

Sample Question Paper - 15
Mathematics (041)
Class- XII, Session: 2021-22
TERM II

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. Q 14 is a case-based problem having 2 sub-parts of 2 marks each.

Section - A

[2 Marks each]

1. Evaluate $\int \frac{\cos 2x}{(\sin x + \cos x)^2} dx$

OR

Find: $\int \frac{e^x(x-3)}{(x-1)^3} dx.$

2. Find the sum of the order and the degree of the following differential equations:

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

3. Find the position vector of a point which divides the join of points with position vectors $(\vec{a} - 2\vec{b})$ and $(2\vec{a} + \vec{b})$ externally in the ratio 2 : 1.
4. Find the equation of line passing through (1, 1, 2) and (2, 3, -1).
5. If A and B are two independent events, then prove that the probability of occurrence of at least one of A and B is given by $1 - P(A) \cdot P(B')$
6. One bag contains 3 red and 5 black balls. Another bag contains 6 red and 4 black balls. A ball is transferred from first bag to the second bag and then a ball is drawn from the second bag. Find the probability that the ball drawn is red.

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Section - B

[3 Marks each]

7. Prove that: $\int_0^a f(x)dx = \int_0^a f(a-x)dx$, hence evaluate $\int_0^\pi \frac{x \sin x}{1 + \cos^2 x} dx$. [AI]

8. Find the general solution of the following differential equation: $x dy - (y + 2x^2)dx = 0$ [AI]
OR

Solve the following differential equation. $\sqrt{1+x^2+y^2+x^2y^2} + xy \frac{dy}{dx} = 0$ [AI]

9. Find the area of a rectangle having vertices A, B, C and D with position vectors $-\hat{i} + \frac{1}{2}\hat{j} + 4\hat{k}$, $\hat{i} + \frac{1}{2}\hat{j} + 4\hat{k}$, $\hat{i} - \frac{1}{2}\hat{j} + 4\hat{k}$ and $-\hat{i} - \frac{1}{2}\hat{j} + 4\hat{k}$, respectively. [AI]
OR

The two vectors $\hat{j} + \hat{k}$ and $3\hat{i} - \hat{j} + 4\hat{k}$ represent the two sides AB and AC, respectively of ΔABC . Find the length of the median through A. [AI]

10. Write the sum of intercepts cut off by the plane $\vec{r} \cdot (2\hat{i} + \hat{j} - \hat{k}) - 5 = 0$ on the three axes.

Section - C

[4 Marks each]

11. A bag A contains 4 black and 6 red balls and bag B contains 7 black and 3 red balls. A die is thrown. If 1 or 2 appears on it, then bag A is chosen, otherwise bag B. If two balls are drawn at random (without replacement) from the selected bag, find the probability of one of them being red and another black.

12. Find the area of the region bounded by the circle $x^2 + y^2 = 1$.

OR

Find the area of the region bounded the curve $y = x + 1$ and the lines $x = 2$ and $x = 3$.

13. If the vector $\vec{p} = a\hat{i} + \hat{j} + \hat{k}$, $\vec{q} = \hat{i} + b\hat{j} + \hat{k}$ and $\vec{r} = \hat{i} + \hat{j} + c\hat{k}$ are coplanar, then for $a, b, c \neq 1$, then show that.

$$\frac{1}{1-a} + \frac{1}{1-b} + \frac{1}{1-c} = 1$$

[AI]

Case-Based/Data Based

14. The rate of increase in the number of bacteria in a certain bacteria culture is proportional to the number present. Given that the number triples in 5 hours.



Based on the above information, answer the following questions:

(i) If 'N' is the number of bacteria, then find the differential equation. Also, find the general solution of obtained differential equation. [2]

(ii) If N_0 is the initial count of bacteria, the find the bacteria count after 10 hours. [2]

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