

Mathematics

1. Find the number of solutions of the equation:

$$\cos^2\theta + 2\cos\theta - 8 = 0$$

- A) Exactly two solutions
- B) Exactly four solutions
- C) Infinitely many solutions
- D) No solution

2. What is the locus of the point z satisfying the condition $\arg\left(\frac{z-1}{z+1}\right) = \frac{\pi}{3}$?

- A) A parabola
- B) A circle
- C) Pair of straight line
- D) An ellipse

3. If z is a complex number, then $|3z - 1| = 3|z - 2|$ represents:

- A) Y-axis
- B) A circle
- C) X-axis
- D) A line parallel to y-axis

4. If $A = \{x : x = n^2, n = 1, 2, 3\}$, then the number of subsets of A is:

- A) 16
- B) 15
- C) 4
- D) 8

5. Find the domain of $f(x) = \sqrt{2 - 2x - x^2}$.

- A) $[-\sqrt{3}, \sqrt{3}]$
- B) $[-1-\sqrt{3}, -1+\sqrt{3}]$
- C) $[-3, 3]$
- D) $[-\sqrt{3} - 2, \sqrt{3} + 2]$

6. Find the period of the function $f(x) = 3\sin\frac{\pi x}{3} + 4\cos\frac{\pi x}{4}$.

- A) 6
- B) 24
- C) 8
- D) 2π

7. If the sum of 40 arithmetic mean between two numbers is 120, then the sum of 50 arithmetic mean between them is equal to:

- A) 130
 - B) 160
 - C) 140
 - D) 150
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8. What is the next term in the following sequence?

1, 2, 4, 7, 11,.....

- A) 17
 - B) 16
 - C) 15
 - D) 14
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9. Number of diagonals of a convex hexagon is:

- A) 3
 - B) 6
 - C) 9
 - D) 12
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10. Find the value of $\tan \frac{\pi}{8} \tan \frac{3\pi}{8}$.

- A) 0
 - B) 1
 - C) 1/2
 - D) $\sqrt{3}$
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11. What is the minimum value of $3\cos x + 4\sin x + 8$?

- A) 5
 - B) 9
 - C) 7
 - D) 3
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12. $\lim_{x \rightarrow 0} \frac{\sin x^n}{\sin^m x}$, $n > m > 0$, is equal to:

- A) 1
 - B) 0
 - C) m/n
 - D) n/m
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13. $\lim_{x \rightarrow 0} \frac{x^2}{|x|}$

- A) Is equal to 1
 - B) Is equal to -1
 - C) Is equal to 0
 - D) Does not exist
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14. If $f(x) = 1 + x + \frac{x^2}{2} + \dots + \frac{x^{100}}{100}$, then $f'(1)$ is equal to:

- A) 1/100
- B) 100
- C) 0
- D) 99

15. If $P(A \cap B) = \frac{1}{2}$, $P(A' \cap B') = \frac{1}{3}$, $P(A) = p$ & $P(B) = 2p$, then what is the value of p ?

- A) 1/3
- B) 4/9
- C) 1/9
- D) 7/18

16. Three digit numbers are formed using the digits 0, 2, 4, 6, 8. Out of these numbers, a number is chosen at random. Find the probability that this number has the same digits.

- A) 1/25
- B) 1/16
- C) 16/25
- D) 1/645

17. There are two bookcases A and B. A contains 2 Hindi and 3 Kannada books and B contains 4 Hindi and 5 Kannada books. One book is taken random from one of the bookcases and is found to be Kannada. Find the probability that it was from bookcase B.

- A) 25/52
- B) 52/25
- C) 1/52
- D) 1

18. The points $(4, 7, 8)$, $(2, 3, 4)$ & $(-1, 2, 1)$ are the three vertices of a parallelogram. Find the fourth vertex of the parallelogram.

- A) $(1, 2, -5)$
- B) $(1, 6, 5)$
- C) $(1, -2, 5)$
- D) $(-1, 2, 5)$

19. If $\vec{a} = 2i + j + k$ & θ is the angle between the vectors \vec{a} & z-axis, then find the value of $\cos\theta$.

- A) $1/\sqrt{6}$
- B) $\sqrt{5}/12$
- C) $\sqrt{5}/6$
- D) $1/\sqrt{3}$

20. $\vec{a}, \vec{b}, \vec{c}$ are the three vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, $|\vec{a}| = 1$, $|\vec{b}| = 2$, $|\vec{c}| = 3$, then what is the value of $\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}$?

- A) 0
 B) -7
 C) 7
 D) 1

21. The sum of $\begin{bmatrix} 2 & -3 \\ 5 & -7 \end{bmatrix}$ and its multiplicative inverse is:

- A) $\begin{pmatrix} 4 & -6 \\ 10 & -14 \end{pmatrix}$
 B) $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$
 C) $\begin{pmatrix} 0 & -2 \\ -2 & 0 \end{pmatrix}$
 D) $\begin{pmatrix} -5 & 0 \\ 0 & -5 \end{pmatrix}$

22. If $A = \begin{bmatrix} 5 & 8 & 10 \\ 5 & 2 & 1 \\ 6 & 9 & 12 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 5 & 12 \\ 3 & 10 & 13 \\ 4 & 9 & 5 \end{bmatrix}$, then find $A \cdot B$.

- A) $\begin{bmatrix} 5 & 8 & 10 \\ 5 & 2 & 1 \\ 6 & 9 & 12 \end{bmatrix}$
 B) $\begin{bmatrix} 74 & 195 & 214 \\ 20 & 54 & 91 \\ 87 & 228 & 249 \end{bmatrix}$
 C) $\begin{bmatrix} 0 & 89 & 10 \\ 0 & 2 & 1 \\ 6 & 228 & 12 \end{bmatrix}$
 D) $\begin{bmatrix} 7 & 13 & 22 \\ 8 & 12 & 14 \\ 10 & 18 & 17 \end{bmatrix}$

23. Find x , if $[x \quad -5 \quad -1] \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix} \begin{bmatrix} x \\ 4 \\ 1 \end{bmatrix} = 0$.

- A) 4
- B) 7
- C) $\pm 4\sqrt{3}$
- D) $\pm 3\sqrt{4}$

24. Find the solution of $\frac{dy}{dx} = \left(\frac{y}{x}\right)^{\frac{1}{3}}$.

- A) $x^{\frac{2}{3}} + y^{\frac{2}{3}} = c$
- B) $x^{\frac{1}{3}} + y^{\frac{1}{3}} = c$
- C) $y^{\frac{2}{3}} - x^{\frac{2}{3}} = c$
- D) $y^{\frac{1}{3}} - x^{\frac{1}{3}} = c$

25. Find position function at $t=0$, $s=3$, if an insect is moving with the velocity $v(t) = \cos 2\pi t$ along a straight line.

- A) $\frac{1}{2\pi} \cos \pi t + 1.5$
- B) $\frac{1}{2\pi} \cos 2\pi t + 0.5$
- C) $-\frac{1}{2\pi} \sin 2\pi t + 3$
- D) $\frac{1}{2\pi} \sin 2\pi t + 3$

26. Solution of the differential equation $xdy - ydx = y^2(xdy + ydx)$ is:

- A) $\frac{x}{y} - xy = c$
- B) $\frac{x}{y} + xy = c$
- C) $\frac{y}{x} - xy = c$
- D) $\frac{y}{x} - xy = 0$

27. The radius of the circle passing through the foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ and having its centre (0, 3) is:

- A) 4
- B) 3
- C) $\sqrt{12}$
- D) $7/2$

28. The equation $mx - y + 2 - 3m = 0, m \in R$ represents which of the following family?

- A) Lines through (2, 3)
- B) Lines through (3, 2)
- C) Lines through (-2, 3)
- D) Lines with intercepts (1, 1) on two axes

29. If the straight line $x + y + 1 = 0$ is changed into the form $x \cos \alpha + y \sin \alpha = p$, then $\alpha = ?$

- A) $\pi / 4$
- B) $3\pi / 4$
- C) $5\pi / 4$
- D) $7\pi / 4$

30. A pair of dice is rolled. Find P (A/B) if,

- A: 2 appears on atleast one die.
- B: Sum of numbers appearing on die is 8.

- A) $1/12$
- B) $1/36$
- C) $1/6$
- D) $2/5$