ADDIS ABABA CITY ADMINISTRATION EDUCATION BUREAU

LIDETA SUB CITY EDUCATION OFFICE

MATHEMATICS MODEL EXAMINATION FOR GRADE 12

2017E.C/JANUARY 2025

NUMBER OF QUESTIONS:65 TIME ALLOED: 3 HOURS

GENERAL DIRECTIONS THIS BOOKLET CONTAINS EXAMINATION MATHEMATICS IN THIS EXAMINATION; THERE ARE A TOTAL OF 65 MULTIPLE CHOICE QUESTIONS. CAREFULLY SELECT THE BEST ANSWER AND BLACKEN ONLY THE LETTER OF YOUR CHOICE ON THE SEPARATE ANSWER SHEET PROVIDED. FOLLOW THE INSTRUCTIONS ON THE ANSWER SHEET AND THE EXAMINATION PAPER 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 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.

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

I. ATTENTION!

MAKE SURE THAT YOU HAVE WRITTEN ALL THE REQUIRED INFORMATION ON THE SEPARATE ANSWER SHEET CORRECLEY BEFORE YOU RETURN IT.

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

1. Which of the following is true about 37569?

   A. it is divisible by 2 C. it is divisible by 3

   B. it is divisible by 6 D. it is divisible by 9

2. Which one of the following is the fractional form of the decimal number 4.8121212…?

   A. $\frac{44}{9}$ B. $\frac{4764}{900}$ C. $\frac{4764}{999}$ D. $\frac{4764}{990}$

3. Let $a = 2\sqrt{7}$ and$b = 5$, then which one of the statements is true?

   A. $a > b$ B. $a < b$ C. $a = b$ D. None

4. What is the simplified form of the expression $\frac{\sqrt[5]{192}}{\sqrt[5]{6}}$?

   A. 32 B. 2 C. $\frac{32}{5}$ D. $\frac{1}{32}$

5. The simplest form of $3\sqrt{12} - \sqrt{3} + 2\sqrt{\frac{1}{3}} + \frac{1}{9}\sqrt{27} + \sqrt{27} - 3^{3/2}$ is equal to

   A. $6\sqrt{3}$ B. $\sqrt{3}$ C. $4\sqrt{3}$ D. $2\sqrt{3}$

6. The simplified form of $\frac{2\sqrt{3}}{\sqrt{3}+\sqrt{2}} - \frac{\sqrt{3}}{\sqrt{3}-\sqrt{2}}$ is

   A. $3 + 3\sqrt{3}$ C. $3 - 3\sqrt{3}$

   B. $3 + 3\sqrt{6}$ D. $3 - 3\sqrt{6}$

7. A certain publishing enterprise printed 93,462 copies of Mathematics Student Textbook for Grade 12. If you are asked on a radio to report the number of these textbooks to the nearest 100, then what would be the correct figure that you will report?

   A. 93,000 B. 93,400 C. 93,500 D. 94,000

8. Let $= \frac{2-\sqrt{3}}{2+\sqrt{3}}$, then what is the value of $x + \frac{1}{x}$?

   A. 14 B. 1 C. 0 D. $\frac{7}{4}$

9. According to the division algorithm, what should be the value of q and r respectively so that, 320 = 13q + r ?

   A. 8 and 24 C. 26 and 6

   B. 24 and 8 D. 8 and 28

10. What is the solution set of the equation $25^{1-x} = \sqrt{125}$?

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

11. The solution of the system $\begin{cases} x - y = 1 \\ x + y = 5 \end{cases}$?

A. $(3\,,2)$ B. $(2\,,3)$ C. $(-3\,,2)$ D. $(-3\,,-2)$

12. In room, there are rabbits and chickens. When we count the heads of rabbits and chickens together it is 64 and when we count the legs of rabbits and chickens together it is 174. If the number of chickens is x and the number of rabbits is , then which of the following statements is true?

A. $x = 23\ \&\ y = 41$ C. $x = 24\ \&\ y = 40$

B. $x = 36\ \&\ y = 28$ D. $x = 41\ \&\ y = 23$

13. The solution set of the equation $|x - 1|$ = $|2x + 6|$ is

A. $\{-\frac{5}{3}, 7\}$ C. $\{-7\}$

B. $\{\frac{-5}{3}\}$ D. $\{-7, \frac{-5}{3}\}$

14. If the roots of the equation $2x^2+12x\ +\ 8\ =\ 0$ are r_1 andr_2, then the value of $\frac{1}{r_1+1} + \frac{1}{r_2+1}$

A. -3 B. -4 C. 4 D.3

15. What is the factorized form of $x^2 + 6x + 5$?

A. $(x + 2)(x + 3)$ C. $(x - 1)(x - 5)$

B. B. $(x + 5)(x + 1)$ D. $(x - 2)(x + 3)$

16. Which of the following set is a finite set?

A. $\{x: x\ is\ an\ integer\ less\ than\ five\}$

B. $\{x: x\ is\ a\ natural\ \ number\ between\ 0\ \ and\ 1\}$

C. $\{x: x\ is\ a\ natural\ \ number\ greater\ than\ and\ 1\}$

D. $\{x: x\ is\ a\ rational\ number\ between\ 0\ \ and\ 1\}$

17. If two sets A and B are given as $A = \{-2\,, 0,\ \{-2, 2\}\}$ and$\{-2, 0, 2\}$, then which one of the following is true about these sets?

A. $A \cap B = B$ B. $B \backslash A = \emptyset$ C. $A \cup B = A$ D. $(A \cap B) \cup \{-2, 2\} = B$

18. From a total of 100 students, 50 are older than 18 years and 65 are younger than 20 years. What is the number of students whose ages are between 18 and 20 ?

A. 15 B. 25 C. 35 D. 45

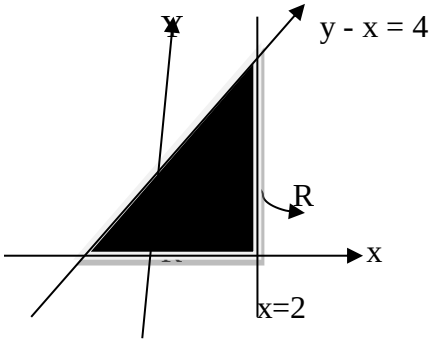
19. If $B \subseteq A$, then which of the following is NOT true?

A. $A \cup B = A$ B. $A \backslash B \subset B$ C. $B \backslash A = \emptyset$ D. $A' \subseteq B'$

20. If $R = \{(x, y): y = 2x + 1\}$ is a relation on A, where $A = \{1, 2, 3, 4, 5, 6\}$, then domain of R is:

A. $\{1, 2, 3, 4, 5, 6\}$ B. $\{1, 2\}$ C. $\{3, 5\}$ D. $\{3, 5, 7, 9, 11, 13\}$

21. Which one of the following system of linear inequalities represents the shaded region R?



A. R = { (X , y) : y ≤ x +4, x ≥ 0 & x ≤ 2}

B. R = { (x , y) : y ≤ x + 4, x ≥ 0& x ≤ 2}

C. R = { (x , y) : x ≤ y + 4, y ≥ 0& x ≤ 2}

D. R = { (x , y) : y ≤ x +4 & x ≤ 2}

22. The set of all second components or coordinates of the elements of a relation is called _____

A. Range of a relation C. Inverse of a relation

B. Domain of a relation D. None

23. Let $R = \{(x, y): x, y \in \mathbb{R} \text{ and } y = 3x + 6\}$ is a relation. What is the inverse of a relation R?

A. $R^{-1} = \{(x, y): x, y \in \mathbb{R} \text{ and } y = 3x + 6\}$

B. $R^{-1} = \{(x, y): x, y \in \mathbb{R} \text{ and } y = 3x - 2\}$

C. $R^{-1} = \left\{(x, y): x, y \in \mathbb{R} \text{ and } y = \frac{1}{3}x - 2\right\}$

D. $R^{-1} = \{(x, y): x, y \in \mathbb{R} \text{ and } y = 3x + 2\}$

24. Which of the following function is a power function?

A. $f(x) = \log x$ B. $f(x) = 3^x$ C. $f(x) = 5x^{2/3}$ D. $f(x) = sinx$

25. If $x < 0$,then the simplest form of $f(x) = \frac{x - |x|}{x}$ is equal to

A. $2x$ B. 2 C. -2 D. 0

26. Given $f(x) = 3 - sgn\, x$. What is the value of $f(3)$?

A. 0 B. 3 C. 2 D. 1

27. Given the greatest integer function $f(x) = \lfloor x \rfloor$, then which one is NOT true?

A. $f(\pi) = 3$ B. $f(-\pi) = -4$ C. $f(\pi - 3) = 0$ D. $f(3 - \pi) = 0$

28. Which of the following is the inverse of $f(x) = \sqrt{x-3}$?

A. $f^{-1}(x) = \frac{1}{\sqrt{x-3}}$ $, x \neq 3$ C. $f^{-1}(x) = x^2 + 3$ $, x \geq 3$

B. $f^{-1}(x) = \sqrt{x+3}$ $, -\infty < x < \infty$ D. $f^{-1}(x) = x^2 + 3$ $, x \geq 0$

29. Let R=$\{(x, y): x, y \in \mathbb{R}, y > x^2 - 1 \text{ and } y < 3\}$.which one the following is true?

A. The domain of R is $\{x: -2 \leq x \leq 2\}$ C. $(-1,3) \in$ R

B. The range of R is $\{y: -1 < x < 3\}$ D. $(2,2) \notin$ R

30. Which of the following is rational expression?

A. $\frac{5}{x^2+\sqrt{x}-9}$ B. $\frac{x^2+1}{\sqrt{x^4+4x+4}}$ C. $\frac{x+2}{x^2+x-9}$ D. $\frac{x^{3/2}+x-1}{x^2-1}$

31. Which one of the following is the domain of rational expression $x - \frac{x^2+1}{x^4-x}$?

A. $\mathbb{R}\backslash\{-1\}$ *B*. $\mathbb{R}\backslash\{0,1\}$ *C*. $\mathbb{R}\backslash\{-1,0,1\}$ *D*. $\mathbb{R}\backslash\{0\}$

32. Which one of the following represent the solution set for the equation $\frac{1}{x-2} = \frac{3}{x+2} - \frac{6x}{x^2-4}$

A. {1,3} B.{-2} C.{-2, 2} D.∅

33. Which one of the following is NOT true about the rational function $f(x) = \frac{x+1}{x^2+3x+2}$?

A. $Domain = \{x \in \mathbb{R} : x \neq -2, -1\}$

B. $x = -2$ is a vertical asymptote to the graph of $f(x)$.

C. $y = 0$ is a horizontal asymptote to the graph of $f(x)$.

D. The line $y = x$ is an oblique asymptote to the graph of $f(x)$.

34. What is the domain of the function $f(x) = \frac{x^2-5x+6}{x^2+x+4}$?

A. $\mathbb{R}$ B. $\mathbb{R}\backslash\{2, 3\}$ C. $\mathbb{R}\backslash\{-2\}$ D. $\mathbb{R}\backslash\{2\}$

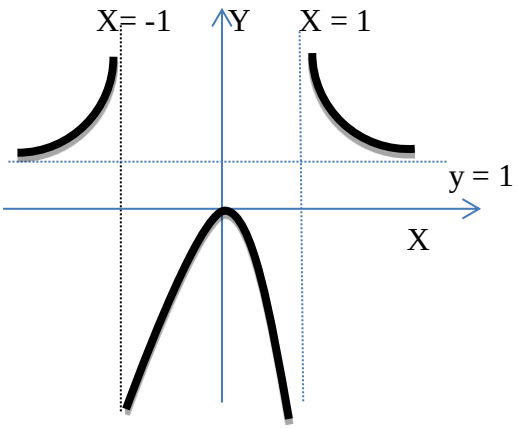
35. Which one of the following function could most likely be drawn as the graph below?

A. $f(x) = \frac{x^2}{1-x^2}$

B. $f(x) = \frac{1-x}{1-x^2}$

C. $f(x) = \frac{x}{x^2-1}$

D. $f(x) = \frac{x^2}{x^2-1}$



36. What is the value of x and y respectively in each of the following matrices A and B if $A = B$

$A = \begin{pmatrix} x+y & 5 & m \\ 3 & -1 & 4 \\ 6 & 1 & 9 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 5 & m \\ x-y & -1 & 4 \\ p & 1 & k \end{pmatrix}$?

A. $2\ \&-1$ B. $-1\ \&-2$ C. $1\ \&2$ D. $3\ \&1$

37. Which of the following is the product AB of two matrices $A = \begin{pmatrix} -3 & 1 \\ 2 & 4 \end{pmatrix}$ & $B = \begin{pmatrix} -1 & 2 \\ 3 & 0 \end{pmatrix}$?

A. $\begin{pmatrix} -6 & 6 \\ 10 & 4 \end{pmatrix}$ B. $\begin{pmatrix} 6 & 6 \\ 10 & 4 \end{pmatrix}$ C. $\begin{pmatrix} 6 & -6 \\ 10 & 4 \end{pmatrix}$ D. $\begin{pmatrix} 6 & -6 \\ 14 & 4 \end{pmatrix}$

38. Let A be a square matrix of order n. If $A = A^t$, then matrix A

A. Skew symmetric matrix C. Identity matrix

B. Symmetric matrix D. Diagonal matrix

39. Let $A = \begin{pmatrix} 6 & 2 & -4 \\ 3 & -6 & 4 \\ 1 & 3 & -1 \end{pmatrix}$, then which of the matrix is obtained from A by applying the following elementary row operations

i. $R_1 \leftrightarrow R_3$ ii. $R_2 \longrightarrow R_2 - 3R_1$ iii. $R_3 \longrightarrow \frac{1}{2}R_3$

A. $\begin{pmatrix} 1 & 3 & -1 \\ 0 & -15 & 7 \\ 3 & 1 & -2 \end{pmatrix}$ C. $\begin{pmatrix} 1 & 3 & -1 \\ 0 & -15 & 7 \\ 3 & 1 & -2 \end{pmatrix}$

B. B. $\begin{pmatrix} 1 & 3 & 1 \\ 0 & -15 & 1 \\ 3 & 1 & -2 \end{pmatrix}$ D. $\begin{pmatrix} 1 & 3 & -1 \\ 0 & -15 & 7 \\ 3 & 1 & 2 \end{pmatrix}$

40. Which of the following systems of linear equations has infinitely many solutions?

A. $\begin{cases} 2x+3y=1 \\ x-2y=3 \end{cases}$ C. $\begin{cases} x+y=3 \\ 2x+2y=6 \end{cases}$

B. $\begin{cases} 3x-2y=2 \\ 9x-6y=5 \end{cases}$ D. $\begin{cases} x+y=1 \\ x-y=3 \end{cases}$

41. Let $A = \begin{pmatrix} 5 & 7 \\ 3 & 4 \end{pmatrix}$, then what is the inverse of matrix A ?

A. $A^{-1} = \begin{pmatrix} 4 & -3 \\ -7 & 5 \end{pmatrix}$ C. $A^{-1} = \begin{pmatrix} 4 & -7 \\ -3 & 5 \end{pmatrix}$

B. $A^{-1} = \begin{pmatrix} 4 & 7 \\ 3 & 5 \end{pmatrix}$ D. $A^{-1} = \begin{pmatrix} -4 & 7 \\ 3 & -5 \end{pmatrix}$

42. In a triangle, the smallest angle measures 10° more than the half of the largest angle. The middle angle measures 12° more than the smallest angle. What are the measures of the largest angle?

A. 78° B. 59° C. 74° D. 47°

43. Which of the following is the determinant of matrix A, if $A = \begin{pmatrix} 1 & 1 & 5 \\ 0 & 3 & 4 \\ 0 & 0 & 2 \end{pmatrix}$?

A. 6 B. 5 C. 0 D. 15

44. Let A be a square matrix of order 3 with$\det(A) = 4$, the statements is NOT true?

A. $\det(2A) = 32$ C. $\det(A^t) = -4$

B. $\det(A^{-1}) = 0.25$ D. $\det(AA^t) = 16$

45. What is the inverse of matrix $A = \begin{pmatrix} 1 & 2 & 3 \\ 0 & 1 & 4 \\ 0 & 0 & 1 \end{pmatrix}$?

A. $\begin{pmatrix} 1 & -2 & 5 \\ 0 & 1 & -4 \\ 0 & 0 & 1 \end{pmatrix}$ B. $\begin{pmatrix} 1 & 2 & 5 \\ 0 & 1 & 4 \\ 0 & 0 & 1 \end{pmatrix}$ C. $\begin{pmatrix} 1 & 2 & 5 \\ 0 & 1 & -4 \\ 0 & 0 & 1 \end{pmatrix}$ D. $\begin{pmatrix} 1 & -2 & 5 \\ 0 & 1 & 4 \\ 0 & 0 & 1 \end{pmatrix}$

46. A sequence that has a last term is called _____

A. Finite sequence C. Fibonacci sequence

B. Infinite sequence D. Mulatu sequence

47. What is the 20^{th} term of the sequence $3,\ 8,\ 13,\ 18,\ \ldots$?

A. 110 B. 98 C. 85 D. 72

48. What is the geometric mean between $\sqrt{2}$ and $\sqrt{8}$?

A. $\pm 2\sqrt{2}$ B. $\pm\sqrt{2}$ C. ± 4 D. ± 2

49. Which of the following is equal to the sum $\sum_{n=1}^{5} 2n^2$?

A. $2 + 8 + 18 + 32 + 50$ C. $2 + 4 + 8 + 16 + 32$

B. $2 + 4 + 6 + 8 + 10$ D. $2 + 8 + 16 + 32 + 64$

50. What is sum of all two-digit numbers whose remainder is 1 when it divided by 5?

A. 963 B. 693 C. 369 D. 1,926

51. What is the sum of the series $\sum_{k=1}^{\infty}(-4)\left(\frac{3}{2}\right)^{2-k}$?

A. 18 B. -18 C. $\frac{-32}{9}$ D. -9

52. A person has 2 parents, 4 grandparents, 8 great grandparents and so on. What is the total number of his ancestors during the 10^{th} generations?

A. 1,024 B. 4,092 C. 5,048 D. 2,046

53. $\int x(x^2 + 2)\,dx$?

A. $\frac{1}{3}x^3 + x^2 + c$ C. $\frac{1}{4}x^4 - x^2 + c$

B. $\frac{1}{4}x^4 + x^2 + c$ D. $\frac{1}{4}x^4 + x^2$

54. What does the derivative of a function represent at a point?

A. The average rate of change of the function.
B. The instantaneous rate of change of the function.
C. The area under the curve of the function.
D. The integral of the function.

55. Let$f(x) = x^2 + 2x - 3$. Then what is the value of $\frac{f(h-2) - f(-2)}{h}$ as h gets closer and closer to 0?

A. 6 B. -6 C. -2 D. 2

56. Let $f(x) = x^3\left(1 - \frac{1}{x}\right)\left(1 + \frac{1}{x}\right)$. Then $f'(x)$ is equal to:

A. $3x^2 - 2x$ B. $3x^2 - 1$ C. $3x^2$ D. $3x - 1$

57. Let $f(x) = x - x^2$ and $g(x) = 3 - x$,then what is the value of $(fog)'(-1)$?

A. 0 B. -3 C. 7 D. -7

58. Which one of the following is NOT true about the function $(x) = 2x^3 + 3x^2 - 3$?

A. -1 *and* 0 are critical numbers of f C. 2 is local maximum value of f

B. f is decreasing on $[-1, 0]$ D. -3 is local minimum value of f

59. What is the equation of the tangent line and normal line to the graph of $f(x) = x^3 - 3x - 4$ at $(-1, f(-1))$ respectively?

A. $y = -1$ *and* $x = 0$ C. $x = -2$ *and* $y = -1$

B. $y = 6x + 12$ *and* $y = \frac{35-x}{6}$ D. $y = -2$ *and* $x = -1$

60. If radius r of a hemisphere is increasing at the rate of $3cm/sec$, then what is the rate of change of the area when diameter is $4cm$?

A. 6πcm^2/sec B. 36πcm^2/sec C. 12πcm^2/sec D. 24πcm^2/sec

61. For the purpose of road management, flow of vehicles needs to be regulated. On the average it was observed that the speed of vehicles in km/hr follow the formula $f(x) = 10\left(x + \frac{50}{2x+1}\right)$, x is the speed in km/hr. Which of the following is the following is the minimum speed of a vehicle in the situation?

A. 115 B. 105 C. 95 D. 45

62. Which one of the following is the area of a region that enclosed by the curve of $f(x) = 3x^2 + 2$, the x-axis and the vertical lines x = 1and x = 2?

A. $15\ sq.units$ $B.9\ sq.units$ $C.10\ sq.units$ $D.\frac{16}{3}\ sq.units$

Answer question 63 and 65 with the given data sets of the following

$value(x)$	$3-7$	$8-12$	$13-17$	$18-22$
$frequency(f)$	4	6	8	2

63. What is the range of the data?

A. 10 B. 15 C. 11 D. 20

64. What is the mean deviation about the mean of the data?

A. 6 B. 12 C. 5 D. 9

65. What is the standard deviation of the data?

A. $2\sqrt{5}$ B. 20 C. $\sqrt{21}$ D. 21