ADDIS ABABA CITY ADMINISTRATION EDUCATION BUREAU
ADDIS ABEBA
GRADE 12 MATHEMATICS MODEL EXAMINATIONS
TAHASAS 2015/JANUARY 2023

NUMBER OF QUESTIONS: 65 **TIME ALLOWED: - 3 HOURS**

GENERAL DIRECTIONS

THIS BOOKLET CONTAINS **EXAMINATION FOR SOCIAL SCINCE STUDENTS ONLY**.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 and carefully **blacken** the letter of your best choice on the separate answer sheet provided.

1. Which one of the following is defines a one – to – one correspondence function?

   A. $f = \{(-1,2),(1,-2),(0,3),(2,5)\}$
   B. f: $[0,\infty) \to [0,\infty)$ defined by $f(x) = 1 - \sqrt{x}$
   C. g: $R \to (1,\infty]$ defined by $g(x) = 3^{1-x}$
   D. f: $R \to R$ defined by $f(x) = |2 - x|$

2. Which one of the following is the inverse of $f(x) = \frac{x-7}{x+3}$?

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

3. Let $f(x) = x - x^3$ and $g(x) = 1 - x$, then which one of the following statement is **true?**

   A. $(f+g)(-1) = -2$ C. $(fg)(-1) = 1$
   B. $(f-g)(-1) = -2$ D. $\left(\frac{f}{g}\right)(-1) = -1$

4. Which of the following is **TRUE** about the power function $f(x) = 2x^{-\frac{3}{2}}$?

   A. The domain is $(0,\infty)$ C. The range is $[0,\infty)$
   B. It is increasing function D. It is symmetric with respect to y – axis

5. What is the simplified form of $\frac{4-x^2}{x^2+2x-8}$?

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

6. What is the solution set of $\frac{3}{x-1} + \frac{6}{x} = \frac{9}{x-2}$?

   A. $\left\{\frac{4}{15}\right\}$ C. $\left\{\frac{4}{5}\right\}$
   B. $\left\{\frac{15}{4}\right\}$ D. $\left\{\frac{5}{4}\right\}$

7. In the decomposition $\frac{3x^2-2x-4}{x^3+2x} = \frac{A}{x} + \frac{Bx+C}{x^2+2}$ what is the value of A, B, and C respectively?

   A. $-2,\ 5,-2$ C. -2, 5, 2
   B. $3,-5,\ 2$ D. -2, 3, 1

8. Which of the following is **true** about the graph of $f(x) = \frac{3x^2-2}{x-x^2}$?

   A. y=3 is its horizontal asymptote.
   B. The graph has y-intercept at (0, 1).
   C. X = 0 and x=1 are its vertical asymptotes.
   D. Y=x-2 is its oblique asymptote.

9. What is the distance from the center of the circle given by $(x-2)^2 + (y-3)^2 = 36$ to the line $3x - 4y - 1 = 0$?

   A. $\frac{5}{7}$ C. $-\frac{7}{5}$
   B. 5 D. $\frac{7}{5}$

10. Which one of the following is **not true** about the hyperbola given by $\frac{(x-3)^2}{9} - \frac{(y+2)^2}{4} = 1$?

   A. Its vertices are at (0, - 2) and (6, -2)
   B. An asymptotes to the hyperbola is $y = -\frac{3}{2}x$
   C. Its foci are at $\left(3 - \sqrt{13}, -2\right)$ and $\left(3 + \sqrt{13}, -2\right)$
   D. Its center is at $(3, -2)$

11. Let line l_1: $3y - 4x - 6 = 0$ and $line$ l_2: $2y - 2x - 1 = 0$ represent two intersecting lines in a plane. If θ is an acute angle of intersection between $l_1 and\ l_2$, then what is tanθ ?

   A. $\frac{4}{7}$ C. $\frac{-3}{7}$
   B. $\frac{1}{7}$ D. $\frac{-1}{7}$

12. Which one of the following is the equation of a circle with center $(-2,3)$ and radius is 4 units?

   A. $x^2 + y^2 + 4x - 6y - 3 = 0$ C. $x^2 + y^2 + 2x - 6y - 6 = 0$
   B. $x^2 + y^2 - 4x + 6y - 3 = 0$ D. $x^2 + y^2 - 2x + 6y - 6 = 0$

13. The planet Mars travels around the sun in an ellipse whose equation is approximately given by $\frac{x^2}{13^2}+\frac{y^2}{12^2}=1.\ where$ x and y are measured in millions of kilometers. What is the distance from the sun to the other focus of the ellipse in millions of kilometers?

A. 5 C. 25
B. 10 D. 13

14. Which one of the following is the standard form of the equation of the parabola with vertex (2, 3) and focus (-4, 3)?

A. $(x-2)^2=-6(y-3)$ C. $(y-3)^2=24(x-2)$

B. $(x-2)^2=6(y-3)$ D. $(y-3)^2=-24(x-2)$

15. If p, q and r be propositions such that p⇒ (q ∨ ¬r) is False. Then which of the following proposition has truth value True?

A. p ⇒ ¬r C. ¬r ⇒ ¬q

B. ¬p ⇔ ¬q D. q ⇔ r

16. Which one of the following argument is invalid?

A. r ⇒p, q⇒ r, q⊢p C. r⇒ ¬q, q ⊢¬r

B. p⇒¬q, p, r⇒ q⊢r D. ¬r ⇒ q, ¬q ⊢ r

17.For real number x and y which one of the following is **NOT TRUE?**

A. $(\forall x)(x^2+x+1\neq 0)$ C. $(\forall x)(x^2+1\leq 0)$

B. $(\exists x)(x^2-4x+4\leq 0)$ D. $(\exists x)(x^2\geq 0)$

18. Let p:π is a rational number. And q: 6 is a composite number. Then the contrapositive and its truth value of the conditional statement p ⇒ q are respectively:

A. $\urcorner p \Rightarrow q \ \ and\ True$ C. $\urcorner q \Rightarrow \urcorner p \ \ and\ False$

B. $q \Rightarrow \urcorner p \ \ and\ False$ D. $\urcorner q \Rightarrow \urcorner p$ and True

19. Which one of the following is a quantitative data?

A. Social status
C. religion
B. Beauty of a picture
D. Number of room in a house

20. The number of days that students were missing from school due to sickness in one year was recorded

Number of day of sickness	3	4	5	6	7
Frequency	2	4	8	4	2

What is the $variance\ (\delta^2)\ of\ the\ data?$

A. 1 .2
C. 2.7
B. 1.7
D. 1.97

21. A bag contains 7 white, 5 red and 8 black balls. One ball is drawn at random.

What is the probability that the drawn is **NOT** red?

A. $\frac{5}{4}$
C. $\frac{3}{4}$
B. $\frac{7}{20}$
D. $\frac{1}{4}$

22. The mark that students scored in an examination is grouped in class intervals as shown in the following table.

Class Interval(Mark)	55-64	65-74	75-84	85-94	95-100
Number of students	8	12	20	6	4

What is the second quartile (Q_2) of the distribution?

A. 74.5
C. 77.5
B. 77
D. 76

23. Let A and B be two events. Suppose that the probability that neither event occurs is $\frac{1}{10}$. What is the probability that at least one of the events occurs?

A. $\frac{9}{10}$ C. 0

B. $\frac{2}{10}$ D. $\frac{1}{10}$

24. Which of the following is the standard deviation of the data given as: 4, 6, 8, 10, 12?

A. $3\sqrt{2}$ C. 8

B. 4 D. $2\sqrt{2}$

25. What is the coefficient of x^2y^3 in the binomial expansion$(2x + y)^5$?

A. -40C. 80

B. 40 D. -80

26. In rolling a fair die, what is the probability of obtaining 2 or 4?

A.$\frac{1}{2}$ C.$\frac{1}{3}$

B.$\frac{1}{6}$ D.$\frac{1}{4}$

27. If A=$\begin{pmatrix} x & -1 \\ 2x & 1 \end{pmatrix}$, then what is the value non zero matrix x, det (2A)= x^2?

A. 12 C. 3

B. 6 D. -6

28. Which one of the following is **not true** about the matrix$\begin{pmatrix} 1 & -1 & 3 \\ -2 & 0 & 2 \\ 4 & 5 & -4 \end{pmatrix}$?

A. The minor of the entry$-$ 4 is -2 C. The minor of the entry -1 is 0

B. The cofactor of 2 is - 9 D. The cofactor of the entry 3 is 10

29. Let A and B be invertible 3x3 matrix such that $|A| = 3$ and $|B|$=7, then what is the value of$|B^T A^{-1}|$?

A. $\frac{3}{7}$ C.$\frac{7}{3}$

B. 21 D.$\frac{1}{21}$

30. Let A =$\begin{pmatrix} 1 & 6 & -4 \\ 4 & 3 & -8 \\ 0 & -2 & 2 \end{pmatrix}$. Which one of the following is equal to$\frac{1}{2}(A + A^T)$?

A. $\begin{pmatrix} 1 & 5 & -2 \\ 5 & 3 & -5 \\ -2 & -5 & 2 \end{pmatrix}$ C. $\begin{pmatrix} -2 & 3 & -2 \\ -5 & -5 & -2 \\ 1 & 2 & -5 \end{pmatrix}$

B. $\begin{pmatrix} -2 & -5 & 2 \\ 5 & 3 & -5 \\ 1 & 5 & -2 \end{pmatrix}$ D. $\begin{pmatrix} 5 & 3 & -5 \\ -2 & -5 & 2 \\ 1 & 5 & -2 \end{pmatrix}$

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

A. $\begin{bmatrix} -5 & -5 \\ 9 & 13 \end{bmatrix}$ C. $\begin{bmatrix} 12 & -2 \\ 14 & -4 \end{bmatrix}$

B. $\begin{bmatrix} 14 & 2 \\ -12 & -4 \end{bmatrix}$ D. $\begin{bmatrix} 14 & -2 \\ 2 & -4 \end{bmatrix}$

32. Consider the system of linear equation$\begin{cases} 2x - ay = 8 \\ -4x + 6y = 7 \end{cases}$, then which of the following is TRUE?

A. $If\ a < 3, then\ the\ system\ has\ infinitely\ many\ solution.$

B. $If\ a \neq 3, then\ the\ system\ has\ a\ unique\ solution.$

C. $If\ a = 3, then\ the\ system\ has\ infinite\ solution.$

D. $If\ a < 3, then\ the\ system\ has\ a\ unique\ solution.$

33.What are the modulus and argument of the complex number $1 - \sqrt{3}\,i$ respectively?

A. $2\ and\ \frac{5}{3}\pi$ C. $2\ and\ \frac{-5}{3}\pi$

B. $2\sqrt{2}\ \ and -\frac{\pi}{3}$ D. $2\sqrt{2}\ and\ \frac{\pi}{3}$

34.The multiplicative inverse of the complex number $2 - 3i\ \ is$:

A. $\frac{2}{13} - \frac{3}{13}i$ C.$-2 - 3i$

B. $-2 + 3i$ D. $\frac{2}{13} + \frac{3}{13}i$

35. In the set of complex number the solution set of $2x^2 - 4x + 20$ is:

A. $\{3 + i, 3 - i\}$ C. $\{1 + 3i, 1 - 3i\}$

B. $\emptyset$ D. $\{2 + 6i, 2 - 6i\}$

36. What is the value of k so that the line with equation $3x + ky - 4 = 0$ is parallel to the line with $x - 5y - 2 = 0$?

A. 15 C. 12

B. -12 D.-15

37.Let R=$\{(x, y/2x + y \leq 14, 3x - 2y \leq 12, -x + 2y \leq 4, x \geq 0\}$.which one of the following points is in R?

A. $(2, -3)$ C.$(3\ ,\ 4)$

B. $(6\ , 2)$ D.$(4, -1)$

38.What is the maximum value of $Z = 4x + 5y$ subject to: $\begin{cases} x \geq 0 \\ y \geq 0 \\ 2x + 2y \leq 10 \\ x + 2y \leq 6 \end{cases}$?

A. 20 C. 15

B. 21 D. 22

39. If $\{A_n\}_{n=1}^{\infty}$ is an arithmetic sequence such that its 1st term $A_1 = -7$ and its 5th term $A_5 = 21$, then its 11th term is equal to:

A. 36 C. 40
B. 53 D. 63

40. If the nth term of a geometric progression is given by $G_n = 3^{n-1}$, then what is the fourth partial sum of this sequence?

A. 40 C. 30
B. 27 D. 36

41. A sequence has nth term given by $a_n = n^2 + 15$, then what is the value of n for which a_n=184

A. -13 C. -12
B. 12 D. 13

42. The sum of value of $\sum_{n=2}^{50}\left(\frac{2}{n-1} - \frac{2}{n}\right)$?

A. $\frac{49}{25}$ C. $\frac{7}{25}$
B. $\frac{98}{25}$ D. $\frac{1}{25}$

43. A ball is dropped from a height of 20 meters on each bounce it rebounds $\frac{1}{3}$ of the distance it falls. How far does it travel before coming to rest?

A. 120m C. 40m
B. 80m D. 60m

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

45. Which one of the following is **NOT TRUE** about the sequence $a_n = \left(2 + \frac{1}{n}\right)_{n=1}^{\infty}$?

A. The least upper bound is 3 C. It is a monotonic sequence
B. The greatest lower bound is 2 D. It is divergent sequence

46. Which one of the following is equal to $\lim_{x\to\infty} \frac{1-n-2n^2}{6n^2+1}$?

A. $-\frac{1}{3}$ C. $\frac{-1}{6}$

B. $\frac{1}{6}$ D. ∞

47. Which one of the following is equal to $\lim_{x\to-2} \frac{x+2}{\sqrt{x+6}-2}$?

A. $-\frac{1}{4}$ C. $2\sqrt{2}$

B. 4 D. Does not exist

48. A function f is defined by $f(x) = \begin{cases} x^2+2\,, for\ x \geq 3 \\ 5-kx\,,\ for\ x < 3 \end{cases}$. What is the value of k, if f is continuous at x = 3?

A. 3 C. -2

B. 2 D. -3

49. Which one of the following is **TRUE?**

A. $\lim_{x\to0^-} \frac{x-|x|}{x} = 1$ C. $\lim_{x\to-1} \frac{x^2-1}{x+1}$ *does not exist*

B. $\lim_{n\to\infty} \frac{2n+5}{6n+1} = 3$ D. $\lim_{x\to4} \frac{\sqrt{x}-2}{x-4} = \frac{1}{4}$

50. Which one of the following is equal to $\lim_{x\to0} \frac{\sin(x-2)}{x^2+x-6}$?

A. $-\frac{1}{3}$ C. $\frac{1}{3}$

B. $-\frac{1}{5}$ D. $\frac{1}{5}$

51. What is the value of $\lim_{x\to\infty} \left(1-\frac{1}{2x+1}\right)^{6x+50}$?

A. e^{-3} C. e^{-12}

B. e^{-6} D. e^{6}

52.Which one of the following sequences is a divergent sequence?

A. $\left\{\frac{(-1)^n}{2^n}\right\}$ C. $\left\{\frac{1+3^n}{2^n}\right\}$

B. $\left\{\frac{1}{n}+\cos(\frac{1}{n})\right\}$ D. $\left\{\frac{1-2^n}{3^n}\right\}$

53.Let f(x) = $\sqrt{2x^2-4}$, then what is the value of $\lim_{x\to 2}\frac{f(x)-f(2)}{x-2}$?

A. 4 C. $\frac{1}{2}$

B. 2 D. the limit does not exist

54. What is the equation of the line tangent to the curve $f(x)=x^3+2x-1\ at\ x=-1$?

A. $y=5x+1$ C. $y=5x+9$

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

55. What is the value of the constant a so that $f(x)=\begin{cases} ax^2+2x, if, x<2 \\ 2x+4, if, x\geq 2 \end{cases}$ is continuous on$(-\infty,\infty)$?

A. 1 C. 2

B. 0 D. 4

56.Which one of the following is necessarily true about a function f(x)?

A. If f is continuous at x = a, then f is differentiable at x = a.

B. If f is not differentiable at x = a , then $\lim_{x\to a^-} f(x)=\lim_{x\to a^+} f(x)$

C. If f is differentiable at x = a , then $\lim_{x\to a} f(x) = f(a)$

D. If f is differentiable at x = a, then f is not continuous at x = a.

57.What is the derivative of the function f(x) =$\sqrt{5+x^2}$ at x=2?

A. $-\frac{2}{3}$ C. $\frac{-4}{5}$

B. $\frac{4}{5}$ D. $\frac{2}{3}$

58. If f(x) = $e^{2x}sinx$, then what is the value of $f''(0)$?

A. 4 C. -3

B. 3 D. -4

59. If f(x) = $3x^2-5x+2$ then which of the following is **not true**?

A. $f'(x)$is a continuous function C. $f''(10)$ =6

B. $f''(x)$is a constant function D. $f'(\frac{11}{6}) \neq f''(\frac{11}{6})$

60.What is (are) the critical number(s) of the function f(x) = $2x-3x^{\frac{2}{3}}$?

A. {0, 1} C. {1}

B. {0, -1} D. {0}

61. The ratio of students to teachers in a school is 30:2. If the number of students is 420 and the number of female teachers is 10, what is the number of male teachers in the school?

A. 18 C. 36
B. 10 D. 54

62. The selling price of an item in a shop is Birr 200 with markup of Birr 60. How much profit does the shop owner earns if he sells his items with discount of 20% of its selling price?

A. Birr 10 C. Birr 40
B. Birr 30 D. Birr 20

63. Birtukan has invested 8000 Birr in a fruit wholesaler. A year later the audio report on the business indicates that there was 6000Birr balance. What is the rate of decrease in one year?

A. 0.5 C. 0.16
B. 0.25 D. 0.32

64. A jacket discounted by 30% for holiday has a price tag of Birr 490. What is the amount of discount?

A. Birr 147 C. Birr 210
B. Birr 150 D. Birr 700

65. Suppose that you deposited Birr 10,000 regularly at the end of every month in a saving account that pays 12% annual interest compounded monthly. Approximately how much many is in the account at the end of 3 years?
[Given $(1.01)^{36} = 1.43, (1.1)^{12} = 3.14, (1.1)^{-12} = 0.318$]

A. Birr 430,000 C. 314,000
B. Birr 318,000 D. 143,000