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ACADEMY

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ADDIS ABABA CITY ADMINISTRATION EDUCATION BUREAU ADDIS ABEBA

GRADE 12 MATHEMATICS MODEL EXAMINATIONS

TIR 2016/JUARY 2024

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 correct answer from the given alternatives and carefully blacken the letter of your correct choice on the separate answer sheet provided.

1. The solution set of the equation $\log_2(2x-5) = 4$ is .

A. $\{86\}$ **B.** $\{43\}$ **C.** $\left\{\frac{69}{2}\right\}$ **D.** $\{64\}$

2. A function f is said to be an exponential function,where .

A. $f(x) = a^x$, $a \neq 0$ **C.** $f(x) = a^x$, $a \in R$ and $a \neq 0$

B. $f(x) = a^x$, a ¿ 0 **D.** $f(x) = a^x$, $a ¿ 0 \wedge a \neq 1$

3. The GCF of two numbers is 9 and their LCM is 54.If one of the numbers is 18, then the other number is ---------.

A. 36 **B. 54** **C. 27** **D. 72**

4.csc 240^0**=----------**

A. $-\sqrt{3}$ **B. -2** **C.** $-\frac{\sqrt{2}}{2}$ **D.** $-\frac{2\sqrt{3}}{3}$

5. Which one of the following is correct?

A. tan $495^0 > 0$ **C. sin(-** 495^0**)¿** 0

B. tan(- 495^0**)¿** 0 **D. sin** $495^0 > 0$

6. If a position vector is given as V=5i+j, then which one of the following vectors is equal to V?

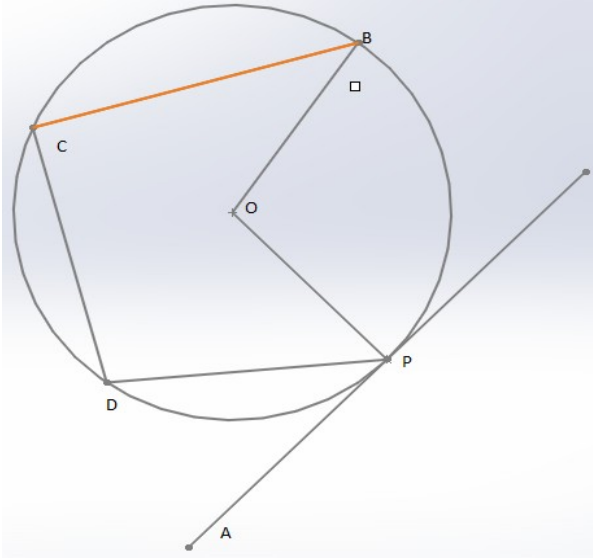
A. $\overrightarrow{RS}$ **where R(1,3) and S(6,4)** **C.** $\overrightarrow{GH}$ **where,G(3,-1) and H(2,2)**

B. $\overrightarrow{PQ}$**,where P(-3,-4) and Q(2,-1)** **D.** $\overrightarrow{EF}$ **whre ,E(-1,-2) and F(0,3)**

7. Two dice are rolled simultaneously. What will be the probability that the sum of the two numbers on the upper faces is greater than 9?

A. $\frac{1}{12}$ **B.** $\frac{1}{6}$ **C.** $\frac{5}{12}$ **D.** $\frac{1}{4}$

8. In the figure shown below, $\overline{AP}$ **is a tangent to circle ,O where m(¿** APD **¿=** 40^0 **and m(** ¿ BOP ¿ **?**



What is the degree measure of $\angle BCD$ **?**

$A.\ 60^0$ **B.** 140^0 **C.** 70^0 **D.** 90^0

9. If f= $\{(1,2),(-3,2),(2,5)\}$ **and g =** $\{(2,4),(1,5),(3,2)\}$**, then which one of the following is not true?**

A. f + g = $\{(1,7),(2,9)\}$ **C. Domain of f + g is** $\{1,2\}$

B. f – g = $\{(-2,7),(2,1)\}$ **D. f +g =** $\{(3,6),(-2,7),(5,7)\}$

10. Of 100 students ,65 are members of HIV AIDS club and 30 are members of a minimedia club. If 20 are members of neither club, then how many students are members of both HIV AIDS and Minimedia club?

A. 15 **B. 20** **C. 95** **D. 35**

11. Consider the system of linear equations $\begin{cases} 2x-y=1 \\ 3x-2y=-4 \end{cases}$

Which one of the following is true about its solution ?

A. It has no solution **C. It is difficult to determine**

B. It has a unique solution **D. It has infinitely many solution**

12. Which one of the following pairs represents equal sets ?

A. $\{x\epsilon Z:(x^2-9)(x-5)=0\}$ **and** $\{x\epsilon N:(x^2-9)(x-5)=0\}$

B. $\{x: x\ is\ an\ even\ natural\ number\ less\ than\ 50\}$ **and** $\{x: x\ is\ an\ odd\ natural\ number\ less\ than\ 50\}$

C. $\{x: x\epsilon N \wedge 4<x<11\}$ **and** $\{x: x\epsilon W \wedge 5\le x\le 10\}$

D. $\{1,2,3,4,5,6\}$ **and** $\{a,b,c,d,e,f\}$

13. If f(x) = $3x^7$- ax^6 + $5x^3$ – x + 11 is divided by x + 1, the remainder is 15 then the value of a is ------

A. 11 **B. -5** **C. 5** **D. - 11**

14. Consider the polynomial function f(x) = x$(x-2)^2(x+2)^4(x+1)^3$,which one of the following is true about the graph of f(x)?

A. The graph of f(x) crosses the x-axis at x=2 and x=-2

B. The graph of f(x) crosses the x-axis at x=0 and x= -1

C. The graph of f(x) touches the x-axis at x=0 and x= -1

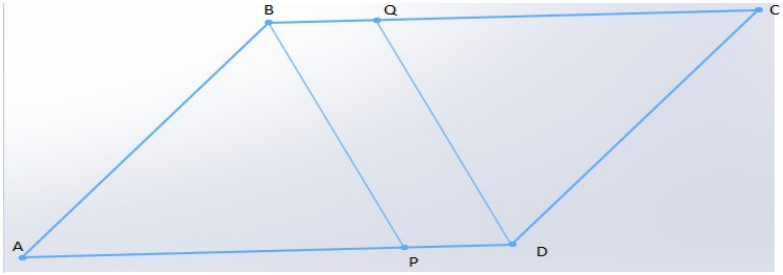
D. The graph of f(x) does not have a relative extremum at x = 2 and x = -2.

15. The solution set of the inequality x^2 – 7x + 12 ≥ 0 *is*:

A. $\{x: 3 \leq x \leq 4\}$ **C.** $\{x: x \leq 3 \vee x \geq 4\}$

B. $\{x: x \leq 3 \vee x \geq 4\}$ **D.** $\{x: -4 \leq x \leq -3\}$

16.In the figure shown below ABCD is a parallelogram and $\overline{BP}$ bisects ¿$B \wedge \overline{QD}$ bisects ¿D .Which one of the following is not correct?



A.BPDQ is a parallelogram **C.** ΔCQD**is an equilateral triangle**

B. $\Delta ABP \cong \Delta CDQ$ **D.** $\overline{BP} \equiv \overline{QD}$

17. A right triangle has vertices P(1,1) , Q(1,5) , and R(7,5). Which one of the following is the gradient of the hypotenuse of this triangle ?

A. - $\frac{2}{3}$ **B.** $\frac{3}{2}$ **C. 0** **D.** $\frac{2}{3}$

18. A frustum of a regular square pyramid has height 6cm, where its upper base of sides 2cm and the lower base of sides 6cm. Then what is the volume of this frustum?

A. 208cm^3 **B. 260**cm^3 **C. 104**cm^3 **D. 312**cm^3

19. The circumference of the cylinder is 12πcm and whose lateral face area is 288$\pi\, cm^2$. Then what is the volume of this cylinder?

A. $864\pi\, cm^3$ **B.** $288\pi\, cm^3$ **C.** $144\pi\, cm^3$ **D.** $36\pi\, cm^3$

20. If a regular quadrilateral has radius 5 units. Then what is the perimeter of this regular quadrilateral?

A. $5\sqrt{2}$ **units** **B.** $10\sqrt{2}$ **units** **C.**$20\sqrt{2}$ **units** **D.20 units**

21. If p(x) = $4x^3 \wedge Q(X) = 3x^2$ **– 3x , then what is the solution set of** $\frac{P(X)}{4xQ(x)} + \frac{1}{x} = \frac{1}{Q(x)}$ **?**

A. $\{-4,1\}$ **B.** $\{1\}$ **C.** $\{4\}$ **D.** $\{-1,4\}$

22. Which of the following functions is a one- to-one correspondence function?

A. f: R → R**, f(x) =** $5x^2$ **– 7** **C. h : [0,∞¿ → ¿ , h(x) =** x^2

B. g : R → R **, g(x) =** 2^x **D. r : [0,∞¿ → ¿ ,r(x) = x + 5**

23. What is the equation of the directrix for the parabola whose equation is y^2 **+ 8x + 6y + 25 = 0?**

A. y=3 **B. x=2** **C. x=0** **D. x = 4**

24. Which one of the following is an equation of the circle whose endpoints of a diameter are (0,-2) and (2,2)?

A. $x^2 + y^2$ **C.** $(x-1)^2 + y^2$

B. $x^2 + y^2$ **– 2y – 4** **D.** $x^2 + y^2$**- 2x- 4**

25. If (P∨Q) $_{=}$ **(**$\neg r \wedge$ **r) is true , then which one of the following is necessarily true?**

A. $\neg P \vee$ **Q** **B.** $\neg r \wedge r$ **C.** $\neg p \underset{\Rightarrow}{} r$ **D.** $\neg Q \underset{=}{} (P \vee Q)$

26. Which one of the following forms represents an exhaustive set of events if a die is thrown once?

A. $\{1,2,3\}$ **,**$\{4,5\}$ **,** $\{6\}$ **C.** $\{1,2\}$ **,** $\{4\}$ $\{4,5,6\}$

B. $\{1,2,3\}$**,** $\{3,4\}$**,** $\{6\}$ **D.** $\{1,2\}$ **,**$\{2\}$ **,** $\{4,5\}$**,** $\{5,6\}$

27. A bag contains 3 red , 4 yellow and 6 green balls. One ball is drawn at a random. What is the probability that the drown ball is Not yellow?

A. $\frac{4}{13}$ **B.** $\frac{9}{13}$ **C.** $\frac{6}{13}$ **D.** $\frac{5}{13}$

28. In the binomial equation of $(x+y)^5$ **what is the coefficient of the term** x^2y^3 **?**

A. 20 **B. 1** **C. 5** **D. 10**

29. Which of the following is the inverse of the matrix $\begin{bmatrix} 2 & 3 \\ 3 & 4 \end{bmatrix}$**?**

A. $\begin{bmatrix} -2 & 3 \\ 3 & -4 \end{bmatrix}$ **B.** $\begin{bmatrix} -4 & -3 \\ -3 & -2 \end{bmatrix}$ **C.** $\begin{bmatrix} -4 & 3 \\ 3 & -2 \end{bmatrix}$ **D.** $\begin{bmatrix} 4 & -3 \\ -3 & 2 \end{bmatrix}$

30. Let A = $\begin{bmatrix} 1 & 2 & 6 \\ 3 & 4 & -8 \\ 0 & 7 & 9 \end{bmatrix}$ **and B =** $\begin{bmatrix} 10 & 0 & 2 \\ -6 & 3 & 8 \\ 1 & 5 & 12 \end{bmatrix}$**. Then which of the following is equal to - 3A + 2B ?**

A. $\begin{bmatrix} 17 & -6 & -14 \\ -21 & -6 & 40 \\ 2 & -11 & -3 \end{bmatrix}$ **C.** $\begin{bmatrix} 17 & -6 & -14 \\ -21 & -6 & 40 \\ 2 & 11 & -3 \end{bmatrix}$

B. $\begin{bmatrix} 17 & 6 & -14 \\ -21 & -6 & 40 \\ -2 & 11 & -3 \end{bmatrix}$ **D.** $\begin{bmatrix} 11 & 2 & 8 \\ -3 & 7 & 16 \\ 1 & 12 & 21 \end{bmatrix}$

31. What is the polar form of 2+2$\sqrt{3}$ **i ?**

A. 4($\cos\frac{\pi}{2}$**+i**$\sin\frac{\pi}{2}$ **C.** 4 ¿+$\sin\frac{\pi}{3}$ **)**

B. 2¿+**i**$\sin\frac{\pi}{3}$ **D.** 4 ¿ **- i**$\sin\frac{\pi}{3}$ **)**

32. What is the maximum value of Z = 2x + 3y ,subject to : $x \geq 0$

$y \geq 0$

$2y + x \leq 16$

$X - y \leq 10$

A.0 B. 30 C. 20 D. 24

33.If Birr 4000 is deposited in a bank with interest rate 10% per annum compounded semi-annually , then how much Birr it be by the end of one year?

A. 4400 B. 400 C. 4100 D. 4200

34. A theatre hall has 231 **seats arranged in rows in a way that the first row has** 15**seats, the second row has** 21**seats, the third row has** 27**seat, and so on. How many seats are in the last row?**

A. 45 **B.** 57 **C.** 51 **D.** 39

35. If the first term and common difference of an arithmetic sequence are 3 **and** 2 **respectively, then what is the sum of the first** 30 **terms of the sequence?**

A.960 **B.** 825 **C.** 915 **D.** 1,920

36. Let the sequence is given by the recurrence relation

$A_1 = 10 \wedge A_n = A_{n-1} - 4 \text{ for } n \geq 2$ **, then which one is <u>not true</u> about the given sequence?**

A.The sum of the first six terms is 0**.** **C.** $A_{51} = -190$

B. It is an arithmetic sequence. **D.** $A_1 - A_6 = 0$

37. What is the sum of the infinite series $\frac{1}{7} - \frac{3}{7^2} + \frac{3^2}{7^3} - \frac{3^3}{7^4} + \ldots$ **?**

$A.10$ **B.** $\frac{1}{10}$ **C.** $\frac{1}{4}$ **D.** $\frac{4}{7}$

38. In a geometric sequence the first term 9 **and the sum to infinity is** 6**. What is the common ratio of the sequence?**

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

39. The fractional form of a number 2.765765- - - is equal to:

A. $\frac{2765}{100}$ **B. 2.765766** **C.** $\frac{307}{111}$ **D. 2.765765000**

40. If the third and fifth terms of a geometric progression are respectively $\frac{1}{2}$ **and** $\frac{1}{8}$ **and the second term is negative, then which of the following is not true about the progression?**

A. The common ratio is - $\frac{1}{2}$ **C. The fourth term is -** $\frac{1}{4}$

B. The first term is 2 **D. The sum of the first four term is – 1**

41. A ball is dropped from a height of 20 meters .On each bounce it rebounds $\frac{3}{4}$ **of the distance it fell. How far does it travel before coming to rest?**

A. 140 meters **B. 80 meters** **C. 120 meters** **D. 60 meters**

42. Let $S_n = 6n^2$**, n = 1,2,3, - - -, be the sum of the first n terms of an arithmetic sequence** $\{a_n\}_{n=1}^{\infty}$ **which of the following is the third term** a_3 **?**

A. 30 **B. 20** **C. 36** **D, 42**

43. What is the sum of the first 20 terms of the sequence 3, 7, 11, 15, 19, - - - ,?

A. 741 **B. 820** **C. 899** **D. 903**

44. If k**-geometric means are inserted between** $\frac{1}{8}$ **and** 16**, then the sum of the resulting terms is** $\frac{255}{8}$**.**

What is the value of the third geometric mean?

A. 8 **B.** 4 **C.** 1 **D.** $\frac{1}{2}$

45. *If* $\sum_{n=1}^{\infty} 3^{nt} = \frac{1}{80}$, then what the value of t ?

A. -3 **B.** -4 **C.**4 **D.**3

46. Which of the following is a formula for the nth term of a geometric sequence (an) *if* a_3 **=8 and** a_6**= -64?**

A. -(-2)^n **B. 2(-2)$^{n-1}$** **C. (-1)$^{n-1}$(2)^n** **D. (-2)^n**

47. What is the seventh term of an arithmetic sequence whose third term is – 4 and common difference is 5?

A. 15 **B. – 15** **C. 16** **D. – 16**

48. Suppose $\int_1^3 f(x)dx = 6$ **and** $\int_1^2 f(x)dx = 10$**, what is the value of** $\int_2^3 f(x)dx$

A. – 4 **B. 4** **C. 16** **D. 2**

49. Which of the following is true about the function defined by f(x) = x^3 **-** $3x^2$ **on [-1,3]?**

A. Its critical numbers are 0,2,3 and its maximum value is 0.

B. Its critical numbers are o and 2 and its maximum value is 15

C. Its critical numbers are o and 2 and its maximum value is – 4

D. Its critical numbers are o and 2 and its maximum value is 0

50. Which one is false ?

A. $\int_0^3$ ¿¿)**dx = - 6**

B. $\int_{-2}^{2} x^3$**dx = 0**

C. $\int_9^{16} \frac{1}{\sqrt{x}}$**dx = 2**

D. $\int_0^2 (2x-4)dx = 4$

51. What is the equation of the tangent line to the graph of $f(x)=x^3+2$ *at* $(0,2)$**?**

A. $y=2x+2$ **B.** $y=\frac{2}{3}x+2$ **C.** $y=2$ **D.** $y=-x+1$

52. If $f(x)=\frac{1}{3}x^3+c\,x^2+ax+5$ has a local minimum value at $x=1$, then which one of the following is true about the possible values of $a \wedge c$?

A. $a=3, c=-2$ **C.** $a=-2c-1, c \leftarrow 1$

B. $a=-2c-1, c>-1$ **D.** $a=-2c-1$, *c any real number*

53. Which of the f0ll0wing is a geometric sequence?

A. 1, 1.5, 2.5, 3.5, - - - **C. 8, - 4, 2, - 1, - - -**

B. 0.1, 0.01, 0.011, 0.000111, - - - **D. 0.1, 0.11, 0.12, 0.13, - -**

54. What is the area of the region bounded by y = 0 and the graph of f(x) = 9 - x^2 on the interval [-2, 2]?

A. $\frac{92}{3}$ **B. .** $\frac{16}{3}$ **C. 36** **D.** $\frac{124}{3}$

55. The acceleration of a body at any time t is given by a(t) = 6+3t+2t^2 with initial velocity v(0) = 9. Then what is velocity v of the body as a function of time?

A. v(t) = $t^3 + \frac{3}{2}t^2$ **+ 6t – 9** **C. v(t) =** $t^3 + \frac{3}{2}t^2$ **+ 6t +9**

B. v(t) = t^3 **+ 3** t^2 **+ 6t + 9** **D. v(t) =** $\frac{2}{3}t^3 + \frac{3}{2}t^2$ **+ 6t +9**

56. A candle has a starting length of 16 cm. Thirty minutes after lighting it , the length became 10 cm, then how long the candle takes to completely burn out ?

A. 50 minutes **B. 80 minutes** **C. 30 minutes** **D. 60 minutes**

57. Consider the following table below.

Value(x)	**5 - 9**	**10- 14**	**15 - 19**	**20 - 24**
Frequency(f)	**4**	**2**	**3**	**1**

What is the range of the given data?

A.30 **B. 26.75** **C. 20** **D.19**

58. A circular plate of metal is being expanded by heating. If radius of plate increases at the rate of $0.3\,cm/sec$**, then what is the rate of increase of area when its radius** $15\,cm$**?**

$A.90\pi\,cm^2/sec$ **B.** $9\pi\,cm^2/sec$ **C.** $\frac{9}{2}\pi\,cm^2/sec$ **D.** $9\,cm^2/sec$

59. Let $f(x)=\frac{1}{(1-\sqrt{x})^2}$**. Then** $f'(4)$ **is equal to:** **A.** 1 **B.** 2 **C.** $\frac{1}{2}$ **D.** $\frac{-1}{2}$

60. Let $f \wedge g$ be differentiable functions and $h(x)=g(f(3x+1))$. If $f'(1)=f(1)=2 \wedge g'(2)=1$, then what is the value of $h'(0)$?

$A.2$ **B.** 1 **C.** 6 **D.** 4

61. Which one of the following is not absolute measures of dispersion?

A. Range **C. Inter – quartile range**

B. Mean deviation **D. Coefficient of range**

62. Consider the following frequency distribution table.

Value(x)	0 -5	6 - 11	`12 - 17	18 - 23	24 - 29
Frequency(f)	5	8	7	10	3

What is the mean deviation about the median?

A. 6.26 **B. 14** **C. 33** **D.207.5**

63. Based on question number 62 the mean of the distribution frequency the mean of the data is equal to:

A. 6.26 **B. 14.14** **C. 33** **D.207.5**

64. If all values in a given data set are equal to 14, then one of the following will hold true?

A. Modal value is 14. **C. Range is 14**

B. Mean deviation about the mean is 0. **D. Standard deviation is equal to the mean value**

65. Consider the given frequency distribution table .

What is the mean of the data?

value	5	10	- 4	0	11
frequency	3	4	2	4	3

A. 1.375 **B. 6** **C. 6.25** **D. 5**