Bihar Board Class 12 Mathematics Set J 2026

Question Paper

Conducted by the Bihar School Examination Board (BSEB)

Time Allowed: 3 hrs 15 min **Maximum Marks: 100**

General Instructions

(i) This question booklet is divided into two sections: **Section A** and **Section B**. The paper has **138 questions** (100 + 30 + 8) and carries **100 marks**.

(ii) In **Section A**, there are 100 objective type questions, out of which **any 50 questions** are to be answered, each carrying **1 mark**. If more than 50 questions are answered, only the first 50 answers are evaluated. The answers are marked on the OMR answer sheet.

(iii) In **Section B**, there are 30 short answer type questions, out of which **any 15 questions** are to be answered, each carrying **2 marks**.

(iv) Apart from these, Section B has 8 long answer type questions, out of which **any 4 questions** are to be answered, each carrying **5 marks**.

(v) Candidates must enter the 10-digit Question Booklet Serial No. on the OMR answer sheet and should give their answers in their own words as far as practicable.

(vi) Figures in the right-hand margin indicate full marks. 15 minutes of extra time have been allotted to read the questions carefully.

Section A: Objective Type Questions (any 50 to be answered, 1 mark each)

1. **If** $y = \sqrt{\sin x + \sqrt{\sin x + \sqrt{\sin x + \cdots}}}$ **then** $\frac{dy}{dx} =$ [1 mark]

(A) $\frac{1}{2y-1}$

(B) $\frac{\cos x}{2y-1}$

(C) $\frac{\sin x}{2y-1}$

(D) $\frac{2y-1}{\cos x}$

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2. **If** $x^n + y^n = a^n$ **then** $\frac{dy}{dx} =$ [1 mark]

(A) $-\frac{x^{n-1}}{y^{n-1}}$

(B) $\frac{x^{n-1}}{y^{n-1}}$

(C) $-\frac{y^{n-1}}{x^{n-1}}$

(D) nx^{n-1}

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3. **If** $x = a(1-\cos\theta),\ y = a(\theta + \sin\theta)$, **then** $\frac{dy}{dx} =$ [1 mark]

(A) $\tan\frac{\theta}{2}$

(B) $-\tan\frac{\theta}{2}$

(C) $\cot\frac{\theta}{2}$

(D) $-\cot\frac{\theta}{2}$

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4. **If** $y = x^x$ **then** $\frac{dy}{dx} =$ [1 mark]

(A) $x^x(\log x + 1)$

(B) $\log x$

(C) $(\log x + 1)$

(D) nx^{n-1}

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5. $\frac{d}{dx}\sin^{-1}(3x - 4x^3) =$ [1 mark]

(A) $\frac{3}{\sqrt{1-x^2}}$

(B) $\frac{-3}{\sqrt{1-x^2}}$

(C) $\frac{1}{\sqrt{1-x^2}}$

(D) $\frac{-1}{\sqrt{1-x^2}}$

6. $\frac{d}{dx}(\sin 3x \cdot \cos 5x) =$ [1 mark]

(A) $4\cos 8x$

(B) $4\cos 8x - \cos 2x$

(C) $\cos 2x$

(D) $\cos 2x - 4\cos 8x$

7. $\frac{d}{dx}(\cos x^3) =$ [1 mark]

(A) $-3x^2 \sin x^3$

(B) $\sin x^3$

(C) $3x^2 \sin x^3$

(D) $3x^2$

8. **If** $f : R \to R$**, where** $f(x) = 3x - 5$**, then** $f^{-1}(x) =$ [1 mark]

(A) $\frac{1}{3}(x+5)$

(B) $\frac{1}{3}(x-5)$

(C) $3x - 5$

(D) none of these

9. $\int (x+2)\,dx =$ [1 mark]

(A) $(x+2)^3 + k$

(B) $\frac{x^2}{2} + k$

(C) $\frac{x^2}{2} + 2x + k$

(D) $\log(x+2) + k$

10. $\int \frac{\cos 2x}{(\sin x + \cos x)^2}\,dx =$ [1 mark]

(A) $2\log(\sin x + \cos x) + k$

(B) $\log(\sin x + \cos x) + k$

(C) $\log(\sin x - \cos x) + k$

(D) $-\frac{1}{\sin x + \cos x} + k$

11. **The angle between the straight lines** $\frac{x-2}{2} = \frac{y-1}{7} = \frac{z+3}{-3}$ **and** $\frac{x+2}{-1} = \frac{y-4}{2} = \frac{z-5}{4}$ **is** [1 mark]

(A) $\frac{\pi}{2}$

(B) 0

(C) $\frac{\pi}{6}$

(D) $\frac{\pi}{4}$

12. **The distance of the plane $x + 2y - 2z = 9$ from the point $(2, 3, -5)$ is** [1 mark]

(A) 1

(B) 2

(C) 3

(D) 4

13. **If two planes $x - 4y + \lambda z + 3 = 0$ and $2x + 2y + 3z = 5$ are perpendicular to each other then $\lambda =$** [1 mark]

(A) 1

(B) 2

(C) 3

(D) 4

14. **If the line $\frac{x - x_1}{a_1} = \frac{y - y_1}{b_1} = \frac{z - z_1}{c_1}$ is parallel to the plane $a_2x + b_2y + c_2z + d = 0$, then** [1 mark]

(A) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

(B) $a_1x + b_1y + c_1z + d = 0$

(C) $a_1a_2 + b_1b_2 + c_1c_2 = 0$

(D) none of these

15. **The equation of the plane whose intercepts on the x, y and z-axes are -2, 3 and 4 respectively, will be** [1 mark]

(A) $6x - 4y - 3z + 12 = 0$

(B) $6x + 4y + 3z + 12 = 0$

(C) $6x - 4y - 3z = 0$

(D) none of these

16. **If the direction cosines of two straight lines are l_1, m_1, n_1 and l_2, m_2, n_2 then the cosine of the angle between the lines will be** [1 mark]

(A) $(l_1 + m_1 + n_1)(l_2 + m_2 + n_2)$

(B) $\frac{l_1}{l_2} + \frac{m_1}{m_2} + \frac{n_1}{n_2}$

(C) $l_1l_2 + m_1m_2 + n_1n_2$

(D) none of these

17. **If operation 'o' is defined as $(a\,o\,b) = a^3 + b^3$, then $4\,o\,(1\,o\,2) =$** [1 mark]

(A) 729

(B) 793

(C) 783

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(D) 792

18. **If $n(A) = 4$ and $n(B) = 2$, then $n(A \times B)$ is?** [1 mark]

(A) 6

(B) 8

(C) 16

(D) none of these

19. $\begin{vmatrix} a+ib & c+id \\ -c+id & a-ib \end{vmatrix} =$ [1 mark]

(A) $a^2 + b^2 + c^2 + d^2$

(B) $a^2 - b^2 - c^2 - d^2$

(C) $a^2 - b^2 + c^2 + d^2$

(D) $a^2 + b^2 + c^2 - d^2$

20. **The maximum value of $Z = 4x + y$ subject to the constraints $x + y \leq 50,\ x \geq 0,\ y \geq 0$ is** [1 mark]

(A) 50

(B) 250

(C) 0

(D) none of these

21. **If $A = \begin{pmatrix} 1 & -1 \\ -1 & 1 \end{pmatrix}$, then $A^3 =$** [1 mark]

(A) $3A$

(B) $4A$

(C) $2A$

(D) none of these

22. **If $A = \begin{pmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{pmatrix}$ and $A + A' = I$, then $\alpha =$** [1 mark]

(A) π

(B) $\frac{\pi}{3}$

(C) $\frac{3\pi}{2}$

(D) $\frac{\pi}{6}$

23. **If $A = \begin{pmatrix} 3 & -5 \\ -1 & 2 \end{pmatrix}$ then $\text{adj}\ A =$** [1 mark]

(A) $\begin{pmatrix} 2 & 5 \\ 1 & 3 \end{pmatrix}$

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(B) $\begin{pmatrix} 2 & 3 \\ 1 & 5 \end{pmatrix}$

(C) $\begin{pmatrix} 1 & 3 \\ 2 & 5 \end{pmatrix}$

(D) none of these

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24. **If** $A = \begin{pmatrix} 1 & 2 & 3 & 4 \end{pmatrix}$ **and** $B = \begin{pmatrix} 1 \\ 2 \\ 3 \\ 4 \end{pmatrix}$ **then** $AB =$ [1 mark]

(A) $\begin{pmatrix} 30 \end{pmatrix}$

(B) $\begin{pmatrix} 10 \end{pmatrix}$

(C) $\begin{pmatrix} 20 \end{pmatrix}$

(D) $\begin{pmatrix} 40 \end{pmatrix}$

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25. $A = [a_{ij}]_{m \times n}$ **is a square matrix if** [1 mark]

(A) $m = n$

(B) $m < n$

(C) $m > n$

(D) none of these

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26. $A = \begin{pmatrix} 3 & -4 \\ 1 & -1 \end{pmatrix} \Rightarrow A + A' =$ [1 mark]

(A) $\begin{pmatrix} 6 & -3 \\ -3 & -2 \end{pmatrix}$

(B) $\begin{pmatrix} 6 & 3 \\ 3 & 2 \end{pmatrix}$

(C) $\begin{pmatrix} 6 & 3 \\ -3 & -2 \end{pmatrix}$

(D) $\begin{pmatrix} 6 & 3 \\ -3 & 2 \end{pmatrix}$

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27. $f : A \to B$ **will be an into function if** [1 mark]

(A) $f(A) \subset B$

(B) $f(A) = B$

(C) $f(A) \supset B$

(D) none of these

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28. **What type of a relation is "less than" in the set of real numbers?** [1 mark]

(A) Only symmetric

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(B) Only transitive

(C) Only reflexive

(D) Equivalence

29. $|3\vec{i}+4\vec{j}+7\vec{k}| =$ [1 mark]

(A) $\sqrt{14}$

(B) $\sqrt{74}$

(C) $\sqrt{61}$

(D) $\sqrt{94}$

30. $\vec{i}\cdot(\vec{j}\times\vec{k}) =$ [1 mark]

(A) 1

(B) 0

(C) -1

(D) $\vec{i}$

31. $\frac{d}{dx}(e^{x-a}) =$ [1 mark]

(A) e^{x-a}

(B) $(x-a)e^{x-a}$

(C) e^{x}

(D) $-e^{x-a}$

32. $\frac{d}{dx}\sqrt{x^2+ax+1} =$ [1 mark]

(A) $\frac{x+a}{2\sqrt{x^2+ax+1}}$

(B) $\frac{2x+a}{2\sqrt{x^2+ax+1}}$

(C) $\frac{2x+a}{\sqrt{x^2+ax+1}}$

(D) $\frac{1}{2\sqrt{x^2+ax+1}}$

33. $\frac{d}{dx}(\sin x^2) =$ [1 mark]

(A) $2x\cos x^2$

(B) $\cos x^2$

(C) $x^2\cos x^2$

(D) $x\cos x^2$

34. $\frac{d}{dx}\sqrt{\cot x} =$ [1 mark]

(A) $\frac{1}{2\sqrt{\cot x}}$

(B) $\sqrt{\text{cosec}^2 x}$

(C) $\frac{-\text{cosec}^2 x}{2\sqrt{\cot x}}$

(D) $\frac{\text{cosec}^2 x}{2\sqrt{\cot x}}$

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35. $\frac{d}{dx}(\tan^{-1}\sqrt{x} + \cot^{-1}\sqrt{x}) =$ [1 mark]

(A) $\frac{\pi}{2}$

(B) 0

(C) 1

(D) π

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36. $\frac{d}{dx}\left(2\tan^{-1} x\right) =$ [1 mark]

(A) $\frac{1}{1+x^2}$

(B) $\frac{2}{1+x^2}$

(C) $\frac{1}{2(1+x^2)}$

(D) $\frac{1}{1-x^2}$

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37. $\frac{d}{dx}(\cos\sqrt{x}) =$ [1 mark]

(A) $\sin\sqrt{x}$

(B) $\frac{-\sin\sqrt{x}}{2\sqrt{x}}$

(C) $\frac{\sin\sqrt{x}}{2\sqrt{x}}$

(D) $\frac{1}{2\sqrt{x}}$

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38. $\frac{d}{dx}\left\{\lim_{x\to 0}\frac{x^5 - a^5}{x-a}\right\} =$ [1 mark]

(A) a

(B) 0

(C) $5a^4$

(D) 5

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39. $\frac{d}{dx}(\cot^{-1} x) =$ [1 mark]

(A) $\frac{1}{1+x^2}$

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(B) $\frac{-1}{1+x^2}$

(C) $\frac{1}{x}$

(D) $\frac{-1}{x}$

40. **The equation of the tangent to the curve $y = x^2 + 4x + 1$ at the point $x = 3$ is** [1 mark]

(A) $x + 10y = 8$

(B) $10x + y = 8$

(C) $10x - y = 8$

(D) $x - 10y = 8$

41. $\int_0^1 \frac{e^{\sqrt{x}}}{\sqrt{x}}\, dx =$ [1 mark]

(A) $2(e-1)$

(B) $e-1$

(C) $2(e+1)$

(D) $e+1$

42. $\int_0^1 xe^x\, dx =$ [1 mark]

(A) 1

(B) 0

(C) 2

(D) -1

43. $\int_1^4 \frac{dx}{\sqrt{x}} =$ [1 mark]

(A) 1

(B) -2

(C) 2

(D) -1

44. $\int_0^a \sqrt{a^2 - x^2}\, dx =$ [1 mark]

(A) $\frac{\pi}{4}$

(B) $\frac{a^2}{4}$

(C) $\frac{\pi a^2}{4}$

(D) π

45. $\int_{-2}^2 |x|\, dx =$ [1 mark]

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(A) 4

(B) 3

(C) 2

(D) 0

46. The order and degree of the differential equation $(\frac{d^2s}{dt^2})^2 + (\frac{ds}{dt})^3 + 4 = 0$ is [1 mark]

(A) order = 2, degree = 1

(B) order = 2, degree = 2

(C) order = 1, degree = 2

(D) order = 1, degree = 1

47. The integrating factor of the differential equation $(1 + x^2)\frac{dy}{dx} + y = e^{\tan^{-1} x}$ is [1 mark]

(A) $e^{\tan^{-1} x}$

(B) $e^{\sin^{-1} x}$

(C) $\tan^{-1} x$

(D) $\sin^{-1} x$

48. The solution of differential equation $\frac{dy}{dx} = e^{x+y}$ is [1 mark]

(A) $e^x + e^{-y} = k$

(B) $e^x + e^y = k$

(C) $e^{-x} + e^y = k$

(D) $e^{-x} + e^{-y} = k$

49. The solution of differential equation $x\frac{dy}{dx} = \cot y$ is [1 mark]

(A) $x \cos y = k$

(B) $x \tan y = k$

(C) $x \sec y = k$

(D) $x \sin y = k$

50. If the operation $*$ is defined as $a * b = a + 2b$, then $(2 * 3) * 4$ is [1 mark]

(A) 30

(B) 20

(C) 16

(D) 15

51. $\begin{vmatrix} 23 & 12 & 11 \\ 36 & 10 & 26 \\ 63 & 26 & 37 \end{vmatrix} =$ [1 mark]

(A) 1

(B) -1

(C) 0

(D) 2

52. $\begin{vmatrix} a-b & b-c & c-a \\ b-c & c-a & a-b \\ c-a & a-b & b-c \end{vmatrix} =$ [1 mark]

(A) 1

(B) 0

(C) -1

(D) $a+b+c$

53. $\begin{vmatrix} x & 4 \\ 2 & 2x \end{vmatrix} = 0 \Rightarrow x =$ [1 mark]

(A) ± 2

(B) ± 1

(C) ± 3

(D) 0

54. $\begin{vmatrix} \cos 15^\circ & \sin 15^\circ \\ \sin 75^\circ & \cos 75^\circ \end{vmatrix} =$ [1 mark]

(A) 1

(B) 0

(C) -1

(D) $\frac{1}{2}$

55. $1 - P(A' \cap B') =$ [1 mark]

(A) $P(A \cap B)$

(B) $P(A \cup B)$

(C) $P(A)$

(D) $P(B)$

56. **If A, B and C are three independent events then $P(ABC) =$** [1 mark]

(A) $P(A) + P(B) + P(C)$

(B) $P(A) - P(B) - P(C)$

(C) $P(A) \cdot P(B) \cdot P(C)$

(D) None of these

57. $P(A) = \frac{7}{13},\ P(B) = \frac{9}{13},\ P(A \cap B) = \frac{4}{13} \Rightarrow P(A/B) =$ [1 mark]

(A) $\frac{4}{9}$

(B) $\frac{4}{7}$

(C) $\frac{12}{13}$

(D) $\frac{1}{6}$

58. **If the odds against the event A is $3:7$ then $P(A) =$** [1 mark]

(A) $\frac{3}{10}$

(B) $\frac{7}{10}$

(C) $\frac{3}{7}$

(D) $\frac{7}{3}$

59. $\frac{d}{dx}(\log x^n) =$ [1 mark]

(A) $\frac{1}{x^n}$

(B) n

(C) $\frac{1}{x}$

(D) $\frac{n}{x}$

60. $\frac{d^2}{dx^2}(\sin 2x) =$ [1 mark]

(A) $4\sin 2x$

(B) $4\cos^2 2x$

(C) $-4\sin 2x$

(D) $2\sin 4x$

61. $\tan^{-1}(-\frac{1}{\sqrt{3}}) =$ [1 mark]

(A) $\frac{\pi}{3}$

(B) $\frac{\pi}{6}$

(C) $-\frac{\pi}{3}$

(D) $-\frac{\pi}{6}$

62. $2\tan^{-1}\frac{1}{3} =$ [1 mark]

(A) $\tan^{-1}\frac{3}{2}$

(B) $\tan^{-1}\frac{3}{4}$

(C) $\tan^{-1}\frac{4}{3}$

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(D) $\tan^{-1}\frac{2}{3}$

63. $x \in R, \cot(\tan^{-1} x + \cot^{-1} x) =$ [1 mark]

(A) 1

(B) $\frac{1}{2}$

(C) 0

(D) $\frac{1}{3}$

64. $\sin(\cos^{-1} 3/5) =$ [1 mark]

(A) $\frac{3}{4}$

(B) $\frac{4}{5}$

(C) $\frac{3}{5}$

(D) $\frac{5}{4}$

65. $\tan^{-1}(1) + \cos^{-1}(-\frac{1}{2}) + \sin^{-1}(-\frac{1}{2}) =$ [1 mark]

(A) π

(B) $\frac{2\pi}{3}$

(C) $\frac{3\pi}{4}$

(D) $\frac{\pi}{2}$

66. $\cos^{-1}(\cos\frac{7\pi}{6}) =$ [1 mark]

(A) $\frac{\pi}{6}$

(B) $\frac{\pi}{3}$

(C) $\frac{5\pi}{6}$

(D) $\frac{7\pi}{6}$

67. $\tan^{-1} 2 + \tan^{-1} 3 =$ [1 mark]

(A) $-\frac{\pi}{4}$

(B) $\frac{\pi}{4}$

(C) $\frac{3\pi}{4}$

(D) π

68. **If** $|x| \leq 1$**, then** $\tan(\cos^{-1} x) =$ [1 mark]

(A) $\frac{\sqrt{1-x^2}}{x}$

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(B) $\frac{x}{1+x^2}$

(C) $\frac{\sqrt{1+x^2}}{x}$

(D) $\sqrt{1-x^2}$

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69. $\tan^{-1}\frac{x}{y} - \tan^{-1}\frac{x-y}{x+y} =$ [1 mark]

(A) $-\frac{3\pi}{4}$

(B) $\frac{\pi}{2}$

(C) $\frac{\pi}{4}$

(D) $\frac{\pi}{3}$

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70. $|x| \leq 1, \cos^{-1}(\frac{1-x^2}{1+x^2}) =$ [1 mark]

(A) $2\cos^{-1} x$

(B) $2\sin^{-1} x$

(C) $2\tan^{-1} x$

(D) $\tan^{-1} 2x$

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71. $\int \frac{1-\cos 2x}{1+\cos 2x}\, dx =$ [1 mark]

(A) $\tan x + x + k$

(B) $\tan x - x + k$

(C) $x - \tan^2 x + k$

(D) $\tan\frac{x}{2} + k$

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72. $\int \frac{dx}{x-1} =$ [1 mark]

(A) $\log|x+1| + k$

(B) $-\log|x+1| + k$

(C) $\log|x-1| + k$

(D) $\log x + k$

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73. $\int \log x\, dx =$ [1 mark]

(A) $\frac{1}{x} + k$

(B) $x\log x + k$

(C) $x\log x - x + k$

(D) $x\log x + x + k$

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74. $\int \cos\sqrt{x}\, dx =$ [1 mark]

(A) $\sin\sqrt{x} + \cos\sqrt{x} + k$

(B) $\frac{1}{2}(\sqrt{x}\sin\sqrt{x} - \cos\sqrt{x}) + k$

(C) $2(\sqrt{x}\sin\sqrt{x} + \cos\sqrt{x}) + k$

(D) $\sin\sqrt{x} + k$

---

75. $\int e^x(\tan^{-1}x + \frac{1}{1+x^2})dx =$ [1 mark]

(A) $e^x\tan^{-1}x + k$

(B) $e^x \cdot \frac{1}{1+x^2} + k$

(C) $e^x + k$

(D) $\tan^{-1}x + k$

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76. $\int \frac{dx}{x^2 - a^2} =$ [1 mark]

(A) $\frac{1}{a}\tan^{-1}\frac{x}{a} + k$

(B) $\frac{1}{2a}\log|\frac{x-a}{x+a}| + k$

(C) $\frac{1}{2a}\log|\frac{a+x}{a-x}| + k$

(D) $\frac{1}{a}\log|\frac{x-a}{x+a}| + k$

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77. $\int \sin^2\frac{x}{2}\,dx =$ [1 mark]

(A) $\frac{1}{2}x - \frac{1}{2}\sin x + k$

(B) $\frac{1}{2}x - \frac{1}{2}\cos x + k$

(C) $\frac{1}{2}\sin x + k$

(D) $-\frac{1}{2}\sin x + k$

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78. $\int \frac{\tan(\sin^{-1}x)}{\sqrt{1-x^2}}\,dx =$ [1 mark]

(A) $\log|\sec(\sin^{-1}x)| + k$

(B) $\log|\cos(\sin^{-1}x)| + k$

(C) $\tan(\sin^{-1}x) + k$

(D) $\log|\sin^{-1}x| + k$

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79. $\int \frac{dx}{e^x + e^{-x}} =$ [1 mark]

(A) $\cot^{-1}(e^x) + k$

(B) $\tan^{-1}(e^x) + k$

(C) $\log|e^x + 1| + k$

(D) $\sin^{-1}(e^x) + k$

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80. $\int_0^1 \frac{dx}{1+x^2} =$ [1 mark]

(A) $\frac{\pi}{2}$

(B) $\frac{\pi}{3}$

(C) $\frac{\pi}{4}$

(D) π

81. $\vec{i} \times \vec{k} =$ [1 mark]

(A) 1

(B) $\vec{k}$

(C) $\vec{j}$

(D) $-\vec{j}$

82. $\vec{a} \cdot (\vec{a} \times \vec{a}) =$ [1 mark]

(A) 1

(B) 0

(C) $\vec{a}$

(D) -1

83. **If \[\vec{a} = 3\hat{i} + \hat{j} - 2\hat{k} \quad \text{and} \quad \vec{b} = \hat{i} + \lambda \hat{j} - 3\hat{k} \] are perpendicular to each other, then the value of λ is:** [1 mark]

(A) -3

(B) -6

(C) -9

(D) -1

84. **The projection of the vector $\vec{i} + 3\vec{j} + 7\vec{k}$ on the vector $2\vec{i} - 3\vec{j} + 6\vec{k}$ is** [1 mark]

(A) 5

(B) 25

(C) 6

(D) none of these

85. $|\vec{a}| = 2,\ |\vec{b}| = 3,\ \vec{a} \cdot \vec{b} = 4 \Rightarrow |\vec{a} - \vec{b}| =$ [1 mark]

(A) 5

(B) $\sqrt{5}$

(C) 4

(D) 2

86. **If $\vec{a} = \vec{i} - \vec{j} + 2\vec{k}$ and $\vec{b} = 2\vec{i} + 3\vec{j} - 4\vec{k}$ then $|\vec{a} \times \vec{b}| =$** [1 mark]

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(A) $\sqrt{174}$

(B) $\sqrt{87}$

(C) $\sqrt{93}$

(D) none of these

87. **If $|\vec{a}+\vec{b}|=|\vec{a}-\vec{b}|$, then** [1 mark]

(A) $|\vec{a}|=|\vec{b}|$

(B) $\vec{a} \parallel \vec{b}$

(C) $\vec{a} \perp \vec{b}$

(D) none of these

88. $2\vec{j}\cdot(-3)\vec{k}=$ [1 mark]

(A) 6

(B) -6

(C) 0

(D) $-6\vec{i}$

89. **The direction ratios of a straight line are $2, 6, -3$. Then its direction cosines are** [1 mark]

(A) $\frac{1}{7}, \frac{2}{7}, \frac{3}{7}$

(B) $\frac{2}{7}, \frac{-6}{7}, \frac{3}{7}$

(C) $\frac{2}{7}, \frac{6}{7}, \frac{-3}{7}$

(D) none of these

90. **If a line makes angles α, β and γ with the positive directions of x, y and z axes respectively, then** [1 mark]

(A) $\cos^2\alpha+\cos^2\beta+\cos^2\gamma=1$

(B) $\sin^2\alpha+\sin^2\beta+\sin^2\gamma=4$

(C) $\cos^2\alpha+\cos^2\beta+\cos^2\gamma=2$

(D) $\sin^2\alpha+\sin^2\beta+\sin^2\gamma=1$

91. $\int_0^1 \frac{x^3\,dx}{1+x^8}=$ [1 mark]

(A) $\frac{\pi}{2}$

(B) $\frac{\pi}{4}$

(C) $\frac{\pi}{8}$

(D) $\frac{\pi}{16}$

92. $\int_1^e \frac{(\log x)^2}{x}\,dx =$ [1 mark]

(A) $\frac{1}{3}$

(B) $\frac{1}{3}e^3$

(C) $\frac{1}{3}(e^3-1)$

(D) e^3

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93. $A = \begin{pmatrix} 4 & 2 & 3 \end{pmatrix} \Rightarrow A' =$ [1 mark]

(A) $\begin{pmatrix} 4 & 2 & 3 \end{pmatrix}$

(B) $\begin{pmatrix} 3 \\ 2 \\ 4 \end{pmatrix}$

(C) $\begin{pmatrix} 3 & 2 & 4 \end{pmatrix}$

(D) $\begin{pmatrix} 4 \\ 2 \\ 3 \end{pmatrix}$

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94. $\int_0^{\pi/4} \frac{e^{\tan x}}{\cos^2 x}\,dx =$ [1 mark]

(A) $e-1$

(B) $e+1$

(C) $\frac{1}{e}+1$

(D) $\frac{1}{e}-1$

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95. $\int_0^{\pi/2} \cos^2 x\,dx =$ [1 mark]

(A) $\frac{\pi}{2}$

(B) π

(C) $\frac{\pi}{4}$

(D) 1

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96. $\int_0^{\pi/3} \cos^3 x\,dx =$ [1 mark]

(A) $\frac{3\sqrt{3}}{8}$

(B) $\frac{\sqrt{3}}{8}$

(C) $\frac{3}{8}$

(D) $\frac{1}{8}$

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97. $\int_0^{2\pi} |\sin x|\,dx =$ [1 mark]

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(A) 2

(B) 4

(C) 1

(D) 3

98. $\int_0^{\pi/2} \frac{\sin x}{\sin x + \cos x}\, dx =$ [1 mark]

(A) π

(B) $\frac{\pi}{2}$

(C) 0

(D) $\frac{\pi}{4}$

99. $\int_{-\pi}^{\pi} \sin^5 x\, dx =$ [1 mark]

(A) $\frac{3\pi}{4}$

(B) 2π

(C) $\frac{5\pi}{6}$

(D) 0

100. $\int_0^a \frac{\sqrt{x}}{\sqrt{a-x}+\sqrt{x}}\, dx =$ [1 mark]

(A) a

(B) $\frac{a}{2}$

(C) $2a$

(D) $3a$

Section B: Short Answer Type Questions (any 15 to be answered, 2 marks each)

SA-1. **Find the distance between the planes $2x - y + 3z + 4 = 0$ and $6x - 3y + 9z - 3 = 0$.** [2 marks]

SA-2. **Find the value of p so that the straight lines $\frac{x-1}{-1} = \frac{y+3}{p} = \frac{z-7}{2}$ and $\frac{x+1}{p} = \frac{y}{2} = \frac{z+6}{-3}$ are perpendicular to each other.** [2 marks]

SA-3. **If $f : R \to R;\ f(x) = (3 - x^3)^{\frac{1}{3}}$, then prove that $(f \circ f)(x) = x$.** [2 marks]

SA-4. **Integrate : $\int \frac{dx}{1+\cos x}$.** [2 marks]

SA-5. **Integrate : $\int \sec^4 x\, dx$.** [2 marks]

SA-6. **Integrate :** $\int \frac{\sin^{-1} x}{\sqrt{1-x^2}}\, dx$**.** [2 marks]

SA-7. **Find** $\frac{dy}{dx}$ **when** $x^{\sin y} = y^{\sin x}$**.** [2 marks]

SA-8. **Find the inverse matrix of the following matrix :** $\begin{pmatrix} 4 & 1 \\ 2 & 3 \end{pmatrix}$ [2 marks]

SA-9. **If matrix** $A = \begin{pmatrix} 1 & 2 \\ -3 & 4 \end{pmatrix}$, $B = \begin{pmatrix} 0 & 7 \\ 2 & -4 \end{pmatrix}$**, then find the value of** $(4A - B)$**.** [2 marks]

SA-10. **If** $\vec{a} + \vec{b} + \vec{c} = \vec{0}$**, then prove that** $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a}$**.** [2 marks]

SA-11. **Find the area of the parallelogram whose adjacent sides are vectors** $\hat{i} + 2\hat{j} + 3\hat{k}$ **and** $-3\hat{i} - 2\hat{j} + \hat{k}$**.** [2 marks]

SA-12. **Find the sine of the angle between the two vectors** $3\hat{i} + \hat{j} + 2\hat{k}$ **and** $2\hat{i} - 2\hat{j} + 4\hat{k}$**.** [2 marks]

SA-13. **Find the slope at the point** $(1, \sqrt{2})$ **of the curve** $x^2 + y^2 = 3$**.** [2 marks]

SA-14. **Find** $\frac{dy}{dx}$ **when** $x = at^2,\ y = 2at$**.** [2 marks]

SA-15. **If** $y = \sec\{\tan(\sqrt{x})\}$**, then find** $\frac{dy}{dx}$**.** [2 marks]

SA-16. **Prove that** $\tan^{-1} 1 + \tan^{-1} 2 + \tan^{-1} 3 = \pi$**.** [2 marks]

SA-17. **Find the value of** $2\tan^{-1}\frac{1}{3} + \tan^{-1}\frac{1}{7}$**.** [2 marks]

SA-18. **Prove that** $\sec^2(\tan^{-1} 2) + \text{cosec}^2(\cot^{-1} 3) = 15$**.** [2 marks]

SA-19. **Integrate :** $\int \frac{dx}{x^2 + 6x + 13}$**.** [2 marks]

SA-20. **Find the value of** $\int_0^a \frac{x\, dx}{\sqrt{a^2 + x^2}}$**.** [2 marks]

SA-21. **Solve :** $\log_e\left(\frac{dy}{dx}\right) = ax + by$**.** [2 marks]

SA-22. **Solve :** $\int_1^2 \frac{\log x}{x}\, dx$**.** [2 marks]

SA-23. **Find the value of** $\int_0^{\pi/2} \frac{\sqrt{\cos x}}{\sqrt{\cos x} + \sqrt{\sin x}}\, dx$**.** [2 marks]

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SA-24. **Solve :** $\frac{dy}{dx} + 2y \tan x = \sin x$. [2 marks]

SA-25. **Prove that the value of the determinant** $\begin{vmatrix} 102 & 18 & 36 \\ 1 & 3 & 4 \\ 17 & 3 & 6 \end{vmatrix} = 0$. [2 marks]

SA-26. **Prove that** $\begin{vmatrix} 0 & a & b \\ c & 0 & b \\ c & a & 0 \end{vmatrix} = 2abc$. [2 marks]

SA-27. **Find the value of** x**, when** $\begin{vmatrix} 2x & 8 \\ 4 & x \end{vmatrix} = 0$. [2 marks]

SA-28. **If** A **and** B **are two events such that** $P(A) = \frac{1}{4},\ P(B) = \frac{1}{3}$ **and** $P(A \cup B) = \frac{1}{2}$ **then prove that** A **and** B **are independent events.** [2 marks]

SA-29. **Two dice are thrown. Find the probability that the numbers appeared have the sum 8 if the second die always exhibits 4.** [2 marks]

SA-30. **Maximize** $Z = 3x + 2y$
subject to $3x + y \leq 15$
$x \geq 0,\ y \geq 0$ [2 marks]

Section B: Long Answer Type Questions (any 4 to be answered, 5 marks each)

LA-31. **Prove that** $\begin{vmatrix} x & y & z \\ x^2 & y^2 & z^2 \\ yz & zx & xy \end{vmatrix} = (x-y)(y-z)(z-x)(xy+yz+zx)$. [5 marks]

LA-32. **If** $\sin^{-1} x + \sin^{-1} y + \sin^{-1} z = \pi$ **then prove that** $x\sqrt{1-x^2} + y\sqrt{1-y^2} + z\sqrt{1-z^2} = 2xyz$. [5 marks]

LA-33. **Solve :** $(x^2 - y^2)\frac{dy}{dx} = 2xy$. [5 marks]

LA-34. **Prove that** $\int_0^{\pi/2} \left(\sqrt{\tan x} + \sqrt{\cot x}\right) dx = \pi\sqrt{2}$. [5 marks]

LA-35. **Find** $\frac{dy}{dx}$**, when** $x^y + y^x = 1$. [5 marks]

LA-36. **Prove that** $|\vec{a} \times \vec{b}|^2 + (\vec{a} \cdot \vec{b})^2 = a^2b^2$. [5 marks]

LA-37. **Maximize** $Z = x + y$
subject to $x - y \leq -1$

$-x + y \leq 0,\ x \geq 0,\ y \geq 0$ [5 marks]

LA-38. **10 coins are tossed. What is the probability that exactly 5 heads appear ?** [5 marks]