SUBJECT: MATHEMATICS CLASS: XIII

MAX. MARKS | 100 **DURATION: 3 HRS**

General Instruction:

- (i) All questions are compulsory.
- (ii) This question paper contains 29 questions.
- (iii) Question 1-4 in Section A are very short-answer type questions carrying 1 mark each.
- (iv) Question 5-12 in Section B are short-answer type questions carrying 2 marks each.
- (v) Question 13-23 in Section C are long-answer-I type questions carrying 4 marks each.
- (vi) Question 24-29 in Section D are long-answer-II type questions carrying 6 marks each.

SECTION - A Questions 1 to 4 carry 1 mark each.

- 1. If the binary operation * on the set of integers Z, is defined by $a *b = a + 3b^2$, then find the value of 2 = 4.
- 2. If $f: R \rightarrow R$ be defined by $f(x) = (3 x^3)^{1/3}$, then find $f \circ f(x)$.
- If A is a 3 × 3 matrix, |A| ≠ 0 and |3A| = k |A|, then write the value of k.
- Find a vector in the direction of vector 2i-3j+6k which has magnitude 21 units

Find the unit vector in the direction of vector \overrightarrow{PQ} , where P and Q are the points (1, 2, 3) and (4, 5, 6), respectively.

SECTION - B

Onestions 5 to 12 carry 2 marks each.

- 5. Prove that $\tan^{-1} \sqrt{x} = \frac{1}{2} \cos^{-1} \left(\frac{1-x}{1+x} \right), x \in (0,1)$
- 6. If $\begin{bmatrix} x-y & z \\ 2x-y & w \end{bmatrix} = \begin{bmatrix} -1 & 4 \\ 0 & 5 \end{bmatrix}$, find the value of x+y.
- 7. If $y = \cot^{-1} \sqrt{\frac{1 \sin x}{1 + \sin x}}$, find $\frac{dy}{dx}$.
- **8.** Evaluate: $\int \frac{xe^x}{(1+x)^2} dx$

OR

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

- 9. Find the approximate change in the volume V of a cube of side x meters caused by increasing the side by 2%.
- 10. If \vec{a} and \vec{b} are perpendicular vectors, $|\vec{a} + \vec{b}| = 13$ and $|\vec{a}| = 5$ find the value of $|\vec{b}|$.

If $\vec{a} = 5\vec{i} - \hat{j} - 3\hat{k}$ and $\vec{b} = \hat{i} + 3\hat{j} - 5\hat{k}$, then show that the vectors $\vec{a} - \vec{b}$ and $\vec{a} + \vec{b}$ are perpendicular.

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