

Mathematics model exam

IN 2012 E.C MATHEMATICS MODEL EXAMINATIONS STANDARDIZED WORKSHEET FOR GRADE 12 STUDENTS PREPARED JOINTLY BY INJIBARA AND AGEWMIDIR GENERAL AND PREPARATORY SHOOOL MATHEMATICS TECHEARS .
TIME ALLOWED 3:00hrs

INSTRUCTION 1: CHOOSE THE CORRECT ANSWER AMONG THE GIVEN ALTERNATIVES.

1. Which of the following is TRUE about a matrix?

- A. If A is a square matrix, then $A + A^T$ is symmetric matrix.
- B. If the determinant of a matrix is zero, then it is invertible
- C. Diagonal matrix is a matrix whose elements below the diagonal are zero.
- D. If A is a square matrix, then A^{-1} exists.

2. Which one of the following is FALSE about the determinant of a matrix?

- A. $|A| = |A^T|$
- B. If A has a row (column) zero ,then $|A| = 0$
- C. If B is found by interchanging two rows(columns) of A, then $|A| = -|B|$
- D. If $|A| = 10$,then $|3A| = 30$

3. Let A be a 3x3 invertible matrix and B be any 3x3 matrix . If $|A| = a$ and $|B| = b$,then which of the following is not TRUE ?

- A. $|A^T A| = a^2$ B. $|A^{-1} B| = ab$ C. $|kA| = k^3 |A|$, for any $k \in \mathbb{R}$ D. If $b = 0$, then B is not invertible

4. Let A be a 3x3 matrix and $|A| = -2$. Then what is the value $|\text{adj}(a)|$?

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

5. If A is a square matrix of order 3 and $|A| = 5$, then what is the value of $\det(A \cdot \text{adj}(a))$?

- A. 125 B. 5 C. 25 D. 3

6. Let Z_1 and Z_2 be complex numbers. Which one of the following is FALSE ?

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A. $\overline{Z_1} = Z_1$ B. $\overline{Z_1 Z_2} = Z_1 Z_2$ C. $\frac{\overline{Z_1}}{Z_2} = \frac{\overline{Z_1}}{\overline{Z_2}}$ D. $Z_1 + \overline{Z_1} = 2\text{im}(z_1)$

7.If $Z = -3+4i$ and $W = 1+2i$, then what is the value of $\frac{2Z}{W} + \overline{W}$?

A. $2+3i$ B. $3-2i$ C. $3+5i$ D. $1-i$

8.Let $Z = \left(\frac{1-i}{1+i}\right)^{18}$. Then what is the value of Z ? A. 1 B. $-i$ C. -1 D. $1-i$

9. What is the principal argument and modules of $Z = 1+i$?

A. π and $\sqrt{2}$ B. $\frac{\pi}{4}$ and 1 C. $\frac{\pi}{3}$ and 1 D. $\frac{\pi}{6}$ and 2

10.If $C \neq 0$, then what is the value of $\lim_{x \rightarrow C} \frac{x^2 - c^2}{x^4 - c^4}$?

A. $\frac{1}{c^2}$ B. $\frac{1}{2c^2}$ C. $\frac{1}{6c^2}$ D. 0

11.What is the value of $\lim_{X \rightarrow 0} \frac{\sin X \cos 2X}{X^2 + 3X}$?

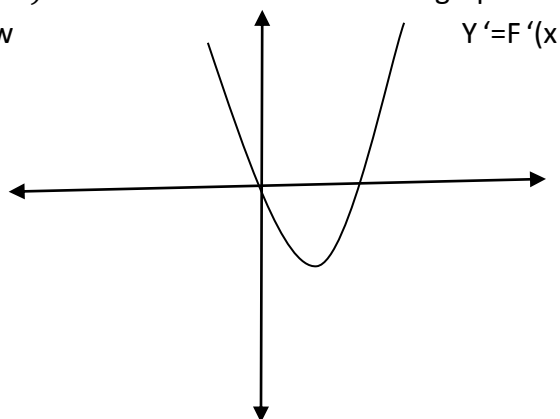
A. 1 B. $\frac{2}{3}$ C. $\frac{1}{3}$ D. 2

12.Which of the following is equal to $\int x(e^x + \sin(x^2)) dx$?

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

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

13.Suppose $f: (-\infty, \infty) \rightarrow R$ is differentiable and the graphs of its derivatives $Y' = F'(x)$ is as shown in the figure below



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Which of the following is true about f ?

- A. f is increasing on $(1, \infty)$ C. f has no relative maximum value
B. B. f is concave up ward on $(0, \infty)$ D. f has relative minimum value at $x=2$

14. Which of the following relation holds for the sequence -10,-3,4,11,...?

- A. $a_n = a_{n-1} - 8$ C. $a_n = a_{n-1} - 7$
B. $a_n = a_{n-1} + 7$ D. $a_n = a_{n-1} + 8$

15. Which of the following is convergent sequence ?

- A. $\left\{\left(\frac{7}{4}\right)^n\right\}$ B. $\left\{\frac{3n}{n+1}\right\}$ C. $\left\{\frac{n^2}{n+1}\right\}$ D. $\left\{\frac{(-1)^n}{3}\right\}$

16. What is the value of $\int_{-1}^1 \frac{e^x}{1+e^x} dx$?

- A. $\ln(e + 1)$ B. $\ln\left(\frac{1}{e} + 1\right)$ C. $\ln e^x$ D. 1

17. What is the sum of the first n terms (n natural numbers for n=100

- A. 1010 B. 5050 C. 5151 D. 11011

18. Given the sum $S_{16}=368$ of an arithmetic sequence and $A_1=1$. Find A_8 ?

- A. $\frac{323}{15}$ B. $\frac{44}{15}$ C. $\frac{16}{7}$ D. 969

19. The integral of $\int_0^2 x\sqrt{4-x^2} dx$ is equal to

- A. $\frac{32}{3}$ B. $\sqrt{3}$ C. $\frac{\sqrt{3}}{8}$ D. $\frac{8}{3}$

20. $\lim_{n \rightarrow \infty} \left(1 + \frac{5}{x+3}\right)^{x+1}$ is equal to

- A. e^{-3} B. e^2 C. e^5 D. e^{-1}

21. What is the area of the region that is bounded by the graph of $g(x)=x^2-1$ and $f(x)=7-x^2$

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- A. 32 B. $\frac{68}{3}$ C. $\frac{78}{3}$ D. $\frac{64}{3}$

22. Let $\{a_n\}$ be a sequence satisfying the condition $a_{(n+m)} = a_n \times a_m$ If $\sum_{i=1}^n a_i = 126$ and $a_1 = 2$, then which of the following equal is to n?

- A. 12 B. 8 C. 6 D. 4

23. Which of the following FALSE about the graph of the rational function $f(x) = \frac{x^2 - 2x - 8}{4 - x^2}$?

- A. The graph of the function has two vertical asymptote
 B. $y = -1$ is the horizontal asymptote of the graph of $f(x)$
 C. When $x \rightarrow 2^-$ then $y \rightarrow -\infty$
 D. $(4, 0)$ is the x-intercept of the graph of $f(x)$

24. For what value of a and b in the function $f(x) = \begin{cases} 3x - 6, & \text{if } x \leq -3 \\ ax^2 + 2b, & -3 < x < 5 \\ \log_5 x, & \text{if } x \geq 5 \end{cases}$ continuous on R

- A. 3 & -12 B. 0 & 1 C. 1 & -12 D. -12 & 2

25. Which of the following is true about $\left\{ \frac{\pi^n}{4^{n(n+1)}} \right\}$?

- A. It converges to 0 B. It is divergent C. It is unbounded D. It is increasing

26. If $f(4) = -3$, $f'(4) = 1$, $g(1) = 2$ and $g'(1) = -1$ and $G(x) = f(3x+1) \times g(x^2)$, then what is the value of $G'(1)$?

- A. -20 B. 0 C. 12 D. 5

27. Let $h(x) = \begin{cases} 4x^2 - 1, & \text{for } x < -4 \\ 18, & \text{for } x = -4 \\ 2 - 4x, & \text{for } x > -4 \end{cases}$, then which of the following is TRUE ?

- A. $h(x)$ is continuous at $x = -4$ C. $\lim_{x \rightarrow -4} h(x)$ does not exist
 B. $h(x)$ is differentiable at $x = -4$ D. $h'(4) = 4$

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28. What is the value of $\int_1^4 \frac{x+1}{x^2+2} dx$?

- A. $3\ln 3$ B. $\ln 6$ C. $\frac{9}{2} + 3\ln \frac{5}{3}$ D. $\ln 5 - \ln 2$

29. Let $y = (\ln x)^3$, then $\frac{d^2y}{dx^2}$ is equal to :

- A. $\frac{3 \ln x (2x - \ln x)}{x^2}$ B. $6 \ln x$ C. $\frac{3 \ln x (2 - x \ln x)}{x^2}$ D. $\frac{3(\ln x)^2}{x}$

30. A box is to have a square base, an open top and volume $32m^3$. Find the dimension of the box that uses the least amount of material.

- A. $\sqrt{2}$ m and 16m B. $4\sqrt{2}$ m and 1m C. $2\sqrt{2}$ m and 4m D. 4m and 2m

31. Find the point(s) on $f(x) = x^3 + 1$ that is closest to the point (0,2).

- A. $(\frac{-1}{\sqrt{2}}, \frac{1}{2})$ B. $(\sqrt{2}, \sqrt{8} + 1)$ C. (0,1) D. $(\frac{-1}{\sqrt{2}}, \frac{3}{2})$

32. $\lim_{x \rightarrow 3} \frac{x-3}{\sqrt{12-x} - \sqrt{x+6}}$ is equal to:

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

33. Which of the following is equal to $\int_{\frac{\pi}{6}}^{\frac{\pi}{2}} \frac{\cot x}{\sin x} dx$?

- A. $\frac{e^n}{n}$ B. $\frac{n^2}{\sqrt{n^2+24}}$ C. $\frac{2n^3+4}{100-n^2}$ D. $(\frac{3}{\pi})^n$

34. Which of the following is **NOT** the critical number of $f(x) = \begin{cases} x^2 - x + 1, & \text{if } x < -2 \\ \frac{2x}{x^2+1}, & \text{if } x \geq -2 \end{cases}$?

- A. -1 B. -2 C. 0 D. $\frac{1}{2}$

35. Let $f(x) = \frac{\sin(x-2)}{4-2x+4x^2-2x^3}$, then $\lim_{x \rightarrow 2} f(x)$

- A. $\frac{-1}{10}$ B. 0 C. $\frac{1}{6}$ D. doesn't exist

36. What is the equation of the tangent line to the graph of $f(x) = e^{\cos x} + \sin x$ at (0, f(0)) ?

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- A. $Y=x+2$ B. $Y=-x+2$ C. $Y=-x-e$ D. $Y=x+e$

37. Let $\int \frac{1}{f(x)} dx \ln(\cos x)$, then $f(x)$ is given by:

- A. $\sec x$ B. $\ln(\cos x)$ C. $-\cot x$ D. $\csc^2 x$

38. The volume of the solid generated by revolving the graph of $y=x^2$ in between $x=0$ and $x=3$ about x-axis in cubic unit is: A. $\frac{243}{5}\pi$ B. $\frac{81}{5}\pi$ C. $\frac{64}{3}\pi$ D. 9π

39. Consider a circle whose center is on the x-axis. If a line given by $y=x$ is tangent to the circle at a point $(2,2)$, what is the equation of the circle?

- A. $(x-2)^2 + y^2 = 4$ B. $x^2 + y^2 = 8$ C. $(x-1)^2 + y^2 = 5$ D. $(x-4)^2 + y^2 = 8$

40. What is the distance from the center to one of the focus of the hyperbola $\frac{(y-3)^2}{16} - \frac{(y+1)^2}{9} = 1$

- A. 8 B. 10 C. 5 D. 6

41. An iron wire bent in a shape of a parabola has latus rectum of length 60cm. What is its focal length?

- A. 60cm B. 30cm C. 15cm D. 7.5cm

42. Let L be a line consisting the point $(1,5)$ and its angle of inclination be $\theta = 135^\circ$. What is the distance from the line L to the point $(-1,1)$

- A. $2\sqrt{2}$ B. $3\sqrt{2}$ C. $4\sqrt{2}$ D. $6\sqrt{2}$

43. If the truth value of $(p \wedge \neg p) \Leftrightarrow [(q \vee \neg q) \Rightarrow r]$ is true, then which of the following must be TRUE ?

- A. $\neg r$ B. q C. $\neg q$ D. p

44. What is the set of B for which $f: \mathbb{R} \rightarrow B$ defined by $f(x) = x^2 + 8x + 10$ is onto?

- A. $(-4, \infty)$ B. $(4, \infty)$ C. $(-6, \infty)$ D. $(6, \infty)$

45. If $x < 0$, then the simplest form of $f(x) = \frac{x - |x|}{x}$ is equal to :

- A. 2 B. $2x$ C. 0 D. -2

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46.If $f(x)=\ln(\frac{x}{x-2} + 2)$ for $x>1$,then the inverse of f ?

- A. $f^{-1}(x) = e^{\frac{x}{x+1}-2}$ C. $f^{-1}(x) = \frac{e^x-2}{e^x+1}$
 B. $f^{-1}(x) = \frac{e^x}{e^x+1} - 2$ D. $f^{-1}(x) = \frac{2(e^x-2)}{e^x-3}$

47. Which of the following represents the solution set for the rational equation

$$\frac{1}{x-2} = \frac{3}{x+2} - \frac{6x}{x^2-4}?$$

- A. $\{-2\}$ B. $\{-4,2\}$ C. $\emptyset$ D. $\{\frac{-1}{2}, \frac{1}{2}\}$

48.Which one of the following is true about signum, absolute value and greater integer function?

- A. $\text{sgn}(x) \leq [x]$ for all $x \geq 0$ C. $\text{sgn}(x) \pm [x]$ for all $x \in R$
 B. $\text{sgn}(x) \leq [x]$ for all $x \leq 0$ D. $|x| = x \text{sgn}(x)$ for all $x \in R$

49.What is the partial fraction decomposition of $\frac{x^2+x+1}{(x+2)(x^2+1)}$?

- A. $\frac{5}{3(x+2)} + \frac{2x+1}{3x^2+3}$ C. $\frac{2}{3(x+2)} + \frac{2x+1}{3(x^2+1)}$
 B. $\frac{2}{5(x+2)} + \frac{3x+1}{5(x^2+1)}$ D. $\frac{3}{5(x+2)} + \frac{2x+1}{5(x^2+1)}$

50.Let $f(x)=\frac{3x+1}{x-2}$,then what is the range of $f(x)$?

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

51.A three –digit library identification card is to be printed from the number 0,1,2,3,4,5 in such a way that the first is non-zero and no number is repeated. How many such cards can be printed?

- A. 120 B.100 C.180 D.150 11.

52.The solution set of $Z^3= 8$ in the set of complex number is _____

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

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FOR NATURAL SCINCE STUDENTS ONLY

53.What is the image of the circle $(x - 1)^2 + (y + 5)^2 = 1$ When reflected about the line $Y=2x-1$?

- A. $(x + \frac{19}{5})^2 + (y + \frac{13}{5})^2 = 1$ B. $(x - \frac{19}{5})^2 + (y + \frac{13}{5})^2 = 1$
C. $(x + \frac{19}{5})^2 + (y - \frac{13}{5})^2 = 1$ D. $(x - \frac{19}{5})^2 + (y - \frac{13}{5})^2 = 1$

54.Let $\vec{a}$ and $\vec{b}$ are vectors with $|a|=4$, $|b|=7$ and the angle between $\vec{a}$ and $\vec{b}$ is $\frac{\pi}{3}$. The value of $|3a - 2b|$?

- A. 196 B. 144 C.172 D. $2\sqrt{43}$.

55 .The equation of the line L: $3x-2y=1$ after it has been rotated about the origin through 360° is _____

- A.L': $y+7x+7+13\sqrt{2}$ B.L': $3x+2y-1=0$ C. L': $3x-2y-1=0$ D.None

56. If $F(x)=\csc x$, which one is true ?

- A. Its Domain is $\{x \in \mathbb{R}: x \neq k\pi, k \in \mathbb{Z}\}$ B. Its Domain is $\{x \in \mathbb{R}: x \neq (\frac{2k+1}{2})\pi, k \in \mathbb{Z}\}$
C. Its Range is $(-\infty, -1) \cup [1, \infty)$ D. Its period is π

57.The exact value $\arccos(\cos(\frac{5\pi}{6}))$ is _____

- A. $-\frac{5\pi}{6}$ B. $\frac{5\pi}{6}$ C. $\frac{2\pi}{3}$ D. not defined

58.What is the image of the point $(-5,7)$ when reflected about the line $y=mx$, where $\theta=\frac{\pi}{4}$ is the angle b/n the positive x-axis and the line of reflection?

- A. $(-5,7)$ B. $(7,-5)$ C. $(2,3)$ D. $(-2,3)$

59.If $\vec{V}=2i+3j$ and $\vec{u}=3i-j$, then the unit vector in the direction of $\vec{v} + \vec{u}$ is _____

- A. $\frac{5i}{\sqrt{29}} + \frac{2j}{\sqrt{29}}$ B. $\frac{2i+3j}{\sqrt{13}}$ C. $\frac{3i-j}{\sqrt{10}}$ D.none

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60. What is the exact value of $\cos(15^\circ)$?

- A. $\frac{\sqrt{6}}{4}$ B. $\frac{\sqrt{2}}{4}$ C. $\frac{\sqrt{6}-\sqrt{2}}{4}$ D. $\frac{\sqrt{6}+\sqrt{2}}{4}$

61. Which one of the following is NOT true about $f(x)=3\sin(\frac{1}{2}x-\frac{\pi}{3})+1$?

- A. Its Period $P=4\pi$ C. Its amplitude is 6
B. Its Phase shift $\frac{2\pi}{3}$ D. Its graph completes full cycle on $[\frac{2\pi}{3}, \frac{14\pi}{3}]$

FOR SOCIAL SCIENCE STUDENTS ONLY

53. What is the value of x and y which maximize the value of the objective function respectively?

When $Z=F(x)=2x+5$ subject to

$$\begin{aligned} X &\geq 0 \\ Y &\geq 0 \\ 3X + 2Y &\leq 6 \\ -2X + 4Y &\leq 8 \end{aligned}$$

- A. 0 and 0 B. 2 and 4 C. $\frac{1}{2}$ and $\frac{9}{4}$ D. 1 and 9

54. Which one of the following is the correct formula to calculate ordinary annuity?

- A. $A=(1+\frac{r}{m})^{mt}$ B. $S=R(\frac{(1+i)^n-1}{i})$ C. $A=P(1+r)^n$ D. $A=PI$

55. The population of Injibara city increasing at a rate of 3% per year if the present population of the city is 500,000. find the population after 10 years.

- A. 450,204 B. 537,567 C. 671,958 D. 612,5876.

56. Which one of the following is TRUE about $\begin{cases} 2x - 2y + 3z = 0 \\ 7y - 9z = 0 \\ 5x - 2y + 6z = 0 \end{cases}$

- A. It has unique solution B. It has no solution C. It has infinite solution D. It has two solution

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57.. Abebe and Almaz divide 4500Birr in the ratio of 2:3 respectively . How much birr does Almaz get ?

- A. 900 Birr B.2700 Birr C. 1800 Birr D.2250 Birr

58.If the cost price of teff is birr2500 per quintal and you sell for Birr2700 per quintal .Then which one is not True ?

- A. mark up=200 B. mark up percent with respect to cost price=8%
C. mark up percent with respect to cost price=. mark up percent with respect to Selling D. none

59. If the cost price is greater than the selling price ,then which one is true?

- A. Mark up exists B. Discount exists C.Deperciation exists D. All

60.A price of machinery costs Birr 60,000 with salvage value 12,000 and useful life of 8 years. What is the accumulated depreciation at the end of 6 years?

- A. 6,000 B.48,000 C.36,000 D.None

By: mathematics teachers

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