

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. Find the vector equation of a line passing through a point with position vector $2\hat{i} - \hat{j} + \hat{k}$ and parallel to the line joining the points $-\hat{i} + 4\hat{j} + \hat{k}$ and $\hat{i} + 2\hat{j} + 2\hat{k}$.

2. Find: $\int \frac{dx}{\sqrt{4x - x^2}}$.

3. Find the general solution of the following differential equation: $\frac{dy}{dx} = e^{x-y} + x^2 e^{-y}$.

4. (a) Events A and B are such that $P(A) = \frac{1}{2}$, $P(B) = \frac{7}{12}$ and $P(\overline{A \cup B}) = \frac{1}{4}$. Find whether the events A and B are independent or not.

OR

(b) A box B_1 contains 1 white ball and 3 red balls. Another box B_2 contains 2 white balls and 3 red balls. If one ball is drawn at random from each of the boxes B_1 and B_2 , then find the probability that the two balls drawn are of the same colour.

5. Let X be a random variable which assumes values x_1, x_2, x_3, x_4 such that $2P(X = x_1) = 3P(X = x_2) = P(X = x_3) = 5P(X = x_4)$. Find the probability distribution of X .

6. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{a} \cdot \vec{b} = 1$ and $\vec{a} \times \vec{b} = \hat{j} - \hat{k}$, then find $|\vec{b}|$.

Section B

7. (a) Find: $\int e^x \sin 2x \, dx$.

OR

(b) Find: $\int \frac{2x}{(x^2 + 1)(x^2 + 2)} \, dx$.

8. Find the equation of the plane passing through the line of intersection of the planes $\vec{r} \cdot (\hat{i} + \hat{j} + \hat{k}) = 10$ and $\vec{r} \cdot (2\hat{i} + 3\hat{j} - \hat{k}) + 4 = 0$ and passing through the point $(-2, 3, 1)$.

9. (a) Let $\vec{a} = \hat{i} + \hat{j}$, $\vec{b} = \hat{i} - \hat{j}$ and $\vec{c} = \hat{i} + \hat{j} + \hat{k}$. If $\hat{n}$ is a unit vector such that $\vec{a} \cdot \hat{n} = 0$ and $\vec{b} \cdot \hat{n} = 0$, then find $|\vec{c} \cdot \hat{n}|$.

OR

(b) If $\vec{a}$ and $\vec{b}$ are unit vectors inclined at an angle 30° to each other, then find the area of the parallelogram with $(\vec{a} + 3\vec{b})$ and $(3\vec{a} + \vec{b})$ as adjacent sides.

10. Evaluate: $\int_0^{\pi/2} \frac{1}{1 + (\tan x)^{2/3}} \, dx$.

Section C

11. (a) Solve the following differential equation:
 $(y - \sin^2 x) dx + \tan x dy = 0$.

OR

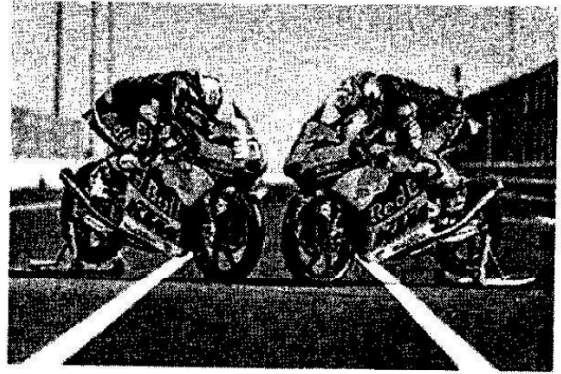
(b) Find the general solution of the differential equation: $(x^3 + y^3) dy = x^2 y dx$.

12. Find the area bounded by the curves $y = |x - 1|$ and $y = 1$, using integration.

13. In a factory, machine A produces 30% of total output, machine B produces 25% and the machine C produces the remaining output. The defective items produced by machines A , B and C are 1%, 1.2%, 2% respectively. An item is picked at random from a day's output and found to be defective. Find the probability that it was produced by machine B .

14. Case Study Problem:

Two motorcycles A and B are running at the speed more than the allowed speed on the roads represented by the lines $\vec{r} = \lambda(\hat{i} + 2\hat{j} - \hat{k})$ and $\vec{r} = (3\hat{i} + 3\hat{j}) + \mu(2\hat{i} + \hat{j} + \hat{k})$ respectively.



Based on the above information, answer the following questions:

14(a). Find the shortest distance between the given lines.

14(b). Find the point at which the motorcycles may collide.

- End of Question Paper -