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# **JEE Main & Advanced** **Physics DPP**

**DPP-2 Vectors (Unit Vectors, Resolution of a vector)**  
**By Physicsaholics Team**

Q) Direction of unit vector of vector  $\vec{A}$  is:

- (a) Always in the direction of  $\vec{A}$
- (b) Always opposite to the direction of  $\vec{A}$
- (c) Always perpendicular to the direction of  $\vec{A}$
- (d) In any random direction.

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Ans. a

Unit Vector of  $\vec{A} = \hat{A}$

$$\hat{A} = \frac{\vec{A}}{|\vec{A}|}$$

$\hat{A}$  has magnitude 1 and is in the direction of  $\vec{A}$ .



Q) Which of the following is negative vector of  $\vec{A} = 2\hat{i} - 3\hat{j} + 4\hat{k}$ :

(a)  $\vec{B} = 2\hat{i} - 3\hat{j} + 4\hat{k}$

(b)  $\vec{B} = 2\hat{i} + 3\hat{j} + 4\hat{k}$

(c)  $\vec{B} = -2\hat{i} - 3\hat{j} - 4\hat{k}$

(d)  $\vec{B} = -2\hat{i} + 3\hat{j} - 4\hat{k}$

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Ans. d

$$\vec{A} = 2\hat{i} - 3\hat{j} + 4\hat{k}$$

Negative vector ( $\vec{B}$ ) =  $-\vec{A} = -(2\hat{i} - 3\hat{j} + 4\hat{k})$

$$\boxed{\vec{B} = -2\hat{i} + 3\hat{j} - 4\hat{k}}$$

Q) Find the magnitude of vector  $\vec{P} = 10\hat{i} + 30\hat{j}$  :

(a)  $10\sqrt{10}$

(b)  $10\sqrt{20}$

(c)  $20\sqrt{10}$

(d) 45

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Ans. a

Given,  $\vec{p} = 10\hat{i} + 30\hat{j}$

$$\therefore |\vec{p}| = p = \sqrt{10^2 + (30)^2}$$

$$p = \sqrt{10^2 + 900}$$

$$p = \sqrt{100 + 900} = \sqrt{1000}$$

$$\boxed{p = 10\sqrt{10}}$$

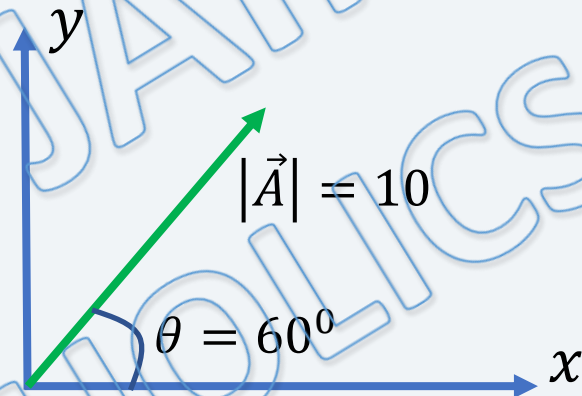
Q) Represent the given vector in  $\hat{i}$  &  $\hat{j}$  notation:

(a)  $\vec{A} = 5\hat{i} + 5\hat{j}$

(b)  $\vec{A} = 5\hat{i} - 5\hat{j}$

(c)  $\vec{A} = 5\hat{i} + 5\sqrt{3}\hat{j}$

(d)  $\vec{A} = 5\sqrt{3}\hat{i} + 5\hat{j}$

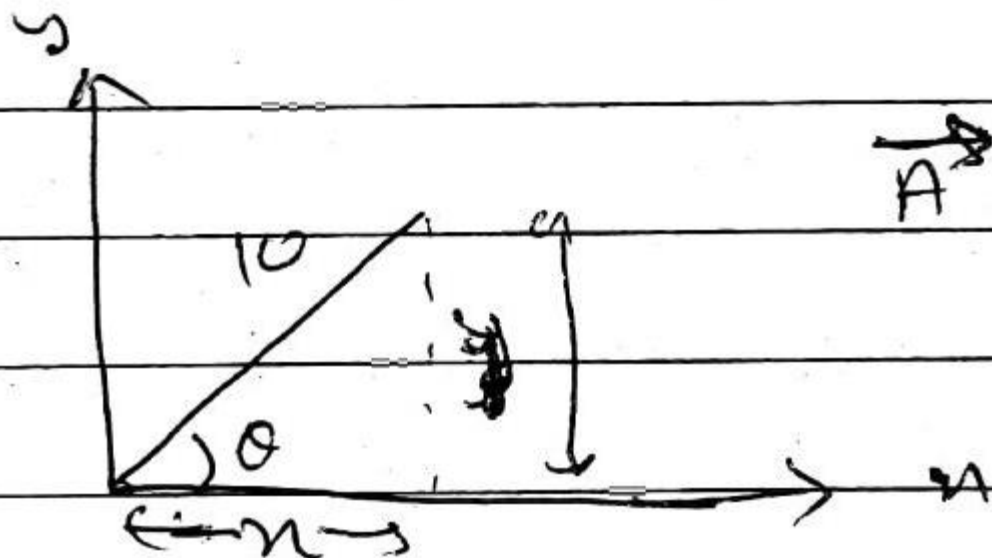


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Ans. c





$$\vec{A} = x\hat{i} + y\hat{j}$$

$$x = 10 \cos 60^\circ = 5$$

$$y = 10 \sin 60^\circ = 5\sqrt{3}$$

$$\vec{A} = x\hat{i} + y\hat{j}$$

$$\vec{A} = 5\hat{i} + 5\sqrt{3}\hat{j}$$

Q) Find a unit vector in the direction of  $\vec{P} = \hat{i} + \hat{j}$ :

(a)  $\hat{P} = \hat{i} + \hat{j}$

(b)  $\hat{P} = \frac{\hat{i}}{\sqrt{2}} + \frac{\hat{j}}{\sqrt{2}}$

(c)  $\hat{P} = \hat{i} - \hat{j}$

(d)  $\hat{P} = \frac{\hat{i}}{\sqrt{2}} - \frac{\hat{j}}{\sqrt{2}}$

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Ans. b

$$\vec{p} = \hat{i} + \hat{j}$$

$$\hat{p} = \frac{\vec{p}}{|\vec{p}|}$$

$$|\vec{p}| = \sqrt{1^2 + 1^2} = \sqrt{2}$$

$$\therefore \hat{p} = \frac{\vec{p}}{\sqrt{2}} = \frac{\hat{i} + \hat{j}}{\sqrt{2}}$$

$$\hat{p} = \frac{\hat{i}}{\sqrt{2}} + \frac{\hat{j}}{\sqrt{2}}$$

Q) Find a vector  $\vec{Q}$  of magnitude 5 unit in the the direction of  $\vec{P} = 6\hat{i} + 8\hat{j}$ :

(a)  $\vec{Q} = 6\hat{i} + 8\hat{j}$

(b)  $\vec{Q} = 3\hat{i} + 4\hat{j}$

(c)  $\vec{Q} = \frac{6}{\sqrt{2}}\hat{i} + \frac{8}{\sqrt{2}}\hat{j}$

(d)  $\vec{Q} = \frac{3}{\sqrt{2}}\hat{i} + \frac{4}{\sqrt{2}}\hat{j}$

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Ans. b

$$\vec{p} = 6\hat{i} + 8\hat{j}$$

$$\hat{p} = \frac{\vec{p}}{|\vec{p}|} ; |\vec{p}| = \sqrt{6^2 + 8^2}$$

$$|\vec{p}| = 10$$

$$\hat{p} = \frac{6\hat{i} + 8\hat{j}}{10} = \frac{3}{5}\hat{i} + \frac{4}{5}\hat{j}$$

$$\vec{q} = |\vec{q}| \cdot \hat{p} = 5 \cdot \hat{p}$$

$$\vec{q} = 5 \left( \frac{3}{5}\hat{i} + \frac{4}{5}\hat{j} \right)$$

$$\boxed{\vec{q} = 3\hat{i} + 4\hat{j}}$$



Q) Find a vector of magnitude 3 in the direction opposite to the direction of  $\vec{c} = \frac{1}{2}\hat{i} + \frac{1}{2}\hat{j}$ :

(a)  $\vec{P} = -\frac{1}{2}\hat{i} - \frac{1}{2}\hat{j}$

(b)  $\vec{P} = -\frac{3}{2}\hat{i} - \frac{3}{2}\hat{j}$

(c)  $\vec{P} = -\frac{\sqrt{3}}{2}\hat{i} - \frac{\sqrt{3}}{2}\hat{j}$

(d)  $\vec{P} = -\frac{3}{\sqrt{2}}\hat{i} - \frac{3}{\sqrt{2}}\hat{j}$

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Ans. d

$$\vec{c} = \frac{1}{2}\hat{i} + \frac{1}{2}\hat{j}$$

$$\text{direction of } \vec{c} = \hat{c} = \frac{c\vec{c}}{|\vec{c}|}$$

$$|\vec{c}| = \sqrt{\left(\frac{1}{2}\right)^2 + \left(\frac{1}{2}\right)^2} = \frac{1}{\sqrt{2}} \text{ or } \frac{\sqrt{2}}{2}$$

$$\hat{c} = \frac{\frac{1}{2}\hat{i} + \frac{1}{2}\hat{j}}{\left(\frac{1}{\sqrt{2}}\right)}$$

$$\hat{c} = \frac{1}{\sqrt{2}}\hat{i} + \frac{1}{\sqrt{2}}\hat{j}$$

$$\text{opposite direction of } \vec{c} = -\hat{c} = -\frac{1}{\sqrt{2}}\hat{i} - \frac{1}{\sqrt{2}}\hat{j}$$

$$\therefore \text{Vector } \vec{p} = (3)(-\hat{c})$$

$$\vec{p} = 3\left(-\frac{1}{\sqrt{2}}\hat{i} - \frac{1}{\sqrt{2}}\hat{j}\right)$$

$$\boxed{\vec{p} = -\frac{3}{\sqrt{2}}\hat{i} - \frac{3}{\sqrt{2}}\hat{j}}$$

Q) Find the resultant vector  $\vec{R}$ , where  $\vec{R} = \vec{A} + \vec{B}$ , if  $\vec{A} = 2\hat{i} + 3\hat{j}$  and  $\vec{B} = 4\hat{i} - 4\hat{j}$  :

(a)  $\vec{R} = 6\hat{i} + 7\hat{j}$

(b)  $\vec{R} = 6\hat{i} - \hat{j}$

(c)  $\vec{R} = 6\hat{i} - 7\hat{j}$

(d)  $\vec{P} = \hat{i} - \hat{j}$

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Ans. b

$$\vec{A} = 2\hat{i} + 3\hat{j}$$

$$\vec{B} = 4\hat{i} - 4\hat{j}$$

$$\vec{R} = \vec{A} + \vec{B}$$

$$= (2\hat{i} + 3\hat{j}) + (4\hat{i} - 4\hat{j})$$

$$\boxed{\vec{R} = 6\hat{i} - \hat{j}}$$

$$\boxed{\vec{R} = 6\hat{i} - \hat{j}}$$

Q) Find the resultant vector  $\vec{R} = \vec{A} - \vec{B}$ , if  $\vec{A} = 5\hat{i} - 3\hat{j}$  and  $\vec{B} = 3\hat{i} + 7\hat{j}$  :

(a)  $\vec{R} = 2\hat{i} - 10\hat{j}$

(b)  $\vec{R} = 2\hat{i} - 4\hat{j}$

(c)  $\vec{R} = 8\hat{i} - 7\hat{j}$

(d)  $\vec{P} = 2\hat{i} + 4\hat{j}$

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Ans. a

$$\vec{R} = \vec{A} - \vec{B}$$

$$\vec{A} = 5\hat{i} - 3\hat{j}$$

$$\vec{B} = 3\hat{i} + 7\hat{j}$$

$$\vec{R} = \vec{A} - \vec{B}$$

$$= (5\hat{i} - 3\hat{j}) - (3\hat{i} + 7\hat{j})$$

$$\boxed{\vec{R} = 2\hat{i} - 10\hat{j}}$$

Q) If  $\vec{A} = 4\hat{i} - 3\hat{j}$  and  $\vec{B} = 6\hat{i} + 8\hat{j}$ , then magnitude and direction of  $\vec{A} + \vec{B}$ :

- (a)  $5, \tan^{-1}\left(\frac{3}{4}\right)$  from  $x$  - axis
- (b)  $5\sqrt{5}, \tan^{-1}\left(\frac{1}{2}\right)$  from  $x$  - axis
- (c)  $10, \tan^{-1}(5)$  from  $x$  - axis
- (d)  $25, \tan^{-1}\left(\frac{3}{4}\right)$  from  $x$  - axis

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Ans. b

$$\vec{A} = 4\hat{i} - 3\hat{j}$$

$$\vec{B} = 6\hat{i} + 8\hat{j}$$

$$\vec{A} + \vec{B} = 10\hat{i} + 5\hat{j}$$

$$|\vec{A} + \vec{B}| = \sqrt{(10)^2 + (5)^2} = \sqrt{100 + 25}$$

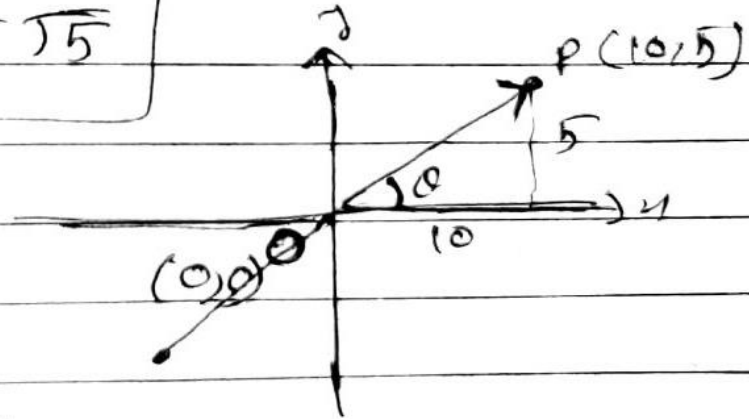
$$|\vec{A} + \vec{B}| = \sqrt{125}$$

$$|\vec{A} + \vec{B}| = 5\sqrt{5}$$

$$\tan \theta = \frac{y}{x}$$

$$\tan \theta = \frac{5}{10} = \frac{1}{2}$$

$$\theta = \tan^{-1}\left(\frac{1}{2}\right) \quad \theta \text{ is from } x\text{-axis.}$$



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