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*ETHIOPIAN SECONDARY SCHOOL LEAVING CERTIFICATE EXAMINATION*

*(ESSLCE)*

*MATHEMATICS FOR NATURAL SCIENCE, TAHISAS 2014/15 (DECEMBER 2022)*

**BOOKLET CODE: 052**

**SUBJECT CODE: 02**

**TIME ALLOWED: 3:00 HOURS**

**GENERAL DIRECTIONS**

THIS BOOKLET CONTAINS ***MATHEMATICS*** EXAMINATION FOR THE ***NATURAL SCIENCE*** **CANDIDATES ONLY**. THE CODE FOR THIS SUBJECT IS **02** AND THE CODE FOR THIS PARTICULAR BOOKLET IS **052**. PLEASE COPY THESE CODES ON YOUR ANSWER SHEET WHERE IT READS ***BOOKLET CODE*** AND ***SUBJECT CODE***. THEN, BLACKEN THE CORRESPONDING BOXES IN THE COLUMNS BELOW EACH NUMBER.

IN THIS EXAMINATION THERE ARE A TOTAL OF **65 MULTIPLE CHOICE ITEMS**. CAREFULLY SELECT THE BEST ANSWER FROM THE SUGGESTED OPTIONS AND BLACKEN ONLY THE LETTER OF YOUR CHOICE ON THE SEPARATE ANSWER SHEET PROVIDED. FOLLOW THE INSTRUCTIONS ON THE EXAMINATION PAPER AND THE ANSWER SHEET CAREFULLY. USE ONLY **PENCIL** TO MARK YOUR ANSWERS. YOUR ANSWER MARK SHOULD BE **HEAVY** AND **DARK**, COVERING THE ANSWER SPACE COMPLETELY. PLEASE ERASE ALL UNNECESSARY MARKS COMPLETELY INCLUDING ANSWERS YOU HAVE CHANGED FROM YOUR ANSWER SHEET.

YOU ARE ALLOWED TO WORK ON THE EXAM FOR **3 HOURS**. WHEN TIME IS CALLED, YOU MUST IMMEDIATELY STOP WORKING, PUT YOUR PENCIL DOWN, AND WAIT FOR FURTHER INSTRUCTIONS.

ANY FORM OF CHEATING OR AN ATTEMPT TO CHEAT IN THE EXAMINATION WILL RESULT IN AN AUTOMATIC DISMISSAL FROM THE EXAMINATION HALL AND CANCELLATION OF YOUR SCORE(S).

PLEASE MAKE SURE THAT YOU HAVE WRITTEN ALL THE REQUIRED INFORMATION ON THE ANSWER SHEET BEFORE YOU START TO WORK ON THE EXAMINATION

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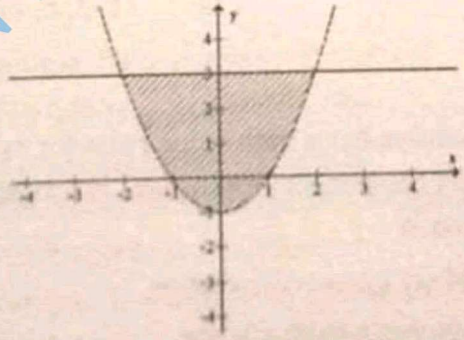
ETHIOPIAN SECONDARY SCHOOL LEAVING CERTIFICATE EXAMINATION (ESSLCE)
*TAHISAS 2014/15 (DECEMBER 2022)*

**BOOKLET CODE: 052** **SUBJECT CODE: 02**
**Number of Items: 65** **Time Allowed: 3 hours**

1. Which of the following is **NOT** a property of the Mean of a given numerical data?
   A. It is affected if a non-zero constant is added to each value.
   B. An extreme value usually affects the mean of the data.
   C. The mean of a collected data is always a single value.
   D. It is the middle value of all the values when arranged in order.

2. Let $f(x) = \sqrt{x+3} + \sin(x-1)$. Then $f'(1) =$ _____.
   A. $\frac{5}{4}$ C. $\frac{1}{4}$
   B. $\frac{3}{4}$ D. $\frac{3}{2}$

3. A relation R is described by the shaded region of the following graph. Which one of the following pairs of sets are the domain and the range of the relation R respectively?



   A. $(-2, 2)$ and $(-1, 3)$ C. $(-2, 2)$ and $[-1, 3]$
   B. $(-2, 2)$ and $(-1, 3]$ D. $[-2, 2]$ and $[-1, 3]$

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# 2014/15 EUEE Maths second round Exam solution

* Feyisa Hailu (Qubee Academy channel owner)

① ANSWER: D

② Given $f(x) = \sqrt{x+3} + \sin(x-1)$, $f'(1) = ?$

$$f'(x) = \left[(x+3)^{1/2} + \sin(x-1)\right]'$$

$$= \frac{1}{2}(x+3)^{-1/2}(x+3)' + (\cos(x-1))(x-1)'$$

$$= \frac{1}{2}(x+3)^{-1/2} + \cos(x-1)$$

then $f'(1) = \frac{1}{2}(1+3)^{-1/2} + \cos(1-1)$

$$= \frac{(4)^{-1/2}}{2} + \cos 0 = \cancel{2+1=3}$$

$$= \frac{1}{2} * \frac{1}{(4)^{1/2}} + 1$$

$$= \frac{1}{2} \cdot \frac{1}{2} + 1 = \frac{1}{4} + 1 = \frac{1+4}{4} = 5/4$$

ANSWER: A

③ ANSWER: B (I think the parabola is broken line).

④ ANSWER: B (velocity of a moving car is a vector quantity)

⑤

$$\Rightarrow \frac{x^2+x}{2-2x} \div \frac{x^2+2x+1}{x^2-1} - x$$

$$\Rightarrow \frac{x(x+1)}{2(1-x)} \div \frac{(x+1)(x+1)}{(x-1)(x+1)} - x \Rightarrow \frac{x(x+1)}{2(1-x)} * \frac{(x-1)(x+1)}{(x+1)(x+1)} - x$$

$$\Rightarrow \frac{x(x+1)}{-2(x-1)} * \frac{(x-1)}{(x+1)} - x \Rightarrow \frac{-x}{2} - x \Rightarrow \frac{-x-2x}{2} = \frac{-3x}{2}$$

ANSWER: D

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4. Which one of the following is a vector quantity?
   A. Size of a plantation farm.
   B. Velocity of a moving car.
   C. Volume of a normal size bottle.
   D. Amount of fat in one liter of milk.

5. For $x \neq -1$ and $x \neq 1$, the simplified form of $\left(\frac{x^2+x}{2-2x} \div \frac{x^2+2x+1}{x^2-1}\right) - x$ is:
   A. $\frac{1}{2(x+1)}$
   B. $-\frac{1-x}{2}$
   C. $\frac{3}{2}x$
   D. $-\frac{3}{2}x$

6. Let A be the set of prime numbers less than 11 and B be the set of positive factors of 21. Which one of the following sets is the symmetric difference of A and B (A Δ B)?
   A. {3, 7}
   B. {1, 2, 5}
   C. {1, 3, 7, 21}
   D. {1, 2, 5, 21}

7. If a compound proposition has a truth value False for every assignment of truth value to all of its component propositions involved, then the negation of the give proposition is
   A. neither a tautology nor a contradiction
   B. both a tautology and a contradiction
   C. a contradiction
   D. a tautology

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⑥ Given

$A = \{2,3,5,7\}$ , $B = \{1,3,7,21\}$

then $A \Delta B = (A \cup B) \setminus (A \cap B)$

$A \cup B = \{1,2,3,5,7,21\}$

$A \cap B = \{3,7\}$

$A \Delta B = (A \cup B) \setminus (A \cap B) = \{1,2,5,21\}$

ANSWER: D

⑦ ANSWER: D

⑧ Given $z = 1 + \sqrt{-4}$ and $w = 3 - 2i$, then $zw = ?$

$z = 1 + 2i$ , $w = 3 - 2i$

$zw = (1+2i)(3-2i) = 3 - 2i + 6i + 4$

$= 7 + 4i$

∴ ANSWER: A

⑨ Given $(x-2)^2 + (y+4)^2 = 1$

center $C(h,k) = (2,-4)$, radius $= r = 1$ , $\theta = \pi/3$

When we want to rotate a circle about the origin through angle $\theta$, we only rotate the centre of the circle. by using the formula

$x' = x\cos\theta - y\sin\theta$

$y' = x\sin\theta + y\cos\theta$.

thus $x' = 2\cos\pi/3 - (-4)\sin\pi/3 = 1 + 4 * \sqrt{3}/2 = 1 + \sqrt{3}/2$

$y' = 2\sin\pi/3 + (-4)\cos\pi/3 = 2 * \sqrt{3}/2 - 4 * 1/2 = \sqrt{3} - 2$

then the image of the circle is

$(x - 1 - \sqrt{3}/2)^2 + (y - \sqrt{3} + 2)^2 = 1$

ANSWER: B

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8. Let $z = 1 + \sqrt{-4}$ and $w = 3 - 2i$. Then zw is equal to.

A. $7 + 4i$
B. $-1 + 4i$
C. $-3 - 2i$
D. $-1 - 8i$

9. Which one of the following is an equation of the image of the circle, with equation $(x-2)^2 + (y+4)^2 = 1$ in rotation about the origin through $\frac{\pi}{3}$?

A. $(x-\sqrt{3}+2)^2 + (y-1-2\sqrt{3})^2 = 1$
B. $(x-1-2\sqrt{3})^2 + (y-\sqrt{3}+2)^2 = 1$
C. $(x+4)^2 + (y-2)^2 = 1$
D. $(x-4)^2 + (y+2)^2 = 1$

10. Which of the following statement is **NOT** true?

A. $\sin^{-1}x = y$ if and only if $x = \sin y$ for $-\frac{\pi}{2} \le y \le \frac{\pi}{2}$
B. $\cos^{-1}x = y$ if and only if $x = \cos y$ for $0 \le y \le \pi$
C. $\tan^{-1}x = y$ if and only if $x = \tan y$ for $y \in \mathbb{R}$
D. $\cos^{-1}x = y$ if and only if $x = \cos$ for $0 \le x \le \pi$

11. Which of the following defines an ellipse in a plane?

A. The locus of all points such that the difference of the distances from two given points in the plane is a constant.
B. The locus of all points such that the sum of the distances from two given points in the plane is a constant.
C. The locus of all points whose distance from two given fixed points in the plane is a constant.
D. The locus of all points in the plane whose distance from a fixed point is a constant.

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15. Which one of the following matrices is the augmented matrix of the system

$$\begin{aligned} -x + 2y - 4 &= 0 \\ 2x - 3y &= 5 \\ -y + 2z &= 0 \end{aligned} \quad ?$$

A. $\left(\begin{array}{ccc|c} -1 & 2 & -4 & 0 \\ 2 & -3 & 0 & 5 \\ 0 & -1 & 2 & -1 \end{array}\right)$

C. $\left(\begin{array}{ccc|c} -1 & 2 & 0 & 4 \\ 2 & -3 & 0 & 5 \\ 0 & -1 & 2 & 0 \end{array}\right)$

B. $\left(\begin{array}{ccc|c} -1 & 2 & 0 & -4 \\ 2 & -3 & 0 & 5 \\ 0 & 2 & -1 & 0 \end{array}\right)$

D. $\left(\begin{array}{ccc|c} -1 & 2 & -4 & 0 \\ 2 & -3 & 0 & 5 \\ 0 & 2 & -1 & 0 \end{array}\right)$

16. Given an ellipse with center at C, foci at F and F′, and V and V′ end points of the major axis. Which of the following gives the eccentricity of the ellipse?

A. $\frac{CV}{FV}$

C. $\frac{VV'}{FF'}$

B. $\frac{CF}{FV}$

D. $\frac{CF'}{CV'}$

17. Given a set A = {1, 2, 3} and R = {(x, y)| y ≤ 2x − 3}, a relation on A, which of the following is the inverse of R?

A. {(2, 1), (3, 1), (3, 2), (3, 3)}

B. {(1, 2), (1, 3), (2, 3), (3, 3)}

C. {(2, 1), (2, 3), (3, 1), (3, 3)}

D. {(1, 2), (3, 2), (3, 1), (3, 3)}

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(10) • $\sin^{-1}x = y$ if and only if $x = \sin y$ for $-\pi/2 \le y \le \pi/2$

• $\cos^{-1}x = y$ if and only if $x = \cos y$ for $0 \le y \le \pi$

• $\tan^{-1}x = y$ if and only if $x = \tan y$ for $-\pi/2 < y < \pi/2$

~~and for y ∈ R~~

• $\cos^{-1}x = y$ if and only if $x = \cos y$ for $0 \le y \le \pi$

ANSWER:

(11) ANSWER: B  12. — 13. — 14. —

(15) ANSWER: D

(16) ~~ecente~~

$$\text{eccentricity} = \frac{\text{distance b/n two foci}}{\text{length of the major axis}}$$

$$= \frac{FF'}{VV'} = \frac{CF}{CV} = \frac{CF'}{CV'}$$

ANSWER: D

(17) Given $A = \{1, 2, 3\}$, $R = \{(x,y) \mid y \le 2x - 3\}$,

$R = \{(2,1), (3,1), (3,2), (3,3)\}$

$\therefore R^{-1} = \{(1,2), (1,3), (2,3), (3,3)\}$

ANSWER: B

(18) Given Range $\mathbb{R}$ and domain $\mathbb{R}$

for (A) $f(x) = 2 - |x|$, range $= y \le 2 \ne \mathbb{R}$

(B) $f(x) = x^2 - 1$, range $= y \ge -1 \ne \mathbb{R}$

(C) $f(x) = -1 + e^x$, range $= y \ge 1 \ne \mathbb{R}$

(D) $f(x) = x^3 - 1$, range $= \mathbb{R} = \mathbb{R}$

ANSWER: D

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18. Which one of the following functions is an onto function from $\mathbb{R}$ into $\mathbb{R}$?

A. $f(x) = 2 - |x|$

B. $f(x) = x^2 - 1$

C. $f(x) = -1 + e^x$

D. $f(x) = x^3 - 1$

19. Given the matrix $A = \begin{pmatrix} 3 & -5 & 1 \\ 2 & 0 & 4 \\ -2 & -4 & 5 \end{pmatrix}$, let $M_{ij}$ be the minor of the entry $a_{ij}$ of A and $C_{ij}$ be the cofactor of the entry $a_{ij}$ of A. Which one of the following is correct?

A. $C_{32} = -10$

B. $C_{21} = -21$

C. $M_{31} = 20$

D. $M_{12} = 2$

20. For what value of a constant k is $\det A = -3$, where,

$$A = \begin{pmatrix} 2 & k & 0 \\ 0 & -1 & -3 \\ 1 & k & 5 \end{pmatrix}?$$

A. $-\frac{13}{9}$

B. $-\frac{7}{3}$

C. $\frac{7}{9}$

D. $\frac{7}{3}$

21. If the $10^{th}$ term of an arithmetic sequence $\{A_n\}$ with a common difference 30 is 1300, which one of the following is its $n^{th}$ term?

A. $1060 + 30n$

B. $1000 + 60n$

C. $1030 + 30n$

D. $1000 + 30n$

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(19) Given $A = \begin{pmatrix} 3 & -5 & 1 \\ 2 & 0 & 4 \\ -2 & -4 & 5 \end{pmatrix}$

$C_{22} = (-1)^{2+2}\begin{vmatrix} 3 & 1 \\ -2 & 5 \end{vmatrix} = (1)^4(15+2) = 17$

$C_{32} = (-1)^{3+2}\begin{vmatrix} 3 & 1 \\ 2 & 4 \end{vmatrix} = (-1)^5(12-2) = -10$

$C_{21} = (-1)^{2+1}\begin{vmatrix} -5 & 1 \\ -4 & 5 \end{vmatrix} = (-1)(-15+4) = -1(-11) = 11$

$M_{31} = \begin{vmatrix} -5 & 1 \\ 0 & 4 \end{vmatrix} = (-20-0) = -20$

$M_{12} = \begin{vmatrix} 2 & 4 \\ -2 & 5 \end{vmatrix} = (10+8) = 18$

ANSWER: A

(20) $A = \begin{pmatrix} 2 & k & 0 \\ 0 & -1 & -3 \\ 1 & k & 5 \end{pmatrix}$, $\det A = |A| = -3$

$\begin{vmatrix} 2 & k & 0 \\ 0 & -1 & -3 \\ 1 & k & 5 \end{vmatrix} = 2(-5+3k) - k(0+3) + 0(0+1) = -3$

$= -10 + 6k - 3k = -3$

$= 3k = -3 + 10$

$= 3k = 7$

$= k = 7/3$

ANSWER: D

(21) $A_{10} = 1300$, $d = 30$

$A_n = ?$

from $A_{10}$, $A_n = A_1 + (n-1)d$

$A_{10} = A_1 + (10-1)*30 = 1300$

$A_1 + 9*30 = 1300$

$A_1 = 1300 - 270 = 1030$

then $A_n = A_1 + (n-1)d = 1030 + (n-1)30$

$A_n = 1030 + 30n - 30$

$A_n = 1000 + 30n$

ANSWER: D

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**BOOKLET CODE: 052** **SUBJECT CODE: 02**

22. Given a geometric sequence $\{G_n\}$ such that its first term is 15 and its common ratio $r = -0.25$, which of the following is the $20^{th}$ partial sum of the sequence?

A. $18(1-4^{-20})$
B. $18(1+4^{-20})$
C. $12(1-2^{-40})$
D. $12(1+2^{-40})$

23. In which of the following intervals is there certainly a zero of the function $f(x) = x^4 - 3x^2 + x + 1$?

A. (1, 2)
B. (0, 1)
C. (−1, 0)
D. (−3, −2)

24. Given p = 170, q = 23 and b is a non-negative integer such that $p = b \times q + r$, then which of the following is the value of r?

A. 1
B. 7
C. 11
D. 9

25. If the sum and the product of the roots of the quadratic equation $x^2 + (k + 1)x + mk = 0$ are −3 and 7 respectively, what is the value of $m$?

A. 2
B. $\frac{7}{2}$
C. $-\frac{7}{2}$
D. −2

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(22) Given $G_1 = 15$, $r = -0.25 = -\frac{1}{4}$

$S_{20} = ?$

We know that $S_n = \frac{G_1(r^n - 1)}{r - 1}$

then $S_{20} = \frac{15\left[\left(-\frac{1}{4}\right)^{20} - 1\right]}{-\frac{1}{4} - 1} = \frac{15\left[\left(-2^{-2}\right)^{20} - 1\right]}{\frac{-1-4}{4}}$

$= \frac{15\left[2^{-40} - 1\right]}{-5/4} = -\frac{15*4}{5}\left[2^{-40} - 1\right]$

$= -12\left[2^{-40} - 1\right] = 12\left[1 - 2^{-40}\right]$

ANSWER: C

(23) A function $f(x)$ has at least one zero on interval $(a, b)$ if and only $f(a) < 0$ and $f(b) > 0$ or $f(a) > 0$ and $f(b) < 0$.

thus for choice:

(A) $f(1) = (1)^4 - 3(1)^2 + 1 + 1 = 1 - 3 + 1 + 1 = 0$
since $f(1) = 0$ not certain to have zero between $(1, 2)$

(B) $f(0) = 1$, $f(1) = 0$ } in this case also $f(x)$ has no zero bln $(0, 1)$

(C) $f(-1) = -2$, $f(0) = 1$ } in this case $f(-1) < 0$ and $f(0) > 0$ thus $f(x)$ have zero bln $(-1, 0)$ certainly

(D) $f(-3) = 52 > 0$, $f(-2) = 3 > 0$ } hence $f(x)$ has no zero bln $(-3, -2)$

ANSWER: D

(24) Given $p = 170$, $q = 23$, and $b > 0$

$p = b * q + r$, $r = ?$

from division theorem when we divided $p$ with $q$ and we get quotient $b$ and remainder $r$. we can write it as follows. $\frac{p}{q} = b + \frac{r}{q} \Rightarrow p = b * q + r$, (multiply both side by $q$)

thus in the question $r$ is remainder of $\frac{p}{q} = \frac{170}{23}$
and the remainder is $9$.

ANSWER: D

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BOOKLET CODE: 052 SUBJECT CODE: 02

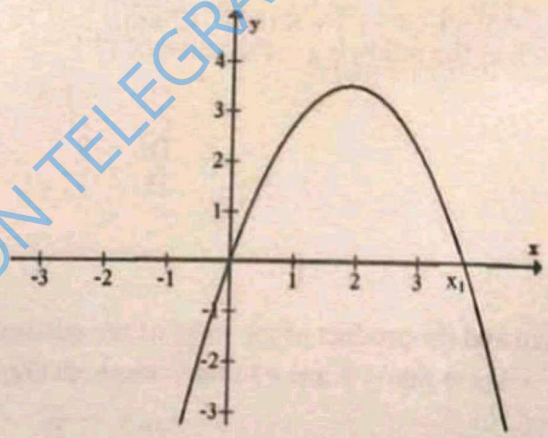
26. If the measure of each interior angle of a regular polygon is 157.5°, what is the number of sides of the polygon?

A. 14
B. 15
C. 16
D. 18

27. A hemispherical container with negligible thickness has a circular edge of perimeter $4\pi$ units. What is the outer surface area of this container?

A. $4\pi$ sq. unit
B. $8\pi$ sq. unit
C. $8\sqrt{2}\,\pi$ sq. unit
D. $16\pi$ sq. unit

28. The following is the graph of the quadratic function $f(x) = -x^2 + bx$. Which of the following is the solution set of the inequality $x^2 - bx > 0$ in the set of all real numbers?




A. $\{x: x < 0 \text{ and } x > x_1\}$
B. $\{x: x < 0 \text{ or } x > x_1\}$
C. $\{x: x \geq 0 \text{ and } x \leq x_1\}$
D. $\{x: x \geq 0 \text{ or } x \leq x_1\}$

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(25) Given equation $x^2 + (k+1)x + mk = 0$

let assume the roots of the equation are $r_1$ and $r_2$

then $r_1 \times r_2 = 7$ and $r_1 + r_2 = -3$

but $r_1 * r_2 = \frac{c}{a} = \frac{mk}{1} = 7 \Rightarrow mk = 7$ ---①

$r_1 + r_2 = -b/a = \frac{-(k+1)}{1} = -3 \Rightarrow k+1 = 3$ ---②

from eqn ② $k+1 = 3$

$\Rightarrow \underline{k = 2}$

then from eqn ① $mk = 7 \Rightarrow m*(2) = 7$

$m = 7/2$

ANSWER: B.

(26) measure of each interior angle $= \frac{(n-2)180^\circ}{n}$

$157.5^\circ \neq \frac{(n-2)180^\circ}{n}$

$157.5n = -360^\circ + 180^\circ n$

$360^\circ = 180^\circ n - 157.5^\circ n$

$360^\circ = 22.5^\circ n$

$n = \frac{360^\circ}{22.5^\circ} = 16$

ANSWER: C

(27) since the hemispherical container has circular edge its perimeter is given as: $P = 2\pi r$

$P = 2\pi r = 4\pi$

$\Rightarrow r = \frac{4\pi}{2\pi} = 2$

thus the hemispherical container has radius $r = 2$

and its surface area is given as:

$S = \frac{4\pi r^2}{2}$, we divide by 2 bic its hemisphere

$S = \frac{4\pi * (2)^2}{2} = \frac{4\pi * 4}{2} = 8\pi$ sq unit

ANSWER: B

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29. Which one of the following radian measures is equal to $60.5°$?

A. $\frac{121}{360}\pi$

B. $\frac{61}{180}\pi$

C. $\frac{5}{12}\pi$

D. $\frac{1}{10}\pi$

30. The simplified form of $\sqrt[3]{-27} \times \sqrt{0.02} \div \sqrt{18}$ is equal to

A. $-10$

B. $-\frac{1}{10}$

C. $\frac{1}{10}$

D. $10$

31. If the sides of a triangle are 8 units, 12 units and 16 units, what is the area of the triangle in square units?

A. $12\sqrt{21}$

B. $36\sqrt{2}$

C. $48$

D. $12\sqrt{15}$

32. Let $u = (-1, 4)$ and $v = (1, -3)$ be vectors in the plane. Which one of the following equal to $u - v$?

A. $(-2, 1)$

B. $(0, 1)$

C. $(-2, 7)$

D. $(0, 7)$

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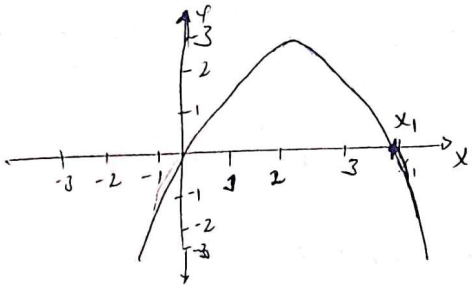
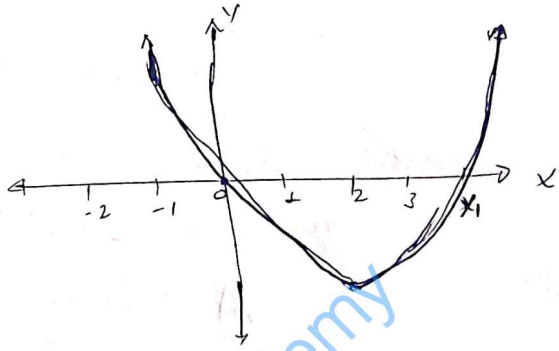
(28) Given $f(x) = -x^2 + 6x$

$x^2 - 6x = -f(x) = -(-x^2 + 6x) = x^2 - 6x$

thus the graph of $f(x) = -x^2 + 6x$ and $g(x) = x^2 - 6x$ is shown below




$f(x) = -x^2 + 6x$




$g(x) = x^2 - 6x$

As you see from graph of $g(x) = x^2 - 6x$, $g(x) > 0$ where

$x < 0$ and $x > x_1$

thus the soln set is: $\{x: x < 0 \text{ and } x > x_1\}$

ANSWER: A.

(29) $60.5°$ to convert degree to radian use the formula

Measure radian $= \frac{\theta * \pi}{180°}$

thus radian $= \frac{60.5° \pi}{180°} = \frac{605\pi}{1800} =$

$= \frac{121\pi}{360}$ //

thus $60.5° = \frac{121\pi}{360}$ radians.

ANSWER: A

(30) $\sqrt[3]{-27} * \sqrt{0.02} \div \sqrt{18} = \sqrt[3]{(-3)^3} * \sqrt{2 \times 10^{-2}} * \frac{1}{\sqrt{2 \times 9}}$

$= -3 * \sqrt{2} * 10^{-1} * \frac{1}{3\sqrt{2}}$

$= -1.0^{-1} = -0.1 = \frac{-1}{10}$

ANSWER: B

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(31) Given, sides of triangle are 8 units, 12 units and 16 units

* We know that if the sides of a triangle is given as a, b, and c then the area of the triangle is given as

$$A = \sqrt{s(s-a)(s-b)(s-c)}, \text{ where } s = \frac{1}{2}(a+b+c)$$

thus $a = 8$, $b = 12$, $c = 16$

then $s = \frac{1}{2}(8+12+16) = \frac{1}{2}(36) = 18$

$$A = \sqrt{18(18-8)(18-12)(18-16)}$$

$$= \sqrt{18(10)(6)(2)}$$

$$= \sqrt{180*12}$$

$$= \sqrt{18*10*4*3} = \sqrt{2*3*3*5*2*2*2*3}$$

$$= \sqrt{2^4*3^2*3*5}$$

$$= 2^2*3\sqrt{15} = 12\sqrt{15} \text{ sq unit.}$$

ANSWER: D

(32) given $U = (-1, 4)$ and $V = (1, -3)$

$$U - V = (-1, 4) - (1, -3) = (-2, 7)$$

ANSWER: C

(33) the equation of the line is given as:

$$L: \quad y - y_0 = m(x - x_0), \quad m = \tan 45^\circ = 1, \quad (x_0, y_0) = (-1, 0)$$

$$y - 0 = 1(x - (-1)) \Rightarrow y = x + 2$$

$$\Rightarrow L: -x + y - 2 = 0$$

then distance from $(3, 1)$ to $L$ is given by,

$$d = \frac{|Ax_0 + By_0 + C|}{\sqrt{A^2 + B^2}}, \text{ where } A = -1, B = 1, C = -2, \quad (x_0, y_0) = (3, 1)$$

$$d = \frac{|-1*3 + 1*1 + (-2)|}{\sqrt{(-1)^2 + (1)^2}} = \frac{|-3 + 1 - 2|}{\sqrt{2}} = \frac{4}{\sqrt{2}} * \frac{\sqrt{2}}{\sqrt{2}} = \frac{4\sqrt{2}}{2}$$

$$= 2\sqrt{2}$$

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**BOOKLET CODE: 052** **SUBJECT CODE: 02**

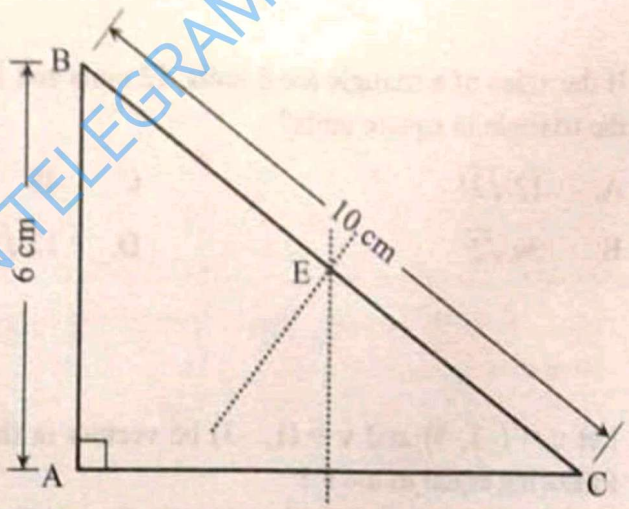
33. The line L through $(-1, 0)$ has angle of inclination $45^\circ$ from the positive x-axis. Which one of the following is the distance from point $(3, 1)$ to L?

A. 3 units
B. $3\sqrt{2}$ units
C. $\frac{3}{2}\sqrt{2}$ units
D. $2\sqrt{3}$ units

34. Given propositions p, q, and r, such that p is False and q is True, which of the following are the truth values of $p \Rightarrow (q \vee r)$ and its converse respectively?

A. True and True
B. True and False
C. False and True
D. False and False

35. In a right angled $\Delta ABC$ shown in the figure below $\angle BAC$ is the right angle. Let E be the point of intersection of the perpendicular bisectors of the sides of the triangle.




If AB = 6 cm and BC = 10 cm, what is the distance between point E and side $\overline{AB}$?

A. $4\sqrt{2}$ cm
B. $3\sqrt{2}$ cm
C. 4 cm
D. 3 cm

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(34) Given $P \equiv F$, $q \equiv T$, $r$ may be T or F.

Since $q \equiv T$, $q \vee r \equiv T$, certainly.

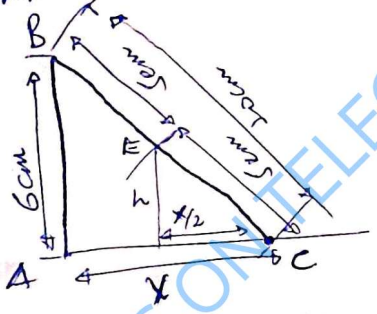
then $p \Rightarrow (q \vee r) \equiv F \Rightarrow T \equiv T$

and its converse is given by

$(q \vee r) \Rightarrow p \equiv T \Rightarrow F \equiv F$

ANSWER: B

(35)




$x = \sqrt{10^2 - 6^2} = 8$, $\frac{x}{2} = 4$,

$h^2 + \left(\frac{x}{2}\right)^2 = 5^2 \Rightarrow h^2 = 5^2 - 4^2 \Rightarrow h = \sqrt{25-16}$

$h = \sqrt{9} = 3$ = distance between point E and side $\overline{AB}$

ANSWER: D.

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BOOKLET CODE: 052 SUBJECT CODE: 02

36. Suppose f and g are continuous functions at a point $x_0$ and $k$ is a positive constant, which one of the following may NOT be continuous at $x_0$?

A. $f \cdot g - k$

B. $(f + k) \cdot g$

C. $\frac{f - g}{g + k^2}$

D. $\frac{f + k}{g^2 + k}$

37. The coordinates of the point that divides the line segment joining the points P $(a, b)$ and Q $(-a, -b)$, where $a, b > 0$, in the ratio 3:2 from Q is:

A. $\left(\frac{1}{5}a, \frac{1}{5}b\right)$

B. $\left(\frac{2}{5}a, \frac{2}{5}b\right)$

C. $\left(-\frac{2}{5}a, -\frac{2}{5}b\right)$

D. $\left(-\frac{1}{5}a, -\frac{1}{5}b\right)$

38. Which one of the following is a correct statement about the function $f(x) = x^3 - 3x^2 + 3x$?

A. It is decreasing on the interval $[1, \infty)$

B. It is increasing only on the interval $(-\infty, 1]$

C. The graph of f is concave upward on the interval $[1, \infty)$

D. The graph of f has no inflection point.

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39. Which one of the following is equal to $\int_0^1 (x+1)e^{-x}\,dx$ ?

A. $-1+\frac{3}{e}$

B. $1-\frac{3}{e}$

C. $-2+\frac{3}{e}$

D. $2-\frac{3}{e}$

40. What is the value of the constant $k$ so that the function

$$f(x)=\begin{cases}\frac{x^2-3x}{\sin x}, & x\neq 0\\ k+1, & x=0\end{cases}$$ is continuous at 0?

A. $-3$

B. $-4$

C. 0

D. 2

41. Which one of the following sequences is convergent?

A. $\left\{\frac{3^n+5^n}{15^n}\right\}$

B. $\left\{\frac{1}{n}+\cos n\pi\right\}$

C. $\left\{\left(-\frac{1}{2}\right)^{1-n}\right\}$

D. $\left\{(-1)^n\frac{n+1}{n}\right\}$

42. Which of the following is the solution set of $\log(1-\frac{3}{x})+2\log x=1$?

A. $\{-2, 5\}$

B. $\{-5, -2\}$

C. $\{-2\}$

D. $\{5\}$

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(39) $\int_0^1 (x+1)e^{-x}dx = \int_0^1 xe^{-x}dx + \int_0^1 e^{-x}dx$

Let first integrate each of them differently.

$\int xe^{-x}dx$ by using tabular form.

| Repeated derivative | | repeated anti-derivative |
|---|---|---|
| $x$ | + → | $e^{-x}$ |
| $1$ | − → | $-e^{-x}$ |
| $0$ | | $e^{-x}$ |

$\int xe^{-x}dx = -xe^{-x} - e^{-x} + c$ and $\int e^{-x}dx = -e^{-x} + c$

then $\int_0^1 xe^{-x}dx + \int_0^1 e^{-x}dx$

$\Rightarrow [-xe^{-x} - e^{-x} + c]\Big|_0^1 + [-e^{-x} + c]\Big|_0^1$

$\Rightarrow [(-e^{-1} - e^{-1}) - (-e^{0}) + (-e^{-1}) - (-e^{0})]$

$\Rightarrow -2e^{-1} + 1 - e^{-1} + 1 = \underline{-3e^{-1} + 2} = 2 - \frac{3}{e}$

ANSWER: D

(40) $f(x) = \begin{cases} \frac{x^2 - 3x}{\sin x}, & x \neq 0 \\ k+1, & x = 0 \end{cases}$ is continuous at 0

since $f(x)$ is continuous at $x=0$, $\lim_{x\to 0^-} f(x) = \lim_{x\to 0^+} f(x) = f(0)$

$\Rightarrow \lim_{x\to 0} \frac{x^2 - 3x}{\sin x} = k+1$

$\Rightarrow \lim_{x\to 0} \frac{x^2}{\sin x} - \lim_{x\to 0} \frac{3x}{\sin x} = k+1$,

$\lim_{x\to 0} x \cdot \frac{x}{\sin x} = \lim_{x\to 0} x \lim_{x\to 0} \frac{x}{\sin x}$

$= 0$

and $\lim_{x\to 0} \frac{3x}{\sin x} = \lim_{x\to 0} \left[\frac{3}{\left(\frac{\sin x}{x}\right)}\right] = 3$

$\Rightarrow 0 - 3 = k+1$

$\Rightarrow \underline{k = -4}$

ANSWER: B.

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(41) A Given sequence is convergent if the limit of the ~~sequence~~ sequence approaches to some constant value as $n$ approaches to infinite.

thus (A) $\lim_{n\to\infty} \frac{3^n+5^n}{15^n} = \lim_{n\to\infty} \frac{3^n}{15^n} + \lim_{n\to\infty} \frac{5^n}{15^n} = \lim_{n\to\infty} \left(\frac{3}{15}\right)^n + \lim \left(\frac{5}{15}\right)^n$

$= \lim_{n\to\infty} \left(\frac{1}{5}\right)^n + \lim_{n\to\infty} \left(\frac{1}{3}\right)^n = 0$

(B) $\lim_{n\to\infty} (-1/2)^{1-n} = \lim_{n\to\infty} (-1/2)^1 \cdot \lim_{n\to\infty} (-1/2)^{-n} = -\frac{1}{2} \lim (-2)^n = -\infty$

(C) $\lim_{n\to\infty} \left\{\frac{1}{n} + \cos n\pi\right\} = \lim_{n\to\infty} \frac{1}{n} + \lim_{n\to\infty} \cos(n\pi)$

doesn't exist blc $\lim_{n\to\infty} \cos(n\pi)$ doesn't exist.

ANSWER: (A)

(42) Given $\log(1-3/x) + 2\log x = 1$

$\Rightarrow$ by properties of logarithm function. $\log a + \log b = \log ab$

$\Rightarrow \log(1-3/x) + \log x^2 = 1$

$\Rightarrow \log\left(1-\frac{3}{x}\right)(x^2) = 1$

$\Rightarrow \log(x^2-3x) = 1$

$\Rightarrow 10^1 = x^2-3x$

$\Rightarrow 10 = x^2-3x$

$\Rightarrow x^2-3x-10 = 0$

$\Rightarrow x^2+2x-5x-10 = 0$

$\Rightarrow x(x+2)-5(x+2) = 0$

$\Rightarrow (x-5)(x+2) = 0$

$\Rightarrow x = 5$ and $x = -2$

ANSWER: $\{-2, 5\}$

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**BOOKLET CODE: 052** **SUBJECT CODE: 02**

43. $\lim_{x \to 0^-} \frac{2x - x^2}{|x|(x-1)} =$ _____.

A. $-2$ C. $1$

B. $0$ D. $2$

44. Let $u = (3, -5)$ and $v = (-1, -1)$. What is u.v ?

A. $-8$ C. $-4$

B. $2$ D. $4$

45. Given that $f(x) = \frac{5x}{2x+3}$, what is the second derivative of f at x?

A. $60(2x+3)^{-3}$ C. $-60(2x+3)^{-3}$

B. $30(2x+3)^{-2}$ D. $-30(2x+3)^{-2}$

46. The derivative of $f(x) = (1 - \frac{1}{x})\ln x$ is equal to:

A. $\frac{1}{x^2}(x - 1 + \ln x)$ C. $\frac{1}{x^2}(x + 1 - \ln x)$

B. $\frac{1}{x^2}(-x - 1 + x\ln x)$ D. $\frac{1}{x^2}(x - 1 + x\ln x)$

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(43) $\lim_{x\to 0^-} \frac{2x-x^2}{|x|(x-1)}$ = ~~2~~

first of all $\frac{2x-x^2}{|x|(x-1)} = \begin{cases} \frac{2x-x^2}{x(x-1)}, & \text{if } x>0 \\ \text{undefined}, & \text{if } x=0 \\ \frac{2x-x^2}{(-x)(x-1)}, & \text{if } x<0 \end{cases}$

thus $\lim_{x\to 0^-} \frac{2x-x^2}{|x|(x-1)} = \lim_{x\to 0^-} \frac{2x-x^2}{(-x)(x-1)} = \lim_{x\to 0^-} \frac{x(2-x)}{(-x)(x-1)} = \lim_{x\to 0^-} \frac{(2-x)}{-(x-1)} = \frac{2}{1} = 2$

ANSWER: D

(44) Given $u=(3,-5)$ and $v=(-1,1)$.

$u.v = (3,-5).(-1,1) = -3-5 = -8$ //

ANSWER: A

(45) $f(x) = \frac{5x}{2x+3}$, $f''(x) = ?$

$f'(x) = \frac{(5x)'(2x+3) - (5x)(2x+3)'}{(2x+3)^2} = \frac{5(2x+3) - 10x}{(2x+3)^2} = \frac{15}{(2x+3)^2}$

$f''(x) = \frac{-15(2)(2x+3)(2)}{(2x+3)^4} = \frac{-60(2x+3)}{(2x+3)^3(2x+3)} = \frac{-60}{(2x+3)^3}$

$= -60(2x+3)^{-3}$

ANSWER: C

(46) $f(x) = (1-\frac{1}{x})\ln x$

$f'(x) = (1-\frac{1}{x})'\ln x + (1-\frac{1}{x})(\ln x)'$

$= (\frac{1}{x^2}\ln x) + (1-\frac{1}{x})(\frac{1}{x})$.

$= \frac{1}{x^2}\ln x + \frac{1}{x} - \frac{1}{x^2} = \frac{1}{x^2}(\ln x + x - 1)$

$= \frac{1}{x^2}(\ln x + x - 1) = \frac{1}{x^2}(x - 1 + \ln x)$

ANSWER: A

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47. Which one of the following is an anti-derivative of $f(x) = \left(3x - \frac{1}{\sqrt{x}}\right)^2$ for $x > 0$?

A. $3x^2 - 4\frac{\sqrt{x}}{x} + \ln x$

B. $3x^3 - 4x\sqrt{x} + \ln x$

C. $3\left(\frac{3}{2}x^2 - 2\sqrt{x}\right) - 1$

D. $\frac{1}{3}\left(3x - \frac{1}{\sqrt{x}}\right) + 1$

48. A radio-active substance decomposes through time exponentially. The amount present at any time t years is governed by the equation $A(t) = 30e^{-\frac{1}{5}t}$ gm for $t \geq 0$. After how many years will half the initial amount decompose?

A. $5 \ln 4$

B. $4 \ln 5$

C. $2 \ln 5$

D. $5 \ln 2$

49. Which of the following is **NOT** a conclusion of the Rolle's Theorem on a function f in [a, b]?

A. f is not strictly monotonic in (a, b).

B. The graph of f has a horizontal tangent line at some point in (a, b).

C. f has a local extreme value at some point in (a, b).

D. f must have a local max value at some point in (a, b).

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(47) $f(x) = \left(3x - \frac{1}{\sqrt{x}}\right)^2$

$$\int \left(3x - \frac{1}{\sqrt{x}}\right)^2 dx = \int \left(9x^2 - \frac{6x}{\sqrt{x}} + \frac{1}{x}\right) dx = \int \left(9x^2 - 6x^{1/2} + \frac{1}{x}\right) dx$$

$$= \frac{9}{3}x^3 - \frac{6x^{3/2}}{3/2} + \ln|x| + C$$

$$= 3x^3 - 4x^{3/2} + \ln|x| + C$$

$$= 3x^3 - 4x\sqrt{x} + \ln|x| + C$$

ANSWER: B

(48) $A(t) = 30e^{\frac{1}{5}t}$ gm.

initially at $t = 0$

$A(0) = 30e^0 = 30$

then * left of half the initial amount decompose after $t$ years

$A(t) = 30e^{-\frac{1}{5}t}$

$15 = 30e^{-\frac{1}{5}t}$

$\frac{1}{2} = e^{-\frac{1}{5}t}$ take ln both side

$\ln 2^{-1} = \ln e^{-\frac{1}{5}t}$

$-\ln 2 = -\frac{1}{5}t$

$t = 5\ln 2$

ANSWER: D

(49) ANSWER: C

(50)

| Value ($x_i$) | 12 | 14 | 15 | 17 | 18 | 20 |
|---|---|---|---|---|---|---|
| Frequency ($f_i$) | 3 | 2 | 4 | 6 | 3 | 2 |
| cf | 3 | 5 | 9 | 15 | 18 | 20 |
| $x_i - \bar{x}$ | -4 | -2 | -1 | 1 | 2 | 4 |
| $(x_i - \bar{x})^2$ | 16 | 4 | 1 | 1 | 4 | 16 |
| $f_i(x_i - \bar{x})^2$ | 48 | 8 | 4 | 6 | 12 | 32 |

$\sigma^2 = \frac{\sum f_i(x_i - \bar{x})^2}{\sum f_i}$

$\sigma^2 = \frac{111}{20}$

$\sigma^2 = 5.5$

$$\bar{x} = \frac{12*3 + 14*2 + 15*4 + 17*6 + 18*3 + 20*2}{3+2+4+6+3+2} = \frac{320}{20}$$

$\bar{x} = 16$

ANSWER: C

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50. What is the variance of the following grouped distribution?

| Value | 12 | 14 | 15 | 17 | 18 | 20 |
|---|---|---|---|---|---|---|
| Frequency | 3 | 2 | 4 | 6 | 3 | 2 |

A. 5.2
B. 5.4
C. 5.5
D. 5.8

51. Let $a = (1, 3, -1)$ and $b = (2, -1, 1)$ be vectors in space. Which one of the following is **true**?

A. $a - b = (-1, 4, -2)$
B. $a + b = (3, 4, 0)$
C. $3a = (3, 9, 3)$
D. $a + 2b = (5, -1, 1)$

52. The following is a data of production of wheat in quintal per hectare by farmers in a certain community

| Production in quintals | 11 – 15 | 16 – 20 | 21 – 25 | 26 – 30 | 31 – 35 |
|---|---|---|---|---|---|
| Number of farmers | 3 | 8 | 12 | 5 | 4 |

Which of the following is the third quartile of the data?

A. 26.4
B. 26.5
C. 26.7
D. 27

53. Which one of the following are dependent events?

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(51) $a = (1, 3, -1)$, $b = (2, -1, 1)$

$a - b = (1,3,-1) - (2,-1,1) = (-1, 4, -2)$

$a + b = (1, 3, -1) + (2, -1, 1) = (3, 2, 0)$

$3a = 3(1, 3, -1) = (3, 9, -3)$

ANSWER: A

(52) Steps to find quartiles for grouped data.

1- Prepare cumulative frequency distribution.

2- Find the class where the $k^{th}$ quartile belongs. the $\left(\frac{kn}{4}\right)^{th}$ item.

3- Use the formula $Q_k = B_L + \left(\frac{\frac{kn}{4} - C_{fb}}{f_k}\right) i$

(Step 1)

| Production in quintals | 11-15 | 16-20 | 21-25 | 26-30 | 31-35 |
|---|---|---|---|---|---|
| Number of farmers | 3 | 8 | 12 | 5 | 4 |
| $C_f$ | 3 | 11 | 23 | 28 | 32 |

(Step 2)

$\frac{3*32}{4} = 24^{th}$ item

$Q_3$ is $\left(\frac{3*32}{4}\right)^{th}$ item - ie $24^{th}$ item which falls in the $4^{th}$ class. $C_f = 28$, $f_3 = 5$ and $C_{fb} = 23$, $B_L = 25.5$

$i = 5$

then $Q_3 = 25.5 + \left(\frac{24 - 23}{5}\right) * 5$

$Q_3 = 25.5 + 1 = 26.5$

ANSWER:- B.

(53) Dependent Events: Two events are said to be dependent, if the occurrence or non-occurrence of one event affects the result of the first drawn card.

ANSWER: D

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A. In a box of red and blue marbles, getting a red marbles first and a blue marbles next with replacement.

B. From a group of male and another group of female students, selecting a female and a male student.

C. Getting a head and number 3 in tossing a coin and a die once.

D. In throwing two coins once, getting two heads and getting two tails.

54. Given the function $f(x) = 3 - \frac{x^3 - 4x}{x^2 - x}$, which of the following is **NOT** true about the graph of f?

A. It has a hole at $x = 0$.

B. $x = 1$ is a its vertical asymptote.

C. $y = -x + 1$ is its oblique asymptote.

D. It has no horizontal asymptote.

55. Which of the following is equal to $\cos(-570°)$?

A. $\frac{1}{2}$

B. $-\frac{1}{2}$

C. $-\frac{\sqrt{3}}{2}$

D. $\frac{\sqrt{3}}{2}$

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(54) $f(x) = 3 - \frac{x^3-4x}{x^2-x}$

- $f(x) = 3 - \frac{x(x^2-4)}{x(x-1)}$, when $x=0$ the fun has hole
- $x=1$, is a its vertical asymptote.
- the function has no horizontal asymptote since it has obligue asymptote.
- $y=-x+2$ is its obligue asymptote

ANSWER: C

(55) $\cos(-570°) = \cos(570°)$, since cos fun is even fun.

then $\cos(570°) = -\cos(570°-360°) = -\cos(210°) =$

$= -\cos(210°-180°) = -\cos(30°) = -\sqrt{3}/2$

the value is Negative because 570° is found on third quadrant and cos is Negative in III quadrant

ANSWER: e

(56) $z = \frac{2}{1+i}$

$|z| = \left|\frac{2}{1+i}\right| = \frac{|2|}{|1+i|} = \frac{2}{\sqrt{2}} * \frac{\sqrt{2}}{\sqrt{2}} = \frac{2\sqrt{2}}{2} = \sqrt{2}$ //

$Arg\left(\frac{2}{1+i}\right) = Arg(2) - Arg(1+i)$

$= 0 - (\pi/4) = -\pi/4$

Hence, $Arg z = -\pi/4 + 2k\pi$, k is an integer, let $k=1$

$Arg z = -\pi/4 + 2\pi = \frac{-\pi+8\pi}{4} = \frac{7\pi}{4}$

$Arg z = 315°$

then $z = \frac{2}{1+i} = \sqrt{2}(\cos 315° + i \sin 315°)$

ANSWER: D

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56. Which of the following is a polar form of the complex number $z = \frac{2}{1+i}$?

A. $\frac{1}{2}(\cos 45^\circ + i \sin 45^\circ)$

B. $\sqrt{2}(\cos 45^\circ + i \sin 45^\circ)$

C. $\frac{1}{2}(\cos 315^\circ + i \sin 315^\circ)$

D. $\sqrt{2}(\cos 315^\circ + i \sin 315^\circ)$

57. Let $g(x) = \sin(x^2 - 4)$, $f(1) = 2$ and $f'(1) = -1$. The $(g \circ f)'(1)$ is equal to:

A. $-4$

B. $-2$

C. $0$

D. $4$

58. Which of the following is the shortest possible distance from the graph of $f(x) = \sqrt{x+1}$ to the point $(1, 0)$?

A. $\frac{3}{2}$ units

B. $\frac{1}{2}\sqrt{5}$ units

C. $\frac{5}{2}$ units

D. $\frac{1}{2}\sqrt{7}$ units

59. A right circular cone is placed in a cube of edge 12 cm. If the base of the cone is inscribed in the base of the cube and its vertex is at the center of the opposite side of the base of the cube, what is the volume of the cone?

A. $216\sqrt{2}\pi \text{ cm}^3$

B. $216\pi \text{ cm}^3$

C. $144\sqrt{2}\pi \text{ cm}^3$

D. $144\pi \text{ cm}^3$

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(57) $g(x) = \sin(x^2-4)$, $f(1)=2$, $f'(1)=-1$

$(gof)'(1) = (g(f(1))' = g'(f(1)) \cdot f'(1)$

$= g'(2) \cdot f'(1)$, hence $f(1)=2$

$= g'(2) \cdot (-1)$, hence $f'(1)=-1$

$= -g'(2)$

but $g'(x) = (\cos(x^2-4))(2x) = 2x\cos(x^2-4)$

then $g'(2) = 2(2)\cos(2^2-4)$

$= 4\cos(4-4)$

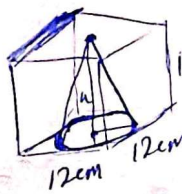
$= 4\cos 0 = \underline{4}$

thus $(gof)'(1) = -g'(2) = \underline{4}$

ANSWER: D

Question 58 lost page.

(59)




, $h = 12cm$

Since the cone is inscribed in a cube edge 12cm, the diameter of the cone is 12cm and its radius is 6cm.

$V = \frac{1}{3}\pi r^2 h = \frac{1}{3} * \pi * (6)^2 * 12$

$= \frac{1}{3} * \pi * 36 \times 12$

$= \underline{144\pi cm^3}$

ANSWER: D

(60) $R = \{1, 2, 3, 4\}$, $B = \{1, 2, 3, 4\}$

$S = \{(1,1),(1,2),(1,3),(1,4),(2,1),(2,2),(2,3),(2,4),(3,1),(3,2),$
$(3,3),(3,4),(4,1),(4,2),(4,3),(4,4)\}$

$E = \{(1,1),(1,3),(1,4),(2,2),(2,3),(2,4),(3,1),(3,2),(3,3),$
$(4,1),(4,2),(4,4)\}$

$P(E) = \frac{n(E)}{n(S)} = \frac{12}{16} = 3/4$ //

ANSWER: B

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BOOKLET CODE: 052 SUBJECT CODE: 02

60. Two group of one red and the other blue colored equal sized piece of papers each labeled 1, 2, 3 and 4, are folded identically. The pieces in each group placed in two different boxes are well shuffled. If one piece is drawn from each box at random, what is the probability that the sum of the pieces drawn is either 5 or an even number?

A. $\frac{1}{2}$ C. $\frac{5}{8}$

B. $\frac{3}{4}$ D. $\frac{9}{16}$

61. What is the image of a line $l$: $y = 2x - 1$ when reflected about the line $y = 2x + 2$?

A. $y = -2x + 5$ C. $y = 2x - 5$

B. $y = 2x + 5$ D. $y = -2x - 5$

62. If $\theta$ is a fourth quadrant angle, which of the following is **NOT** a correct relationship?

A. $\sin(180° - \theta) = \sin\theta$ C. $\cos(\theta - 180°) = \cos\theta$

B. $\sin(\theta - 180°) = -\sin\theta$ D. $\tan(180° - \theta) = -\tan\theta$

63. Consider the equation of the sphere $x^2 + y^2 + z^2 - 2x + 2y - 4z + 5 = 0$. What are its center and radius respectively?

A. (1, –1, 2) and 1 C. (–1, 1, 2) and $\sqrt{5}$

B. (1, 1, –2) and 1 D. (–1, 1, 2) and $\sqrt{5}$

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(61) $l : y = 2x - 1$ → the line to to be reflected

$L : y = 2x + 2$ → the reflection line.

Since, $l$ and $L$ is parallel the slope of image of $l$ is '2'

Now to find find the image of $l$, let take one point from $y = 2x - 1$ → $(0, -1)$ then find the image of $(0, -1)$

Step 1 take slope of the reflection line $m = 2$

Step 2 find the the equation of line by using $m = -1/2$ and passe through $(0, -1)$

$$y - (-1) = -\frac{1}{2}(x - 0) \Rightarrow y + 1 = -\frac{1}{2}x$$
$$\Rightarrow y = -\frac{1}{2}x - 1$$

Step 3 find the intersection point of $y = -1/2x - 1$ and $y = 2x + 2$

$$\Rightarrow -\frac{1}{2}x - 1 = 2x + 2$$
$$\Rightarrow -\frac{1}{2}x - 2x = 3$$
$$\Rightarrow \frac{-x - 4x}{2} = 3$$
$$\Rightarrow -5x = 6 \Rightarrow x = -6/5$$

then $y = 2(-6/5) + 2 = \frac{-12}{5} + 2 = \frac{-12 + 10}{5} = -2/5$

thus, the intersection point is $(-6/5, -2/5)$

the $(-6/5, -2/5)$ is the mid point of $P$ and $P'$

thus, let $P'(a, b)$ is the image of $(0, -1)$

$$\Rightarrow \frac{a + 0}{2} = -6/5 \quad , \quad \frac{b + (-1)}{2} = -2/5$$
$$\Rightarrow \frac{a}{2} = -6/5 \quad , \quad b - 1 = -4/5$$
$$\Rightarrow a = -12/5 \quad , \quad b = -4/5 + 1 = 1/5$$

Now, find equation of line by using slope $m = 2$, and passes through $(-12/5, 1/5)$

$$\Rightarrow y - 1/5 = 2(x - (-12/5))$$
$$y - 1/5 = 2x + 24/5$$
$$y = 2x + 24/5 + 1/5 = 2x + 25/5$$
$$y = 2x + 5$$

ANSWER: B

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(62) $\theta$ is a fourth quadrant angle.

Means that only $\cos\theta$ is Positive

thus * $\sin(180-\theta) = \sin180\cos\theta - \sin\theta\cos180$

$= -(\sin\theta)(-1) = \sin\theta$

* $\cos(\theta-180^\circ) = \cos180^\circ\cos\theta + \sin180\sin\theta$

$= -\cos\theta \neq \cos\theta$

* $\sin(\theta-180^\circ) = \sin\theta\cos180^\circ - \sin180\cos\theta$

$= -\sin\theta$

* $\tan(180^\circ-\theta) = \dfrac{\tan180 - \tan\theta}{1+\tan180^\circ\tan\theta} = \dfrac{-\tan\theta}{1} = -\tan\theta$

ANSWER : C

(63) $x^2+y^2+z^2-2x+2y-4z+5=0$

$x^2-2x+y^2+2y+z^2-4z = -5$

$x^2-2x+1+y^2+2y+1+z^2-4z+4 = -5+1+1+4$

$(x-1)^2+(y+1)^2+(z-2)^2 = 1$

center $(1,-1,2)$ and radius $= r = \sqrt{1} = 1$

ANSWER: A

(64) $\int \dfrac{\sqrt{x}}{x-1}\,dx = ?$

let we integrate it by substitution technique.

let $u=\sqrt{x} \Rightarrow u^2 = x$, then the above eqn become

then $\int \dfrac{u}{u^2-1}\,dy$, but $du = \dfrac{1}{2\sqrt{x}}dx \Rightarrow dx = 2\sqrt{x}\,du = 2u\,du$

thus $\int \dfrac{u}{u^2-1}\cdot 2u\,du = 2\int \dfrac{u^2}{u^2-1}\,du = 2\int\left(1+\dfrac{1}{u^2-1}\right)du$ → by using long division

$\Rightarrow 2\int 1\,du + 2\int \dfrac{1}{u^2-1}\,du = 2u + 2\int\left(\dfrac{1}{2(u-1)} - \dfrac{1}{2(u+1)}\right)du$

$\Rightarrow 2u + 2\left(\frac{1}{2}\ln|u-1| - \frac{1}{2}\ln|u+1|\right) + c$

$\Rightarrow 2u + 2\left(\frac{1}{2}\ln\left|\frac{u-1}{u+1}\right|\right) + c$

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64. $\int \frac{\sqrt{x}}{x-1} dx =$ _____.

A. $2\sqrt{x} + \ln\left|\sqrt{x}-1\right| + c$

B. $2\sqrt{x} + \ln|x-1| + c$

C. $2\sqrt{x} + \ln\left|\frac{\sqrt{x}-1}{\sqrt{x}+1}\right| + c$

D. $2\sqrt{x} + \ln\left|\frac{\sqrt{x}+1}{\sqrt{x}-1}\right| + c$

65. When do we say a given argument is valid?

A. When all the premises are false, then the conclusion must be false.
B. When all the premises are false, then the conclusion must be true.
C. When all the premises are true, then the conclusion must be false.
D. When all the premises are true, then the conclusion must be true.

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***THE END***



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$\Rightarrow 2U + \ln\left|\frac{U-1}{U+1}\right| + C$

but we have $U = \sqrt{x}$

thus $\int \frac{\sqrt{x}}{x-1}\,dx = 2\int \frac{U^2}{U^2-1}\,dU\Big|_{U=\sqrt{x}} = \left(2U + \ln\left|\frac{U-1}{U+1}\right|\right)\Big|_{U=\sqrt{x}} + C$

$= 2\sqrt{x} + \ln\left|\frac{\sqrt{x}-1}{\sqrt{x}+1}\right| + C$

ANSWER: C

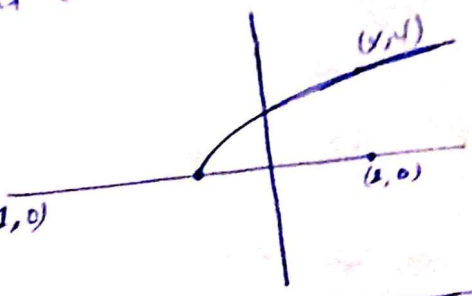
(65) When all the premises are TRUE, and the conclusion of the argument is also TRUE the argument is said to be valid argument

ANSWER: D

(58) Given $f(x) = \sqrt{x+1}$, Point (1, 0)

$y = \sqrt{x+1}$

Let say $(x, y) = (x, \sqrt{x+1})$ is any point on $f(x)$




thus the distance btw $(x,y)$ and $(1,0)$ is shown

$d = \sqrt{(x-1)^2 + (\sqrt{x+1}-0)^2} = \sqrt{(x-1)^2 + (\sqrt{x+1})^2} = \sqrt{x^2 - 2x + 1 + x + 1}$

$= \sqrt{x^2 - x + 2}$

d is shown if $x^2 - x + 2$ is shown and minimize it. thus let $g(x) = x^2 - x + 2$

$g'(x) = 2x - 1$, $g'(x) = 0$, $2x - 1 = 0 \Rightarrow x = 1/2$

then $y = \sqrt{1/2 + 1} = \sqrt{3/2}$

$d = \sqrt{(\frac{1}{2} - 1)^2 + (\sqrt{3/2} - 0)^2} = \sqrt{(-1/2)^2 + (\sqrt{3/2})^2} = \sqrt{1/4 + 3/2}$

$= \sqrt{\frac{1+6}{4}} = \sqrt{7/4} = \frac{\sqrt{7}}{2} = \frac{1}{2}\sqrt{7}$

ANSWER: D

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