#### 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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Michael Rajnik

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