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MATHEMATICS MODEL EXAM – FOR GRADE 12(S)

Sene 2012/ June 2020

GENERAL DIRECTIONS

THIS EXAMINATION CONTAINS 65 QUESTIONS. ATTEMPT ALL THE ITEMS.

FOLLOW THE INSTRUCTIONS ON THE ANSWER SHEET AND THE EXAM PAPER EXACTLY.

USE A PENCIL TO MARK YOUR ANSWERS

- WRITE EVERY NECESSARY INFORMATION ON YOUR ANSWER SHEET.
- YOU ARE ALLOWED TO WORK ON THE EXAM FOR TWO HOURS WHEN THE TIME IS CALLED YOU MUST IMMEDIATELY STOP WORKING.
- PLEASE BLACKEN THE LETTER OF YOUR CHOICE ON THE ANSWER SHEET **PROPERLY**.
- IF YOU FINISH BEFORE TIME IS CALLED, YOU MAY GO BACK AND REVIEW.

TIME ALLOWED – 3:00

Set by: Mr. Mihretu E. & Mr. Kibkab N.

GOOD LUCK

I. Choose the letter that contains the correct answer and then blacken on the space provided.

1. A function $f: A \to B$ is said to be an even function, if and only if, for any x in A,

   A. $f(x) = -f(-x)$ B. $f(-x) = f(x)$ C. $f(-x) = -f(x)$ D. $f(-x) = -f(-x)$

2. Let $f(x) = 2x + 2$ and $g(x) = 5x$. Which one of the following is true?

   A. $(f + g)(-1) = 10$ C. $(fog)(2) = 18$

   B. Domain of (f/g) is set of real numbers. D. $(fogof)(0) = 22$

3. The inverse of a function given by $f = \{(x, y): y = 2 – 4x\}$ is

   A. $\left\{(x,y): y = \frac{x-2}{4}\right\}$ C. $\left\{(x,y): y = \frac{2-x}{4}\right\}$

   B. $\left\{(y,x): y = \frac{2-x}{4}\right\}$ D. $\left\{(x,y): x = \frac{2-y}{2}\right\}$

4. Let $f(x) = \frac{3x^2-3}{x-1}$. The simplified form of $f(x)$ is

   A. $f(x) = 3x + 3$ B. $f(x) = 3x + 1$ C. $f(x) = x + 3$ D. $f(x) = 3x – 3$

5. The zero of a rational function given by $f(x) = \frac{5x^2}{x^2-1}$ is

   A. x = 1 B. x = 1 & -1 C. x = 0 D. No zero of f.

6. Which one of the following is not true about a line L given by equation $y = 3x – 2$?

   A. The line passes through the point (1, 1).

   B. Slope of a line perpendicular to L is -1/3.

   C. 4 -3x + y = 0 is parallel to L.

   D. 1 – x + 3y = 0 is perpendicular to L.

7. For the circle given by an equation $x^2 + y^2 – 4x + 6x = 3$, which one of the following is not true?

   A. The line x – 2y + 1 = 0 is tangent to the circle.
   B. Center of the circle is (2, -3).
   C. The line y = ½x + ½ intersects the circle at two points.
   D. Radius of the circle is 4.

8. Let $x^2 = 4(y + 1)$ be an equation of a parabola. Which one of the following is true?

   A. The parabola opens to the right.
   C. Vertex of the parabola is (0, 1).
   B. The directrix is y = -2.
   D. The focus is (0, 2).

9. The length of the minor axis of a certain ellipse is 30 meters and the distance between its two foci is 40 meters. The distance between one of its foci and the endpoint of the minor axis is

   A. $5\sqrt{7}$ B. 25 C. 35 D. None

Let the truth values of p, q and r are F, T and T, respectively. Answer question number 10 and 11 based on this information.

10. Which one of the following propositions has false truth value?

   A. $\neg(p \wedge q)$
   C. $\neg (p \wedge r) \Rightarrow \neg r$
   B. $(\neg p \vee q) \Rightarrow r$
   D. $(\neg p \vee q) \Leftrightarrow \neg p$

11. Which one of the following has the same truth value to a proposition given by $\neg p \vee \neg q$?

   A. $r \Rightarrow (p \wedge r)$
   C. $(\neg p \wedge q) \vee p$
   B. $r \Leftrightarrow (\neg p \vee q)$
   D. None of these.

12. "If she gets 100 birr, she will buy the book. She does not like reading. Therefore, if she does not get the money, she won't buy the book." The symbolic translation of this proposition is

   A. $[(p \Rightarrow q) \wedge \neg r\ ] \Rightarrow (\neg p \Rightarrow \neg q)$
   C. $[(p \wedge q) \vee \neg r\ ] \Rightarrow \neg r$
   B. $[(p \Rightarrow q) \vee \neg r\ ] \Rightarrow (\neg p \wedge \neg r)$
   D. $[(p \Leftrightarrow q) \wedge \neg r\ ] \Rightarrow \neg(p \wedge q)$

13. Which one of the following is calculated based on all values of variables under study?

   A. Quartile deviation B. Standard deviation C. Range D. Mode

14. If all values in a data set are equal, the mean deviation and the variance will be

   A. Zero
   C. Not determined
   B. One
   D. Negative

15. The 50^{th} percentile of a certain statistical distribution is the same as

   A. Mean B. Mode C. Quartile deviation D. Median

16. If an outcome had never occurred in the experiment, the probability of that outcome or event would be

   A. Infinite
   C. One
   B. Undefined
   D. Zero

17. What is $8C_2 - 5C_3$?

A. 18 B. 2 C. 1 D. 4

18. Suppose you have a bag containing 3 red, 4 blue and 5 white marbles. One marble is selected at random. The probability that no white marble is selected is

A. 9/12 B. 5/12 C. 7/12 D. 5/7

19. Let A and B be two square matrices. Which one of the following is not true?

A. If B is found by interchanging two rows (columns) of A, then |A| = - |B|.

B. If A has a row (column) of zeros, then |A| = 0.

C. A and B commute, i.e., A.B = B.A.

D. If B is found by multiplying one row (column) of A by a scalar c, then c|A| = |B|.

20. Let $A = \begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix}$. Then A^{-1} is

A. $A^{-1} = \begin{bmatrix} 2/5 & 3/5 \\ -2/5 & 2/5 \end{bmatrix}$ B. $A^{-1} = \begin{bmatrix} 4/5 & -3/5 \\ -1/5 & 2/5 \end{bmatrix}$ C. $A^{-1} = \begin{bmatrix} 1/5 & 2/5 \\ 2/5 & 4/5 \end{bmatrix}$ D. $A^{-1} = \begin{bmatrix} 3/5 & 2/5 \\ -4/5 & 2/5 \end{bmatrix}$

21. In elementary row operations of a matrix, what does pivoting mean?

A. Interchanging two rows of a matrix.

B. Adding a constant multiple of one row of a matrix on another row.

C. Multiplying a row of a matrix by a non-zero constant.

D. None of the above.

22. Apply Cramer's rule and solve the following system of linear equations.

$$\begin{cases} x + 2y = 5 \\ -2x + 3y = 4 \end{cases}$$

A. x = -1 and y = 2 C. x = 2 and y = 1

B. x = -1 and y = -2 D. x = 1 and y = 2

23. Let $z_1 = 1 + 2i$ and $z_2 = 3 - i$. Find $z_1.z_2$.

A. 1 + 5i B. 1 – 5i C. 5 + 5i D. 5 – 5i

24. The simplified form of $\frac{2-3i}{i^3}$ is

A. 3 + 2i B. 2 + 3i C. 2 – 3i D. None of these

25. The polar representation of $z = 3 + 3\sqrt{3}i$ is

A. $(5, \pi)$ B. $(6, \pi)$ C. $(6, \pi/3)$ D. $(6, \pi/4)$

26. Consider a graphical region represented by $4x - 2y < 6$. Which one of the following is true about the graph?

A. The graph of the region is found by shading the lower part from the line $4x - 2y = 6$.
B. The origin, (0, 0), lies in the region.
C. The point (2, 3) lies in the region.
D. The x- and y-intercepts are not included in the region or in the solution space.

27. The values of x and y that maximize $Z = 2x + y$ subject to

$$\begin{cases} 3x + y \le 6 \\ x + 2y \le 4 \\ x, y \ge 0 \end{cases}$$

A. (0, 6) B. (8/5, 6/5) C. (2, 0) D. None

28. A company produces two types of steel, Type I and Type II. The table below shows the maximum available hours and profit per ton of each type of steel. Determine the maximum profit.

	Melting	Rolling	Profit per ton
Type I	2	10	100 br
Type II	5	5	80 br
Max. available hours	40	60	

A. Birr 640 B. Birr 800 C. Birr 980 D. Birr 1080

29. If Mr. X deposited Birr 800 saving at 8% interest per year, how much will the amount be at the end of 15^{th} year?

A. Birr 1,200 B. Birr 2,537.73C. Birr 2,030.73 D. Birr 1,537.8

30. Alem has Birr 100 a month deducted from each monthly salary to be deposited into a saving account at Dashen bank. This situation involves

A. Investing B. Personal investing C. Saving D. None

31. If the lender relies on your promise to pay it back and short-term loan, then the type of loan is

A. Secured loan B. Overdraft C. Buying on credit D. Unsecured loan

32. Ato Abebe sold his home for Birr 1.5 million which it acquired for 900,000. Compute the capital gain tax.

A. Birr 60,000 B. Birr 90,000 C. Birr 600, 000 D. Birr 80,000

33. A function whose domain is the set of positive integers or a subset of consecutive positive integers starting with 1 is known as

A. Recursive sequence B. Series C. Sequence D. Infinite series

34. The sum of all two-digit whole numbers that are divisible by five is given by

A. $\frac{3n}{2}(5+n)$ B. $\frac{n}{2}(10+5n)$

C. $\frac{5n}{2}(3+n)$ D. Cannot be determined.

35. The price of a commodity increases at the rate of 8% in four months time. If the present price of the commodity is Birr 240, then the price after a year will be

A. Birr 297.6 B. Birr 302.3 C. Birr 259.5 D. None

36. Suppose your aunt gives you Birr 100 on your 10^{th} birthday, along with a promise to give you one half the previous year's amount each year until the amount reaches 1 cent. What is the total amount that your aunt will give you?

A. Birr 175.60 B. Birr 300 C. Birr 255 D. 198.45

37. We say a sequence $\{a_n\}$ is monotonic, if and only if,

A. It is bounded. C. $\lim_{n\to\infty} a_n = \pm\infty$

B. $\{a_{n+1}\} \leq \{a_n\}\ or\ \{a_{n+1}\} \geq \{a_n\}$ D. $\lim_{n\to\infty} a_n = L$

38. Determine the limit. $\lim_{n\to 5}\left(\frac{\sqrt{x}-\sqrt{5}}{x-5}\right)$

A. $\sqrt{5}/10$ B. $\sqrt{5}/10$ C. $\sqrt{5}/25$ D. None

39. Let$f(x) = \begin{cases} x+2, if\ x>1 \\ ax-1, if\ x\leq 1 \end{cases}$.

What must be the value of a so that f(x) is continuous on (-∞, ∞).

A. 0 B. 1 C. 4 D. 2

40. Which one of the following is a discontinuous function in the set of real numbers?

A. $f(x)=\cos(2x)$ B. $f(x)=3^{4x}$ C. $f(x)=\log_6(x+1)$ D. $f(x)=\frac{x}{|x|}$

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41. If Birr 7,000 is deposited in an account paying 5% annual interest, then how much is in the account after 4 years and six months compounded monthly?

A. Birr 8743 B. Birr 8508.54 C. Birr 8762.16 D. None

42. Evaluate $\lim_{x \to \infty} \left(\frac{x}{x-1}\right)^{2x}$

A. e^{-2} B. e^{2} C. e D. None

43. Which one of the following is not true?

A. The equation of a tangent line to a function f at $(a, f(a))$ is $y - f(a) = m_a(x - a)$.

B. A function is differentiable on [a, b], if it is differentiable on (a, b).

C. The slope of a graph of y = f(x) at a point is the slope of the tangent line at the point of tangency.

D. None of the above.

44. The derivative of $f(x) = 3^{2x+1}$ is

A. $2 \times 4^x ln2$ B. $3 \times 2^x ln4$ C. $3 \times 9^x ln9$ D. None

45. The derivative of $f(x) = \ln \sqrt[3]{x^2}$ is

A. $1/3x$ B. $2/x$ C. $3/2x$ D. $2/3x$

46. The derivative of $f(x) = x.sin\ 2x$ is

A. $2sin\ 2x + cos\ x$ B. $sin2x + xcos2x$ C. $sin\ 2x + 2xCos2x$ D. None

47. Given $f(x) = \frac{2x}{x^2-1}$. Find $f'(0)$.

A. -2 B. 2 C. 4 D. None

48. Which of the following conditions should the function f satisfy so that according to the Rolle's theorem, there is a number C in (a, b) such that $f'(c) = 0$?

A. f is continuous on [a, b] and differentiable on (a, b).

B. f is continuous on [a, b] and $f(a) = f(b)$.

C. $f(a) = f(b)$.

D. A and C

49. Find the critical numbers of $f(x) = 3x^2 (x + 2)$.

A. 0 and -4/3 B. 0 and -2 C. 0 and 4/3 D. 0 and 2

50. Find two nonnegative real numbers whose sum is 12 and whose product is maximum.

A. 12 and 6 B. 6 and 6 C. 2 and 18 D. None

51. A company has determined that its total profit (in Birr) for a certain product is modeled as $P(x) = -x^3 + 320x^2 + 30{,}000x$, where x is the number of units produced and sold. What production level will yield a maximum profit?

A. 147.7 B. 67.7 C. 107.7 D. None

52. The population of a certain urban area has been growing according to the model

$P(t) = 120t^2 + 100t + 20{,}000$, where t is time in years, with t = 0 representing the year 1998 E. C. Determine the rate of change per year for the last 7 years?

A. 900 B. 1040 C. 940 D. None

53. Which one of the following is not true?

A. Integration is the reverse of derivation.
B. The integration of a constant is zero.
C. In the indefinite integral, $\int f(x)dx$, f(x) is said to be the integrand of the integral.
D. None of the above.

54. Integrate $\int x^2(2x^3 - 1)^3 dx$

A. $\frac{(2x^3-1)^4}{4} + C$ B. $\frac{(2x^3-1)^3}{18} + C$ C. $\frac{(2x^3-1)^4}{24} + C$ D. None

55. Integrate $\int x \sin x \, dx$

A. $x \cos x + \sin x + c$ B. $x \sin x + \cos x + c$ C. $-x \cos x + \sin x + c$ D. None

56. Using the definition of area under the curve, determine the area of the región enclosed by the curve $y = f(x)$ and the x – axis between the lines $x = a$ and $x = b$, when $f(x) = 2x + 1$; $a = 1$, $b = 5$.

A. 24 B. 29 C. 38 D. 28

57. Apply the fundamental theorem of calculus and evaluate $\int_{-1}^{2} x^2 dx$

A. 3 B. 7/3 C. 10/3 D. None.

58. Find the area enclosed by the graph of $f(x) = |x|$ and the *x – axis* between the *y – axis* and $x = 6$.

A. 36 B. 18 C. 24 D. None

59. The best type of graph or chart to represent number of observations at or below a particular value or class is

A. Histogram B. Pre chart C. Ogive D. Line graph

60. 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 mean is 0. D. Standard deviation is equal to the mean value.

61. The salary distribution of two companies in Birr is given below.

COMPANY	A	B
MEAN SALARY	1200	1500
SD	40	80

Which one of the following is not true?

A. The CV of salary for company A is 3.33%.

B. There is more variation of salary in company A.

C. There is more uniformity of salary in company A.

D. No conclusion can be drawn from the given information.

62. The Bowley's coefficient of skewness $\beta = 0$, if the distribution is

A. Positively skewed C. Bi-modal

B. Negatively skewed D. Symmetrical

63. A certain company has increased the price of a product by 30%. If the original price was Birr 24,000, what will be the new price?

A. Birr 30,000 B. Birr 31, 200 C. Birr 32, 000 D. None

64. A truck is purchased with a mortgage of Birr 800,000. If the buyer pays a loan origination fee of 14/3 points, then the loan origination fee is

A. Birr 37,333.33 B. Birr 171, 428.57 C. Birr 73,777.33 D. None

65. Mr. X worked 78 hours last month at an hourly rate of Birr 40 plus time-and-a-half for working over 50 hours per month. The gross pay for Mr. X is

A. Birr 3,120 B. Birr 3,680 C. Birr 5,850 D. None.

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PRINT YOUR REGISTRATION NUMBER, SCHOOL CODE, BOOKLET CODE, AND SUBJECT CODE IN THE SPACES PROVIDED. THEN MARK THE CORRESPONDING BOX IN THE COLUMN BELOW EACH LETTER OR NUMBER.

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REGISTRATION NUMBER

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2	[A] [B] [C] [D] [E]	29	[A] [B] [C] [D] [E]	56	[A] [B] [C] [D] [E]	83	[A] [B] [C] [D] [E]	110	[A] [B] [C] [D] [E]
3	[A] [B] [C] [D] [E]	30	[A] [B] [C] [D] [E]	57	[A] [B] [C] [D] [E]	84	[A] [B] [C] [D] [E]	111	[A] [B] [C] [D] [E]
4	[A] [B] [C] [D] [E]	31	[A] [B] [C] [D] [E]	58	[A] [B] [C] [D] [E]	85	[A] [B] [C] [D] [E]	112	[A] [B] [C] [D] [E]
5	[A] [B] [C] [D] [E]	32	[A] [B] [C] [D] [E]	59	[A] [B] [C] [D] [E]	86	[A] [B] [C] [D] [E]	113	[A] [B] [C] [D] [E]
6	[A] [B] [C] [D] [E]	33	[A] [B] [C] [D] [E]	60	[A] [B] [C] [D] [E]	87	[A] [B] [C] [D] [E]	114	[A] [B] [C] [D] [E]
7	[A] [B] [C] [D] [E]	34	[A] [B] [C] [D] [E]	61	[A] [B] [C] [D] [E]	88	[A] [B] [C] [D] [E]	115	[A] [B] [C] [D] [E]
8	[A] [B] [C] [D] [E]	35	[A] [B] [C] [D] [E]	62	[A] [B] [C] [D] [E]	89	[A] [B] [C] [D] [E]	116	[A] [B] [C] [D] [E]
9	[A] [B] [C] [D] [E]	36	[A] [B] [C] [D] [E]	63	[A] [B] [C] [D] [E]	90	[A] [B] [C] [D] [E]	117	[A] [B] [C] [D] [E]
10	[A] [B] [C] [D] [E]	37	[A] [B] [C] [D] [E]	64	[A] [B] [C] [D] [E]	91	[A] [B] [C] [D] [E]	118	[A] [B] [C] [D] [E]
11	[A] [B] [C] [D] [E]	38	[A] [B] [C] [D] [E]	65	[A] [B] [C] [D] [E]	92	[A] [B] [C] [D] [E]	119	[A] [B] [C] [D] [E]
12	[A] [B] [C] [D] [E]	39	[A] [B] [C] [D] [E]	66	[A] [B] [C] [D] [E]	93	[A] [B] [C] [D] [E]	120	[A] [B] [C] [D] [E]
13	[A] [B] [C] [D] [E]	40	[A] [B] [C] [D] [E]	67	[A] [B] [C] [D] [E]	94	[A] [B] [C] [D] [E]	121	[A] [B] [C] [D] [E]
14	[A] [B] [C] [D] [E]	41	[A] [B] [C] [D] [E]	68	[A] [B] [C] [D] [E]	95	[A] [B] [C] [D] [E]	122	[A] [B] [C] [D] [E]
15	[A] [B] [C] [D] [E]	42	[A] [B] [C] [D] [E]	69	[A] [B] [C] [D] [E]	96	[A] [B] [C] [D] [E]	123	[A] [B] [C] [D] [E]
16	[A] [B] [C] [D] [E]	43	[A] [B] [C] [D] [E]	70	[A] [B] [C] [D] [E]	97	[A] [B] [C] [D] [E]	124	[A] [B] [C] [D] [E]
17	[A] [B] [C] [D] [E]	44	[A] [B] [C] [D] [E]	71	[A] [B] [C] [D] [E]	98	[A] [B] [C] [D] [E]	125	[A] [B] [C] [D] [E]
18	[A] [B] [C] [D] [E]	45	[A] [B] [C] [D] [E]	72	[A] [B] [C] [D] [E]	99	[A] [B] [C] [D] [E]	126	[A] [B] [C] [D] [E]
19	[A] [B] [C] [D] [E]	46	[A] [B] [C] [D] [E]	73	[A] [B] [C] [D] [E]	100	[A] [B] [C] [D] [E]	127	[A] [B] [C] [D] [E]
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21	[A] [B] [C] [D] [E]	48	[A] [B] [C] [D] [E]	75	[A] [B] [C] [D] [E]	102	[A] [B] [C] [D] [E]	129	[A] [B] [C] [D] [E]
22	[A] [B] [C] [D] [E]	49	[A] [B] [C] [D] [E]	76	[A] [B] [C] [D] [E]	103	[A] [B] [C] [D] [E]	130	[A] [B] [C] [D] [E]
23	[A] [B] [C] [D] [E]	50	[A] [B] [C] [D] [E]	77	[A] [B] [C] [D] [E]	104	[A] [B] [C] [D] [E]	131	[A] [B] [C] [D] [E]
24	[A] [B] [C] [D] [E]	51	[A] [B] [C] [D] [E]	78	[A] [B] [C] [D] [E]	105	[A] [B] [C] [D] [E]	132	[A] [B] [C] [D] [E]
25	[A] [B] [C] [D] [E]	52	[A] [B] [C] [D] [E]	79	[A] [B] [C] [D] [E]	106	[A] [B] [C] [D] [E]	133	[A] [B] [C] [D] [E]
26	[A] [B] [C] [D] [E]	53	[A] [B] [C] [D] [E]	80	[A] [B] [C] [D] [E]	107	[A] [B] [C] [D] [E]	134	[A] [B] [C] [D] [E]
27	[A] [B] [C] [D] [E]	54	[A] [B] [C] [D] [E]	81	[A] [B] [C] [D] [E]	108	[A] [B] [C] [D] [E]	135	[A] [B] [C] [D] [E]