

NIFAS SILK LAFTO SUBCITY EDUCATION OFFICE
MATHEMATICS MODEL EXAMINATION FOR **SOCIAL SCIENCE**
(GINBOT 2012/ MAY 2020)

TIME ALLOWED: 3 HOURS

GENERAL DIRECTIONS

THIS BOOKLET CONTAINS **MATHEMATICS** EXAMINATION FOR THE **SOCIAL SCIENCE CANDIDATES 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 INCLUDING ANSWERS YOU HAVE CHANGED 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 OVER UNTIL YOU ARE TOLD TO DO SO.

DIRECTION- CHOOSE THE CORRECT ANSWER FROM THE GIVEN ALTERNATIVES.

- What are the respective values of A, B and C, so that $\frac{4x^2+3x-2}{x^3-x^2} = \frac{A}{x} + \frac{B}{x-1} + \frac{C}{x^2}$?
A. -1, 5, 2 B. 2, 5, -1 C. 1, 5, -2 D. -5, -1, 2
- Which of the following is TRUE about $f: \mathbb{R} \rightarrow [0, \infty)$ given by $f(x)=3^x$?
A. It is an on to function. C. It is a one to one function.
B. It is a one to one correspondence. D. It is symmetric with respect to the y-axis.
- The equation of a circle with centre at (3, 4) and tangent to the y-axis is:-
A. $(x-3)^2 + (y-4)^2 = 100$ C. $(x-3)^2 + (y-4)^2 = 16$
B. $(x-3)^2 + (y-4)^2 = 9$ D. $(x-3)^2 + (y-4)^2 = 25$
- Which of the following pairs of lines are parallel?
A. $L_1: 2x+4y+1=0$ & $L_2: 3y-x+2=0$ C. $L_1: 5x+10y+3=0$ & $L_2: y=2x+10$
B. $L_1: 2y-6x+2=0$ & $L_2: 4y-8x+3=0$ D. $L_1: y-x+1=0$ & $L_2: y-x+5=0$
- Which of the following is true about a parabola $x^2 - 12y - 2x - 11 = 0$?
A. Vertex (1, -1). C. Equation of Directrix is $y=-4$.
B. The focus is (1, 2) . D. Focal length is 2.
- Which of the following equation describes $|z - 1| = 2, z = x + yi$?
A. $(x-2)^2 + y^2 = 4$ C. $x^2 + (y-2)^2 = 4$
B. $(x-1)^2 + y^2 = 4$ D. $x^2 + y^2 = 4$
- If $f(x) = xe^x$, $g(x) = \ln x$ and $h(x) = (f \circ g)(x)$, then which of the following is true?
A. $h(x) = \frac{e^x}{x}$ B. $h(x) = x \ln x$ C. $h(x) = \ln x$ D. $h(x) = e^x$
- Which of the following represent a function?
A. $\{(x, y): x \text{ is a sister of } y\}$ C. $\{(x, y): x \text{ is a father of } y\}$
B. $\{(x, y): x \text{ is the capital city of } y\}$ D. All
- Which one of the following is NOT the intersection point of the hyperbola $x^2 - y^2 = 9$ and the ellipse $x^2 + 9y^2 = 169$?
A. (5, 4) B. (-5, 4) C. (5, -4) D. (4, 5)
- Let $f(x) = \frac{x^2+3x-4}{x-5}$. Which of the following is FALSE about f ?
A. $f(x) \geq 0$ for $x \in [-4, 1] \cup (5, \infty)$. C. Its oblique asymptote is $y = x + 8$.
B. $f(x) < 0$ for $x \in (-\infty, -4) \cup (1, 5)$. D. f is an even function.
- Distance between the pair of parallel lines $2x - 3y + 2 = 0$ & $2x - 3y + 6 = 0$ is
A. $\frac{\sqrt{11}}{13}$ B. $\frac{4\sqrt{11}}{13}$ C. $\frac{6\sqrt{13}}{13}$ D. $\frac{4\sqrt{13}}{13}$

12. Eccentricity of an ellipse whose equation is $9y^2 + 16x^2 - 32x + 36y - 92 = 0$ is?

- A. $\frac{\sqrt{7}}{4}$ B. $\frac{3}{4}$ C. $\frac{\sqrt{2}}{3}$ D. $\frac{4}{3}$

13. Which one of the following is equivalent to $\neg[(\exists x)(p(x) \Rightarrow Q(x))]$?

- A. $(\forall x)(\neg P(x) \Rightarrow \neg Q(x))$ C. $(\forall x)(\neg p(x) \wedge Q(x))$
 B. $(\exists x)(\neg P(x) \Rightarrow \neg Q(x))$ D. $(\forall x)(p(x) \wedge \neg Q(x))$

14. A company produced 20,000 generators and randomly tested 3% of the product. Among

The tested generators, if 50 have defect of type G_1 , 60 have defect type G_2 and 30 have both types of defects. What is the probability that a generator produced is either defect

type G_1 or defect type G_2 ? A. $\frac{2}{15}$ B. $\frac{1}{5}$ C. $\frac{3}{8}$ D. $\frac{11}{60}$

15. For what value of k is a matrix $A = \begin{pmatrix} 7-k & 9 \\ 4 & 1-k \end{pmatrix}$ is singular?

- A. $\{4 - 3\sqrt{5}\}$ B. $\{-4 + 3\sqrt{5}, 4 - 3\sqrt{5}\}$ C. $\{4 - 3\sqrt{5}, 4 + 3\sqrt{5}\}$ D. $\{3\sqrt{5}, -3\sqrt{5}\}$

16. Let z be a complex number, then which of the following is the solution set of $z^3 - 1 = 0$?

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

17. The complex conjugate of $z = 4(\cos \frac{2\pi}{3} - i \sin \frac{2\pi}{3})$ is equal to:-

- A. $-2 - 2\sqrt{3}i$ B. $-2 + 2\sqrt{3}i$ C. $-2\sqrt{3} + 2i$ D. $-2\sqrt{3} - 2i$

18. Which of the following is NOT true about matrix A and B with the operation in its appropriate order?

- A. $(A + B)^T = A^T + B^T$ B. $(AB)^T = B^T A^T$ C. $(AB)^T = A^T B^T$ D. $(A + B)^T = B^T + A^T$

19. Let $A = \begin{pmatrix} 2 & 4 & 1 \\ 3 & 3 & 3 \\ 4 & 2 & 5 \end{pmatrix}$, then the value of $A + A^T$ is equal to

- A. $\begin{pmatrix} 4 & 7 & 5 \\ 6 & 6 & 5 \\ 5 & 5 & 10 \end{pmatrix}$ B. $\begin{pmatrix} 4 & 7 & 5 \\ 7 & 7 & 5 \\ 5 & 5 & 10 \end{pmatrix}$ C. $\begin{pmatrix} 4 & 7 & 5 \\ 7 & 6 & 4 \\ 5 & 5 & 10 \end{pmatrix}$ D. $\begin{pmatrix} 4 & 7 & 5 \\ 7 & 6 & 5 \\ 5 & 5 & 10 \end{pmatrix}$

20. If P and Q are propositions then which one of the following arguments is valid?

- A. $P, P \wedge \neg Q \vdash Q$ B. $P, P \Rightarrow Q \vdash Q$ C. $P, \neg P \Leftrightarrow Q \vdash Q$ D. $\neg P, P \Rightarrow \neg Q \vdash Q$

21. In an arithmetic sequence, if the sum of the first 20 terms is 1000 and the sum of the second 20 terms is 3000, then what is the common difference of the sequence?
- A. 10 B. 5 C. 4 D. 7
22. If the second and fifth terms of a geometric progressions are $\frac{1}{9}$ and $\frac{1}{243}$ respectively, what is general term of the sequence?
- A. $G_n = 3^{n-1}$ B. $G_n = 3^n$ C. $G_n = 3^{-n}$ D. $G_n = 3^{-n+1}$
23. What is the sum of the infinite series $\sum_{k=1}^{\infty} 5 \left(\frac{3^k + 2^k}{6^k} \right)$?
- A. $\frac{3}{2}$ B. $\frac{7}{2}$ C. $\frac{15}{2}$ D. $\frac{35}{2}$
24. A ball is dropped from a height of 60m above a flat surface. In each bounce, it rebounds to $\frac{2}{3}$ of the distance it fell. What is the maximum possible vertical distance the ball could travel?
- A. 240m B. 280m C. 300m D. 400m
25. What are least upper bound and greatest lower bound of the sequence $\left\{ 1 - \frac{(-1)^n}{n} \right\}_{n=1}^{\infty}$ respectively? A. 1 and $\frac{1}{2}$ B. 2 and $\frac{1}{2}$ C. 2 and 0 D. 0 and 2
26. The sequence $\left\{ \frac{1+2+3+\dots+n}{1-n^2} \right\}_{n=1}^{\infty}$ converges to;
- A. $\frac{-1}{2}$ B. $\frac{1}{2}$ C. 2 D. 0
27. Let $f(x) = \frac{x|x-3|}{x^2-9}$, then which one of the following is NOT true about limit of $f(x)$?
- A. $\lim_{x \rightarrow 3^+} f(x) = \frac{1}{2}$ C. $\lim_{x \rightarrow -3^+} f(x) = -\infty$
- B. $\lim_{x \rightarrow 3^-} f(x) = \frac{-1}{2}$ D. $\lim_{x \rightarrow -3^-} f(x) = -\infty$
28. Which one of the following is equal to $\lim_{x \rightarrow 1} \frac{\sin(x-1) + x^2 - 1}{x-1}$?
- A. 0 B. 2 C. 1 D. 3
29. Let $f(x) = \begin{cases} \frac{\sin x}{2Kx}, & \text{if } x < 0 \\ e^x - 2, & \text{if } x \geq 0 \end{cases}$ and if $f(x)$ is continuous at $x=0$, then what is the value of K?
- A. $\frac{-1}{2}$ B. $\frac{-1}{4}$ C. $\frac{1}{2}$ D. $\frac{1}{4}$

30. Which one of the following is equal to $\lim_{x \rightarrow \infty} \left(\frac{2x}{2x+3} \right)^{4-x}$?
- A. e B. $\sqrt{e}$ C. $e\sqrt{e}$ D. e^3
31. Which one of the following is equal to $\lim_{x \rightarrow 0} \frac{4-4\cos x}{x^2}$?
- A. 0 B. 2 C. 1 D. Does not exist
32. If $f(x) = \sqrt{9-x^2}$, then what is the largest interval on which $f(x)$ is differentiable?
- A. $(-9,9)$ B. $(3,\infty)$ C. $(-3,3)$ D. $(-\infty,\infty)$
33. If $f(x) = x^3 - x^2 + x + 2$, then what is $\lim_{x \rightarrow 2} \frac{f(x)-f(2)}{x-2}$?
- A. 8 B. 9 C. 10 D. Does not exist
34. If $f(x) = \ln\left(x^{\frac{3}{5}}\right)$, then what is the derivative of f at $x = 2$? A. $\frac{1}{\sqrt[5]{8}}$ B. $\frac{6}{5}$ C. $\frac{3}{10}$ D. $\frac{1}{\sqrt[5]{4}}$
35. If $y = \frac{\sin x}{1-\cos x}$, then what is $\frac{dy}{dx}$?
- A. $1 - \cos x$ B. $1 - \sin x$ C. $\frac{1}{\cos x - 1}$ D. $\frac{1}{1 - \sin x}$
36. What is the equation of tangent line to the graph of $f(x) = e^x \sin x$ at $x=0$?
- A. $y = x$ B. $y = 1$ C. $y = -x$ D. $y = 0$
37. If $f(x) = \ln(\sqrt{x^2 + 2})$, then which one of the following is equal to $f''(1)$?
- A. $\frac{1}{3}$ B. 3 C. $\frac{1}{9}$ D. 9
38. Let $F(x) = f(3x-2) \cdot g(2-x^2)$, $f'(-2) = g(2) = 3$ and $f(-2) = g'(2) = 4$, then $F'(0)$ is equal to; A. 12 B. 36 C. 27 D. 18
39. If $f(x) = \ln(x+1)$, then which one of the following is equal to $f^n(x)$?
- A. $f^n(x) = \frac{(-1)^n n!}{(x+1)^n}$ C. $f^n(x) = \frac{(-1)^{n-1} (n-1)!}{(x+1)^{n-1}}$
- B. $f^n(x) = \frac{(-1)^{n+1} (n+1)!}{(x+1)^{n+1}}$ D. $f^n(x) = \frac{(-1)^{n-1} (n-1)!}{(x+1)^n}$
40. If $f(x) = x^3 + x - 1$, then what is the value of c that satisfy the conclusion of the Mean-Value theorem in the interval $[0,2]$?
- A. 1 B. $\frac{2\sqrt{3}}{3}$ C. $\frac{\sqrt{3}}{3}$ D. $\frac{\sqrt{2}}{3}$

41. On which one of the following intervals the function $f(x) = x^3 - 3x^2 + 5$ is strictly decreasing?
 A. $(-\infty, 0]$ B. $[0, 2]$ C. $[2, \infty)$ D. $[-2, 0]$

42. Which one of the following is NOT true about the function $f(x) = x^3 - 12x$?

- A. Inflection point of f is $(0, 0)$. C. Its local minimum value is -4 .
 B. Its graph is concave up ward on $(0, \infty)$ D. Its graph is concave down ward on $(-\infty, 0)$

43. Let X and Y be the length and width of the rectangular region respectively. What dimensions should be used to maximize the area of the rectangular region with perimeter 1000m?

- A. $X = 200m$ and $Y = 300m$ C. $X = 250m$ and $Y = 250m$
 B. $X = 400m$ and $Y = 100m$ D. $X = 350m$ and $Y = 150m$

44. The radius of a right circular cone is increasing at the rate of $3 \text{ cm}/\text{min}$. The height h of the cone is related to the radius r by $h = 5r$. What is the rate of change of volume when the radius is 4cm?

- A. $20\pi \text{ cm}^3/\text{min}$ B. $80\pi \text{ cm}^3/\text{min}$ C. $54\pi \text{ cm}^3/\text{min}$ D. $36\pi \text{ cm}^3/\text{min}$

45. If $f(x) = 2 \cos x + x$, then which one of the following is the set of critical numbers of $f(x)$ in the interval $[0, 2\pi]$?

- A. $\{\frac{\pi}{3}, \frac{4\pi}{3}\}$ B. $\{\frac{\pi}{3}, \frac{5\pi}{6}\}$ C. $\{\frac{\pi}{6}, \frac{5\pi}{6}\}$ D. $\{\frac{\pi}{3}, 2\pi\}$

46. Which one of the following is equal to $\int x\sqrt{2x^2 + 1} dx$?

- A. $(2x^2 + 1)\sqrt{2x^2 + 1} + c$ C. $\frac{1}{4}(2x^2 + 1)\sqrt{2x^2 + 1} + 2$
 B. $\frac{1}{3}(2x^2 + 1)\sqrt{2x^2 + 1} - 3$ D. $\frac{1}{6}(2x^2 + 1)\sqrt{2x^2 + 1} - 4$

47. $\int \frac{3}{x^2+x} dx$ is equal to;

- A. $\ln|2x + 1| + c$ C. $3\ln\left|\frac{2x+1}{x}\right| + c$
 B. $\ln|x + 1| + c$ D. $3\ln\left|\frac{x}{x+1}\right| + c$

48. $\int 2e^x \sin x dx$ is equal to;

- A. $e^x(\sin x - \cos x) + c$ C. $\frac{1}{2}e^x(\sin x - \cos x) + c$
 B. $2e^x(\cos x - \sin x) + c$ D. $2e^x \sin x + c$

49. What is the area of the region enclosed by the graph of $f(x) = 3x^2 - 4$ and $g(x) = 2x^2$

- A. 32 B. $\frac{32}{3}$ C. 16 D. $\frac{16}{3}$

50. What is the value of $\int_0^1 (x + 2)e^{x^2+4x} dx$?

- A. $\frac{e^5}{2}$ B. $\frac{1}{2}(e^5 - 1)$ C. $\frac{e}{2}$ D. $\frac{1}{2}(e - 1)$

51. If $a:b = 3:5$ and $b:c = 3:4$, then $a:c$ is equal to:-

- A. 5:4 B. 9:20 C. 20:9 D. 3:4

52. A production company increased its production from 300 units to 500 units. At the same time the company's profit increased from Birr 5000 to Birr 9000. What is the rate of change of profit?

- A. 0.8 B. 0.5 C. 0.4 D. 1.8

53. Find the values of x and y that maximize $Z=2x + 3y$, Subject to: $3x + 7y \leq 42$

$$X + 5y \leq 20$$

$$X \geq 0, y \geq 0$$

- A. $X = 0$ and $y = 4$ C. $x = 14$ and $y = 0$
B. $X = \frac{35}{4}$ and $y = \frac{9}{4}$ D. $X = 5$ and $y = 20$

54. A farmer has Birr 1,700 to buy sheep and goats. Suppose the unit price of sheep is Birr 300 and the unit price of goats is Birr 200. If he decided to buy only sheep, what is the Maximum number of sheep he can buy?

- A. 8 B. 5 C. 20 D. 3

55. Ato Befirdu wants to sell his ox at Birr 11,000 with 10% markup on his cost. What is the Cost of the ox in Birr?

- A. 10,000 B. 1000 C. 9000 D. 5000

56. A steel company has imported 40tons of raw materials from South Africa in 2010. In 2016 the company imported 60tons of raw materials from the same country. What is the rate of change of amount imported?

- A. 0.2 B. 0.5 C. 1.5 D. 0.6

57. A man deposited Birr 2400 in a saving account at 10% compounded semi-annually.

What amount will be accumulated in one year? A. 2600 B. 2650 C. 2646 D. 2640

58. In a class there are 80 students with class list numbers written from 1-80. We need to select a sample of 10 students applying the systematic sampling technique. If the first randomly selected number is 3, then the sample numbers are :-

- A. 3,11,19,27,35,43,51,59,67,75 C. 3,13,21,29,37,45,53,61,69,77
 B. 3,12,20,28,36,44,52,60,68,76 D. 3,10,18,26,42,34,50,58,66,74

59. Consider the following data: 2, 6,6,6,6,6,6,9. What is its inter quartile range?

- A. 6 B. 2 C. 0 D. 0.2

60. A grinding machine that costs Birr 36,000 depreciates 5% of its value each year.

In how many years will its value be $\frac{3}{4}$ of its present value? (Round off the answer to the nearest whole number. Use $\log 6.5 = 0.81$, $\log 8.5 = 0.92$, $\log 7.5 = 0.88$, $\log 9.5 = 0.98$)

- A. 5 B. 6 C. 4 D. 8

61. A family buys 4 children's meals that cost Birr 32.5 each and 3 value meals that cost Birr 52.00 each. How much does the family spend altogether?

- A. Birr 285 B. Birr 200 C. Birr 280 D. Birr 300

62. A boutique is offering a 10% discount on its goods for Holiday. If the price of a shirt in the boutique was Birr 200 before the discount. What is the current (sale) price of the shirt? A. Birr 220 B. Birr 200 C. Birr 180 D. Birr 150

63. What is the annual salary of an employee who is paid Birr 400 weekly?

- A. Birr 20,800 B. Birr 20,000 C. Birr 20,400 D. Birr 40,000

64. If Q_i , D_i and P_i are respectively the i-quartile, decile and percentile of a data arranged in an increasing order, then which one of the following is necessarily true?

- A. $D_3 > P_{25}$ B. $Q_2 = \frac{Q_1 + Q_3}{2}$ C. $P_{25} < Q_1$ D. $Q_2 = \text{Median of data}$

65. Belete and Chala are brothers with 24 and 32 years old respectively. If their father shares Birr 21,000 according to the ratio of their ages, then what is the share of Chala in Birr?

- A. 12,000 B. 9,000 C. 8,000 D. 18,000

