

ADDIS ABABA CITY ADMINISTRATION EDUCATION BUREAU
ADDIS ABEBA
GRADE 12 MATHEMATICS (social) MODEL EXAMINATIONS
2015E.C/2023G.C

NUMBER OF QUESTIONS: 65

TIME ALLOWED: - 3 HOURS

GENERAL DIRECTIONS

THIS BOOKLET CONTAINS **MATHEMATICS (social)**. 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.

DIRECTIONS: For each of the following questions, choose the best answer from the given alternatives.

- The simplified form of the expression $\frac{8\sqrt{50}-4\sqrt{72}}{2\sqrt{32}}$ is:
 - $\frac{1}{2}$
 - 2
 - $\sqrt{2}$
 - $\sqrt[3]{3}$
- Which one of the following numbers is equal to $\frac{3\sqrt{2}+\sqrt{3}}{3\sqrt{2}-2\sqrt{3}}$?
 - $\frac{8-3\sqrt{6}}{6}$
 - $\frac{8+3\sqrt{6}}{6}$
 - $\frac{8+3\sqrt{6}}{2}$
 - $8+3\sqrt{6}$
- If the solution of the equation $2x^2 + (k-3)x - 7 = 0$ are $\frac{7}{2}$ and -1, then what is the value of k?
 - 2
 - 8
 - $-\frac{34}{7}$
 - 2
- The solution set of the inequality $4x^2 + 10x - 6 < 0$ is
 - $(-\frac{1}{2}, 3)$
 - $(-3, \frac{1}{2})$
 - $(-\infty, -3) \cup [\frac{1}{2}, \infty)$
 - $[-3, \frac{1}{2}]$
- Which one of the following is the solution set of the equation $|-2x + 3| = |-x + 6|$?
 - $\{-3, 3\}$
 - $\{-3, -2\}$
 - $\{4, 3\}$
 - $\{4, -3\}$
- Let $A = \{2, 1, 4, 9\}$ and $B = \{0, 1, 2, 3, 4, 5\}$, then $A \Delta B$ is equal to:
 - $\{3, 5\}$
 - $\{3, 4, 5, 9\}$
 - $\{4, 9\}$
 - $\{0, 1, 2\}$
- If two sets A and B are given as $A = \{-1, 0, \{-1, 1\}\}$ and $B = \{-1, 0, 1\}$, then which one of the following is true about these sets?
 - $B/A = \{ \}$
 - $(A/B)/B = \{ \}$
 - $(A \cap B) \cup \{-1, 1\} = B$
 - $A \cup B = A$
- From the following sets which one is equal to set Where $M = \{x \in \mathbb{N} : x = 2n-1, \text{ for } n \in \mathbb{N}\}$

- A. $\{3, 5, 7\}$ C. $\{1, 3, 5\}$
 B. $\{2, 4, 6\}$ D. $\{1, 2, 3\}$
9. If $f(x) = \frac{3}{2}x^2 + \frac{1}{2}x$ and $g(x) = \{(1, 2), (2, 3), (3, 5)\}$, then $\left(\frac{f}{g}\right)(3)$ is equal to:
 A. 15 C. 3
 B. 5 D. cannot be determine
10. Let $f(x) = \sqrt{2-x}$ and $g(x) = x^2 + 2x + 1$, then which one of the following statement is correct?
 A. The domain of $(f + g)$ is the set of real numbers.
 B. The domain of $\left(\frac{g}{f}\right)$ is $(2, \infty)$
 C. The domain of (fg) is $(-\infty, 2]$
 D. The domain of $\left(\frac{f}{g}\right)$ is $(-\infty, 2]$
11. If the measure of each exterior angle of a regular polygon is 40° , then how many sides does this polygon have?
 A. 7 C. 8
 B. 9 D. 10
12. A right cylinder can which is open at the top has base radius of 5cm and height of 10cm. what is the total surface area?
 A. 150cm C. 125cm
 B. 225cm D. 250cm
13. What is the area of a regular hexagon inscribed in a circle with radius 10cm?
 A. 150m^2 C. 300m^2
 B. $150\sqrt{3}\text{m}^2$ D. $300\sqrt{3}\text{m}^2$
14. Consider $\triangle ABC$ with right angle at B and $\angle ACB = 60^\circ$. If the length of $\overline{AB}$ is 10 units, and then what is the area of the triangle? (Given $\tan 30^\circ = 0.6$ and $\tan 60^\circ = 1.73$)
 A. 30sq, units C. $5\sqrt{179}$
 B. 60 sq, units D. $10\sqrt{179}$
15. Which of the following expression is a polynomial expression?
 A. $x^3 - 2x + \cos x$ C. $\frac{5+\pi}{1+\pi^2}$
 B. $\frac{2x^3+7x^2-3x}{\pi x^2}$ D. $5-2x^{1/2}+3x^{3/2}+6x^{-1}$
16. A polynomial function p is given by $P(x) = \frac{2x^3-3x^5+x^2-2x+1}{12} + \frac{x}{2} - x^4$ from the following statements which one is true about P ?

A. In $P(x)$ the coefficient of x is 0

C. its constant term is $\frac{-1}{2}$

B. The degree of $p(x)$ is 3

D. its leading coefficient is $\frac{1}{6}$

17. Let $p(x)$ and $q(x)$ be polynomials given by $p(x)=12x^5+8x^4-4x^3$ and $q(x)=6x^2+4x-2$, for $x \neq -1, \frac{1}{3}$, then what are the quotient and remainder of $\frac{p(x)}{q(x)}$ respectively?

A. $2x^3+1$ and -1

C. $3x^2$ and 0

B. $3x^3+2x+1$ and 1

D. $2x^3$ and 0

18. Which of the following is the value of x in the equation $\left(\frac{125}{27}\right)^x = \sqrt[3]{0.6}$?

A. $\frac{-1}{9}$

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

B. $\frac{1}{9}$

D. 1

19. If $\log 3.42 = 0.5340$ and $\log 2.28 = 0.3579$, then the characteristics of $\log \left(\frac{3.42}{0.228}\right)$ is equal to:

A. 2

C. 0

B. 1

D. -1

20. If $\log_2 x = \frac{1}{3} \log_2 8 - 2 \log_2 \sqrt{3}$, then what is the value of x ?

A. $\frac{\sqrt{3}}{2}$

C. $\frac{3}{2}$

B. $\frac{2}{3}$

D. $\frac{2}{\sqrt{3}}$

21. The solution set of $8^{3x+1} = 16^{1-x}$ is:

A. $\{13\}$

C. $\left\{\frac{3}{2}\right\}$

B. $\left\{\frac{1}{13}\right\}$

D. $\left\{\frac{-1}{13}\right\}$

22. What is the intersection point of the system $\begin{cases} y \geq x - 3 \\ y \leq -\frac{1}{2}x \end{cases}$?

A. $(-2, 2)$

C. $(2, -1)$

B. $\{ \}$

D. $\mathbb{R}$

23. What is the distance between a point $(3, -2)$ and the line $3x - 4y - 2 = 0$?

A. 3

C. 6

B. 5

D. 4

24. What is the equation of a line that passes through the point (1,2) in the xy-plane if it is perpendicular to a line that passes through points (a, 2b) and (b, 2a) .where $a \neq b$?

A. $y=x+3$

C. $y=\frac{1}{2}(x+3)$

B. $y=\frac{-1}{2}(x-3)$

D. $y=x-3$

25. If a line with x-intercept is 4 and y-intercept is -6, then what is its slope?

A. $\frac{-3}{2}$

C. $\frac{3}{2}$

B. $-\frac{2}{3}$

D. $\frac{2}{3}$

26. Which one of the following lines is parallel to the line $5x-2y=0$?

A. $2x+5y=-4$

C. $-5x+2y=6$

B. $Y=-\frac{5}{2}$

D. $-5x-2y=1$

27. If the base of right prism is an equilateral triangle each of whose sides measures 6cm and the altitude each of whose sides measures 10cm. What is the volume of the prism?

A. 90cm^3

C. $90\sqrt{3}\text{cm}^3$

B. $9\sqrt{3}\text{cm}^3$

D. $45\sqrt{3}\text{cm}^3$

28. The lower and the upper base of a frustum of a right circular cone have radii 6m and 4m respectively. If the height of the frustum is 3m, then which of the following is its volume?

A. $34\pi\text{cm}^3$

C. $298\pi\text{cm}^3$

B. $62\pi\text{cm}^3$

D. $76\pi\text{cm}^3$

29. Let $f(x) = \frac{3x-1}{x-2}$, Which of the following is the inverse of f ?

A. $f^{-1}(x) = \frac{-2x-1}{x-3}$

C. $f^{-1}(x) = \frac{2x-1}{x-3}$

B. $f^{-1}(x) = \frac{x-3}{2x-1}$

D. $f^{-1}(x) = \frac{2x+1}{x-3}$

30. Which one of the following is **NOT** onto function?

A. $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = 1 - \frac{2}{3}x$

B. $h: R \rightarrow R$ defined by $h(x) = x^3 + 8$

C. $g: R \rightarrow (-\infty, 1]$ defined by $g(x) = 1 - x^2$

D. $f: R \rightarrow R$ defined by $f(x) = |x - 2|$

31. What is the solution set of the equation $\frac{4}{x-2} + \frac{3x+2}{x^2-x-2} = \frac{-5x-2}{(x-2)(x+1)}$?

A. $\left\{-\frac{2}{3}\right\}$

C. $\left\{\frac{2}{3}\right\}$

B. $\left\{-\frac{3}{4}\right\}$

D. $\left\{-3, \frac{4}{3}\right\}$

32. Which of the following is true about the graph of $f(x) = \frac{x^2-1}{x-x^2}$?

A. $X=0$ and $x=1$ are its vertical asymptotes.

B. The graph has a hole at $x=-2$.

C. $Y=-1$ is its horizontal asymptote.

D. $Y=1$ is an oblique asymptote to the graph of f

33. What is the equation of the circle with center $(3, -2)$ and tangent to y -axis?

A. $\frac{(x-3)^2}{36} + \frac{(y+2)^2}{16} = 1$

C. $(x-3)^2 + (y+2)^2 = 4$

B. $(x-3)^2 + (y+2)^2 = 9$

D. $\frac{(x-3)^2}{36} - \frac{(y+2)^2}{36} = 1$

34. Which of the following is true about the parabola with equation

$$y^2 - 2y + 2x = 0?$$

A. Focal length $p = \frac{1}{4}$

C. Vertex at $(1, \frac{1}{2})$

B. Focus at $(0, 1)$

D. Equation of directrix is $x = \frac{1}{2}$

35. What is the eccentricity of the hyperbola $4x^2 - 9y^2 - 24x - 36y = 36$?

A. $\frac{1}{\sqrt{13}}$

C. $\sqrt{13}$

B. $\frac{\sqrt{13}}{3}$

D. $\frac{-\sqrt{13}}{3}$

36. If $\neg(p \Rightarrow q) \vee \neg r$ is False, then what are the truth values of p , q and r respectively?

A. T, T, F

C. F, F, T

B. F, F, F

D. T, F, T

37. Consider the following argument :

“If he works hard, then he will be successful. He does not be successful. Therefore, he does not work hard.” If “ $p \equiv$ He works hard and $q \equiv$ He will be successful”. Which one of the following is the correct representation of the argument and its validity?

A. $p \Rightarrow q, \neg p \vdash q$ valid argument

C. $p \Rightarrow q, \neg q \vdash \neg p$ Invalid argument

B. $\neg p \Rightarrow \neg q, p \vdash q$ valid argument

D. $p \Rightarrow q, \neg q \vdash \neg q$ valid argument

38. Let $p(x) \equiv x$ is prime, $E(x) \equiv x$ is even, $O(x) \equiv x$ is odd and $x \in U = N$. Which of the following is not true?

A. $(\exists x)(p(x) \Rightarrow O(x))$

C. $(\exists x)(p(x) \wedge E(x))$

B. $(\exists x)(O(x) \wedge E(x))$

D. $(\exists x)(\neg p(x) \wedge O(x))$

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

x	1	3	4	5	7
Frequency	2	5	6	5	2

What are the mean ($\bar{x}$) and variance δ^2 of the data?

A. $\bar{x} = 4, \delta^2 = 2.3$

C. $\bar{x} = 3, \delta^2 = 2.3$

B. $\bar{x} = 3, \delta^2 = 1.3$

D. $\bar{x} = 4, \delta^2 = 1.93$

40. A bag contains 3 red, 4 blue and 3 white balls. Three balls are drawn one after the other. What is the probability of getting a red ball on the first draw, a blue ball on the second draw and a white ball on the third draw if the balls are drawn without replacement?

A. $\frac{9}{250}$

C. $\frac{1}{20}$

B. $\frac{9}{20}$

D. $\frac{1}{250}$

41. Let the data for 100 candidates with frequency are given below,

Class interval	1-3	4-6	7-9	10-12	13-15	16-18	19-21
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Frequency	2	9	x	35	y	10	4
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If the mode is 10.7, then what is x and y respectively?

- A. $x=23$ and $y=17$ C. $x= 17$ and $y= 23$
 B. $x=24$ and $y=18$ D. $x= 18$ and $y=24$

42. Suppose A is a 2×2 matrix with $\det(A) = 4$ and $\det(kA) = 64$, then what is the value of k ?

- A. 3 C. 4
 B. 8 D. 16

43. Let A be a 3×3 matrix and $\det(A)=6$, then what is the value of $\det 2A^T$?

- A. 28 C. 16
 B. 48 D. 12

44. Suppose A is a 3×3 matrix and $B = \begin{pmatrix} 0 & 4 & 1 \\ 5 & 0 & 6 \\ 0 & 4 & 2 \end{pmatrix}$, If $\det(A) = 2$, then what is $\det(A^{-1}B^{-1})$?

- A. $\frac{1}{40}$ C. 40
 B. -40 D. $\frac{-1}{40}$

45. If $Z = \frac{4-2i}{2-i}$ and $W = -3 + 4i$, then what is the value of $|\bar{Z}| + w$?

- A. $-1 + 4i$ C. $5 + 4i$
 B. $-5 + 4i$ D. $-1 - 4i$

46. What is the product of two complex number $z = 3-4i$ and $2+5i$?

- A. $26 - 23i$ C. 23
 B. $14 - 23i$ D. $26 + 23$

47. What is the maximum value of $Z = 3x - 2y$ subject to: $\begin{cases} -x + y \leq 0 \\ -x + 2y \leq 1 \\ 2x - y \leq 4 \\ x \geq 0, y \geq 0 \end{cases}$?

- A. 6 C. 5
 B. 8 D. 10

48. What is the value of k so that the line with equation $4x + ky = 8$ is parallel to the line with equation $x + 2y = 0$?

- A. -8 C. 4

B. 8

D. - 4

49. A wool suit, discounted by 30% for a clearance sale, has a price tag of birr 399. What is the amount of discount?

A. Birr 570

C. Birr 399

B. Birr 171

D. Birr 271

50. A man sells an article for birr 54,000 thereby gaining 35% profit. What was the cost price?

A. Birr 35,100

C. Birr 18,900

B. Birr 14,000

D. Birr 40,000

51. Suppose the 7th and the 12th terms of an arithmetic sequence are 6 and 21 respectively. Then which of the following is not true?

A. The common difference is 3

C. The sum of the first ten terms is 12

B. The 5th term of the sequence is 0D. The 1st term of the sequence is -12

52. Let the sequence $\{G_n\}$ be a geometric progression where $G_3 = 3$ and $G_6 = -81$, then what is the n^{th} term of the sequence?

A. $\frac{1}{3}(-3)^{n-1}$ C. $(-1)^{n-1}(-3^n)$ B. $(-3)^n$ D. $(-1)(-2)^n$

53. What is the sum of the infinite series $\sum_{n=1}^{\infty} 3 \left(\frac{1}{2^n} - \frac{1}{3^{n+1}} \right)$?

A. $\frac{5}{6}$ C. $\frac{-5}{2}$ B. $\frac{-5}{6}$ D. $\frac{5}{2}$

54. If $\int_0^1 \sqrt{1+x^2} dx = \frac{\pi}{4}$, then what is the value of $\int_0^1 (2\sqrt{1+x^2} + 3) dx$?

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

55. What is the value of $\int \frac{\ln x}{\sqrt{x}} dx$?

A. $\sqrt{x} \ln x - 2\sqrt{x} + c$ C. $2\sqrt{x} \ln x + 4\sqrt{x} + c$ B. $2\sqrt{x} \ln x - 4\sqrt{x} + c$ D. $2\sqrt{x}(\ln x - 1) + c$

56. What is the volume of the solid generated when the region bounded by the graph of $y=3x$ and $y=x^2+2$ rotates about the x-axis?

A. $\frac{15}{22} \pi \text{ cub. units}$ C. $-\frac{15}{22} \pi \text{ cub. units}$ B. $\frac{22}{15} \pi \text{ cub. units}$ D. $-\frac{22}{15} \pi \text{ cub. units}$

57. Water is flowing into a vertical cylindrical tank of radius 2cm at the rate of $8\text{cm}^3/\text{min}$, then how fast is the water level rising?

A. $4\pi\text{cm}/\text{min}$

C. $2\pi\text{cm}/\text{min}$

B. $\frac{2}{\pi}\text{cm}/\text{min}$

D. $\frac{8}{\pi}\text{cm}/\text{min}$

58. What is the value of the area of the region **R** bounded between the curve of

$F(x) = \sqrt{x+1}$, the x-axis the lines $x = -1$ and $x = 8$?

A. 54 square units.

C. 27 square units.

B. 9 square units.

D. 18 square units.

59. Let f be a function given by

$f(x) = \frac{1}{3}x^3 - \frac{1}{2}x^2 - 2x + 1$, which of the following is true?

A. The critical numbers are -1 and 2

B. The interval for which f is decreasing is $[-1, 2]$

C. The relative minimum value of f is at $x = 2$

D. The relative maximum value of f is at $x = 2$

60. Let.

$f(x) = \frac{5}{2}x^2 - e^x$, then what is the value of x for the second derivative $f''(x) = 0$?

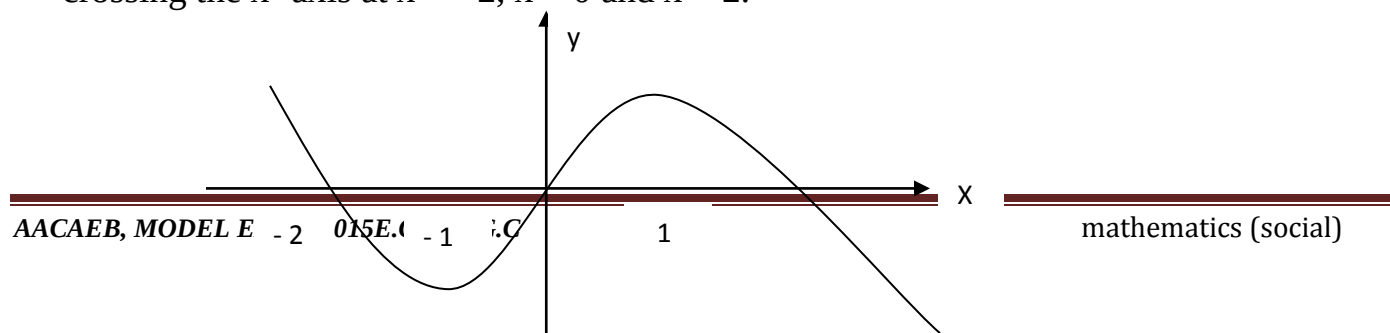
A. $5e$

C. $\ln 5$

B. 0

D. e^5

61. Suppose f is differentiable on $(-\infty, \infty)$ and the graph of its derivative is as shown below crossing the x-axis at $x = -2$, $x = 0$ and $x = 2$.



Which one of the following is true about f ?

A. f is decreasing on $(-\infty, -1] \cup [1, \infty)$

C. f has a local minimum at $x = -2$

B. f is concave up on $[0, \infty)$.

D. f is concave down on $(-1, 1)$

62. Which of the following is the equation of the line tangent to the graph of

$$f(x) = 2x - \sin(1 - x) \text{ At } (1, f(1))?$$

A. $3x - y - 1 = 0$

C. $-3x - y - 1 = 0$

B. $-3x - y - 1 = 0$

D. $3x + y - 1 = 0$

63. A farmer deposited birr 3000 in a bank that pays 5% simple interest per annum. In how many years will his/her amount be Birr 3,300?

A. 2

C. 3

B. 2.5

D. 3.5

64. A home is purchased with a mortgage of birr 800,000. The buyer is expected to pay the initial expenses which are a loan-origination fee of 2 points and 20% down payment.

How much is the initial expend that the buyer needs to pay?

A. Birr 160,000

C. Birr 170,000

B. Birr 176,000

D. Birr 164,000

65. The following table shows the rate of tax that should be paid from the amount of monthly salary that lies in the corresponding interval

Monthly salary (in Birr)	Tax rate
Up to 1000	Nil
1001-2000	20%
2001-3500	30%
3501-6500	35%
Above 6500	40%

How much tax does an employee pay if his monthly salary is birr 4500?

A. Birr 350

C. Birr 1575

B. Birr 1000

D. Birr 2500