



General Instructions

- (i) The examination will be conducted in Computer-Based Test (CBT) mode.
- (ii) Each question carries +5 marks for correct answer and -1 mark for wrong answer.
- (iii) The total number of questions are 50.
- (iv) Duration of the exam is 1 hour (60 minutes).

1. Let A be a 3×3 matrix such that $A^2 = I$. If $\det(A) = -1$ and the sum of eigenvalues is 1, find the set of eigenvalues of A .

- (A) 1, 1, 1
- (B) 1, 1, -1
- (C) -1, -1, 1
- (D) -1, -1, -1

2. Analyze the function $f(x) = |x - 1| + |x - 2| + |x - 3|$. Determine the points where the derivative $f'(x)$ is undefined.

- (A) $x = 1, 3$
- (B) $x = 1, 2, 3$
- (C) $x = 1.5, 2.5$
- (D) $x = 0$

3. Identify the order and degree of the differential equation:

$$\left(\frac{d^3y}{dx^3}\right)^2 + 4\left(\frac{dy}{dx}\right)^4 + y = \sin(x)$$

- (A) Order 3, Degree 4
 - (B) Order 3, Degree 2
 - (C) Order 4, Degree 3
 - (D) Order 1, Degree 4
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4. For the linear differential equation

$$\frac{dy}{dx} + \frac{2}{x}y = x^2$$

calculate the integrating factor (I.F.).

- (A) x
 - (B) x^2
 - (C) x^3
 - (D) $\ln(x)$
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5. Maximize $Z = 5x + 3y$ subject to $x + y \leq 6$ and $x, y \geq 0$. Where does the maximum value occur?

- (A) (0, 0)
 - (B) (0, 6)
 - (C) (6, 0)
 - (D) (3, 3)
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6. A bag has 4 red and 6 black balls. Two balls are drawn without replacement. What is the probability that the second is red given the first was black?

- (A) $4/10$
 - (B) $4/9$
 - (C) $6/9$
 - (D) $2/9$
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7. Find the domain of the function $f(x) = \sin^{-1}(3x - 1)$.

- (A) $[-1, 1]$
 - (B) $[0, 2/3]$
 - (C) $[-1/3, 1/3]$
 - (D) $[1/3, 1]$
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8. For vectors $\vec{a} = 3\hat{i} - \hat{j} + 2\hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} - \hat{k}$, find the scalar projection of $\vec{a}$ onto $\vec{b}$.

- (A) $-1/\sqrt{6}$
 - (B) $1/\sqrt{6}$
 - (C) $-1/6$
 - (D) $1/6$
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9. Let R be a relation on $\{1,2,3\}$ defined by $R = \{(1,1), (2,2), (3,3), (1,2)\}$. Identify the properties satisfied by R.

- (A) Symmetric only
 - (B) Reflexive and Transitive
 - (C) Equivalence relation
 - (D) None of these
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10. Find the local maximum point of the function $f(x) = -x^3 + 3x + 1$

- (A) $x = 1$
 - (B) $x = -1$
 - (C) $x = 0$
 - (D) $x = \sqrt{3}$
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