

MATHEMATICS MODEL EXAM FOR GRADE 12

JIMMA UNIVERSITY COMMUNITY SECONDARY AND PREPARATORY SCHOOL.

MATHEMATICS MODEL EXAMINATION FOR GRADE 12 MIAZIA-2011/APRIL-2019

TIME ALLOWED:-3:00 HOURS

GENERAL DIRECTIONS

THIS EXAMINATION CONTAINS 65 MULTIPLE CHOICE ITEM QUESTIONS.THERE IS ONE BEST ANSWER FOR EACH QUESTIONS.CHOOSE THE BEST ANSWER FROM THE SUGESTED ANSWERS AND BLACKEN THE LETTER OF YOUR CHOICE ON THE ANSWER SHEET PROVIDED WITH HEAVY PENCIL MARK.

YOU ARE NOT ALLOWED TO USE ANY EXTRA PAPER

YOU NEED TO DO ALL YOUR CALCULATIONS ON THE EXAM PAPER.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

MATHEMATICS MODEL EXAM FOR GRADE 12

1 For real numbers x and y , which one of the following statement is true?

- A. $(\forall x)(\exists y)(x^2+y+1=0)$ B. $(\exists x)(\forall y)(x^2+y+1=0)$
 C. $(\exists y)(\forall x)(x^2+y+1=0)$ D. $(\forall y)(\exists x)(x^2+y+1=0)$

2. Which one of the following is NOT true about the graph of $f(x)=3x^4-4x^3-\frac{9}{2}x^2+\frac{1}{2}$?

- A. f is increasing on $\left[-\frac{3}{2}, 0\right] \cup \frac{1}{2}$ B. f is decreasing $(-\infty, -\frac{3}{2}) \cup \left[0, \frac{1}{2}\right]$
 C. f has a minimum value at $x=\frac{3}{2}$ D. $f'(0)=-9$

3. What is the contra positive of "If $x \in N$, then x is integer $\wedge x > 0$. ?

- A. If x is not integer or $x < 0$, then $x \notin \mathbb{N}$ B. If x is integer and $x > 0$, then $x \in \mathbb{N}$.
 C. If x is not integer or $x \leq 0$, then $x \notin N$. D. If $x \notin \mathbb{N}$, then x is integer and $x \leq 0$

4. The volume the solid generated by rotating the region bounded by $y=e^x$, $y=1$ and $x=2$ is

- A. $2\pi(e^2-1)$ B. $\pi(e^2+1)$ C. $\pi(e^2-1)$ D. $2\pi(e^2-2)$

5. Let $\int_2^5 f(x) dx = 7 \wedge \int_9^5 f(x) dx = 2$, then $\int_2^9 4f(x) dx$ equals

- A. 36 B. 20 C. 5 D. 9

6. Let $f(x) = \frac{1}{x^2}$

the x-axis on $[-1, 1]$ equals A. $\frac{1}{6}$ B. $\frac{1}{3}$ C. $\frac{1}{2}$ D. $\frac{5}{6}$

7. When $\int \frac{dx}{\sqrt{x}(1+\sqrt{x})}$ evaluated equals

- A. $2\ln(1+\sqrt{x})+c$ B. $\ln(1+\sqrt{x})+c$ C. $\ln(2+\sqrt{x})+c$ D. $2(1+\sqrt{x})+c$

8. What is the equation of an ellipse with center at $(1, 3)$ vertices at $(6,3)$ and $(1,1)$?

- A. $2(x-1)^2+5(y-3)^2=0$ B. $4(x-1)^2+(y-3)^2=100$
 C. $4(x-1)^2+25(y-3)^2=100$ D. $(x-1)^2+(y-3)^2=100$

9. If a translation T takes the point $(1, 4)$ to the point $(-3, 2)$, then what is the image of the point $(-2,1)$ under T ? A. $(-2,-2)$ B. $(-6,-1)$ C. $(-5, 3)$ D. $(6,0)$

MATHEMATICS MODEL EXAM FOR GRADE 12

10. The parametric vector equation of a line l is given by $(x, y) = (5, 2) + t(-2, 1)$, then the rectangular form of the line is A. $2x + y - 9 = 0$ B. $2y + x + 1 = 0$ C. $2y - x - 9 = 0$ D. $2y + x - 9 = 0$

11. The function $f(x) = x(x+3)e^{\frac{-x}{2}}$ satisfies all conditions of Rolle's Theorem on the interval $[-3, 0]$, then the critical number of f is? A. -2 B. 0 C. -1 D. -9

12. Which of the following is NOT true about $f(x) = \frac{x^2 - 1}{x^2 - 4}$?

A. The range of $f = \{y \in \mathbb{R}; y \leq \frac{1}{4} \vee y > 1\}$ B. $y = 1$ is a horizontal asymptote

C. The graph of f has a vertical asymptote at $x = 2$ and $x = -2$

D. There are no real values of x for $\frac{1}{4} < y < 1$.

13. $\cot(\cos^{-1}\sqrt{1+x})$ equals

A. $\frac{x}{1+x}$

B. $\sqrt{\frac{x}{x+1}}$

C. $\sqrt{\frac{x+1}{x}}$

D. $\sqrt{x}$

14. On the interval $[0, 2\pi]$, what is the solution set of $\cos 2x = \cos x$?

A. $\left\{\frac{\pi}{2}, \frac{3\pi}{2}\right\}$

B. $\left\{\frac{\pi}{6}, \frac{5\pi}{6}\right\}$

C. $\left\{0, \frac{2\pi}{3}, \frac{4\pi}{3}, 2\pi\right\}$

D. $\left\{\frac{3\pi}{2}, \frac{5\pi}{6}\right\}$

15. Which of the following is the derivative of $e^{4x} \sec 3x$?

A. $e^{4x} \sec 3x (4 + \tan 3x)$

B. $e^{4x} \sec 3x (4 + 3 \tan 3x)$

C. $e^{4x} \sec 3x (3 + 4 \tan 3x)$

D. $4e^{4x} \sec 3x \tan 3x$

16. $\lim_{x \rightarrow \infty} \left(\frac{2x+3}{2x+1}\right)^{x+1}$ equals to A. e^2 B. $e+1$ C. e D. $e^{\frac{1}{2}}$

17. What is the angle between the line through the points $(-1, 3)$ and $(2, 3)$ and the line with equation $y - \sqrt{3}x + 6 = 0$? A. 120° B. 60° C. 30° D. 15°

18. Let q be "It is Monday." p be "She will go to school." And r be "She will visit her brother."

Then the symbolic form of "Either she will visit her brother or she will go to school if it is not Monday." is

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

19. A rectangular paper page is to have 96 square meters of print. The margins at the left and

MATHEMATICS MODEL EXAM FOR GRADE 12

Right of page are to be each 2cm, and the margins at the top and bottom are to be each 3cm

What dimensions of the page will produce the smallest area in cm?

- A. 8 by 12 B. 14 by 16 C. 12 by 18 D. 9 by 12

20. What is the image of the ellipse $9(x-2)^2 + 4(y+3)^2 = 36$ if a translation T takes the point

P (-1, 0) to point Q (1, 3)?

A. $9(x-4)^2 + 4(y-6)^2 = 36$

B. $9x^2 + 4(y-4)^2 = 36$

C. $4(x-4)^2 + 9y^2 = 36$

D. $9(x-4)^2 + 4y^2 = 36$

21. Which of the following is true about the graph of $f(x) = xe^x$

A. f has a local minimum at $x=1$

B. f is increasing on $(-1, \infty)$

B. The graph of f is concave upward on $(-\infty, -2)$

D. $(-2, f(-2))$ is an inflection point

22. What is the volume of the solid generated by revolving the region bounded by the graph

Of $g(x) = 4^x$ and the x-axis between $x = \frac{1}{2}$ and $x=1$ about the x-axis in cubic units?

A. $3\pi \ln 2$

B. $3\pi \log_2 e$

C. $6\pi \ln 2$

D. $6\log_2 e$

23. If $f(x) = x g(3x^2 + x) \wedge g(4) = 3 \wedge g'(4) = 2$, then $f'(1)$

A. 14

B. 17

C. 3

D. 5

24. If (3, -2) is the image of (1, 0) under the reflection of a line ℓ , then which of the following is the equation of ℓ ?

A. $y=x-3$

B. $y=x+2$

C. $y=x+3$

D. $y=x-1$

25. What is the equation of the line having slope -1 and that is tangent to the graph of $f(x) = 4x^2 + 3x + 2$?

A. $y+x-1=0$

B. $y+x-2=0$

C. $y+x-3=0$

D. $y-x+1=0$

26. One of the following is the asymptote of the hyperbola $y^2 - x^2 - 4x + 5 = 0$

A. $y=x+2$

B. $y=-x-2$

C. $y=-x-1$

D. $y=-x+1$

27. If R is 180° rotation about the origin and $y = \frac{1}{2}x + 4$ is an equation of a line L, then which of the following is the equation of image of L under R?

MATHEMATICS MODEL EXAM FOR GRADE 12

A. $y=2x+4$

B. $y=-2x-4$

C. $y=\frac{-1}{2}x-4$

D. $y=\frac{1}{2}x-4$

28. Which of the following is true?

A. $\lim_{x \rightarrow 0^+} \frac{x}{\sqrt{1-x}-1} = 0$ B. $\lim_{x \rightarrow 0^+} \frac{x}{\sqrt{1-x}-1} = 0$ C. $\lim_{x \rightarrow 0} \frac{x}{\sqrt{1-x}-1} = -2$ D. $\lim_{x \rightarrow 0} \frac{x}{\sqrt{1-x}-1} = \infty$

29. Let $U = \{0,1,2,\dots,10\}$

$P(x)$ = x is prime

$Q(x)$ = x is an odd and prime

$S(x)$ = x is divisible by 2

Then which one of the following has truth value of True?

A. $(\exists x) P(x)$ B. $(\forall x) Q(x)$ C. $(\exists x) S(x)$ D. $(\exists x)[P(x) \wedge S(x)]$

30. Which one of the following is the set that contains the critical numbers of the function

$f(x) = \cos 2x - 2 \sin x$ on $[0, 2\pi]$?

A. $\left\{\frac{\pi}{6}, \frac{\pi}{2}, \pi, \frac{3\pi}{2}\right\}$ B. $\left\{0, \frac{\pi}{2}, \frac{3\pi}{2}, \pi, 2\pi\right\}$ C. $\left\{\frac{\pi}{2}, \frac{3\pi}{2}, \frac{7\pi}{6}, \frac{11\pi}{6}, 2\pi\right\}$ D. $\left\{0, \frac{7\pi}{6}, \frac{11\pi}{6}, 2\pi\right\}$

31. A flying airplane is sighted in a line from two observation stations A and B. The angle of elevation of the airplane from A is 30° and from B is 60° , A and B are on the same side of the side of the airplane. If the distance between A and B is 12000, what is the altitude of the plane? A. $1200\sqrt{3}m$ B. $600\sqrt{3}m$ C. $600(\sqrt{3}+1)m$ D. $4000\sqrt{3}m$

32. Which one of the following is NOT true about the parabola whose equation is

$y^2 - 8y + 6x + 25 = 0$?

A. The vertex is at $(-\frac{3}{2}, 4)$

B. The focus is at $(-3, 4)$

B. The axis is the line $y=4$

D. The directrix is the line $x = -3$

33. If $f(x) = \begin{cases} \frac{x^2-1}{x}, & \text{if } x \neq 1 \\ kx+1, & \text{if } x = 1 \end{cases}$, then which of the following is the value of k so that f is

MATHEMATICS MODEL EXAM FOR GRADE 12

continuous at $x=1$? A. -1 B. 0 C. 1 D. 2

34. Which one of the following is NOT a correct identity?

A. $\frac{\cos 2x}{1+\sin 2x} = \frac{\cot x - 1}{\cot x + 1}$

B. $\cos 4x - \sin 4x = \cos 2x$

C. $\cos^2\left(\frac{x}{2}\right) = \frac{1+\cos x}{2}$

D. $\tan^2\left(\frac{x}{2}\right) = \frac{1-\cos x}{1+\cos x}, \cos x \neq -1$

35. Let vectors $\vec{a} = 3\mathbf{i} + 2\mathbf{j}$ and $\vec{b} = 5\mathbf{i} + \mathbf{j}$, then which of the following is NOT true?

A. The angle between $\vec{a}$ and $\vec{b}$ is 45°

B. $|\vec{a} + \vec{b}| = \sqrt{65}$

C. $|\vec{a}| + |\vec{b}| = \sqrt{39}$

D. $\vec{a} \cdot \vec{b} = 13$

36. Which of the following is necessarily true?

A. $\frac{d}{dx} \int f(x) dx = \int \frac{d}{dx} (f(x)) dx$

B. $f(x) = |x-3|$ is differentiable for all R .

C. If $\int_a^b f(x) dx = A$, then $\int_a^b (f(x) + x) dx = A + \frac{b^2 - a^2}{2}$

D. None of the above

37. If $\int_0^1 \frac{dx}{\sqrt{1-x^2}} = \frac{\pi}{2}$, then $\int_0^1 \frac{1-2x}{\sqrt{1-x^2}} dx$ equals

A. $\frac{\pi}{2} + 2$

B. $\frac{\pi}{2} - 2$

C. $\frac{\pi}{2} + \frac{1}{2}$

D. $\frac{\pi}{2} - \frac{1}{2}$

38. The largest possible domain of the function $f(x) = \frac{\sqrt{x^2+x-6}}{x^2-4}$ is

A. $\mathbb{R} \setminus (-2, 2)$

B. $(-\infty, -3) \cup (-2, \infty)$

C. $(-\infty, -3) \cup (-2, 2) \cup (2, \infty)$

D. $(-\infty, -3) \cup (2, \infty)$

39. Which one of the following is NOT true about the equation of a conic section given by

$$4x^2 + y^2 - 8x + 2y + 4 = 0$$

A. It is the equation of an ellipse

B. The center is at (1, -1)

C. It's eccentricity is $\frac{\sqrt{3}}{2}$

D. The length of the major axis is one

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

MATHEMATICS MODEL EXAM FOR GRADE 12

41. Which of the following is NOT true for the function $f(x) = \frac{-3}{2} \sin\left(3x + \frac{3}{4}\pi\right)$?

- A. The period is $\frac{2}{3}\pi$ B. The phase shift is $\frac{-\pi}{4}$
 C. The phase angle is 3 D. The amplitude is $\frac{3}{2}$

42. A basket contains 6 yellow, 3 green and 5 white balls. If one ball is drawn from the basket, what is the probability that the ball is NOT yellow?

- A. $\frac{3}{7}$ B. $\frac{4}{7}$ C. $\frac{13}{14}$ D. $\frac{5}{7}$

43. In how many ways can a committee of 5 members be formed from 6 women and 4 men such that at least one man is member of the committee?

- A. 112 B. 156 C. 208 D. 246

44. If the sequence recursively defined by $a_1=1, a_2=-2$ and for $n \geq 3$

$$A_n = A_{n-1} + (A_{n-2})^2 + n, \text{ then the } A_6 \text{ term equals } i$$

- A. 125 B. 41 C. 21 D. 175

45. The equation of the tangent line to the circle with equation $(x-2)^2 + (y-3)^2 = 10$ at the Point $p(-1, 2)$ is A. $-3x-1$ B. $18y=54x+5$ C. $3y = -2x+3$ D. $y = -3x-2$

46. Which one of the following combination of quantifiers matches with its truth value in

the parenthesis. If $P(x, y): x=y+1$, where the universe is the set of all real numbers?

- A. $(\forall x)(\exists y) p(x, y)$ is false B. $(\forall x)(\forall y) p(x, y)$ is true
 C. $(\exists x)(\exists y) p(x, y)$ is true D. $(\exists x)(\forall y) p(x, y)$ is false

47. If $x^2 + 2xy = y^2$ then what is $\frac{dy}{dx}$? A. $\frac{x+y}{y-x}$ B. $2x+2y$ C. $-x$

D. $\frac{x+y}{y}$

48. What is the exact value of the argument of w where $Z = 1 + \sqrt{3}i$ and $\frac{w}{Z} = 2 + 2i$?

MATHEMATICS MODEL EXAM FOR GRADE 12

A. $\frac{7\pi}{12}$

B. $\frac{7\pi}{5}$

C. $\frac{6\pi}{7}$

D. $\frac{3\pi}{4}$

49. If i is an imaginary number what is the simplified form of $\frac{i^{367} i^{288}}{i^{79} i^{142}}$?

A. 1

B. i

C. -1

D. $-i$

50. Which of the following is Not true?

A. If $\lim_{x \rightarrow a} \frac{f(x) - f(a)}{x - a}$ exists, then f is differentiable at a .

B. If f is differentiable at a , then $\lim_{x \rightarrow a} f(x) = f(a)$

C. If f is differentiable at a , then f is continuous at a .

D. If $\lim_{x \rightarrow a} f(x) \exists$, then f is continuous at a .

51. Suppose $\lim_{x \rightarrow -4} f(x) = -1 \wedge \lim_{x \rightarrow -4} f(x) = -1$ is not defined. Which

one of the following is Not true?

A. $\lim_{x \rightarrow -4} f(x) = -1$

B. f is discontinuous at $x = -4$

C. If we redefine $f(-4)$ to be equal to -1 , then the new function will be continuous at $x = -4$.

D. f is continuous everywhere except at $x = -4$

52. For $f(x) = e^{4-x^2}$ then which one of the following is Not true?

A. The function has a local maximum at $x = 0$

B. The function is increasing on $(-\infty, 0)$

C. The graph of the function is concave up on $\left(-\infty, -\frac{1}{\sqrt{2}}\right) \cup \left(\frac{1}{\sqrt{2}}, \infty\right)$

D. The graph of the function is concave down on $\left(\frac{-1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$

53. What is the image of the line given by $(x, y) = (1, 0) + t(3, 6)$ under the translation that takes $(3, 2)$ to $(2, 3)$ followed by rotation of 90° anticlockwise about the origin?

MATHEMATICS MODEL EXAM FOR GRADE 12

A. $y=2x-3$

B. $2y=x+5$

C. $y=2x+3$

D. $2y= -x-5$

54. If $A=(2,-4), B=(-6,4)$ and $\vec{u}$ is a position vector such that $2\vec{u} + \vec{AB} = 0$ then $\vec{u}$ is equal to

A. $(2, -4)$ B. $(4, -2)$ C. $(4, -4)$ D. $(-2, 2)$

55. Consider the following statement.

For any integer n , if $\{n\} \wedge \{2\}$ is even, then n is even "

To show this, a student constructed the following proof.

Proof: Let n is odd implies n^2 is odd.

If n is odd, then there is an integer k such that $n=2k+1$

This implies $n^2 = (2k+1)^2 = 4k^2 + 4k + 1 = 2(2k^2 + 2k) + 1$.

Since $k \in \mathbb{Z}$, $(2k^2 + 2k) \in \mathbb{Z} \wedge n^2 = 2(2k^2 + 2k) + 1$ is odd.

So, for every integer n , if n^2 is even, then n is even is TRUE.

Which one of the following proof method is used in the above proof?

A. Proof by Contradiction

B. Proof by Contra- positive

C. Method of Exhaustion.

D. Principle of Mathematical Induction.

56. If $\frac{5x+1}{x^2(x^2+4)} = \frac{A}{x} + \frac{B}{x^2} + \frac{Cx+D}{x^2+4}$, where A, B, C and D are constants, then what are the

values of A, B, C and D respectively?

A. $\frac{5}{4}, \frac{1}{4}, \frac{-5}{4}, \frac{-1}{4}$ B. $\frac{-5}{4}, \frac{-1}{4}, \frac{1}{4}, \frac{5}{4}$

C. $\frac{-1}{4}, \frac{-5}{4}, \frac{1}{4}, \frac{5}{4}$ D. $\frac{1}{4}, \frac{-5}{4}, \frac{5}{4}, \frac{-1}{4}$

57. Which of the following is equal to $\int \frac{x-1}{(x+1)^2(x+2)} dx$?

A. $3 \ln \left| \frac{x+1}{x+2} \right| - 2 \ln(x+1)^2 + C$

B. $3 \ln \left| \frac{x+1}{x+2} \right| - 2 \left(\frac{1}{x+2} \right)^2 + C$

C. $3 \ln \left| \frac{x+1}{x+2} \right| + 2 \left(\frac{1}{x+1} \right) + C$

D. $3 \ln \left| \frac{x+2}{x+1} \right| + 2 \left(\frac{1}{x+2} \right) + C$

58. . The complex number $i + \sqrt{3}$ in polar form can be written as

MATHEMATICS MODEL EXAM FOR GRADE 12

A. $\frac{1}{2} \left(\sin\left(\frac{\pi}{10}\right) + i \cos\left(\frac{\pi}{10}\right) \right)$

B. $\frac{1}{2} \left(\sin\left(\frac{\pi}{6}\right) + i \cos\left(\frac{\pi}{6}\right) \right)$

C. $2 \left(\cos\left(\frac{\pi}{6}\right) + i \sin\left(\frac{\pi}{6}\right) \right)$

D. $4 \left(\cos\left(\frac{\pi}{6}\right) + i \sin\left(\frac{\pi}{6}\right) \right)$

59. What is the sum of the series $\sum_{n=1}^{\infty} \frac{6^n + 4^n}{12^n}$? A. 1.5 B. 3 C. 1.25 D. ∞

60. Let matrix $A = \begin{pmatrix} 1 & 1 & 1 \\ 3 & 5 & 4 \\ 3 & 6 & 5 \end{pmatrix}$ with $|A| = 1$ be given then A^{-1} equals

A. $\begin{pmatrix} 1 & -3 & 3 \\ 1 & 2 & 4 \\ 3 & 6 & 5 \end{pmatrix}$ B. $\begin{pmatrix} 1 & 1 & 1 \\ 3 & 2 & 1 \\ 3 & 3 & 2 \end{pmatrix}$

C. $\begin{pmatrix} 1 & 1 & 1 \\ -3 & 2 & -1 \\ 3 & -3 & 2 \end{pmatrix}$ D. $\begin{pmatrix} 1 & 1 & 1 \\ 3 & -2 & 1 \\ 3 & 3 & 2 \end{pmatrix}$

61 The sequence $\left\{ \frac{(2n+1)(1-n)}{(n^2-1)} \right\}_{n=1}^{\infty}$ converges to A. -2 B. 1 C. 0 D. ∞

62. what is the exact value of $\sin \left[\sin^{-1} \frac{1}{2} + \cos^{-1} \frac{5}{12} \right]$?

A. $\frac{5+12\sqrt{3}}{26}$ B. $\frac{5-12\sqrt{3}}{26}$ C. $\frac{5+\sqrt{3}}{26}$ D. $\frac{5-2\sqrt{3}}{26}$

63. The following is a frequency distribution on 4 observations. Then the standard deviation is

x	10 - 20	20 - 30	30 - 40	40 - 50
f	1	1	1	1

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

64. The equation $|Z+1|^2 + |Z-1|^2 = 2$ represents, where Z is a complex number

A. A circle of radius 1.

B. The point (0,0)

C. A straight line

D. A circle of radius 4

65. If f and g are twice differentiable functions such that

$g(x) = e^{f(x)}$ and $g''(x) = h(x)e^{f(x)}$, then $h(x)$ equals

A. $f'(x) + f''(x)$ B. $[f'(x) + f''(x)]^2$ C. $f'(x) + [f''(x)]^2$ D. $[f'(x)]^2 + f''(x)$

_____ **END** _____

WISH YOU ALL THE BEST

S.G/M

