

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. A pair of dice is thrown. It is given that the sum of numbers appearing on both dice is an even number. Find the probability that the number appearing on at least one die is 3.

2. $\vec{a}$ and $\vec{b}$ are two unit vectors such that $|2\vec{a} + 3\vec{b}| = |3\vec{a} - 2\vec{b}|$. Find the angle between $\vec{a}$ and $\vec{b}$.

3. (a) Find: $\int \frac{\sin 3x - 3x}{\sin x} dx$

OR

(b) Evaluate: $\int_0^{\log 3} \frac{x e^x}{e^x + 1} dx$

4. Probabilities of A and B solving a specific problem are $\frac{2}{3}$ and $\frac{3}{5}$ respectively. If both of them try independently to solve the problem, then find the probability that the problem is solved.

5. Write the cartesian equation of the line PQ passing through points $P(2, 2, 1)$ and $Q(5, 1, -2)$. Hence, find the y -coordinate of the point on the line PQ whose z -coordinate is -2 .

6. Find the particular solution of the differential equation $\frac{dy}{dx} = 2y^2$, given $y = 1$ when $x = 1$.

Section B

7. (a) Find the equation of the plane passing through points $(2, 1, 0)$, $(3, -2, -2)$ and $(1, 1, -7)$. Also, obtain its distance from the origin.

OR

(b) Find the distance between the lines $x = \frac{y-1}{2} = \frac{z-2}{3}$ and $x+1 = \frac{y+2}{2} = \frac{z-1}{3}$.

8. Find the general solution of the differential equation $x \frac{dy}{dx} - y + x \sin\left(\frac{y}{x}\right) = 0$.

9. (a) Evaluate:

$$\int_0^1 \tan^{-1} x \, dx$$

OR

(b) Find:

$$\int \frac{2x}{x^2 + 3x + 2} \, dx$$

10. Using vectors, find the value of ' b ' if the points $A(-1, -1, 2)$, $B(2, b, 5)$ and $C(3, 11, 6)$ are collinear. Also, determine the ratio in which the point B divides the line-segment AC internally.

Section C

11. (a) Using integration, find the area of the smaller region enclosed by the curve $4x^2 + 4y^2 = 9$ and the line $2x + 2y = 3$.

OR

(b) If the area of the region bounded by the curve $y^2 = 4ax$ and the line $x = 4a$ is $\frac{256}{3}$ sq. units, then using integration, find the value of a , where $a > 0$.

12. Find the distance of the point $(-1, -5, -10)$ from the point of intersection of the line $\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-2}{12}$ and the plane $x - y + z = 5$.

13. Evaluate: $\int_0^{\pi/2} \frac{x}{\sin x + \cos x} dx$

14. Case-Study Based Question

At the start of a cricket match, a coin is tossed and the team winning the toss has the opportunity to choose to bat or bowl. Such a coin is unbiased with equal probabilities of getting head and tail.

Based on the above information, answer the following questions:

(a) If such a coin is tossed 2 times, then find the probability distribution of number of tails. [2]

(b) Find the probability of getting at least one head in three tosses of such a coin. [2]

- End of Question Paper -