

ARADA SUB CITY EDUCATION OFFICE

GRADE 12 MATHEMATICS(SOCIAL) MODEL EXAMINATIONS

TAHISAS 2016 E.C / JANUARY2024 G.C

NUMBER OF QUESTION 65

TIME ALLOWED- 3 HOURS

GENERAL DIRECTIONS

IN THIS EXAMINATIONS THERE ARE A TOTAL OF 65 MULTIPLE CHOICE QUESTIONS. CAREFULLY SELECT THE CORRECT ANSWER AND 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. PLEASE MAKE SURE THAT YOU HAVE WRITTEN ALL THE REQUIRED INFORMATION ON THE ANSWER SHEET BEFORE YOU START TO WORK ON THE EXAMINATION.

DON'T TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

- The simplified form of the expression $\frac{2\sqrt{72}}{3} - \frac{3\sqrt{128}}{4} + 5\sqrt{\frac{1}{2}}$ is equal to :-
 A/ $\frac{\sqrt{2}}{2}$ B/ $\sqrt{2}$ C/ 1 D/ $18\sqrt{2}$
- For what value of b does the system of linear equation in two variables $\begin{cases} 2x + by = 6 \\ 3x - 4y = 5 \end{cases}$ has no solution?
 A/ -6 B/ $-\frac{8}{3}$ C/ $\frac{8}{3}$ D/ 6
- Which one of the following is true about any two sets A and B?
 A/ If $x \in A$ and $x \in B$, then $x \in (A - B)$ C/ If $x \in A$ and $x \notin B$, then $x \in (A - B)$
 B/ If $x \in A$ and $x \notin B$, then $x \in (A \cap B)$ D/ If $x \notin A$ and $x \in B$, then $x \in (A \cup B)$
- Among 1620 students in a school, 13 students failed in English, 14 students failed in Mathematics and 6 students failed in both subjects. How many students passed both in English and Mathematics?
 A/ 1614 B/ 1599 C/ 1593 D/ 1587
- Which one of the following is true about the graph of the function $f(x) = (x - 3)^2 + 5$?
 A/ The vertices of the function is $(-3, 5)$
 B/ The graph of f shifts 3 units to left and 5 units down from the graph of $f(x) = x^2$
 C/ The graph of f shifts 3 units to right and 5 units down from the graph of $f(x) = x^2$
 D/ The graph of f shifts 3 units to right and 5 units up from the graph of $f(x) = x^2$
- Two triangles ABC and DEF are similar. If the length of sides of AB = 4cm, AC = 6cm and DF = 8cm, then what is the length of side DE?
 A/ 16cm B/ 12cm C/ $\frac{16}{3}$ cm D/ $\frac{8}{3}$ cm
- A researcher collected data on the monthly income of 1000 workers in Addis Ababa. After listing down this set of data in the order of the amount of income, the researcher wants to divide it into two equal parts. In order to do this he has to compute the _____ of the data.
 A/ Mode B/ Range C/ Mean D/ Median
- A car travels from a point A 4cm to point B and then $4\sqrt{3}$ cm east to point C. What is the displacement of the car from A to C?
 A/ 8cm north 60° east C/ 8cm north 30° east
 B/ $4\sqrt{10}$ cm north 60° east D/ $4\sqrt{10}$ cm north 30° east
- Which one of the following is true statement?
 A/ If $x^4 + 4x^2 + 3$ is divided by $x - 1$ the constant term of the quotient is 3
 B/ $x - 2$ is the factor of $x^4 + 2x^3 - 3x^2 - 4x + 4$
 C/ If you divided $5x^3 + 4x^2 + 4x + 9$ by $x + 2$, then the remainder is -17
 D/ $x - 1$ is the factor of $x^n + 1$ for a natural number n.
- Which one of the following is correct about the graph of a polynomial function given by $f(x) = x^3(x + 1)^2(x - 2)^5$?
 A/ the graph crosses the x-axis at $x = -1$ C/ the graph touches the x-axis at $x = -1$
 B/ the graph touches the x-axis at $x = 2$ D/ the graph cannot cross the origin

11. Given $\log 2 = 0.3010$ and $\log 3 = 0.4771$, then which one of the following is the value of $\log 18$?

- A/ 1.2552 B/ 1.0791 C/ 0.9542 D/ 0.7781

12. What is the solution set of the equation $4^{2x+2} = 4^{2x-1} + 126$?

- A/ {6} B/ $\left\{\frac{3}{4}\right\}$ C/ {3} D/ $\emptyset$

13. The solution set of $|6 - 2x| + 3 > 8$ is :-

- A/ $\left\{x \in \mathbb{R}: \frac{1}{2} < x < \frac{11}{2}\right\}$ C/ $\left\{x \in \mathbb{R}: \frac{-11}{2} < x < \frac{1}{2}\right\}$
B/ $\left\{x \in \mathbb{R}: x < \frac{1}{2} \text{ or } x > \frac{11}{2}\right\}$ D/ $\left\{x \in \mathbb{R}: x < \frac{-11}{2} \text{ or } x > \frac{1}{2}\right\}$

14. The solution set of the inequality $-2x^2 + 3x + 5 \leq 0$ is:-

- A/ $\left\{x \in \mathbb{R}: 0 \leq x \leq \frac{5}{2}\right\}$ C/ $\left\{x \in \mathbb{R}: x \leq -1 \text{ or } x \geq \frac{5}{2}\right\}$
B/ $\{x \in \mathbb{R}: -1 \leq x \text{ or } x \geq 1\}$ D/ $\left\{x \in \mathbb{R}: -1 \leq x \leq \frac{5}{2}\right\}$

15. The equation of a line passes through the point (3, 2) and parallel to the line $l: y + 3x + 4 = 0$ is:-

- A/ $y + 3x + 11 = 0$ C/ $y - 3x + 11 = 0$
B/ $y - 3x - 11 = 0$ D/ $y + 3x - 11 = 0$

16. If $\sin \theta = \frac{3}{5}$, then what is the value of $\cos(90^\circ - \theta)$?

- A/ $\frac{4}{5}$ B/ $\frac{3}{5}$ C/ $\frac{-3}{5}$ D/ $\frac{3}{4}$

17. What is the height of a tree which cast a shadow of 8m when the angle of elevation of the sun is 60° ?

- A/ $8\sqrt{3} \text{ m}$ B/ $\frac{8\sqrt{3}}{3} \text{ m}$ C/ $4\sqrt{3} \text{ m}$ D/ $\frac{4\sqrt{3}}{3} \text{ m}$

18. An angle formed by two chords intersecting within a circle 54° and one of the intercepted arcs measures 38° . What is the measure of the other intercepted arc?

- A/ 70° B/ 42° C/ 92° D/ 46°

19. The perimeter of a regular hexagon with radius 4cm is:-

- A/ 48cm B/ 24cm C/ $24\sqrt{3} \text{ cm}$ D/ $48\sqrt{3} \text{ cm}$

20. The volume of a right circular cone of height 8cm and radius 3cm is:-

- A/ $8\pi \text{ cm}^3$ B/ $24\pi \text{ cm}^3$ C. $32\pi \text{ cm}^3$ D. $72\pi \text{ cm}^3$

21. The areas of the upper and lower bases of a frustum of a pyramid are 25cm^2 and 64cm^2 respectively. If the altitude of the frustum is 3cm, then what is the altitude of the pyramid?
 A/ 5cm B/ 8cm C/ 10cm D/ 15cm
22. Which of the f/f is TRUE?
 A/ $f: R \rightarrow [0, \infty)$ is given by $f(x) = \left(\frac{1}{3}\right)^x$ is an onto function
 B/ $f(x) = 3x^5 + 5x^3 + x$ is odd function
 C/ The inverse of $f(x) = \frac{2x-3}{5x+2}$ is $f^{-1}(x) = \frac{2x+3}{-5x+2}$
 D/ The range of the function $f(x) = \text{sgn}(x)$ is $\mathbb{R}$
23. For $a \neq \frac{1}{2}, 0, 3$, the simplified form of $\frac{a^2-3a}{6a^3-15a^2-9a}$ is:
 A/ $\frac{1}{3(2a+1)}$ B/ $\frac{3}{a-2}$ C/ $\frac{1}{2a+1}$ D/ $\frac{2a+1}{a+2}$
24. What is the equations of a line passing through P(2,3) and perpendicular to the line $l: \frac{1}{2}x - y + 5 = 0$?
 A/ $y = 2x - 7$ C/ $y = -3x + 7$
 B/ $y = -x + 7$ D/ $y = -2x + 7$
25. What is the standard form of the equations of a circle with center C(-2, 3) and tangent to the x-axis?
 A/ $(x + 2)^2 + (y - 3)^2 = 9$ C/ $(x + 2)^2 + (y - 3)^2 = 4$
 B/ $(x - 2)^2 + (y + 3)^2 = 25$ D/ $(x - 2)^2 + (y - 3)^2 = 4$
26. Let $p(x) \equiv x$ is positive, $Q(x) \equiv x > 7$, then $\neg[(\forall x)Q(x) \vee \Rightarrow p(x)]$ is:
 A/ There is x such that $x > 7$ and x is not positive
 B/ There is x such that $x \leq 7$ and x is positive
 C/ There is x such that $x > 7$ and x is positive
 D/ There is x such that $x \leq 7$ and x is not positive
27. A three- digit library identification card is to be printed from the numbers 0, 1, 2, 3, 4, 5 in such a way that the first is non – zero and no number is repeated. How many such cards can be printed?
 A/ 25 B/ 50 C/ 20 D/ 100
28. A fair coin is tossed twice. What is the probability that both outcomes will be head?
 A/ $\frac{1}{6}$ B/ $\frac{4}{5}$ C/ $\frac{1}{8}$ D/ $\frac{1}{4}$
29. A bag contains 3 blue and 9 red marbles. One marble is drawn at random. What is the probability that the marble is not red?
 A/ $\frac{1}{4}$ B/ $\frac{4}{5}$ C/ $\frac{1}{8}$ D/ $\frac{3}{4}$
30. Suppose A is a 2x2 matrix with $\det(A) = 4$ and $\det(kA) = 64$, then what is the value of k?
 A/ 3 B/ 8 C/ 4 D/ 16
31. What is the solution set of the system $\begin{cases} 2x + y + 3z = -4 \\ 2x + 3y + z = -4 \\ 6x + 5y + 7z = -12 \end{cases}$?
 A/ $\{x = 2, y = -3, z = 1\}$ C/ $\{x = 0, y = -1, z = 1\}$
 B/ $\{x = -2, y = 1, z = -1\}$ D/ No solution

32. The simplified form of $\frac{4-3i}{3+4i} + \overline{1-2i}$ is:-

A/ $1 - 3i$

B/ $1 + i$

C/ $-1 + 3i$

D/ $\frac{1}{2} + \frac{i}{2}$

33. What is the minimum values of the objective function $Z = 2x + 3y$ subject to: $\begin{cases} 2x + y \geq 100 \\ x + 2y \geq 80 \end{cases}$?

A/ 0

B/ 140

C/ 120

D/ 40

34. If Ato Abebe deposits a sum of money in bank at 7.5% interest rate per year compounded monthly, then how long will it take to double?

A/ 8.3 years

B/ 9.3 years

C/ 7 years

D/ 6.3 years

35. A function $f: S \rightarrow N$ defined by $f(1) = 4, f(2) = 2, f(n) = f(n-1) + f(n-2), n \geq 3, f(5) = ______$

A/ 4

C/ 14

B/ 8

D/ 5

36. In an arithmetic sequence, if $A_4 = 8$ and $A_8 = 12$, then A_n is equal to:

A/ 5

C/ 6

B/ 7

D/ 3

37. If the n^{th} terms of a geometric progression is given by $G_n = 3^{n-1}$, then which of the f/f is NOT true about G_n ?

A/ the sum of the first four terms is 40

C/ the sum of the first three terms is 13

B/ the first term is 3

D/ the fourth terms is 27

38. Which of the f/f sigma notation is convergent?

A/ $\sum_{k=0}^n \left(\frac{3}{2}\right)^n$

B/ $\sum_{k=0}^n (-5)^n$

B/ $\sum_{k=0}^n \left(\frac{2}{5}\right)^n$

D/ $\sum_{k=0}^n \left(\frac{4}{3}\right)^{n-1}$

39. Suppose: $3^k \cdot 3^{k^2} \cdot 3^{k^3} \dots = 9$, then what is the value of k?

A/ 3

B/ $\frac{1}{2}$

C/ $\frac{3}{2}$

D/ $\frac{2}{3}$

40. Which of the f/f infinite series $\{G_n\}$ NOT true?

A/ If the common ratio, $r = 1$, then $S_\infty = nG_1$

C/ If the common ratio, $r \geq 1$, then $S_\infty = nG_1$

B/ If $1 < r < 1$, then $S_\infty = \frac{G_1}{1-r}$

D/ The sum of the series $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots = 1$

41. What is the sum of the series $\sum_{n=0}^{\infty} 2^n 3^{1-n}$?

A/ 9

B/ 54

C/ 27

D/ 81

42. A ball is dropped from a height of 20 meters on each bounce it rebounds $\frac{3}{4}$ of the distance it falls.

How far does it travel before coming to rest?

A/ 140m

B/ 200m

C/ 40m

D/ 160m

43. A job applicant finds that a firm A offers a starting salary of Birr 32,000 with a guaranteed raise of Birr 2000 per year. Whereas firm B offers a higher starting salary of Birr 35,000 but will guarantee a yearly raise of only Birr 900. Then what would the annual salary be in the 11th year at firm A?

A/ 43,100

B/ 52,000

C/ 44,100

D/ 4,800

44. A theatre is filling up at a rate of 4 people in the first minute, 6 people in the second minute and 8 people in the third minute and so on. After 6 minutes, the theatre is half full. After how many minutes will the theatre full?
 A/ -12 B/ 9 C/ 54 D/ 8
45. A contest offers 10 prizes with a total value of Birr 13,250. If the difference in value b/n consecutive prizes is Birr 250, what is the value of the first prizes?
 A/ 2,400 B/ 1,250 C/ 3, 500 D/ 2, 450
46. Let $f(x) = 3x^4 + 2$. What is the average rate of change on the interval $[-2, 3]$?
 A/ 39 B/ 59 C/ 243 D/ 45
47. What is the instantaneous rate of change of $f(x) = 2x^3 - 3$ at $x = 2$?
 A/ 24 B/ 21 C/ 27 D/ 3
48. Let $y = (x^3 + 3)^2$. Then $\frac{dy}{dx} =$ __
 A/ $6x^7 + 18x^2 + 18x$ C/ $6x^5 + 18x^2 + 18$
 B/ $6x^5 + 18x^2$ D/ $x^5 + 6x - 18$
49. If $f(x) = \frac{g(x)}{x+1} + (g(x))^2$, $g(1) = 8$ and $g'(1) = 2$, then $f'(1) =$ __
 A/ 31 B/ 32 C/ 30 D/ 29
50. If the volume of a sphere is increasing at the rate of $0.2\pi \text{ cm}^3/\text{sec}$, what is the rate of increase of radius when the radius is 10cm?
 A/ 0.0005cm/sec C/ 0.1cm/sec
 B/ 0.05cm/sec D/ 0.01cm/sec
51. Given $C(x) = 62x^2 + 27,500$ and $R(x) = x^3 - 12x^2 + 40x + 10$ where $C(x)$ and $R(x)$ represent respectively, the total cost revenue from the production and sale of x items. What is total profit $p(x)$?
 A/ $x^3 - 74x^2 + 40x - 27,500$ C/ $74x^2 + 40x - 500$
 B/ $x^3 + 74x^2 - 40x - 27,500$ D/ Cann't be determined
52. What is the absolute maximum and the minimum values respectively of the function

$$f(x) = \begin{cases} x^2 - \frac{x}{3}; & 0 \leq x \leq 1 \\ x^2 + x - \frac{4}{3}; & 1 < x \leq 2 \end{cases} \text{ on } [0, 2]$$

 A/ $\frac{14}{3}, \frac{-2}{27}$ B/ 0, 2 C/ $\frac{-2}{27}, \frac{-14}{3}$ D/ $\frac{-1}{2}, \frac{-3}{4}$
53. A manufacture wants to design an open box that has a square base and a surface area of 48 square unit. What dimensions will produce a box with a maximum volume?
 A/ 32 cubic unit C/ 8 cubic unit
 B/ 16 cubic unit D/ 48 cubic unit
54. Let f be a function given by $f(x) = \frac{1}{3}x^3 - \frac{1}{2}x^2 - 2x + 1$, w/c of the f/f is TRUE?
 A/ The critical numbers are -1 and 2 . C/ The relative minimum value of f is at $x = 2$.
 B/ The interval in w/c f is decreasing is $[-1, 2]$. D/ The relative maximum value of f is at $x = 2$.
55. $\int_{-2}^2 (4 - x^2) dx$ is equal to:
 A/ $\frac{32}{3} \text{ sq. unit}$ B/ $\frac{4}{3} \text{ sq. unit}$ C/ $\frac{20}{3} \text{ sq. unit}$ D/ $\frac{64}{3} \text{ sq. unit}$

56. Let $f(x) = 3x^2$ defined on the interval $[0, 5]$. Then what is the Riemann sum of f on $[0, 5]$ when the interval is divided into 5-sub intervals of equal width?

- A/ 174 B/ 75 C/ 36 D/ 175

57. What is the area S of the region enclosed b/n the graph of $f(x) = x^2 - 1$, the x-axis and the y-axis in the interval $[0, 2]$?

- A/ $\frac{4}{3}$ B/ 2 C/ $\frac{2}{3}$ D/ 4

58. What is the area (in square units) of the region enclosed by the curve $f(x) = x^2 - 4x + 3$, the x-axis, the vertical lines $x = -1$ and $x = 3$?

- A/ 12 B/ 8 C/ 17 D/ 5

59. $\int (x^{-2} - 4x^3 + \sqrt{x}) dx$ is equal to (C is any constant):

- A/ $x^{-2} - \frac{3}{4}x^4 + \sqrt{x} + C$ C/ $-x^{-1} + \frac{3}{4}x^4 + \sqrt{x} + C$
 B/ $-x^{-1} - \frac{3}{4}x^4 + \frac{2}{3}x\sqrt{x} + C$ D/ $x - x^4 + \frac{2}{3}x\sqrt{x} + C$

Answer question number 60 and 61 based on the f/f data set. Consider the following data set which gives the price of cup of coffee in randomly selected 20 coffee house: 10, 5, 9, 12, 10, 12, 13, 8, 15, 12, 12, 13, 13, 10, 12, 5, 14, 6, 14, 10, 8.

60. What is the range of the data set?

- A/ 15 B/ 10 C/ 5 D/ 5

61. What is the medians of the data set ?

- A/ 10 B/ 12 C/ 13 D/ 9

62. Consider the following two sets of data:

A: 20, 60, 60, 60, 60, 60, 60, 60, 100

B: 20, 30, 50, 80, 90, 100

Then which of the following is NOT true?

- A/ both have the same range C/ B is more variable than A
 B/ the inter-quartile range of B is 60 D/ the inter-quartile of A is 40

63. Consider the following grouped data below:

x	0 - 4	5 - 9	10 - 14	15 - 19	20 - 24
f	3	1	2	4	1

What is the mean-deviation about the mean?

- A/ 2 B/ 7 C/ 14 D/ 3

Answer question number 64 and 65 based on grouped data given below:

x	1-5	6 - 10	11 - 15	16 - 20	21 - 25
f	5	8	7	10	3

64. What is the inter-quartile range of this data set?

- A/ 17.5 B/ 7.5312 C/ 17.875 D/ 10.34

65. What is the mean of the given data set?

- A/ 10 B/ 13.6 C/ 11.75 D/ 12.696