

Pre Board Exam 2021-22

Class XII
Mathematics

Time Allowed: 2 hours

Maximum Marks: 40

General Instructions:

1. This question paper contains three sections - A, B and C. Each part is compulsory.
2. Section - A has 6 short answer type (SA1) questions of 2 marks each.
3. Section - B has 4 short answer type (SA2) questions of 3 marks each.
4. Section - C has 4 long answer type questions (LA) of 4 marks each.
5. There is an internal choice in some of the questions.
6. Q14 is a case-based problem having 2 sub parts.

Section A (2 marks questions)

1. What is the mean of the numbers obtained on throwing a die having written 1 on three faces, 2 on two faces and 5 on one face?

2. A and B are two independent events with $P(A) = 0.3$ and $P(B) = 0.6$, then find

- (i) $P(A \text{ or } B)$ (ii) $P(\text{neither } A \text{ nor } B)$

3. Evaluate: $\int \frac{1}{\sqrt{3-2x-x^2}} dx$.

4. Find the sum of the order and degree of the differential equation:

$$\frac{d^2y}{dx^2} + \sqrt[3]{\frac{dy}{dx}} + (1+x) = 0.$$

5. If $|\vec{a} + \vec{b}| = 60$, $|\vec{a} - \vec{b}| = 40$ and $|\vec{a}| = 22$, then find $|\vec{b}|$.

6. Find the vector equation of the line passing through the point A (1,2,-1) and parallel to the line $5x - 25 = 14 - 7y = 35z$.

Or

Find the shortest distance between the following lines:

$$\vec{r} = (\hat{i} + 2\hat{j} + 3\hat{k}) + \lambda(\hat{i} - \hat{j} + \hat{k}) \text{ and } \vec{r} = (2\hat{i} - \hat{j} - \hat{k}) + \mu(-\hat{i} + \hat{j} - \hat{k}).$$

Section B (3 marks questions)

7. Solve the following differential equation:

$$x \frac{dy}{dx} + y - x + x y \cot x = 0$$

Or

Find the particular solution of the differential equation:

$$[x \sin^2(y/x) - y] dx + x dy = 0 \text{ given that when } x = 1, y = \pi/4.$$

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

9. If $\vec{a} = \hat{i} + 4\hat{j} + 2\hat{k}$, $\vec{b} = 2\hat{i} - 2\hat{j} + 7\hat{k}$ and $\vec{c} = 2\hat{i} - \hat{j} + 4\hat{k}$, find a vector \vec{d} which is perpendicular to both the vectors \vec{a} and \vec{b} and $\vec{c} \cdot \vec{d} = 27$.

10. Evaluate: $\int \frac{\sin 4x - 4}{1 - \cos 4x} e^x dx$.

Section C (4 marks questions)

11. Find the area of the region in the first quadrant enclosed by the x-axis, the line $x = \sqrt{3}y$ and the circle $x^2 + y^2 = 4$.

Or

Using integration, find the area of the region bounded by the following curves, after making a rough sketch:

$$y = |x + 1|, x = -3, x = 3, y = 0.$$

12. Find: $\int_0^\pi \frac{x \tan x}{\sec x + \tan x} dx, x \neq \frac{\pi}{2}$

Or

$$\text{Find: } \int \frac{x^2}{x^4 - x^2 - 12} dx.$$

13. Find the equation of the plane passing through the line of intersection of the planes $\vec{r} \cdot (\hat{i} + \hat{j} + \hat{k}) = 1$ and $\vec{r} \cdot (2\hat{i} + 3\hat{j} - \hat{k}) + 4 = 0$ and parallel to x-axis.

Case-based question (4 marks)

14. A letter is known to have come either from TATANAGAR or KOLKATA. On the envelope, only two consecutive letters TA are visible when it is received.

Based on the given information, answer the following questions:

What is the probability that the letter has come from (i) KOLKATA (ii) TATANAGAR?