

**SUBJECT: MATHEMATICS CLASS : XII**
**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.**

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

**OR**

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**
**Questions 5 to 12 carry 2 marks each.**

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

**OR**

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

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

**OR**

If  $\vec{a} = 5\hat{i} - \hat{j} - 3\hat{k}$  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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**Sabine Zange**



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