ARADA SUB CITY EDUCATION OFFICE

MATHEMATICS FOR GRADE 12 FIRST MODEL EXAMINATION

TIR 2018 / JANUARY 2026 NUMBER OF QUESTIONS: 60

GENERAL DIRECTIONS TIME ALLOWED: 3:00 HRS

THIS BOOKLET CONTAINS MATHEMATICS EXAMINATION FOR 12. IN THIS EXAMINATION THERE ARE A TOTAL OF 60 MULTIPLE CHOICE ITEMS. THERE IS ONLY ONE BEST ANSWER FOR EACH ITEM. CHOOSE THE BEST ANSWER FROM THE SUGGESTED OPITIONS AND BLACKEN THE LETER OF YOUR CHOICE ON THE SEPARATE ANSWER SHEET PROVIDED. YOU WILL BE ALLOWED TO WORK ON THE EXAM FOR 3 HOURS. WHEN TIME IS CALLED, YOU MUST IMMEDIATELY STOP WORKING, PUT YOUR PENCIL DOWN AND WATI FOR FURTHER INSTRACTIONS. ANY FORM OF CHEATING OR AN ATTEMT TO CHEAT IN THE EXAMINATION WILL RESULT IN AN AUTOMATIC DISMISSAL FROM THE EXAMNATION HALL AND CANCELLATION OF YOUR SCORE(S). PLEASE MAKE SURE THAT YOU HAVE WRITTEN ALL THE REQUIRED INFORMATION ON THE ANSWER SHEET BEFOR YOU START TO WORK ON THE EXAMIATION.

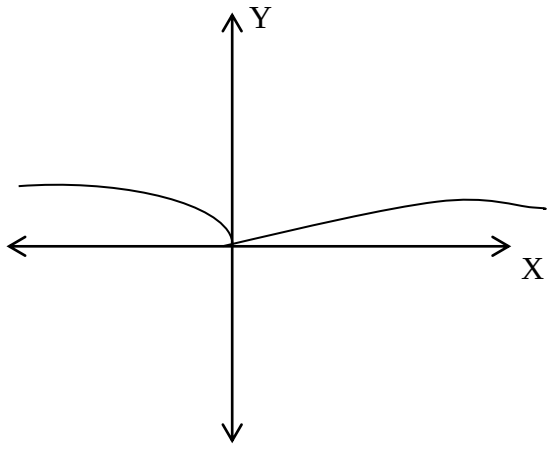
DO NOT TURN THIS PAGE OVER UNTIL YOU ARE TOLD TO DO SO.

1. What is the simplified form of $\sqrt{98} - \sqrt{18}$?
   A. $\sqrt{80}$ B. $3\sqrt{2}$ C. $\sqrt{32}$ D. it is impossible to subtract.
2. If $x = 0.2022002200022 \ldots and\ y = 0.7977997799977 \ldots$, then which of the following is **NOT** true?
   A. x is neither terminating nor repeating decimal. C. $x + y = 1$
   B. $x^2 - y^2 = x - y$ D. $5x < y$
3. After rationalizing the expression $\frac{3}{3\sqrt{3}-2\sqrt{2}}$, the denominator is equal to _____.
   A. 19 B. 57 C. $\frac{3(3\sqrt{3}-2\sqrt{2})}{19}$ D. $\frac{3(3\sqrt{3}+2\sqrt{2})}{19}$
4. The simplified form of the expression $\left(\frac{5}{4}\right)^3 \times \left(\frac{\sqrt{5}}{2}\right)^{-4} \div \left(\frac{\sqrt[3]{5}}{\sqrt{2}}\right)^6$ is
   A. $\frac{5}{2}$ B. $\frac{2}{5}$ C. 5 D. $\sqrt{5}$
5. The solution set of the system $\begin{cases} 3x - y = 5 \\ 3y + 15 = 9x \end{cases}$ is
   A. $\{(0,-5),(1,-2),(2,-1),\ldots\}$ B. $\mathbb{R}$ C. $\emptyset$ D. $\{(t, 3t-5): t \in \mathbb{R}\}$
6. The solution set of $|2x + 1| = x - 7$ is
   A. $\{-8,-2\}$ B. $\{-8,2\}$ C. $\{8,2\}$ D. $\{\}$
7. If $\alpha\ and\ \beta$ are the two roots of the quadratic equation $2x^2 + 3x - 4 = 0$, then what is the value of $\sqrt{\alpha^2 + \beta^2}$?
   A. 5/2 B. 5/2 C. 5 D. √5
8. Suppose $\mathbb{N}$ is the set of natural numbers and $A = \{1,2,\{3\}\}$, then which of the following is true?
   A. $\{3\} \subseteq A$ B. $\mathbb{N} \cup A = \mathbb{N}$ C. $A \setminus \{3\} = A$ D. $A \subseteq \mathbb{N}$
9. Let U be universal set and A, B ⊆ U, such that $n(U) = 16, n(A) = 7, n(B) = 9\ \ and\ \ n(A \cup B) = 13$, then which one of the following is $n(A' \cup B')$?
   A. 3 B. 13 C. 14 D. 16
10. Let $A = \{0,1,2,3,4\}$ and R be a relation from A to A given by $R = \{(x,y): y = x + 2, for, x, y \in A\}$. Which one of the following is true about R?
    A. $(2,3)$ is an element of R C. $(3,5)$ is an element of R
    B. The domain of R is $\{1,2,3,4\}$ D. The range of R is $\{2,3,4\}$
11. Let $R = \{(10,5),(2x,-8),(x+4,3)\}$ be a relation, then the set of all values of x for which the relation R will not be a function is:-
    A. $\{-4,2,6\}$ B. $\{-1,4,5\}$ C. $\{4,5,6\}$ D. $\{-4,5,6\}$
12. The graph of $f(x) = x^2 + 6x + 7$ is obtained from the graph of $g(x) = x^2$ by shifting the graph of $g(x) = x^2$
    A. 6 units to the right and 9 units upward C. 3 units to the left and 2 units downward
    B. 3 units to the right and 2 units downward D. 3 units to the left and 2 units upward
13. Which one of the following points belongs to the relation $R = \{(x,y): y \geq 3x + 1\}$?
    A. $(2,1)$ B. $(0,1)$ C. $(1,3)$ D. $(-2,-6)$

14. Which one of the following functions is one-to-one correspondence?
    A. $f: \mathbb{R} \to [0, \infty), f(x) = 2^x$ C. $f: [0, \infty) \to (-\infty, 0],\ f(x) = -x^2$
    B. $f: [0, \infty) \to [0, \infty),\ f(x) = \sqrt{(1-x)^2}$ D. $\mathbb{R} \to \mathbb{R}, f(x) = \tan x$
15. For $f: \mathbb{R} \to A, f(x) = -x^2 - 6x + 5$ to be onto what must be A?
    A. $(-\infty, 14]$ B. $(-\infty, -22]$ C. $[-22, \infty)$ D. $(-\infty, 0]$
16. The domain of $y = \frac{1}{\sqrt{x}-3}$ is
    A. $\mathbb{R} \setminus \{3\}$ B. $\mathbb{R} \setminus \{9\}$ C. $(0,9) \cup (9, \infty)$ D. $[0,9) \cup (9, \infty)$
17. What must be added to $x^3 + 5x^2 - 3x - 8$ so that $x + 2$ is a factor?
    A. -10 B. 10 C. -14 D. 14
18. Which one of the following is equal to the polynomial function $f(x) = x^2 + 6x + 9$?
    A. $(x^2 + 8x + 10) + (-2x + 1)$ C. $(x + 3)(x - 3)$
    B. $\frac{x^3+6x^2+9x}{x}$ D. $(x^2 + 10x + 11) - (4x + 2)$
19. Which one of the following is always true about a polynomial function of degree 3?
    A. It has three zeros C. Its range is $\mathbb{R}$
    B. It may not cross the x-axis D. It cross the x-axis three times
20. The simplified form of $\log_{4x} 4x^{-1} + 4 \log_{4x} 2x^2 - 4 \log_{4x} x$ is:-
    A. 3 B. 4 C. $\frac{1}{4}$ D. $\sqrt{4}$
21. What is the simplified form of $\frac{2^{\sqrt{5}} \times 2^{\sqrt{20}}}{8^{\sqrt{5}}}$?
    A. 1 B. 2 C. $2^{\sqrt{5}}$ D. $\sqrt{2}$
22. Which one of the following is true about the graph of the function $f(x) = 1 + \left(\frac{1}{2}\right)^x$?
    A. It is increasing on $[0, \infty)$ C. It intersects the y-axis at $(0,1)$
    B. The x-axis is its asymptote D. for $x > 0$, it lies between the lines $y = 1$ and $y = 2$
23. Let $f(x) = \log_{\frac{1}{9}} x$, then which one of the following is true about $f(x)$?
    A. f is an increasing function C. for each $x \in (0,1), f(x) > 0$
    B. $y = 0$ is asymptote of f D. it has y intercept
24. If $\log_x 64 + \log_x \frac{1}{8} = \frac{3}{5}$, then x is equal to:
    A. 32 B. 16 C. 8 D. 4
25. Which one of the following is a power function?
    A. $f(x) = \frac{2}{3}\sqrt{x}$ B. $f(x) = \left(\frac{2}{3}\right)^x$ C. $f(x) = 2x^4 - 1$ D. $f(x) = 4^{2x-1}$
26. Which one of the following statement define the greatest integer function given by $f(x) = \lfloor x \rfloor$?
    A. It is the least integer greater than or equal to x
    B. It is an integer greater than or equal to x
    C. It is an integer less than or equal to x
    D. It is the greatest integer less than or equal to x

27. Which one of the following is NOT true about the given function?
    A. The range of $f(x) = |x| + x$ is $[0, \infty)$
    B. $f(x) = 3 - sgnx \; and \; g(x) = 3 + sgnx$ have the same range
    C. The range of $f(x) = x - |x|$ is $[0, \infty)$
    D. The range of $f(x) = \lfloor x \rfloor + 1$ is $\mathbb{Z}$

28. Which of the following function is best describes the graph shown below?



A. $f(x) = x^{\frac{3}{2}}$
B. $f(x) = x^{\frac{2}{3}}$
C. $f(x) = x^{\frac{-3}{2}}$
D. $f(x) = x^{\frac{-2}{3}}$

29. The inverse of the function define by $f(x) = \frac{3x}{x+2}$ is
    A. $f^{-1}(x) = \frac{-2x}{x-3}$ B. $f^{-1}(x) = \frac{2x}{x-3}$ C. $f^{-1}(x) = \frac{-2x}{x+3}$ D. $f^{-1}(x) = \frac{2x}{x+3}$

30. The simplified form of $\frac{x}{5-x} + \frac{2x-5}{x-5}$ is:- A. -2 B. 1 C. -1 D. 2

31. What is the solution set of the equation $\frac{3}{x+1} - \frac{1}{x-1} = \frac{2}{x}$?
    A. $\left\{\frac{-1}{2}\right\}$ B. $\left\{\frac{1}{2}\right\}$ C. $\{-1\}$ D. $\emptyset$

32. The range of the function $f(x) = \frac{x^2-16}{x-4}$ is
    A. $\mathbb{R} \setminus \{8\}$ B. $\mathbb{R} \setminus \{4\}$ C. $\mathbb{R} \setminus \{0\}$ D. $\mathbb{R}$

33. Which one of the following is NOT true about the graph of $f(x) = \frac{X^3+8}{X^2-4}$?
    A. Its y-intercept is (0, -2)
    B. The vertical asymptote of the graph is x = 2
    C. Its x-intercept is (-2, 0)
    D. Its oblique asymptote is y = x

34. Suppose that $A = \begin{pmatrix} 2 & 2 \\ 6 & -4 \end{pmatrix}$ and $B = \begin{pmatrix} 4 & 0 \\ 2 & -2 \end{pmatrix}$. If $X \; is \; 2 \times 2$ matrix such that $X + 3B^t = BA$, then what is the value of X?
    A. $\begin{pmatrix} 0 & -10 \\ 16 & 14 \end{pmatrix}$ B. $\begin{pmatrix} -4 & 2 \\ -8 & 18 \end{pmatrix}$ C. $\begin{pmatrix} 0 & 4 \\ -8 & 18 \end{pmatrix}$ D. $\begin{pmatrix} -4 & 0 \\ 8 & 18 \end{pmatrix}$

35. Which one of the following is a reduced row echelon form of the matrix $\begin{pmatrix} 1 & 1 & 1 \\ 2 & 1 & 3 \\ 4 & -1 & 4 \end{pmatrix}$?

A. $\begin{pmatrix} 1 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ B. $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{pmatrix}$ C. $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ D. $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{pmatrix}$

36. Consider the system of linear equation $\begin{cases} 2x - 3 = y \\ 6x - 6 = 3y \end{cases}$. Then the system has _____.

A. Exactly two solution B. A unique solution C. Infinite solution D. No solution

37. Which one of the following is the inverse of $\begin{pmatrix} 2 & 3 \\ 3 & 4 \end{pmatrix}$?

A. $\begin{pmatrix} -4 & 3 \\ 3 & -2 \end{pmatrix}$ B. $\begin{pmatrix} -4 & -3 \\ -3 & -2 \end{pmatrix}$ C. $\begin{pmatrix} 4 & -3 \\ -3 & 2 \end{pmatrix}$ D. $\begin{pmatrix} 4 & 3 \\ 3 & 2 \end{pmatrix}$

38. If 20% of salt solution is to be mixed with a 40% of salt to form a mixture of 30% salt solution of 600 liters, then how much amount of the 40% salt solution is needed to form the mixture?

A. 100 liters B. 200 liters C. 300 liters D. 400 liters

39. The determinant of the matrix $\begin{pmatrix} 1 & -1 & 2 \\ 1 & 0 & -1 \\ 3 & 1 & 3 \end{pmatrix}$ is:- A. 7 B. 8 C. 9 D. 10

40. For any $n \times n$ matrix A, which one of the following is true?

A. If B is a matrix obtained by interchanging two rows of A, then $\det(A) = \det(B)$.

B. If A is invertible, then $\det(A) = \frac{1}{\det(A^{-1})}$.

C. $\det(A) = -\det(A^t)$, where A^t is transpose of A

D. If k is a scalar, then $\det(kA) = k\det(A)$

41. For what value of x is the matrix $A = \begin{pmatrix} x & -3 & x \\ -1 & 0 & 2 \\ 2 & 1 & -5 \end{pmatrix}$ non-invertible (singular).

A. 1 B. -1 C. 2 D. -2

42. The 3×3 system of linear equation $AX + B$ has a solution $(2, b, -4)$. If $\det(A) = -2$ and the determinant of the matrix obtained by replacing the second column of A by B is $\frac{1}{4}$, then what is the value of b? A. $\frac{-1}{8}$ B. -8 C. $\frac{-1}{2}$ D. -2

43. What is the fourth term of the sequence $\{a_n\}_{n=1}^{\infty}$ define recursively by $a_1 = -1, a_2 = 3$ and $a_n = na_{n-2} + (n+1)a_{n-1}$, for $n \geq 3$?

A. 51 B. 53 C. 55 D. 57

44. Suppose a geometric sequence $\{G_n\}_{n=1}^{\infty}$ has terms $G_5 = 6$ *and* $G_{10} = -192$. Which of the following is equal to the first term (G_1)?

A. $\frac{3}{8}$ B. $\frac{3}{4}$ C. $\frac{-3}{8}$ D. $\frac{-3}{4}$

45. It is given that a, b, c, d, e, f are consecutive terms in an arithmetic sequence with $a + b + c + d = 64$ and $e + f = 68$, then what is the common difference of the sequence?

A. 7 B. 6 C. 5 D. 4

46. Let the sequence $\{a_n\}_{n=1}^{\infty}$ be an arithmetic sequence where $a_3 = 7$ and the common difference is -4, then the n^{th} term (the general term) of this sequence is:-

A. $13 - 2n$ B. $16 - 3n$ C. $19 - 4n$ D. $22 - 5n$

47. If $\{a_n\}_{n=1}^{\infty}$ is a sequence such that $a_1 = 2$ and $a_{n+1} = a_n + 4$, for all $n \geq 1$. Then $\sum_{n=3}^{35} a_n$ is equal to:-

A. 2460 B. 2458 C. 2450 D. 2442

48. The sum of $-1 + \frac{1}{2} - \frac{1}{4} + \frac{1}{8} - \frac{1}{16} + \cdots$ can be expressed in sigma notation as:-

A. $\sum_{k=1}^{\infty}(-1)^{k-1}2^{-k}$ B. $\sum_{k=1}^{\infty}(-1)^{k}2^{k-1}$ C. $\sum_{k=1}^{\infty}(-1)^{1-k}2^{1-k}$ D. $\sum_{k=1}^{\infty}(-1)^{k}2^{1-k}$

49. The sum of the series $\sum_{n=0}^{\infty}\left(\frac{7-3^n}{15^n}\right)$ is:- A. $\frac{35}{4}$ B. $\frac{25}{4}$ C. $\frac{1}{4}$ D. $\frac{21}{4}$

50. A certain meeting hall has many rows of seats. There are 27 seats in the first row, 31 seats in the second row, 35 seats in the third row and 39 seats in the fourth row, the pattern of seats continue as stated above and at the last row there are 107 seats. What is the total number of seats in the hall?

A. 1407 B. 1427 C. 1307 D. 1327

51. In the xy plane the line y + 4x = k where k is constant is tangent to the graph of $y=x^2+2x+1$. What is the value of k? A. -4 B. -5 C. -7 D. -8

52. What is the local minimum value of the function $f(x) = x^3 - 12x + 1$?

A. -24 B. -20 C. -15 D. -14

53. Let $f(x) = \sqrt{x^3 + 1}$ and $g'(3) = \frac{1}{2}$, then $(gof)'(2)$ is equal to:-

A. 1 B. $\frac{1}{2}$ C. $\frac{1}{3}$ D. $\frac{2}{3}$

54. Let $f(x) = \frac{6x}{a-x}$. For what value of a is $f'(-2a) = \frac{1}{4}$?

A. $\frac{3}{8}$ B. $\frac{8}{3}$ C. $\frac{5}{4}$ D. $\frac{4}{5}$

55. The time rate of change of the radius is of a sphere is $\frac{1}{2\pi}\,cm/_{sec}$ when its radius is $5cm$, what will be the rate of change of the surface area of the sphere with time?

A. $10\,cm^2/_{sec}$ B. $20\,cm^2/_{sec}$ C. $30\,cm^2/_{sec}$ D. $40\,cm^2/_{sec}$

56. $\int_1^3 \left(3x + \frac{1}{x^2}\right) dx$ is equal to:- A. $\frac{34}{3}$ B. $\frac{35}{3}$ C. $\frac{37}{3}$ D. $\frac{38}{3}$

57. What is the area of the region bounded by the graph of the function $f(x) = x^2 - 3x + 2$ and the $x - axis$ on the interval $[0,2]$?

A. 1 B. $\frac{3}{4}$ C. $\frac{3}{2}$ D. $\frac{-3}{4}$

58. The inter quartile range of the data 7,3,5,1,6,1,6,8 is

A. 4.5 B. 4 C. 3.5 D. 3

59. The following table shows a simple frequency distribution table of data with variable x and frequency f

X	2	4	6	8	10
f	2	5	3	3	1

The mean deviation about the median is equal to:- A. 1.4 B. 2 C. 2.4 D. 3

60. The variance of the data 6,2,7,2,5,8, is A. $\frac{29}{6}$ B. $\frac{31}{6}$ C. $\frac{16}{3}$ D. $\frac{17}{3}$

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