LIDETA SUB CITY ADMINISTRATION EDUCATION OFFICE

GRADE 12 MATHEMATICS (FOR NATURAL SCIENCE) MODEL EXAMINATIONS

2016E.C/ 2024G.C

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

GENERAL DIRECTIONS

THIS BOOKLET CONTAINS EXAMINATION MATHEMATICS (FOR NATURAL SCIENCE). 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.

1. For what values of B the function $f: R \to B$ *such that* $f(x) = x^2 + 6x + 3$ *is an onto function*?

   A.[3,∞) B. (- ∞, 3] C . [-6,∞) D. (- ∞, −6]

2. What is the inverse of the function $f(x) = \frac{x+1}{2x-1}$?

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

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

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

   A. The domain $R \setminus \{0\}$

   B . The range of f *is* $[0, \infty)$

   C. f *is increasing on* (- ∞, 0]

   D. f *is decreasing*[0,∞)

4. Which of the following is a valid logical argument?

   A. p $\Longrightarrow$ q, $\neg r \wedge q \vdash p \vee r$

   B. p $\Longrightarrow \neg$ q, $p,\ r \Longrightarrow q \vdash \neg r$

   C. p, p $\Longrightarrow$ q, $r \vee \neg q \vdash p \wedge \neg r$

   D. $p \vee q$, p $\vdash q$

5. If the truth value of p is T ,then which of the following compound propositions has a truth value T for any proposition q?

   A. $(p \Longrightarrow q) \wedge \neg q$

   B. $(p \wedge \neg p) \wedge q$

   C. $(\neg p \wedge q) \Longrightarrow q$

   D. $\neg p \Leftrightarrow (p \vee \neg q)$

6. Which of the following sentences is a statement?

   A. You are a good student

   B. No woman should die while giving birth

   C. Sudan is a country in Africa

   D. Hurry up the rain is coming

7. Consider the following frequency distribution table

Value	5	3	7	6	8
frequency	3	4	5	3	5

What is the sixth decile?

A. 7.5 B.7 C. 6.5 D.5

8. The following is the frequency of a grouped data. The mean of the following frequency table is 50 . Then what is the value of f_1 *and* f_2 *respectively*.

Class interval	frequency
0-20	17
20-40	f_1
40-60	32
60-80	f_2
80-100	19
Total	120

A. 27 &25 B. 22&30 C.28 & 24 D. 36&24

9. How many three-digit numbers can be formed from 3,4,5,6 and 7 if each digit is used at most once?

A.125 B.120 C.60 D. 250

10. A fair die is tossed once. the probability that either an even number or 3 will be appear is

A.$\frac{3}{4}$ B.$\frac{4}{5}$ C.$\frac{2}{3}$ D.$\frac{1}{6}$

11. A committee of 3 members is to be selected from 4 men and 5 women. what is the probability of selecting exactly two women in the committee?

A.$\frac{10}{21}$ B.$\frac{5}{42}$ C.$\frac{1}{21}$ D.$\frac{5}{21}$

12. A group of 8 students mean average score is 67 in a test, a second group of 17 student has a mean average score of 81 in the same test. What is the mean average score of all 25 students?

A.82.22 B. 81.23 C.76.52 D.77.32

13. Let Z be complex number. Then the solution set of $z^2 - z + 1 = 0$

A. $\{\frac{-1\pm i\sqrt{3}}{2}\}$ B. $\{\frac{1\pm i\sqrt{3}}{2}\}$ C. $\{\frac{1\pm i\sqrt{3}}{3}\}$ D. $\{1 \pm i\sqrt{3}\}$

14. If z= $4+4\sqrt{3}\,i$ then what is principal argument of z^{10}?

A.$\frac{10\pi}{3}$ B. $\frac{\pi}{3}$ C. $\frac{2\pi}{3}$ D. $\frac{-2\pi}{3}$

15. What is the modulus of $= 1 - i\sqrt{3}$?

A. 4 B. 2 C. 1 D. $\sqrt{5}$

16. A translation takes $x^2 + (y+1)^2 = 5\ to (x-2)^2 + y^2 = 5$ *then what is the image of* $(1,3)$ *under this transformation?*

A. (3,4) B. (3,2) C. (-1,2) D. (-2,3)

17. what is cosine of an angle between u=(1,-1) and v= (1,1)?

A.1 B.0 C.-1 D. $\sqrt{3}$

18. What is the image of (-1,5) when reflected about the line $l: y = x - 2$?

A. (7, -3) B. (3,1) C.(1,-3) D. (5,7)

19. What is the image of the circle $x^2 + y^{2\cdot} - 4x - 6y + 12 = 0$ *when it is reflected* with respect to the line $y = -x$?

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

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

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

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

20. Which of the following is true ?

A.$sin^{-1}(0) = \frac{\pi}{2}$

B. $tan^{-1}(0) = 1$

C .The domain of $y = tan^{-1}x$ *is* $(-\infty, \infty)$

D. The domain of $y = cos^{-1}x$ *is* $(-1,1)$

21. If $\cot(\theta) = 2$ *then which of the following is* equal to $\csc(\theta)$?

A.$\sqrt{5}$ B. $\frac{2}{\sqrt{5}}$ C. $\frac{1}{\sqrt{5}}$ D. $\frac{1}{2}$

22. what is the period (P) and the range(R) of$f(x) = 5\sin\left(\frac{1}{3}x + 2\right) + 3$

A. $P = 6\pi, R = [-2,8]$ B . $P = \frac{2\pi}{3}, R = [-5,5]$

C. $P = 6\pi, R = [-5,5]$ D. $P = \frac{2\pi}{3}, R = [-2,8]$

23. $What\ is\ the\ value\ of\ cot270^0 + 2cos90^0 + 4sec^2180^0$?

A.-2 B.-4 C.4 D.8

24. $If\ f(x) = \pi^2 + 1, then\ f'(x) =$

A. 2π B. 1 C. π^2 D.0

25. Let $f(x) = \frac{6x}{x+a}$ For what value $of\ a\ is\ f'(a) = 1$?

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

26. $If\ f(x) = x^2\sqrt{2x+12}$ *What is the slope of tangent line to the graph of* f *at x=2?*

A. -4 B.2 C. 18 D. 17

27. What is the equation of a normal line to the graph of $f(x) = 3x^2 + 4x - 5$ at (1,2)?

A. $x + 10y - 21 = 0$ B. $- x + 10y - 19 = 0$

C. $x + 10y + 21 = 0$ D. $x + 10y + 19 = 0$

28. For what value(s) of x does the graph of $f(x) = \sqrt{x^2 - x}$ have a vertical tangent line?

A.0 & -1 B. 1&-1 C. 0&1 D. 1

29. What is the sum of all multiples of 4 that are between 30 and 301 ?

A.12,882 B. 11,288 C. 6,288 D. 6,882

30. If $y = \frac{3}{x^3}$, then what is value of $\frac{dy}{dx}|_{x=1}$

A. -9 B.9 C. $\frac{9}{4}$ D. $\frac{-9}{4}$

31. On which of the following interval $f(x) = 2x^5 + 3\ increase$?

A. $(-\infty, 0]$ B .$[0, \infty)$ C. $(-\infty, 0)U(0, \infty)$ D.$(-\infty, \infty)$

32. If the Volume of sphere is increasing at rate of $0.4\pi\ cm^3/s$,then what is the rate of increase of the radius at r=10cm?

A. $\frac{1}{200} cm/s$ B. $\frac{16}{9000} cm/s$ C. $\frac{1}{1000} cm/s$

D.$\frac{1}{3000} cm/s$

33. $If\ g(x) = xf(x) - \sqrt{f(x)}\ \ f(2) = f'(2) = 4, then\ \ which\ of$ the following is equal $tog'(2)$?

A.11 B.8 C.2 D.0

34. If f is integrable on a closed interval $[a,b]$ and $c \in [a,b]$, then which one of the following properties is NOT true about f?

A. $\int_a^a f(x)dx = 0$

B. $\int_a^b f(x)dx = \int_b^a f(x)dx$

C. $\int_a^b f(x)dx = \int_a^c f(x)dx + \int_c^b f(x)dx$

D. $\int_a^b f(x)dx = \int_a^c f(x)dx - \int_b^c f(x)dx$

35. What is the area of the region bounded by $f(x) = x^2 + 3$ and x- axis on the closed interval $[-1,\ 3]$?

A. $\frac{4}{3}$ Square units C. $\frac{26}{3}$ Square units

B. $\frac{22}{3}$ Square units D. $\frac{64}{3}$ Square units

36. If $f(x) = x^5 + 2x$, then what is the value of $\left(\frac{f(1+h) - f(1)}{h}\right)$ as $h \to 0$?

A. 2 B. 7 C. 5 D. Does not exist.

37. Let $f(x) = x^3 - 3x$, what is the possible values of x at which the slope of the line tangent to $f(x)$ is 0 ?

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

38. Which one of the following is the average rate of change the function $f(x) = x^3 - 9x$, on the interval $1 \le x \le 6$.

A. 43 B. 34 C. 16 D.23

39. Which one of the following is the instantaneous rate of change of the function $f(x) = 2x^2 + 9$ at x = 3?

A. 12 B. -12 C. 16 D.-1

40. Which one of the following is not rational expression?

A. $\frac{2x^4-16}{x-2}$ B. $\frac{\log_2 8}{x^3+5}$ C. $\frac{5x}{2\pi}$ D. $\sqrt{x^2-25}$

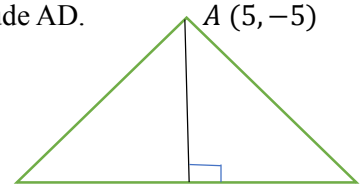
41. Which one of the following is the partial fraction of $\frac{2x}{x^2-4}$?

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

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

42. If $A(5,-5)$, $B(4,\ 4)$ and $C(0,\ 2)$ are the vertices of ΔABC and $AD \perp BC$ as shown figure 1.1 below. Find the equation of altitude AD.

Figure 1.1



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

B. $y = 2x + 5$ D. $y = -2x - 5$

43. What is the center and radius of the circle with equation $x^2 + y^2 - 4x + 6y + 8 = 0$?

A. $(2, -3)$ and 5 C. $(-2,\ 3)$ and $\sqrt{5}$

B. $(-2,\ 3)$ and 5 D. $(2, -3)$ and $\sqrt{5}$

44. Which one of the following is NOT true about the equation of the parabola $y = -\frac{1}{2}x^2$?

A. The focus is $(0, -\frac{1}{2})$ C. The directrix is $\frac{1}{2}$

B. The focal length is 4 D. The parabola opens downward

45. What is the distance between the point $P(-2, -3)$ and the line L: $12x - 5y - 30 = 0$?

A. $\frac{46}{13}$ units B. 3 units C. 39 units D. 2 units

46. If $A = \begin{bmatrix} 1 & 2 \\ -2 & 0 \end{bmatrix}$, $B = \begin{bmatrix} -1 & -2 \\ 3 & 1 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$, then $3A - 2B + 2C$ is

A. $\begin{bmatrix} 7 & 10 \\ -12 & -4 \end{bmatrix}$ B. $\begin{bmatrix} 3 & 4 \\ -5 & 0 \end{bmatrix}$ C. $\begin{bmatrix} 1 & 2 \\ -2 & 0 \end{bmatrix}$ D. $\begin{bmatrix} 5 & 10 \\ -12 & 4 \end{bmatrix}$

47. For a square matrix A and a non-singular matrix B of the same order. Then the value of the determinant of $A^{-1}BA$ is equal to:

A. $|A|$ B. $|A^{-1}|$ C. $|B|$ D. $|B^{-1}|$

48. If $A = \begin{pmatrix} 5 & 2y - 3x & 2 \\ -2 & 3 & 6 \\ 3 & 0 & 4 \end{pmatrix}$ and $B = \begin{pmatrix} 5 & -2 & 2 \\ -2 & 3 & 4x - y \\ 3 & 0 & 4 \end{pmatrix}$, where $A = B$. What is the value of the variable x and y respectively?

A. 2 and -2 C. -2 and 2

B. -2 and -2 D. 2 and 2

49. What is the determinant of matrix $A = \begin{pmatrix} 2 & 0 & -2 \\ 1 & 0 & 3 \\ 7 & 0 & 5 \end{pmatrix}$?

A. 20 B. 0 C. 16 D. 24

50. If A is a $3x3$ matrix with $det\ (A) = 6$, then what is the $det\ (2A^T)$?

A. $\frac{1}{2}$ B. 12 C. 36 D. 48

51. Which of the following is neither arithmetic nor geometric progression?

A. $\{3, 7, 11, 15, 19 \ldots\}$ C. $\{-\frac{1}{3},\ \frac{1}{9}, -\frac{1}{27}, \frac{1}{81} \ldots\}$

B. $\{-1, 1, -1, 1 \ldots\}$ D. $\{-3, -1, 2, 4, 6 \ldots\}$

52. In an A.P, If $a_5 = 10$ and $a_{10} = 45$, what is the common difference and the first term?

A. $d = 7\ and\ a_1 = -18$ C. $d = -7\ and\ a_1 = -18$

B. $d = 7\ and\ a_1 = 18$ D. $d = -7\ and\ a_1 = 18$

53. If x + 3, 2x + 3 and 4x -1 are consecutive terms of a Geometric progression, then what is the possible value of x?

A. 12 B. -12 C. -6 D. 6

54. In an arithmetic progression, if $A_1 = 1, A_n = 20$ & $S_n = 399$, then what is the value of n?

A. 19 B. 21 C. 42 D. 38

55. What is the sum of $\sum_{n=2}^{20}\left(\frac{1}{n-1}-\frac{1}{n}\right)$?

A. $\frac{17}{20}$ B. $\frac{23}{20}$ C. $\frac{21}{20}$ D. $\frac{19}{20}$

56. If $A_1 = 4$ *and* $d = 5$, of an arithmetic progression, then what is the value of S_{12}?

A. 378 B. 408 C. 403 D. 354

57. What is n^{th} terms of an arithmetic progression whose n^{th} partial sum is $5n^2 - 1$?

A. $-10n - 5$ C. $10n - 5$

B. $5 - 10n$ D. $10n + 5$

58. It is given that a, b, c, d, e are an arithmetic sequence. If $a + b + c = 9$ and $d + e = 26$. What is the first term and common difference respectively?

A. 4 and -1 C. -1 and 1

B. -4 and 1 D. -1 and 4

59. If $\{a_n\}$ is a sequence such that $a_1 = 2$ and $a_{n+1} = a_n + 4$ for all n ≥ 1, then $\sum_{n=1}^{35} a_n$ is equal to:

A. 2,460 B. 2,458 C. 2,450 D. 2,442

60. The sum of the series $\sum_{n=0}^{\infty} 5(\frac{2}{3})^n$ is equal to

A 10 B.15 C. $\frac{10}{3}$ D. 5

61. The fraction form of the recurring decimal $0.5\overline{6}$ is equal to:

A. $\frac{17}{30}$ B. $\frac{15}{17}$ C. $\frac{2}{3}$ D. $\frac{19}{45}$

62. The sum of the first 12 terms of a geometric sequence with first term 0.3 and common ratio 0.1 is equal to;

A. $\frac{1}{3}(\frac{10^{11}-1}{10^{11}})$ C. $-\frac{1}{3}(\frac{10^{12}-1}{10^{12}})$

B. $\frac{3}{10}(\frac{10^{12}-1}{10^{12}})$ D. $\frac{1}{3}(\frac{10^{12}-1}{10^{12}})$

63. A certain item gains one – tenth of its value each year. If the item is worth Birr 30, 000 today, how much will it be worth 3 years from now?

A. 90,000 Birr B. 30,900 Birr C. 39,930 Birr D. 21, 870 Birr

64. The equation of an ellipse with center at (1,4) and Vertices at (10,4) and (1,2)is

$4(x-1)^2 + 81(y-4)^2 = 324$ C. $9(x-1)^2 + 4(y-4)^2 = 1$

A. $(x-1)^2 + 9(y-4)^2 = 4$ D. $2(x-1)^2 + 9(y-4)^2 = 4$

65. If the equation $(x-2)^2 - (y+2)^2 = 1$ represents a hyperbola, which one of the following represents the equation of an asymptote of the hyperbola?

A. $y = 4 + x$ B. $x + y = 1$ C..$x = 2 - y$ D..$x + 2y = 3$