

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. The Cartesian equation of a line AB is: $\frac{2x-1}{12} = \frac{y+2}{2} = \frac{z-3}{3}$. Find the direction cosines of a line parallel to line AB .

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

3. (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.

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

5. 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 $|\vec{b}|$.

6. 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 .

Section B

7. (a) If $\vec{a}$ and $\vec{b}$ are two vectors such that $|\vec{a} + \vec{b}| = |\vec{b}|$, then prove that $(\vec{a} + 2\vec{b})$ is perpendicular to $\vec{a}$.

OR

(b) If $\vec{a}$ and $\vec{b}$ are unit vectors and θ is the angle between them, then prove that $\sin \frac{\theta}{2} = \frac{1}{2} |\vec{a} - \vec{b}|$.

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

OR

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

9. Evaluate: $\int_1^3 \frac{\sqrt{x}}{\sqrt{x} + \sqrt{4-x}} \, dx$.

10. Find the distance of the point $(2, 3, 4)$ measured along the line $\frac{x-4}{3} = \frac{y+5}{6} = \frac{z+1}{2}$ from the plane $3x + 2y + 2z + 5 = 0$.

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

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

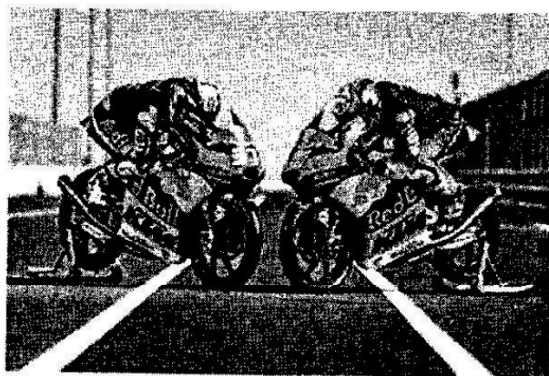
OR

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

13. There are two boxes, namely box-I and box-II. Box-I contains 3 red and 6 black balls. Box-II contains 5 red and 5 black balls. One of the two boxes, is selected at random and a ball is drawn at random. The ball drawn is found to be red. Find the probability that this red ball comes out from box-II.

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 -