

PART 1 - MATHEMATICS

Topic : Vector algebra

SECTION-A : (Maximum Marks : 8)

This section contains **TWO** questions.

Each question has **TWO** lists: **List-I** and **List-II**.

Four options are given representing matching of elements from List-I and List-II. **ONLY ONE** of these four options corresponds to a correct matching.

For each question, choose the option corresponding to the correct answer.

Answer to each question will be evaluated according to the following marking scheme :

Full Marks : +4 If **ONLY** the correct option is chosen;

Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);

Negative Marks : -1 In all other cases.

1. Let $\vec{a}$, $\vec{b}$ be two vectors, and let P, Q and R be the points with position vectors $\vec{a}$, $\vec{b}$ and $\vec{a} + \vec{b}$, respectively, with respect to the origin O. If $|\vec{a} + \vec{b}| = \sqrt{21}$, $|\vec{a} - \vec{b}| = 3$, and $\vec{a}$ and $(\vec{a} - \vec{b})$ are perpendicular to each other, then the area of the triangle OPR is

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- (A) $\sqrt{3}$ (B) $\frac{\sqrt{3}}{2}$ (C) $\frac{3\sqrt{3}}{2}$ (D) $\frac{3}{2}$

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2. Let $\vec{w} = \hat{i} + \hat{j} - 2\hat{k}$, and $\vec{u}$ and $\vec{v}$ be two vectors, such that $\vec{u} \times \vec{v} = \vec{w}$ and $\vec{v} \times \vec{w} = \vec{u}$. Let α , β , γ , and t be real numbers such that
- $$\vec{u} = \alpha\hat{i} + \beta\hat{j} + \gamma\hat{k}, \quad -t\alpha + \beta + \gamma = 0, \quad \alpha - t\beta + \gamma = 0, \quad \text{and } \alpha + \beta - t\gamma = 0.$$

Match each entry in **List-I** to the correct entry in **List-II** and choose the correct option.

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List-I		List-II	
P.	$ \vec{v} ^2$ is equal to	1.	0
Q.	If $\alpha = \sqrt{3}$, then γ^2 is equal to	2.	1
R.	If $\alpha = \sqrt{3}$, then $(\beta + \gamma)^2$ is equal to	3.	2
S.	If $\alpha = \sqrt{2}$, then $t + 3$ is equal to	4.	3
		5.	5

- (A) (P) $\rightarrow$ (2), (Q) $\rightarrow$ (1), (R) $\rightarrow$ (4), (S) $\rightarrow$ (5) (B) (P) $\rightarrow$ (2), (Q) $\rightarrow$ (4), (R) $\rightarrow$ (3), (S) $\rightarrow$ (5)
 (C) (P) $\rightarrow$ (2), (Q) $\rightarrow$ (1), (R) $\rightarrow$ (4), (S) $\rightarrow$ (3) (D) (P) $\rightarrow$ (5), (Q) $\rightarrow$ (4), (R) $\rightarrow$ (1), (S) $\rightarrow$ (3)

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Space for Rough Work

SECTION-B : (Maximum Marks : 4)

This section contains **ONE** question.

The answer to each question is a **NON-NEGATIVE INTEGER**.

For each question, enter the correct integer corresponding to the answer in the place designated to enter the answer.

Answer to each question will be evaluated according to the following marking scheme :

Full Marks : +4 If **ONLY** the correct answer is entered;

Zero Marks : 0 In all other cases.

3. Let $\vec{p} = 2\hat{i} + \hat{j} + 3\hat{k}$ and $\vec{q} = \hat{i} - \hat{j} + \hat{k}$. If for some real numbers α , β , and γ , we have $15\hat{i} + 10\hat{j} + 6\hat{k} = \alpha(2\vec{p} + \vec{q}) + \beta(\vec{p} - 2\vec{q}) + \gamma(\vec{p} \times \vec{q})$, then the value of γ is _____.

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Space for Rough Work

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Test Pattern : **JEE (Advanced)**

ANSWER KEY

SECTION-A

[illegible]

SECTION-B

[illegible]