter $= 2(l + b)$

$144 = 2(7x + 5x)$

$144 = 24x$

$x = 6$ metres

Length $= 7x$

$= 7 \times 6 = 42$ metres

Breadth $= 5x$

$= 5 \times 6 = 30$ metres

Reqd. area $= (42 \times 30)$ sq. m.

$= 1260$ sq. m^2

61. (A) 159% of $6531{\cdot}8 + 5{\cdot}5 \times 1015{\cdot}2 = ? + 5964{\cdot}9$

$\frac{159 \times 6531{\cdot}8}{100} + 5{\cdot}5 \times 1015{\cdot}2 = ? + 5964{\cdot}9$

$10385{\cdot}562 + 5583{\cdot}6 = ? + 5964{\cdot}9$

$15969{\cdot}162 = ? + 5964{\cdot}9$

$? = 15969{\cdot}162 - 5964{\cdot}9$

$= 1004{\cdot}262 = 10000$

62. (A) 11 15 38 126

$\times 1 + 4$ $\times 2 + 8$ $\times 3 + 12$

Similarly,

a	b	c	d	e
7	11	30	102	424	2140

$\times 1 + 4$ $\times 2 + 8$ $\times 3 + 12$ $\times 4 + 16$ $\times 5 + 20$

Therefore, the number 102 will come in place of (c).

63. (C) 2 3 8 27

$\times 1 + 1$ $\times 2 + 2$ $\times 3 + 3$

Similarly,

a	b	c	d	e
5	6	14	45	184	925

$\times 1 + 1$ $\times 2 + 2$ $\times 3 + 3$ $\times 4 + 4$ $\times 5 + 5$

Therefore, the number 925 will come in place of (e).

64. (D) 2 3 9 40·5

$\times 1{\cdot}5$ $\times 3$ $\times 4{\cdot}5$

Similarly,

a	b	c	d	e
4	6	18	81	486	3645

$\times 1{\cdot}5$ $\times 3$ $\times 4{\cdot}5$ $\times 6$ $\times 7{\cdot}5$

Therefore, the number 18 will come in place of (b).

65. (A) 12 28 64 140

$\times 2 + 4$ $\times 2 + 8$ $\times 2 + 12$

Similarly,

a	b	c	d	e
37	78	164	340	696	1412

$\times 2 + 4$ $\times 2 + 8$ $\times 2 + 12$ $\times 2 + 16$ $\times 2 + 20$

Therefore, the number 1412 will come in place of (e).

66. (B) 5 12 60 340

$\times 4 - 8$ $\times 4 + 12$ $\times 6 - 20$

Similarly,

a	b	c	d
7	20	92	532	3222

$\times 4 - 8$ $\times 4 + 12$ $\times 6 - 20$ $\times 6 + 30$

Therefore, the number 3222 will come in place of (d).

67. (B) Total of the exports and domestic consumption

In 1988 $=$ (7·5 + 15) thousand tonnes

$=$ 22·5 thousand tonnes

In 1989 $=$ (10 + 15) thousand tonnes

$=$ 25 thousand tonnes

In 1990 $=$ (12·5 + 17·5) thousand tonnes

$=$ 30 thousand tonnes

In 1991 $=$ (20 + 22·5) thousand tonnes

$=$ 42·5 thousand tonnes

In 1992 $=$ (20 + 30) thousand tonnes

$=$ 50 thousand tonnes

In 1993 $=$ (25 + 35) thousand tonnes

$=$ 60 thousand tonnes

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In 1994 = (15 + 20) thousand tonnes
= 35 thousand tonnes

Clearly the exports and domestic consumption is highest in 1993.

68. (A) Domestic consumption in 1990
= 12·5 thousand tonnes

Domestic consumption in 1991
= 22·5 thousand tonnes

∴ Difference = (22·5 – 12·5) thousand tonnes
= 10 thousand tonnes

Export in 1991 = 20 thousand tonnes

Export in 1992 = 30 thousand tonnes

∴ Difference = (30 – 20) thousand tonnes
= 10 thousand tonnes

Therefore, the required answer is 1991 and 1992.

69. (D) Since the domestic consumption and export in 1995 is not given hence the data is inadequate to answer the question.

70. (C)

Year	Fluctuations in Exports from Previous Year (Increase/Decrease)
1989	10 – 15 = – 5
1990	17·5 – 10 = 7·5
1991	20·0 – 17·5 = 2·5
1992	30 – 20·0 = 10
1993	35 – 30 = 5
1994	15 – 35 = –20

Clearly, the fluctuation in exports is maximum in 1994 from previous year.

71. (D) Average domestic consumption

$$= \frac{7{\cdot}5 + 10 + 17{\cdot}5 + 20 + 30 + 35 + 15}{7}$$

$$= \frac{142{\cdot}5}{7} = 20{\cdot}35 \text{ thousand tonnes}$$

∴ Difference = (20·35 – 17·5) thousand tonnes
= 2·85 thousand tonnes = 2850 tonnes

72. (B) Percentage of marks obtained by student B in History

$$= \frac{105}{150} \times 100 = 70\%$$

Percentage of marks obtained by student C in Hindi

$$= \frac{90}{100} \times 100 = 90\%$$

∴ Required difference = (90 – 70) = 20

73. (D) Percentage of marks obtained by student F in Science

$$= \frac{160}{200} \times 100 = 80\%$$

Required answer $= \frac{170}{80} = 21{\cdot}25$

74. (C) Percentage of marks obtained by student C in English

$$= \frac{150}{200} \times 100 = 75\%$$

Average percentage of marks obtained by C in all the six subjects

$$= \frac{680}{1000} \times 100 = 68\%$$

∴ Required difference = 75 – 68 = 7

75. (A) Percentage of marks obtained by student D

In History $= \frac{85}{150} \times 100 = 56{\cdot}66\%$

In Science $= \frac{115}{200} \times 100 = 57{\cdot}5\%$

In Geography $= \frac{95}{100} \times 100 = 47{\cdot}5\%$

In English $= \frac{125}{200} \times 100 = 62{\cdot}5\%$

In Hindi $= \frac{65}{100} \times 100 = 65\%$

In Maths $= \frac{135}{200} \times 100 = 67{\cdot}5\%$

Hence, it is clear that student D got more than 70% in none of the subjects.

76. (A) Average percentage of marks obtained by six students in English

$$= \left(\frac{70 + 65 + 75 + 62{\cdot}5 + 72{\cdot}5 + 55}{6}\right)\%$$

$$= \frac{400}{6} = 67\%$$

77. (B) (A) $40\% \text{ of } 160 + \frac{1}{3} \text{ of } 240 = 144$

(B) $120\% \text{ of } 1200 = 1440$

(C) $38 \times 12 - 39 \times 8 = 144$

(D) $1648 - 938 - 566 = 144$

(E) $6\frac{1}{2} \text{ of } 140 - 2{\cdot}5 \times 306{\cdot}4 = 144$

Therefore, the required answer is part B.

78. (A)

8 A 2 + 3 B 5 + C 4 = 1271

Step. 1 : 2 + 5 + 4 = 11

Step 2 : 8 + 3 = 11

From above it is clear that (A + B + C) must be equal to 16. Since the digits 1234567 and 8 are already used in equation. Therefore, only single digit number which can be used for AB and C is 6 and 9. Hence in place of C we cannot use the number 7.

79. (D) Let the two digits number be xy that is $10x + y$.

$$10x - y = \frac{1}{9}[10x + y - 10y - x]$$

or $$10x - y = \frac{1}{9}[10x + y - 10y - x]$$

or $$10x - y = \frac{1}{9}[9x - 9y]$$

or $$10x - y = x - y$$

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Since the number of equations formed is one and the number of unknown quantities are two, therefore we can't calculate the required answer. Hence, data is inadequate.

80. (B) Let the first number be x and the second number be y.

$$0{\cdot}35x + y = 1{\cdot}2y$$

or $$0{\cdot}35x = 1{\cdot}2y - y$$

or $$0{\cdot}35x = 0{\cdot}20y$$

$$y = \frac{0{\cdot}35}{0{\cdot}20} = \frac{35}{20} = \frac{7}{4}$$

Thus, $$y : x = 7 : 4.$$

81. (B) Let the three consecutive even numbers be x $(x + 2)$ and $(x + 4)$.

$$x + x + 2 + x + 4 = \frac{176}{4} - 14$$

$$3x + 6 = 44 - 14$$

$$3x = 30 - 6$$

$$x = \frac{24}{3} = 8$$

The middle number is $x + 2$ that is

$$8 + 2 = 10.$$

82. (D) $$\frac{P}{Q} = \frac{5}{8}$$

$\Rightarrow$ $$8P = 5Q \quad \ldots(i)$$

$$\frac{P+4}{Q+4} = \frac{2}{3}$$

$$3P + 12 = 2Q + 8$$

$$3P - 2Q = -4 \quad \ldots(ii)$$

After putting the value of P from equation (i) and (ii) we get

$$3\left(\frac{5Q}{8}\right) - 2Q = -4$$

$$\frac{15}{8}Q - 2Q = -4$$

or $$15Q - 16Q = -32$$

$$-Q = -32$$

$$Q = 32 \text{ years}$$

83. (C) Let the number be x.

$$\frac{2}{5} \text{ of } 30\% \text{ of } \frac{1}{4} \text{ of } x = 15$$

or $$\frac{2}{5} \times \frac{30}{100} \times \frac{1}{4} \times x = 15$$

or $$3x = 1500$$

$\therefore$ $$x = 500$$

$\therefore$ $$20\% \text{ of } x = \frac{20 \times 500}{100}$$

$$= 100$$

84. (D) $4T + 7C = \text{Rs. } 12090$

$\therefore$ $3(4T + 7C) = \text{Rs. } 3 \times 12090$

$$12T + 21C = \text{Rs. } 36270$$

$$= \text{Rs. } 36000$$

85. (A) Required value $= \left(\frac{4263{\cdot}05}{253} \times 39\right)$

$$= \text{Rs. } 657{\cdot}15$$

$$\simeq \text{Rs. } 650$$

86. (D) $2x + 2y = 12 + y + \sqrt{(12)^2 + y^2}$

The number of equation formed is one and the number of unknown quantities are two. Therefore, we cannot calculate the required answer. Hence, data is inadequate.

87. (D) $18\frac{2}{5} \text{ of } 150{\cdot}8 + ? = 8697{\cdot}32 - 3058{\cdot}16$

$$\frac{92}{5} \times 150{\cdot}8 + ? = 8697{\cdot}32 - 3058{\cdot}16$$

$$2774{\cdot}72 + ? = 5639{\cdot}16$$

$$? = 5639{\cdot}16 - 2774{\cdot}72$$

$$= 2864{\cdot}44$$

88. (C) Length and breadth of a rectangle are different from one another length is always more than the breadth. Since the square of diagonal

$$= (\text{length})^2 + (\text{breadth})^2$$

$\therefore$ $(\text{length})^2 + (\text{breadth})^2 = (64 + x^2)$

$$= (8^2 + x^2)$$

So, length will be 8 cm.

89. (A) Cost price per kg of mixture

$$= \frac{25 \times 16{\cdot}50 + 35 \times 24{\cdot}50}{(25 + 35)}$$

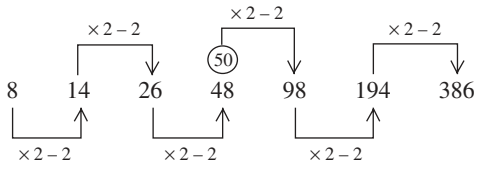
$$= \text{Rs. } 21{\cdot}16$$

For 25% profit the selling price of mixture

$$= \text{Rs. } 21{\cdot}16 \times 1{\cdot}25 = \text{Rs. } 26{\cdot}45$$

$$= \text{Rs. } 26{\cdot}50$$

90. (D)



$\therefore$ The wrong term is 48.

91. (D) $3\frac{3}{5} \text{ of } 157{\cdot}85 + 39\% \text{ of } 1847 = ? - 447{\cdot}30$

$$\frac{18}{5} \times 157{\cdot}85 + \frac{39 \times 1847}{100} = ? - 447{\cdot}30$$

$$1288{\cdot}59 = ? - 447{\cdot}30$$

$$? = 1288{\cdot}59 - 447{\cdot}30$$

$$= 1735{\cdot}89$$

$$= 1800$$

92. (C) Sales in 1992 = 10 lakh tonnes

Sales in 1995 = 9 lakh tonnes

$\therefore$ Required difference = (10 – 9) lakh tonnes

= 1 lakh ton

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93. (A) Sales in 1991 = 7 lakh tonnes

Sales in 1992 = 10 lakh tonnes

∴ Combined sales of 1991 and 1992

= (7 + 10) lakh tonnes

= 17 lakh tonnes

Sales in 1994 = 12 lakh tonnes

∴ Required percentage $= \frac{17}{12} \times 100$

$= 141{\cdot}66 = 140\%$

94. (B) Production in 1993 = 11 lakh tonnes

Production in 1994 = 16 lakh tonnes

∴ Required percentage $= \left(\frac{16-11}{11}\right) \times 100$

$= 45{\cdot}45\% \simeq 45\%$

95. (C) The percentage of sales to production in 1991

$$\frac{7}{8} \times 100 = 87{\cdot}5$$

The percentage of sales to production in 1992

$$\frac{10}{12} \times 100 = 83{\cdot}3$$

The percentage of sales to production in 1993

$$\frac{9}{11} \times 100 = 81{\cdot}8$$

The percentage of sales to production in 1995

$$\frac{9}{14} \times 100 = 64{\cdot}2$$

The percentage of sales to production in 1996

$$\frac{17}{18} \times 100 = 94$$

Hence, the percentage of sales to production was maximum in 1996.

96. (B) Required percentage drop

$$= \frac{(10-9)}{10} \times 100 = 10\%$$

97. (D) Ratio between the ages of Rati, Madhuri and Kajri = 4 : 5 : 6

∴ Sum of ratios = 4 + 5 + 6 = 15

∴ Age of Kajri $= \frac{6}{15} \times 60$

= 24 years

98. (D)

99. (B) Let the number be x.

∴ $\frac{1}{14}$ of $x = 12$

or $x = 12 \times 14 = 168$

∴ 150% of 168 $= \frac{168 \times 150}{100}$

$= 252$

100. (D) If 20272 is divided by 13 the remainder is 5. Hence, from the number 20272 if (13 – 5) *i.e.*, 8 is added then the result will be completely divisible by 13.

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