

OROMIA EDUCATION BUREAU

FIRST ROUND MATHEMSTICS MODEL EXAM FOR GRADE 12, 2017/2025.

TIME ALLOWED: 3 HOURS.

GENERAL DIRECTIONS

THIS BOOKLET CONTAINS FIRST ROUND *MATHEMATICS* MODEL EXAM FOR **GRADE 12**. IN THIS EXAM THERE ARE TOTAL OF **60** MULTIPLE CHOICES QUESTIONS.

THERE IS ONLY ONE BEST ANSWER FOR EACH QUESTION. CHOOSE THE BEST ANSWER FROM THE SUGGESTED OPTIONS AND WRITE THE LETTER OF YOUR CHOICE ON THE 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 PEN/PENCIL DOWN, AND WAIT FOR FURTHER INSTRUCTIONS.

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

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

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

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DIRECTION: FOR EACH OF THE FOLLOWING QUESTIONS CHOOSE THE BEST ANSWER FROM THE SUGGESTED OPTIONS AND WRITE THE LETTER OF YOUR CHOICE ON THE ANSWER SHEET PROVIDED.

1. In the set of natural numbers, which one of the following defines a prime number?
A. An odd number that has more than two different divisors.
B. A number that has exactly three different factors.
C. A number that has no positive divisors other than 1 and itself.
D. A number that has exactly one divisor.
2. If the $GCF(a, 169) = 13$ and $LCM(a, 169) = 338$ what is the value of a ?
A. 26 B. 394 C. 52 D. 20
3. If $a = 5 + 2\sqrt{6}$ and $b = \frac{1}{a}$, then which one of the following is the value of $a^2 + b^2$?
A. $98 - 40\sqrt{6}$ B. 98 C. 1 D. $40\sqrt{6}$
4. After rationalizing the denominator of the expression $\frac{3\sqrt{2} + \sqrt{3}}{3\sqrt{2} - 2\sqrt{3}}$, what will be the simplified expression?
A. $\frac{14 + 3\sqrt{6}}{2}$ B. $\frac{24 + 8\sqrt{6}}{6}$ C. $\frac{8 + 3\sqrt{6}}{2}$ D. $\frac{8 - 3\sqrt{6}}{2}$
5. The solution set of the equation $|7 - (x + 2)| + |3x - 3| = 0$ is equal to:
A. $\{-1, 2\}$ B. $\{ \}$ C. $\left\{ -\frac{7}{4}, \frac{1}{2} \right\}$ D. $\left\{ \frac{1}{2}, \frac{7}{4} \right\}$
6. Let A, B and C are three sets described as follows:
A = The set of natural numbers less than 5 , B = $\{x : x \in \mathbb{N} \text{ and } x \text{ is a factor of } 6\}$ and C = $\{3, 4, 5, 6\}$.
Then which of the following is **true**?
A. $A \cap B = A$ C. $A \cup B = B$
B. $A \cup (B \cap C) = B$ D. $A \cap (B \cup C) = A$
7. A line from the top of a cliff to the ground just passes over the top of a pole 20 meters high. The line meets the ground at a point 15 meters from the base of the pole. If it is 120 meters away from this point to the base of the cliff, then how high is the cliff (*in meters*)?
A. 160 B. 90 C. 320 D. 180
8. Given vectors \vec{u} having initial point $(2, -3)$ and terminal point $(-3, 2)$ and \vec{v} with initial point $(4, 7)$ and terminal point $(-1, -1)$, then $\vec{v} - \vec{u}$ is equal to:
A. $(0, 13)$ B. $(0, -13)$ C. $(10, -3)$ D. $(10, -13)$
9. Which one of the following is the mean deviation about the mean of the data given below?
38 44 70 54 40 46 63 55 42 48
A. 50 B. 5 C. 8.4 D. 8

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10. The following table shows an analysis of monthly wages paid to workers in two firms A and B, belonging to the same industry.

	Firm A	Firm B
Number of wage earners	586	648
Mean of monthly wages	Birr 5,253	Birr 5,253
Variance of the distribution wages	100	121

Which one of the following statements is **true** about this data?

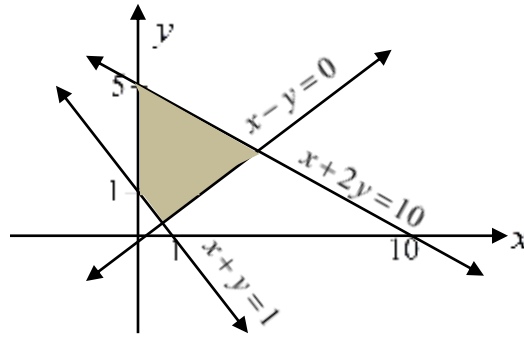
- A. Firm A pays larger amount of monthly wages.
 B. Firm B has greater variability in the individual wages.
 C. Firm A has greater variability in the individual wages.
 D. Firm B pays smaller amount of monthly wages.
11. If the mean of the following data is 28, then the value of the missing frequency f is equal to:

x	0–10	10–20	20–30	30–40	40–50	50–60
Frequency	12	18	27	f	17	6

- A. 14 B. 4 C. 20 D. 10
12. Which one of the following numbers is the coefficient of a^5b^7 in expansion of $(a-b)^{12}$?
- A. 101,376 B. 792 C. -101,376 D. -792
13. If $\frac{2}{6!} + \frac{1}{7!} = \frac{x}{8!}$, then which one of the following is the value of x ?
- A. 120 B. 26.13 C. 56 D. 840
14. What is the number of ways of selecting 9 balls from 6 red balls, 5 white balls and 5 blue balls if each selection consists of 3 balls of each colour?
- A. 40 B. 2,000 C. 48,000 D. 160
15. A man wants to cut three lengths from a single piece of board of length 91cm. The second length is to be 3cm longer than the shortest and the third length is to be twice as long as the shortest. What are the possible lengths of the shortest (in centimeters) board if the third piece is to be at least 5cm longer than the second?
- A. [0, 8] B. (0, 8) C. [8, 22] D. (22, ∞)
16. Let $A = \{1, 2, 3, \dots, 20\}$. If a relation R from A to A is defined by $R = \{(x, y) : 3x - y = 0\}$ where $x, y \in A$, then find the range of R.
- A. {1, 2, 3, 4, 5, 6} B. {3, 6, 9, 12, 15, 18} C. {6, 9, 12, 15, 18, 21} D. \mathbb{R}
17. In an examination, a question paper consists of 12 questions divided into two parts that is part I and part II, containing 5 and 7 questions respectively. If a student is required to attempt 8 questions in all, selecting at least 3 from each part, then in how many ways can a student select the questions?
- A. 210 B. 175 C. 385 D. 420

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18. Which one of the following is the sum of all natural numbers between 100 and 1000 exclusive, which are divisible by 5?
 A. 99,550 B. 97,350 C. 550,000 D. 98,450
19. If the sum of some terms of a geometric sequence is 315 and its first term and common ratio are 5 and 2 respectively, then find the last term of this sequence.
 A. 160 B. 180 C. 224 D. 150
20. Given that a graph of system of linear inequalities as shown below.



Which one of the following system of linear inequalities is represented by the shaded region in the graph?

- A. $\begin{cases} x+2y \leq 10 \\ x+y \geq 1 \\ x-y \leq 0 \\ x \geq 0 \\ y \geq 0 \end{cases}$ B. $\begin{cases} x+2y \leq 10 \\ x+y \geq 1 \\ x-y \geq 0 \\ x \geq 0 \\ y \geq 0 \end{cases}$ C. $\begin{cases} x+2y \geq 10 \\ x+y \leq 1 \\ x-y \geq 0 \\ x \geq 0 \\ y \geq 0 \end{cases}$ D. $\begin{cases} x+2y \geq 10 \\ x+y \geq 1 \\ x-y \leq 0 \\ x \geq 0 \\ y \geq 0 \end{cases}$

21. Which one of the following is the 12th term of geometric sequence whose 8th term is 192 and common ratio is 2?
 A. 3,072 B. 6,144 C. 4,450 D. 9,216
22. The sum to n of the series $\frac{1}{1 \times 2} + \frac{1}{2 \times 3} + \frac{1}{3 \times 4} + \dots$ is equal to:
 A. $\frac{n+1}{n}$ B. $\frac{1}{n(n+1)}$ C. $\frac{n}{n+1}$ D. $n(n+1)$
23. If the sum of the squares of two consecutive odd positive integers is 290, then which one of the following is the two numbers?
 A. -13 and 11 B. 13 and 15 C. 11 and 13 D. 9 and 11
24. Which of the following sampling methods involves dividing the population into subgroups or strata, then randomly selecting individuals from each stratum?
 A. Multistage sampling C. Cluster sampling
 B. Systematic sampling D. Stratified sampling
25. If A and B are square matrices of order 3 with $\det(A)=6$ and $\det(B)=5$, then which one of the following is **true**?
 A. $\det(3A^T B)=90$ B. $\det(2AB)=240$ C. $\det(4A)=24$ D. $\det(2B^2)=50$

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26. Which one of the following is the slope of the tangent line to the curve $f(x) = x^3 - 3x + 2$ at the point whose x -coordinate is 3?
- A. 20 B. $-\frac{1}{24}$ C. 24 D. 26
27. If the volume of a cube is increasing at the rate of $8\text{cm}^3 / \text{s}$, then how fast is the surface area increasing when the length of an edge is 12cm ?
- A. $\frac{2}{9}\text{cm}^2 / \text{s}$ B. $\frac{8}{3}\text{cm}^2 / \text{s}$ C. $3\text{cm}^2 / \text{s}$ D. $12\text{cm}^2 / \text{s}$
28. If the total revenue in Birr received from the sale of x units of a product is given by $P(x) = 13x^2 + 26x + 15$, then which one of the following is the marginal revenue (*in Birr*) when $x = 10$?
- A. 286 B. 1,575 C. 301 D. 26
29. Which of the following is the largest interval on which the function $f(x) = 2x^3 - 3x^2 - 36x + 7$ is increasing?
- A. $(-\infty, 2] \cup [3, \infty)$ B. $(-\infty, -3] \cup [2, \infty)$ C. $(-\infty, -2] \cup [3, \infty)$ D. $[-2, 3]$
30. What is the area (*in square units*) of the region bounded by the graph of $y = x^3$ and the x -axis between the lines $x = -2$ and $x = 1$?
- A. $\frac{16}{4}$ B. $\frac{15}{4}$ C. 9 D. $\frac{17}{4}$
31. Let $f(x) = x^3 - 6x^2 + 9x + 15$. Which of the following is a local maximum value of f ?
- A. $f(1)$ B. $f(3)$ C. $f(-1)$ D. $f(-3)$
32. Which one of the following is the area (*in square units*) of a parallelogram whose adjacent sides are $i + k$ and $2i + j + k$?
- A. $\sqrt{2}$ B. $\sqrt{3}$ C. 2 D. 3
33. Which one of the following is the coordinates of the centroid of ΔABC with vertices $A(2, 1)$, $B(5, 8)$ and $C(8, 3)$?
- A. (4, 5) B. (5, 8) C. (5, 2) D. (5, 4)
34. A sequence is recursively defined by $a_n = a_{n-1} + (a_{n-2})^2 + n, \forall n \geq 3$. If $a_1 = 1, a_2 = -2$, then which one of the following is the value of a_6 ?
- A. 29 B. 175 C. 125 D. 493
35. Which one of the following is the partial fraction decomposed form of $\frac{x^2 + 3}{x^3 + x^2 + x + 1}$?
- A. $\frac{2}{x+1} - \frac{1+x}{x^2+1}$ B. $\frac{2}{x+1} + \frac{1-x}{x^2+1}$ C. $\frac{1}{x+1} + \frac{x-1}{x^2+1}$ D. $\frac{1}{x+1} - \frac{x+1}{x^2+1}$
36. What is the solution set of the equation $\frac{3x}{x+4} + \frac{2}{x^2+6x+8} = \frac{1}{x+2}$?
- A. $\{-2\}$ B. $\left\{-2, \frac{1}{3}\right\}$ C. $\{\}$ D. $\left\{\frac{1}{3}\right\}$

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37. What is the solution set of the system of linear equation $\begin{cases} x + y + z = 1 \\ y + z = 3 \\ x - 2y + z = -5 \end{cases}$?
- A. $\{(-2, 2, 1)\}$ B. $\{(2, -2, 1)\}$ C. $\{(2, 1, -2)\}$ D. $\{(-2, -2, 1)\}$
38. Which of the following is **NOT** true about the graph of $f(x) = \frac{x+3}{x^2+5x+6}$?
- A. The graph has hole at $(-3, -1)$.
B. The horizontal asymptote of the graph is the x - axis.
C. The vertical asymptote of the graph are $x = -3$ and $x = -2$
D. The graph has no x - intercept
39. If the image of point $(-1, 2)$ under translation T is $(3, -1)$, then what is the image of the point $(-1, 3)$ under this translation?
- A. $(4, -3)$ B. $(3, 0)$ C. $(-5, 6)$ D. $(5, -6)$
40. Find the fifth decile (D_5) of the data given below:
10, 13, 15, 12, 18, 15, 16, 12, 13, 20, 17, 14, 19, 18, 23, 2
- A. 15.5 B. 16 C. 12.5 D. 15
41. What is the image of the line $l: y = x + 5$ after it has been reflected about the line $L: y = 2x + 1$?
- A. $y = -5x + 11$ B. $y = 5x - 11$ C. $y = x + 11$ D. $y = 7x - 19$
42. If $u = 3i + 2j + 5k$ and $v = i - 3j + 2k$ are two vectors, then $3u \cdot (u \times v)$ is equal to:
- A. -12 B. 12 C. 0 D. -6
43. Which one of the following series is divergent?
- A. $\left\{(-1)^n \left(\frac{2}{3}\right)^{n+1}\right\}_{n=1}^{\infty}$ C. $\left\{\left(\frac{2}{3}\right)^{n+2} \left(\frac{4}{5}\right)^{n-1}\right\}_{n=1}^{\infty}$
B. $\{2^{1-n}\}_{n=1}^{\infty}$ D. $\left\{\left(\frac{2}{3}\right)^{1-n} \left(\frac{1}{2}\right)^{-n}\right\}_{n=1}^{\infty}$
44. What is the absolute maximum value of $f(x) = x^3 + 6x^2$ on $[-1, 1]$?
- A. 32 B. 7 C. 5 D. 0
45. $\int_0^2 (3x^2 + 2x) dx$ is equal to:
- A. 20 B. 10 C. 12 D. 8
46. For the company the total cost and total revenue in Birr for manufacturing x amount of product is given by $C(x) = 2x + 7,000$ and $R(x) = 10x - \frac{x^2}{1,000}$ respectively, then what is the maximum profit for this company?
- A. Birr 8,000 B. Birr 16,000 C. Birr 9,000 D. Birr 32,000

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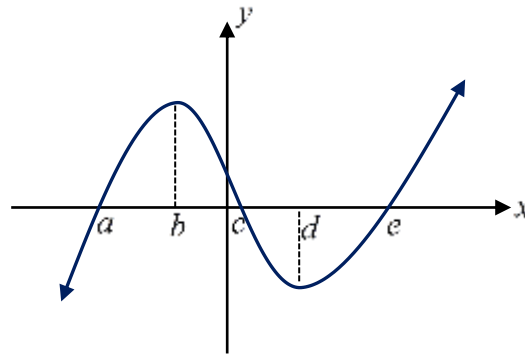
47. If you toss a coin four times, what is the number of favourable outcomes are there for getting at least two tails?
 A. 9 B. 12 C. 11 D. 8
48. If $f(x) = \sqrt{x^2 + 2x + 1}$, then $f'(2)$ is equal to:
 A. 2 B. $\frac{1}{3}$ C. $\frac{2}{3}$ D. 1
49. Which one of the following is the sum of infinite series $0.33 + 0.0033 + 0.000033 + \dots$?
 A. $\frac{33}{(10)^n}$ B. $\frac{2}{3}$ C. $\frac{33}{(10)^{n+1}}$ D. $\frac{1}{3}$
50. A box contains 8 items of which 6 are defective. If three items are randomly selected out of the box, then what is the probability in which two will be defective and the other will be non-defective?
 A. $\frac{3}{14}$ B. $\frac{15}{56}$ C. $\frac{5}{56}$ D. $\frac{15}{28}$
51. If $A = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 2 \\ 1 & 3 \end{pmatrix}$, then $(BA)^{-1}$ is equal to:
 A. $\begin{pmatrix} 2 & 1 \\ 3 & 1 \end{pmatrix}$ B. $\begin{pmatrix} -2 & 1 \\ 3 & -1 \end{pmatrix}$ C. $\begin{pmatrix} 1 & -1 \\ -3 & 2 \end{pmatrix}$ D. $\begin{pmatrix} -1 & 1 \\ 3 & -2 \end{pmatrix}$
52. Which of the following relation is a function?
 A. $R = \{(1, 0), (4, 5), (1, 3), (6, -6)\}$ C. $R = \{(x, y) : x, y \in \mathbb{R} \text{ and } x^2 + y^2 = 16\}$
 B. $R = \{(x, y) : x, y \in \mathbb{R} \text{ and } x + y = 9\}$ D. $R = \{(x, y) : x, y \in \mathbb{R} \text{ and } x \text{ is a father of } y\}$
53. If $f(x) = \sqrt{x+2}$ and $g(x) = \frac{1-2x}{x}$, then $(f \circ g)\left(\frac{1}{4}\right)$ is equal to:
 A. 2 B. $\frac{1}{4}$ C. $\frac{1}{2}$ D. 4
54. Grade 12 students in class A, B, C and D took Mathematics Final Exam which is marked out of 40. The following table shows the mean score and standard deviation of scores of students in each class.

Class	Mean	Standard deviation
A	32	5.85
B	32	5.80
C	32	6.02
D	32	6.05

- Which one of the following statements is **true** about these data?
- A. The result of class D students is highly variable.
 B. Exam result of class A students is more consistent than class B students.
 C. The most consistent Exam result is class C students' result.
 D. Exam result of class C students is more consistent than class B students.

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55. Look at the following graph of $f'(x)$.



Which of the following is **NOT** true?

- A. $f(a)$ local minimum. C. $f(c)$ local maximum.
 B. f is decreasing on $(-\infty, a] \cup [c, e]$. D. f is increasing on $(-\infty, b] \cup [d, \infty)$.
56. If $f(x) = \lfloor x \rfloor$, $g(x) = |x|$ and $h(x) = \text{sgn } x$, then which one of the following is necessarily **true**?

- A. $f(x) - g(x) \leq 0, \forall x \in \mathbb{R}$ C. $h(x) = \frac{g(x)}{x}, \forall x \in \mathbb{R}$
 B. $f(x) \geq h(x), \forall x \in \mathbb{R}^+$ D. $f\left(g\left(-\frac{5}{2}\right)\right) + g\left(f\left(-\frac{6}{5}\right)\right) = 0$

57. Which of the following matrices is in reduced echelon form?

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

58. Which one of the following is a vector equation of the line $3x + 5y = 15$?

- A. $r = 3j + \lambda(3i + 5j), \lambda \in \mathbb{R}$ C. $r = \lambda(5i - 3j), \lambda \in \mathbb{R}$
 B. $r = 5i + \lambda(5i - 3j), \lambda \in \mathbb{R}$ D. $r = (-i + 4j) + \lambda(+5j - 3i), \lambda \in \mathbb{R}$

59. Which of the statements is **NOT** true about the reflection?

- A. In a reflection every point of a figure is moved along the same direction through the same distance.
 B. Reflection is a transformation in which distance is preserved.
 C. A reflection is a one-to-one mapping.
 D. Reflection in the line L is a function on the points of the plane.

60. Which one of the following statements is **NOT** true?

- A. In normal distributions the Pearson's coefficient of skewness is zero.
 B. In symmetrical distribution the Pearson's coefficient of skewness is less than then Bowley's coefficient of skewness.
 C. In distribution, if mode < medain < mean, then the distribution is positively skewed.
 D. In distribution, if mean < medain < mode, then the Bowley's coefficient of skewness $\beta < 0$.

THE END