**OROMIA EDUCATION BUREAU SECONDARY SCHOOLS PROGRAMME**

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

**TIME ALLOWED: 3 HOURS.**

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**GENERAL DIRECTIONS**

THIS BOOKLET CONTAINS SECOND 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 OVER UNTIL YOU ARE TOLD TO DO SO.**

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# OEB SECONDARY SCHOOLS PROGRAMME

**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. After rationalizing the denominator of $\frac{5}{3\sqrt{3}-2\sqrt{2}}$, the denominator is equal to _____.

   A. 35 B. $\frac{5\left(3\sqrt{3}-2\sqrt{2}\right)}{19}$ C. 19 D. $\frac{5\left(3\sqrt{3}+2\sqrt{2}\right)}{19}$

2. The solution set of the equation $5|2x-1|-3|4x+5|=2$ is equal to:

   A. $\left\{\frac{6}{11}\right\}$ B. $\left\{-11,-9,-\frac{6}{11}\right\}$ C. $\{\ \}$ D. $\left\{-9,-\frac{6}{11}\right\}$

3. In a survey of $600$ students in a school, if $250$ students were found to be drinking tea and $225$ drinking coffee, $75$ were drinking both coffee and tea, then how many students were drinking neither coffee nor tea?

   A. 400 B. 550 C. 200 D. 125

4. Given a relation $R=\{(x,\ y): y>x-2,\ y>-x-2 \text{ and } y\le 4\}$. Which of the following is the domain and range of R respectively?

   A. $(-6,\ 6)$ and $(-2,\ 4]$ C. $[-6,6]$ and $(-2,4)$

   B. $(-2,\ 4]$ and $(-6,\ 6)$ D. $(-2,\ 4)$ and $(-6,\ 6)$

5. $\Delta ABC$ and $\Delta DEF$ are similar and the area of $\Delta ABC=12m^2$. If $\overline{DE}$ is twice of $\overline{AB}$, then which one of the following is the area of $\Delta DEF$?

   A. $6m^2$ B. $48m^2$ C. $36m^2$ D. $24m^2$

6. Vector $\overrightarrow{AB}$ has initial point $A(2,\ -1)$ and terminal point $B(-4,\ 7)$. Which of the following vector is a unit vector in the same direction as $\overrightarrow{AB}$?

   A. $-\frac{3}{5}i+\frac{4}{5}j$ B. $\frac{3}{5}i-\frac{4}{5}j$ C. $-\frac{3}{50}i-\frac{4}{50}j$ D. $\frac{3}{50}i+\frac{4}{50}j$

7. Which of the following is the range of the function $f(x)=\frac{x+2}{x-2}$?

   A. $\mathbb{R}\setminus\{2\}$ B. $\mathbb{R}\setminus\{-2\}$ C. $\mathbb{R}\setminus\{-1\}$ D. $\mathbb{R}\setminus\{1\}$

8. A job applicant finds that a firm A offers a starting salary of Birr 5,000 with a guaranteed raise of Birr 600 per year. Over the first 20 years, how much would be earned at firm A?

   A. Birr $214,000$ B. Birr $16,400$ C. Birr $264,000$ D. Birr $216,000$

9. If $\{a_n\}$ is arithmetic sequence with first term is $10$ and the tenth term is $-26$, then $a_{101}$ is equal to:

   A. 420 B. 380 C. –410 D. –390

10. What is the area (*in square units*) of a region enclosed by the graph of $f(x)=1-x^2$ and the $x-$axis where $0\le x\le 2$?

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

11. What is the constant term in the expansion of $\left(x-\frac{2}{x^2}\right)^6$?

    A. –160 B. –60 C. 60 D. 240

12. If a square ABCD is inscribed in a circle of radius $4cm$, then what is the area of the segment cut off by the chords $\overline{AB}$, $\overline{BC}$, $\overline{CD}$ and $\overline{AD}$?

A. $16(\pi+2)cm^2$ B. $16(\pi-2)cm^2$ C. $16(\pi+1)cm^2$ D. $16(\pi+1)cm^2$

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

A. $x+2$ is a factor of $f(x)=x^3-3x^2-4x+12$.

B. A polynomial function $f(x)=x^4-6x^3+x^2+12x-6$ has real root between $-1$ and $0$.

C. If you divide $f(x)=x^4+6x^3-10x+3$ by $x^2-1$, then the remainder is $-4x+4$.

D. The graph of a polynomial function of degree $n$ has at most $n-1$ turning points.

14. The following is the frequency distribution of a grouped data.

| Class interval | $3-7$ | $8-12$ | $13-17$ | $18-22$ |
|---|---|---|---|---|
| Frequency | 4 | 1 | 10 | 5 |

What is the mean of this distribution?

A. 14 B. 7 C. 15 D. 28

15. If $P(-2, 5)$ and $Q(8, -1)$ are points on the coordinate plane, so that $Q$ is the mid-point of $\overline{PR}$, then what are the coordinates of point $R$?

A. $(-7, 18)$ B. $(14, 3)$ C. $(18, -7)$ D. $(3, 2)$

16. Mr. Soresa divided Birr $40,000$ for three workers A, B and C in the ratio of $\frac{1}{2}$, $\frac{3}{10}$ and $\frac{1}{5}$ respectively, then what is C's share (*in Birr*)?

A. $20,000$ B. $8,000$ C. $12,000$ D. $13,333.33$

17. What is the solution set of the equation $\log_2(x+2)+\log_2(x-1)=2$?

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

18. If $\cos\theta=-\frac{3}{5}$ and $\tan\theta<0$, then which of the following is **true**?

A. $\sin\theta=-\frac{4}{5}$ B. $\cot\theta=-\frac{4}{3}$ C. $\csc\theta=\frac{5}{4}$ D. $\tan\theta=\frac{4}{3}$

19. What is the volume of frustum of pyramid if the areas of the bases of frustum of pyramid are $81cm^2$, $121cm^2$ and its altitude is $6cm$?

A. $602\pi cm^3$ B. $602cm^3$ C. $301cm^3$ D. $903\pi cm^3$

20. The simplified form of the expression $\frac{x^2-4}{x^2+3x-10}\div\frac{x^2+5x+6}{x^2+8x+15}$ for $x\neq -5,-3,-2$ and $2$ is equal to:

A. $\frac{x+2}{x+5}$ B. $\left(\frac{x+2}{x+5}\right)^2$ C. $\frac{x-2}{x+3}$ D. 1

21. If $f(x)=(\pi^2+1)^4$, then what is the value of $f'(x)$?

A. 0 B. $8\pi(\pi^2+1)^3$ C. $4(\pi^2+1)^3$ D. $8(\pi^2+1)^3$

22. Which of the following is a geometric sequence?

A. $1,\ 1.5,\ 2.25,\ 3.375,\ ...$

B. $1,\ \frac{1}{8},\ \frac{1}{32},\ \frac{1}{64},\ ...$

C. $27,\ 21,\ 15,\ 9,\ ...$

D. $1,\ 4,\ 8,\ 12,\ 15,\ ...$

23. If $A=\begin{pmatrix}1 & 2 & 3\\ 2 & 4 & -5\\ 3 & -5 & 6\end{pmatrix}$ be a $3\times 3$ matrix, then which of the following is **NOT** true?

A. A is symmetric matrix.

B. The determinant of A is $-71$.

C. A is invertible matrix.

D. The cofactor of $a_{32}$ is equal to 11 .

24. Which one of the following is the equation of the line tangent to the circle $x^2+y^2-8x-10y-128=0$ at the point $(-8,\ 10)$?

A. $5x-12y+136=0$

B. $12x-5y+146=0$

C. $12x+5y+146=0$

D. $5x+12y+136=0$

25. What is the image of the circle $x^2+y^2-4x+6y+12=0$ when it is rotated by $\frac{\pi}{2}$ about the origin?

A. $(x-3)^2+(y-2)^2=1$

B. $(x+3)^2+(y+2)^2=1$

C. $(x-3)^2+(y+2)^2=1$

D. $(x+3)^2+(y-2)^2=1$

26. Which of the following vector is orthogonal to the vector $\mathbf{u}=(-4,\ 6)$?

A. $\mathbf{v}=(-3,\ 2)$ B. $\mathbf{v}=(-1,\ -1)$ C. $\mathbf{v}=(3,\ -2)$ D. $\mathbf{v}=(-3,\ -2)$

27. Which of the following is **NOT** true about transformation?

A. Reflection is onto mapping.

B. Translation move rectangles to congruent rectangles.

C. Rotation move circles to congruent circles.

D. Reflection is a non- rigid motion.

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28. A balloon, which always remains spherical on inflation, is being inflated by pumping in $900cm^3$ of gas per second. What is the rate at which the radius of the balloon increases when the radius is $15cm$?

A. $\pi cm/s$ B. $1cm/s$ C. $\frac{1}{\pi}cm/s$ D. $\frac{1}{4}cm/s$

29. If the total revenue in Birr received from the sale of $x$ units of a product is given by $R(x)=3x^2+36x+5$, then which one of the following is the marginal revenue (*in Birr*) when $x=20$?

A. 156 B. 120 C. 1,925 D. 1,236

30. If the vectors from the origin to the points A and B are $a=2i-3j+2k$ and $b=2i+3j+k$ respectively, then which one of the following is the area (*in square units*) of triangle OAB?

A. $\frac{229}{2}$ B. $\sqrt{85}$ C. $\frac{\sqrt{229}}{2}$ D. $2\sqrt{229}$

31. Which one of the following vectors has initial and terminal points $(2,\ 5,\ 0)$ and $(-3,\ 7,\ 4)$ respectively?

A. $-5i+2j-4k$ B. $-5i+2j+4k$ C. $5i-2j-4k$ D. $-i+12j+4k$

32. If the GCF of 65 and 117 is expressed in the form of $65m-117$, then which one of the following is the value of $m$?

A. 1 B. 2 C. 3 D. 4

33. Which one of the following is the greatest ratio among the ratios $3:2,\ 8:5,\ 121:75$ and $5:3$?

A. $5:3$ B. $8:5$ C. $121:75$ D. $3:2$

34. If Benti earns Birr $18,000$ per month and his wife Derartu earns Birr $20,000$ per month, then which one of the following is the ratio of Derartu's earnings to their total earnings?

A. $9:10$ B. $10:19$ C. $9:19$ D. $10:18$

35. Which one of the following is the maximum value of the following linear programming problem?

Maximize: $Z = 4x + y$ subject to: $\begin{cases} x + y \le 50 \\ 3x + y \le 90 \\ x \ge 0,\ y \ge 0 \end{cases}$

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A. 120 B. 110 C. 200 D. 50

36. A factory manufactures has two types of screws A and B. Each type of screw requires the use of two machines, an automatics and a hand operated. It takes 4 minutes on the automatic and 6 minutes on hand operated machines to manufacture a package of screws A, while it takes 6 minutes on automatics and 3 minutes on the hand operated machines to manufacture a package screws B. Each machine is available for at most 4 hours on any day. If the manufacturer can sell a package of screws A at a profit of Birr 7 and screws B at a profit of Birr 10, then which one of the following is a constraint of the linear programming problem to maximize the profit given by $P(x,\ y) = 7x + 10y$?

A. $\begin{cases} 4x + 6y \le 240 \\ 6x + 3y \le 240 \\ x \ge 0,\ y \ge 0 \end{cases}$

C. $\begin{cases} 4x + 6y \ge 240 \\ 6x + 3y \le 240 \\ x \ge 0,\ y \ge 0 \end{cases}$

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B. $\begin{cases} 6x + 4y \le 240 \\ 3x + 6y \le 240 \\ x \ge 0,\ y \ge 0 \end{cases}$

D. $\begin{cases} 6x + 4y \ge 240 \\ 3x + 6y \ge 240 \\ x \ge 0,\ y \ge 0 \end{cases}$

37. Corner points of the feasible region determined by the system of linear inequalities $2x + y \le 10,\ x + 3y \le 15,\ x \ge 0,\ y \ge 0$ are $(0,\ 0), (5,\ 0), (3,\ 4)$ and $(0,5)$. Let $Z = px + qy$, where $p,\ q > 0$. If the maximum of $Z$ occurs at $(3,\ 4)$ and $(0,\ 5)$, then which one of the following relation of $p$ and $q$ is **true**?

A. $q = 3p$ B. $p = 3q$ C. $p = q$ D. $p > \frac{1}{3}q$

38. What percent of 15 is equal to 600?

A. 400 B. 90 C. 690 D. $4,000$

39. A shop sales a pack of 30 articles for Birr $6,600$. It planned to clear the articles during a holiday. If the shop sells each item for Birr 200, then what is the approximate percent of discount has it made?

A. 9.091% B. 10% C. 90.091% D. 8%

40. If 12% tax on a pair of shoes amounts to Birr 45, then what will happen to the amount of 8% tax?

A. 30 B. 37.5 C. 40 D. 35

41. The corner points of the feasible region of a linear programming problem are $(0, 2), (3, 0), (6, 0), (6, 8)$ and $(0, 5)$. If $Z = 4x + 6y$ is the objective function, then the minimum value of $Z$ occurs at:

A. $(0, 2)$ only

B. $(3, 0)$ only

C. any point on the line segment joining the points $(0, 2)$ and $(3, 0)$

D. the mid- point of the line segment joining the points $(0, 2)$ and $(3, 0)$ only.

42. The corner points of the feasible region determined by the system of linear constraints are $(0, 0), (0, 40), (20, 40), (60, 20), (60, 0)$. If the objective function is $Z = 5x + 6y$, then which one of the following is true about the quantity in Column A and Column B?

| **Column A** | **Column B** |
|---|---|
| Maximum of Z | 421 |

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A. The quantity in Column A is greater.

B. The quantity in Column B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined based on this information.

43. A box of oranges is inspected by examining three randomly selected oranges drawn without replacement. If all the three oranges are good, then the box is approved for sale, otherwise it is rejected. What is the probability that a box containing 15 oranges out of which 12 are good and 3 are bad ones will be approved for sale?

A. $\frac{12}{15}$ B. $\frac{1}{5}$ C. $\frac{44}{91}$ D. $\frac{88}{225}$

44. If the perecentage of the profit earned on an article by selling it at Birr 960 was 20, then which one of the following is the cost of the article?

A. Birr 600 B. Birr 800 C. Birr 900 D. Birr 840

45. If the number of person infected by corona virus is 230,000 and out of them 10,000 people are died, out of the remaining 43% has been cured, then the number of persons still infected is what percent of the total number of infected person initially?

A. 57% B. 54.5% C. 56.5% D. 65%

46. Meti sold a shoe for Birr10,000 with 60% markup on selling price, then which one of the following is the cost price (*in Birr*)?

A. 4,000 B. 6,000 C. 16,000 D. 5,000

47. Let A and B be $3\times3$ matrices such that $A = \begin{pmatrix} -2 & 3 & -1 \\ 0 & 1 & 2 \\ 0 & 0 & 3 \end{pmatrix}$ and $|B| = \frac{1}{3}$. Which of the following is equal to $\det(2A^TB)$?

A. 16 B. –4 C. –16 D. 48

48. If A and B are two non-zero square matrices of the same order such that $(A+B)^2 = A^2 + B^2$, then which one of the following is **true**?

A. $AB = 0$ B. $BA = 0$ C. $AB = BA$ D. $AB = -BA$

49. Let $P = (1, a, a)$ and $Q = (a-1, 1, 1)$ be two points in space and the distance between P and Q is 3. Then which one of the following sets contains the value of $a$?

A. $\{-9, 1\}$ B. $\left\{-\frac{1}{3}, 3\right\}$ C. $\left\{-3, \frac{1}{3}\right\}$ D. $\{-1, 9\}$

50. If the probability of occurrence of an event is $\frac{2}{3}$, then what is the probability of non-occurrence of an event?

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

51. A red ball and 4 white balls are in a box. If two balls are drawn without replacement, what is the probability of getting two white balls?

A. $\frac{1}{5}$ B. $\frac{4}{5}$ C. $\frac{16}{25}$ D. $\frac{3}{5}$

52. For two vectors $\vec{A}$ and $\vec{B}$ which of the following is necessarily **true?**

A. If $|\vec{A}| = |\vec{B}|$, then $\vec{A} = \vec{B}$

B. $|k\vec{A}| = k|\vec{A}|$ for $k \in \mathbb{R}$

C. If $\vec{u}$ is a unit vector in the direction of $\vec{A}$, then $\vec{A} \cdot \vec{u} = |\vec{A}|$

D. If $\vec{A}$ is parallel to $\vec{B}$, then $\vec{A} \cdot \vec{B} = 0$

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53. The following is a table of simple frequency distribution of a data with variable $x$.

| $x$ | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|
| $f$ | 2 | 4 | 8 | 4 | 2 |

Which of the following is **NOT** true about this data?

A. The mode is 5 C. The standard deviation is $\sqrt{1.2}$

B. The middle quartile is 5 D. The $75^{th}$ percentile is 6.5

54. If the length and breadth of a steel tape are $10m$ and $2.4cm$ respectively, then the ratio of the length to the breadth is equal to:

A. 5:1.2 B. 25:6 C. 1,250:3 D. 625:6

55. A farmer bought bull for Birr 44,000 and a cow for Birr 18,000. If he sold the bull at a loss of 5% but made a profit of 10% on the cow, then the net result of transaction is:

A. loss of Birr 200 C. loss of Birr 400

B. profit of Birr 400 D. profit of Birr 200

56. What is the solution set of the system of linear equation $\begin{cases} x + y - z = 1 \\ x + 2y - 3z = 1 \\ 2x + 3y - 4z = 2 \end{cases}$ ?

A. $\{(1, 1, 0)\}$ C. $\{\ \}$

B. $\{(1-k, 2k, k) : k \in \mathbb{R}\}$ D. $\{(2k, 1-k, k) : k \in \mathbb{R}\}$

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57. Which of the following pairs of lines are perpendicular?

A. $l_1 : y = 2x - 1$ and $l_2 : y = 2x + 1$

C. $l_1 : y + 2x = 1$ and $l_2 : 2y - x = -1$

B. $l_1 : y - 2x = -2$ and $l_2 : y - \frac{1}{2}x = 1$

D. $l_1 : y = 3x + 1$ and $l_2 : y = \frac{1}{3}x + 1$

58. Suppose the following data represents the weight of students in kilogram:

60, 67, 63, 64, 61, 49, 52, 68, 55, 61. Which one of the following is **NOT** true?

A. Mean deviation about the mean of the data is $4.8$.

B. Mean deviation about the median of the data is $4.6$.

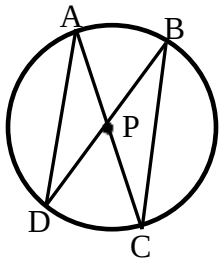
C. Mean deviation about the mode of the data is $4.6$.

D. Mean deviation about the mean of the data is $4.6$.

59. A tent is in the shape of a cylinder surmounted by a conical top. If the height and diameter of the cylinder part are $5m$ and $6m$ respectively and the slant height of the top is $8m$, then which one of the following is the area of the canvas used to make the tent?

A. $54\pi m^2$ B. $39\pi m^2$ C. $78\pi m^2$ D. $63\pi m^2$

60. In the circle below, chords $\overline{AC}$ and $\overline{BD}$ intersect at a point P inside the circle, if $m(\angle DAC) = 35^o$ and $m(\angle APB) = 65^o$, then $m(\angle ACB)$ is equal to:




A. $130^o$ B. $60^o$ C. $70^o$ D. $30^o$

# THE END

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