

Question Paper

Conducted by the Central Board of Secondary Education (CBSE)



Time Allowed: 2 Hours

Maximum Marks: 40

General Instructions

- (i) This question paper contains **14 questions**. All questions are compulsory.
- (ii) Section A: Questions 1 to 6 carry 2 marks each.
- (iii) Section B: Questions 7 to 10 carry 3 marks each.
- (iv) Section C: Questions 11 to 14 carry 4 marks each.
- (v) Question 14 is a case study with two subparts, each carrying 2 marks.
- (vi) Attempt one alternative where an internal choice is provided. Follow the instructions within each question.
- (vii) Use of calculators is not allowed.

Section A

1. Write the projection of the vector $(\vec{b} + \vec{c})$ on the vector $\vec{a}$, where $\vec{a} = 2\hat{i} - 2\hat{j} + \hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} - 2\hat{k}$ and $\vec{c} = 2\hat{i} - \hat{j} + 4\hat{k}$.

2. Find the general solution of the differential equation: $\log\left(\frac{dy}{dx}\right) = ax + by$.

3. Two cards are drawn successively with replacement from a well shuffled pack of 52 cards. Find the probability distribution of the number of spade cards.

4. A pair of dice is thrown and the sum of the numbers appearing on the dice is observed to be 7. Find the probability that the number 5 has appeared on at least one die.

OR

The probability that A hits the target is $\frac{1}{3}$ and the probability that B hits it, is $\frac{2}{5}$. If both try to hit the target independently, find the probability that the target is hit.

5. If the distance of the point $(1, 1, 1)$ from the plane $x - y + z + \lambda = 0$ is $\frac{5}{\sqrt{3}}$, find the value(s) of λ .

6. Find: $\int \frac{dx}{x^2 - 6x + 13}$.

Section B

7. If $\vec{a}, \vec{b}, \vec{c}$ are three vectors such that $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c}$ and $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}$, $\vec{a} \neq \vec{0}$, then show that $\vec{b} = \vec{c}$.

OR

If $|\vec{a}| = 3$, $|\vec{b}| = 5$, $|\vec{c}| = 4$ and $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, then find the value of $(\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a})$.

8. Evaluate: $\int_{-1}^2 |x^3 - x| dx$.

9. Show that the lines: $\frac{1-x}{2} = \frac{y-3}{4} = \frac{z}{-1}$ and $\frac{x-4}{3} = \frac{2y-2}{-4} = z-1$ are coplanar.

10. Find the particular solution of the differential equation $x \frac{dy}{dx} - y = x^2 e^x$, given $y(1) = 0$.

OR

Find the general solution of the differential equation $x \frac{dy}{dx} = y(\log y - \log x + 1)$.

11. Find: $\int \frac{x^2}{(x^2 + 1)(3x^2 + 4)} dx.$

OR

Evaluate: $\int_{-2}^1 \sqrt{5 - 4x - x^2} dx.$

12. Using integration, find the area of the region bounded by the curves $x^2 + y^2 = 4$, $x = \sqrt{3}y$ and x -axis lying in the first quadrant.

13. Find the distance of the point $(1, -2, 9)$ from the point of intersection of the line $\vec{r} = 4\hat{i} + 2\hat{j} + 7\hat{k} + \lambda(3\hat{i} + 4\hat{j} + 2\hat{k})$ and the plane $\vec{r} \cdot (\hat{i} - \hat{j} + \hat{k}) = 10$.

14. Case Study Problem:

A shopkeeper sells three types of flower seeds A_1 , A_2 , A_3 . They are sold in the form of a mixture, where the proportions of these seeds are 4 : 4 : 2, respectively. The germination rates of the three types of seeds are 45%, 60% and 35% respectively.

Based on the above information, answer the following questions:

14(a). Calculate the probability that a randomly chosen seed will germinate.

14(b). Calculate the probability that the seed is of type A_2 , given that a randomly chosen seed germinates.

- End of Question Paper -