

## Three Dimensional Geometry - Class XII

### Past Year JEE Questions

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#### Questions

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##### Question: 01

The magnitude of the projection of the vector  $2\hat{i} + 3\hat{j} + \hat{k}$  on the vector perpendicular to the plane containing the vectors  $\hat{i} + \hat{j} + \hat{k}$  and  $\hat{i} + 2\hat{j} + 3\hat{k}$ , is

- A.  $\frac{\sqrt{3}}{2}$
- B.  $\sqrt{6}$
- C.  $\sqrt{\frac{3}{2}}$
- D.  $3\sqrt{6}$

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#### Solutions

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##### Solution: 01

##### Explanation

Let vector  $\vec{p}$  is perpendicular to the both vectors  $\hat{i} + \hat{j} + \hat{k}$  and  $\hat{i} + 2\hat{j} + 3\hat{k}$ .

$$\therefore \vec{p} = (\hat{i} + \hat{j} + \hat{k}) \times (\hat{i} + 2\hat{j} + 3\hat{k})$$

$$= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 1 & 1 \\ 1 & 2 & 3 \end{vmatrix}$$

$$= \hat{i} - 2\hat{j} + \hat{k}$$

Now a vector  $\vec{a} = 2\hat{i} + 3\hat{j} + \hat{k}$  is given and we have to findout projection of vector  $\vec{a}$  on  $\vec{p}$ .

$\therefore$  Projection of vector  $\vec{a}$  on  $\vec{p}$

$$= |\vec{a}| \cos \theta$$

$$= |\vec{a}| \times \frac{\vec{a} \cdot \vec{p}}{|\vec{a}| |\vec{p}|}$$

$$= \frac{\vec{a} \cdot \vec{p}}{|\vec{p}|}$$

$$= \frac{(2\hat{i} + 3\hat{j} + \hat{k}) \cdot (\hat{i} - 2\hat{j} + \hat{k})}{\sqrt{1+4+1}}$$

$$= \frac{2-6+1}{\sqrt{6}}$$

$$= \frac{-3}{\sqrt{6}}$$

Magnitude of projection of vector  $\vec{a}$  on  $\vec{p}$

$$= \left| \frac{-3}{\sqrt{6}} \right| = \frac{3}{\sqrt{6}} = \frac{\sqrt{6}}{\sqrt{2}}$$