



**ADDIS ABEBA EDUCATION BUREAU**

**ARADA SUB CITY EDUCATION OFFICE**

**MATHEMATICS MODEL EXAMINATION**

**FOR GRADE 12 SOCIAL SCIENCE.**

**JANUARY 2025**

**NUMBER OF QUESTIONS:65**

**TIME ALLOWED: 3:00 HRS**

**GENERAL DIRECTIONS**

**THIS BOOKLET CONTAINS MATHEMATICS EXAMINATION FOR THE SOCIAL SCIENCE CANDIDATES ONLY.**

**IN THIS EXAMINATION, THERE ARE A TOTAL OF 65 MULTIPLE CHOICE QUESTIONS.**

**THERE IS ONLY ONE BEST ANSWER FOR EACH QUESTION. CHOOSE THE BEST ANSWER FROM THE SUGGESTED OPITIONS AND BLACKEN THE LETER OF YOUR CHOICE ON THE ANSWER SHEET.USE ONLY PENCIEL TO MARK YOUR ANSWERS.**

**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 INSTRUCTIONS.**

**ANY FORM OF CHEATING OR AN ATTEMPT 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.**

**DIRECTIONS:** FOR EACH OF THE FOLLOWING PROBLEMS, CHOOSE THE BEST ANSWER FROM THE GIVEN ALTERNATIVES AND CAREFULLY **BLACKEN** THE LETTER OF YOUR BEST CHOICE ON THE SEPARATE ANSWER SHEET PROVIDED.

1. The mark that students scored in an examination is grouped in class intervals as shown in the following table for the f/f grouped data table below:

| Age | 5 - 7 | 8 - 10 | 11 - 13 | 14 - 16 | 17 - 19 |
|-----|-------|--------|---------|---------|---------|
| F   | 7     | 12     | 19      | 10      | 2       |

What is QD of the distribution respectively?

- A. 11.5 B. 2.5 C. 14 D. 15.5

2. What is the fractional form of the purely recurring decimal number  $0.\overline{87}$ ?

- A.  $\frac{87}{9}$  B.  $\frac{87}{7}$  C.  $\frac{87}{99}$  D.  $\frac{87}{100}$

3. What is the normal line to the graph of a function  $f(x) = \sqrt{20 - x^2}$ ; (2,4)?

- A.  $y = -\frac{1}{2}x + 5$  B.  $y = 2x$  C.  $y = -2x$  D.  $y = \frac{1}{2}x + 5$

4. What is the slope of a secant line to the graph of the function  $f(x) = 2 + (x-1)\ln x$  at  $x=1$  and  $x=e$ ?

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

5. A theatre hall has 60 rows of seats. The first row has 40 seats the second row has 44 seats; the third row has 48 seats and so on. What is the seating capacity of the theatre hall?

- A. 12490 B. 12480 C. 9480 D. 9490

6. Which one of the following is set of critical numbers of  $f(x) = \sqrt{x^2 - 4}$

- A.  $\{-2, 2\}$  B.  $\{-2, 0, 2\}$  C.  $\{-1, 0, 1\}$  D.  $\{-1, 1\}$

7. Which of the following is the interval on which  $f(x) = x^3 + 3x^2 - 9x + 8$  is strictly decreasing?

- A.  $(-\infty, -3)$  B.  $[-3, 1]$  C.  $[1, \infty)$  D.  $(-3, 1)$

8. The inverse of the matrix  $A = \begin{pmatrix} 1 & 0 & 2 \\ 2 & -1 & 3 \\ 4 & 1 & 8 \end{pmatrix}$  is:

- A.  $\begin{pmatrix} -11 & 2 & 2 \\ -4 & 0 & 1 \\ 6 & -1 & -1 \end{pmatrix}$  B.  $\begin{pmatrix} 3 & -3 & 3 \\ -5 & 3 & -3 \\ -4 & 3 & -5 \end{pmatrix}$  C.  $\begin{pmatrix} 2 & -2 & 1 \\ 5 & 3 & 3 \\ 4 & -3 & 1 \end{pmatrix}$  D.  $\begin{pmatrix} 1 & -1 & 0 \\ 2 & 1 & 2 \\ 3 & -1 & 0 \end{pmatrix}$

9. Which of the following is the product of AB of the two matrices  $A = \begin{pmatrix} 13 & -3 \\ -4 & 1 \end{pmatrix}$  and

$B = \begin{pmatrix} 1 & 3 \\ 4 & 13 \end{pmatrix}$  is:

- A.  $\begin{pmatrix} 13 & -3 \\ -4 & 1 \end{pmatrix}$  B.  $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$  C.  $\begin{pmatrix} 13 & 3 \\ 4 & 1 \end{pmatrix}$  D.  $\begin{pmatrix} \frac{13}{2} & \frac{3}{2} \\ 4 & 1 \end{pmatrix}$

10. Suppose that  $A = \begin{pmatrix} 1 & 0 & 1 \\ -2 & 2 & -1 \\ 3 & 4 & -3 \end{pmatrix}$  and  $B = \begin{pmatrix} 0 & 1 & 3 \\ 3 & 5 & -1 \\ 2 & -2 & 4 \end{pmatrix}$  are given, if  $C = A^T B + B^T$ , then what is the entry of  $C_{32}$ ?

- A. -6                      B. 1                      C. 7                      D. - 14

11. For Any nxn square matrix A, Which of the following is false?

- A. If K is scalar , then  $\det(KA) = k^n \det(A)$   
 B. The determinant of A is equal to the determinant of its transpose.  
 C. If A is invertible ,then  $\det(A) = \det(A^{-1})$ .  
 D. IF interchange the two row of the matrix changes the sign of the determinant.

12. Which one of the f/f is the determinant of matrix  $A = \begin{pmatrix} 1 & 3 & 5 \\ 6 & 4 & 2 \\ 9 & 7 & 0 \end{pmatrix}$ ?

- A. -45                      C. 70  
 B. -14                      D. 77

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

- A.  $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{pmatrix}$  B.  $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$  C.  $\begin{pmatrix} 1 & 1 & 1 \\ 0 & 1 & 3 \\ 0 & 0 & 1 \end{pmatrix}$  D.  $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{pmatrix}$

14. What is the solution set of the system of linear equation

$$\begin{cases} x - 3y - 2z = 6 \\ 2x - 4y - 3z = 8 \\ -3x + 6y + 8z = -5 \end{cases} \text{ is?}$$

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

15. What are the domain and range of the function  $f(x) = x^{\frac{-8}{3}}$  respectively?

- A.  $[0, \infty), \mathbf{R} \setminus \{0\}$     B.  $\mathbf{R} \setminus \{0\}, (0, \infty)$     C.  $[0, \infty), [0, \infty)$     D.  $(0, \infty), (0, \infty)$

16. The solution set of greatest integer  $\lfloor x - 2 \rfloor = -3$  is?

- A.  $\emptyset$                       B.  $\{x: -1 \leq x < 0\}$     C.  $\{x: -2 \leq x < -1\}$     D. 3

17. Which one of the following is false statement?

- A.  $\operatorname{sgn}(x^2 - 25) = -1$  for  $x \in (-3, 3)$                       B. for  $\operatorname{sgn} x - 2$ , range is  $\{-4, 0, 4\}$   
 C.  $\operatorname{sgn}(\sqrt{5} - 4) = -1$                       D.  $\operatorname{sgn}(4 + \sqrt{5}) = 1$

18. The solution set of  $|7 - 2x| + |-2x + 7| = 6$  is?

- A.  $\emptyset$                       B.  $\{2, 5\}$                       C.  $\{0, 6\}$                       D.  $\{-2, 3\}$

19. If  $R = \{(x, y); y \geq -5 \text{ and } -y \leq x + 1\}$ , then the domain of  $R^{-1}$  is

- A.  $[3, \infty)$                       B.  $(3, \infty)$                       C.  $[-5, \infty)$                       D.  $(-\infty, -5]$

20. Which of the following functions is not inverse to each other in their respective domain?

A.  $f(x) = 3x + 2; g(x) = \frac{x-2}{3}$  C.  $f(x) = 8x^3 + 2; g(x) = \frac{1}{2}\sqrt[3]{x-2}$

C.  $f(x) = x^3; g(x) = \sqrt[3]{x}$  D.  $f(x) = \sqrt[3]{x+8}; g(x) = x^3 + 8$

21. The solution set of  $\frac{x+1}{x-1} + \frac{x-1}{x+1} = \frac{2x-2}{1-x^2}$  is

A.  $\{-1, 0\}$  B.  $\{-1, 2\}$  C.  $\{0\}$  D.  $\{1, 2\}$

22. If  $\frac{x-1}{x^3+3x+4x^2} = \frac{A}{x} + \frac{B}{x+1} + \frac{C}{x+3}$  then what is the respective value of A, B & C?

A.  $\frac{1}{2}, \frac{3}{2}, 2$  B.  $\frac{5}{3}, \frac{1}{3}, -2$  C.  $-3, 1/3, 2$  D.  $-1/3, 1, -2/3$

23. If  $f(x) = \frac{4-x^2}{x^2-2}$ , then w/c of the f/f is TRUE about the function f?

A/  $x = \sqrt{2}$  is vertical asymptotes C/  $x = -\sqrt{2}$  and  $x = \sqrt{2}$  is a vertical asymptotes

B/ the graph has y-intercept at (0, 2) D/  $y = 1$  is an horizontal asymptotes

24. The simplest form of  $\left(\frac{2}{x-3} - \frac{1}{x+2}\right) \div \left(\frac{x+7}{x^2-x-6}\right), x \neq -7, -2, 3$  is:

A/ 1 B/  $\frac{x+7}{x+2}$  C/  $\frac{x+7}{x-3}$  D/  $\frac{x}{x+7}$

25. The following is frequency distribution table of grouped data with variable x

For the f/f grouped data table below, what is standard deviation of the data?

| Age | 3-7 | 8-12 | 13-17 | 18-22 |
|-----|-----|------|-------|-------|
| F   | 4   | 6    | 8     | 2     |

A.  $\sqrt{21}$  B.  $\sqrt{23}$  C.  $\sqrt{24}$  D. 5

26. Which of the following is not Rational function?

A.  $\frac{x+1}{x-2}$  B.  $\frac{3x-5}{(x+1)^2}$  C.  $4 - 3x^2 + 3x$  D.  $\frac{7}{x^2+x-6}$

27. Which one of the following is true about the range and interquartile range of the given data?

A. Both are measure on variability of each item the data.

B. Both are affected by extreme values in the data.

C. Both are measure on variability of the data.

D. Both are considering only the middle 50% of the data.

28. If 30% salt solution is to be mixed with 20 % salt to form a mixture of a 25% salt solution of 500 liters. Much of each is needed? A. 250 B. 500 C. 125 D. 750

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

A.  $\begin{pmatrix} 2 & 1 \\ 3/2 & 1 \end{pmatrix}$  B.  $\begin{pmatrix} 1 & 4 \\ 2 & 3 \end{pmatrix}$  C.  $\begin{pmatrix} 1 & -1 \\ -3/2 & 2 \end{pmatrix}$  D.  $\begin{pmatrix} -2 & -1 \\ -3/2 & -1 \end{pmatrix}$

30. Suppose that  $A = \begin{pmatrix} 1 & 0 & 2 \\ 2 & -1 & 3 \\ 4 & 1 & 8 \end{pmatrix}$  then the result of  $\frac{1}{2}(A + A^t)$  is ?

A.  $\begin{pmatrix} 1 & 0 & 1 \\ -2 & 2 & -1 \\ 3 & 4 & -3 \end{pmatrix}$  B.  $\begin{pmatrix} 0 & 1 & 3 \\ 3 & 5 & 0 \\ 2 & 0 & 4 \end{pmatrix}$  C.  $\begin{pmatrix} 1 & 1 & 3 \\ 1 & -1 & 2 \\ 3 & 2 & 8 \end{pmatrix}$  D.  $\begin{pmatrix} 0 & 1 & 6 \\ 1 & 5 & -1 \\ 5 & 2 & 4 \end{pmatrix}$

31. A ball is dropped from a height of 40 meter. Each time it drops  $h$  meters, it rebounds 20 % of the height. What is the total vertical distance travelled by the ball before comes to rest?

A/ 60m

B/ 120m

C/ 160m

D/ 80m

32. What is the instantaneous rate of change of  $f(x) = 6x^2 - 3$  at  $x = 2$ ?

A/ 24

B/ 21

C/ 27

D/ 3

33. Which of the following is not a characteristic of a function?

A) Each input has exactly one output

B) The same input can have different outputs

C) The graph passes the vertical line test

D) The relation can be represented as an equation

34. Which of the following statements is true about the relation  $R$  defined by  $R = \{(x, y) | y = x^2\}$ ?

A) It is a function.

B) It is not a function.

C) It can have multiple outputs for a single input.

D) Both A and C are true.

35. A car rental service charges \$20 per day plus an additional fee of \$0.25 per mile driven. Which of the following best describes the total cost  $C$  in terms of the number of days  $d$  and miles  $m$ ?

A)  $C = 20d + 0.25m$

B)  $C = 20 + 0.25dm$

C)  $C = 20d + 25m$

D)  $C = 0.25d + 20m$

36. Which of the following statements is **True** regarding the set of rational numbers?

A) All rational numbers can be expressed as a fraction where the denominator is zero.

B) Rational numbers include integers, fractions, and terminating decimals.

C) The set of rational numbers is only made up of positive numbers.

D) Rational numbers cannot be expressed in decimal form.

37. Which one of the following is **Not** a rational number ?

A.  $\sqrt{3 + 2\sqrt{2}} + \sqrt{3 - 2\sqrt{2}}$

C.  $\sqrt{2.25 + \sqrt{2}} - \sqrt{2.25 - \sqrt{2}}$

B.  $\sqrt{4 + 2\sqrt{3}} - \sqrt{4 - 2\sqrt{3}}$

D.  $\sqrt{7 + 4\sqrt{3}} + \sqrt{7 - 4\sqrt{3}}$

38.  $a = 3 + 2\sqrt{2}$  and  $b = 3 - 2\sqrt{2}$ . then which one of the is **Not true**?

A.  $a^2 - b^2 = 24\sqrt{2}$

C.  $(a + b)^2 = 36$

B.  $\sqrt{a^2 + b^2} = \sqrt{34}$

D.  $(a - b)^2 = 12$

39. The simplest form of  $\left[\frac{3}{2\sqrt{2}-1} - \frac{1}{\sqrt{2}+1}\right] \div [10 - \sqrt{2}]$  ?

A.  $\frac{1}{6}$

B.  $\frac{-1}{6}$

C.  $\frac{1}{7}$

D.  $\frac{-1}{7}$

40. The area of a square garden is 85 square meters. Estimate the side length of the garden.

A. 9 m

B. 7 m

C. 11 m

12 m

41. The numerical value of  $\sqrt{176} - 2\sqrt{275} + \sqrt{1584} - \sqrt{891}$

A.  $-3\sqrt{11}$

B.  $3\sqrt{11}$

C.  $11\sqrt{3}$

D.  $-11\sqrt{3}$

42. Which of the following is the simplest form obtained by rationalizing the denominator of  $\frac{\sqrt{5 + 2\sqrt{6}}}{\sqrt{5 - 2\sqrt{6}}}$  ?

A.  $\frac{1}{5-2\sqrt{6}}$

B.  $5 + 2\sqrt{6}$

C.  $\frac{1}{\sqrt{49-20\sqrt{6}}}$

D.  $\sqrt{49 + 20\sqrt{6}}$

43. What does Euclid's division algorithm primarily help to find for two integers a and b (where  $a > b$ )?

A) The product of a and b

C) The least common multiple (LCM) of a and b

B) The greatest common divisor (GCD) of a and b

D) The sum of a and b

44. When the expression  $\left(\frac{6}{3} - \frac{8}{4}\right) + \sqrt{\frac{1}{16} + \frac{1}{9}}$  is simplified it gives

A.  $-5/12$

B.  $7/12$

C.  $5/12$

D.  $-7/12$

45. The solution set of  $3^x + 3^{x+3} = \frac{28}{9}$

A. 2

B. 3

C. -3

D. -2

46. Two students A and B bought exercise books and pens at the same time. Student A bought 10 exercise books and 3 pens for birr 92. Students B bought 12 exercise books and 2 pens for birr 104. If each exercise book had the same price as it did the pens, the price for each exercise book and each pen respectively

A. e=8 birr and p=-4    B. e=4 and p=-8    C. e=-8 and p=-4    D. e=8 and p=4

47. If  $\begin{cases} 3x + ay = -12 \\ 4x + 8y = k \end{cases}$ , then determine the values of a and k so that the system has empty solutions

A.  $a = 6$  and  $k \neq -16$     B.  $a = 6$  and  $k = 16$     C.  $a = 6$  and  $k = -16$     D.  $a = -6$  and  $k = 16$

48. The solution set of the equation  $|12 - |4x - 5|| = 13$  ?

A.  $\{1, \frac{3}{2}, 5, \frac{15}{2}\}$     B.  $\{\frac{3}{2}, \frac{15}{2}\}$     C.  $\{1, 5\}$     D.  $\{\frac{3}{2}, \frac{5}{2}\}$

49. Which of the following is **not** true about the quadrature equation  $x^2 + kx - 2k = 0$ ?

A. If  $k = 0$  or  $k = -8$ , then the roots are real and equal

B. If  $k = 4$ , then it does not have real roots

C. If  $k = 1$ , then the solution set is  $\{-2, 1\}$ .

D. If  $k$  is positive, then it has two real and unequal root

50. A rectangular swimming pool that is 10m longer than its width. The pool is completely surrounded by concrete deck that is 4m wide. The total area of the pool and the deck is  $600\text{m}^2$ . the dimensions of the pool is ?

A. The pool is 12m by 22m    B. The pool is 22m by 10m    C. -12m by 22m    D. -22m by 12m

51.  $(A \setminus B) \cup B = A$ , then which of the following is always true?

A)  $B = \emptyset$     B)  $A = B$     C)  $B \subseteq A$     D)  $A \subseteq B$

52. In a school of 150 students, 115 takes Mathematics and 85 take Physics. How many students take Mathematics and Physics only ?

A. 50 and 75    B. 55 and 35    C. 115 and 70    D. 65 and 35

53. Which of the following statements is **true** regarding subsets and proper subsets?

- A) Every proper subset is also a subset, but not every subset is a proper subset.
- B) A proper subset must contain all elements of the original set.
- C) An empty set cannot be a proper subset of any non-empty set.
- D) All subsets are proper subsets.

54. If  $A, B$  and  $C$  are any three sets in the same universal set, then which of the following is **NOT** equal to  $A \setminus (B' \cup C)$ ?

A.  $A \cap B \cap C'$

C.  $A \cap (B \setminus C)$

B.  $B \cap (A \setminus C)$

D.  $A \cap (C \setminus B)$

55. If  $A = \{0, 1, 2, 3, 4, 5\}$ ;  $B = \{0, 1, 2, 3, 4\}$  and  $R$  is a relation from  $A$  to  $B$  such that  $R = \{(x, y) : y = \sqrt{x-1}\}$ , then what is the range of  $R$

A.  $\{1, 2, 5\}$

C.  $\{0, 1, 2\}$

B.  $\{0, 1, \sqrt{2}, \sqrt{3}, 2\}$

D.

56. If  $A = \{-2, -1, 0, 1, 2\}$  and  $R = \{(x, y) : x \in A, y \in A \text{ and } x - y \in A\}$  then which of the following is **Not true**

A. If  $x \in A$ , then  $(x, y) \in R$

C. If  $x \in A$ , and  $y \in A$ , then  $(x, y) \in R$

B. If  $(x, y) \in R$ , then  $(y, x) \in R$

D. If  $(x, y) \in R$ , then  $y - x \in R$

57. Which of the following is an arithmetic sequence

A. 3, 8, 11, 15, ... ..

C.  $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \dots \dots \dots$

B.  $\frac{1}{3}, 1, \frac{5}{3}, \frac{7}{3}, \dots \dots \dots$

D.  $1, 4 + 2P, 7 + 4, 10 + 6P \dots \dots \dots$

58. If the sum of the first three consecutive terms of an arithmetic progression  $\{A_n\}$ , with  $A_n > 0$  for all  $n$ , is 9 and the sum of their squares is 35, then what is the sum  $S_n$  of the first  $n$  terms?

A.  $n^2$

B.  $n^2 - 1$

C.  $2n^2 + 1$

D.  $5n^2 + 1$

59. Suppose a radioactive material loses one-third of its mass per year. If its current mass is 81 gram then how much will its mass be just after of years?

A. 27g

B.  $\frac{1}{27}$ g

C.  $\frac{128}{27}$ g

D.  $\frac{128}{81}$ g



60. What is the sum  $\sum_{n=1}^{30} (-1)^n \left( \frac{1}{n} + \frac{1}{n+1} \right)$ ?

- A.  $-\frac{29}{30}$       B.  $\frac{29}{30}$       C.  $\frac{30}{31}$       D.  $-\frac{30}{31}$

61. In a sequence  $\{f_n\}$ , let  $f_1 = 3$ , and  $f_{n+1} = \frac{n}{f_n^2}$  for  $n \geq 1$  then  $f_4$  is ?

- A.  $\frac{1}{9}$     B. 162    C. 4542    D. 8748

62. What is the sum of the series  $\sum_{n=0}^{\infty} 2^n 3^{2-n}$ ? ..... A.7    B.27    C.19    D. $\infty$

63. Which one of the ff describe the mechanical meaning of derivative?

A) Average rate of change

C) Slope of tangent line at a point

B) Gradient of the graph of the function

D) Slope of secant line

64. Given  $f(1) = -1$  and  $f'(1) = 1$ . if  $g(x) = (f(2x+1) + 2)^2$  then  $g'(0) = \underline{\hspace{2cm}}$

- A) 4    B) 2    C) -2    D) -4

65. A right circular cylinder with a volume of  $343\pi \text{ cm}^3$  is to be constructed. The height  $h$  of the cylinder and the radius  $r$  of the base in order to use the minimum amount of material.

- A.  $\sqrt[3]{7}$                       B.  $\sqrt[3]{8}$                       C.  $7\sqrt{5}$                       D.  $7\sqrt[3]{4}$