

QUIZ 1

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Semester 01 Class BSCS (Applied Physics) Section 1B

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Q1. Carefully examine the short questions below and answer them in concise and clear way. (5)

- a) What does $\vec{A} \cdot \vec{A}$, the scalar product with it self, give? What about $\vec{A} \times \vec{A}$, the vector product with itself? [2 Marks]

$\vec{A} \times \vec{A}$ i.e self cross product will give a null vector

Proof:

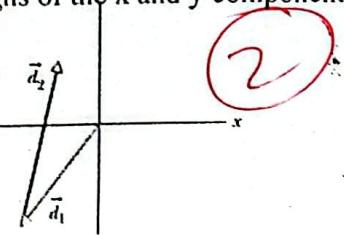
$$\vec{A} \times \vec{A} = A|A| \sin 0^\circ \hat{n} = \boxed{\vec{0}} \quad (\because \sin 0^\circ = 0)$$

$$\vec{A} \cdot \vec{A} = \vec{A}^2 ?$$

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- b) The two vectors shown in figure lie in an xy plane. What are the signs of the x and y components, respectively, of (a) $\vec{d}_1 + \vec{d}_2$ and (b) $\vec{d}_1 - \vec{d}_2$? [2 Marks]

(a) $\vec{d}_1 + \vec{d}_2$ \rightarrow x-component is negative
 \rightarrow y-component is positive



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(b) $\vec{d}_1 - \vec{d}_2$ \rightarrow x-component is negative
 \rightarrow y-component is negative

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- Solution: c) Find the magnitude and direction of $\left(\frac{3}{4}\hat{i} - 2\hat{j}\right)$ [1 Mark]

$$\text{Let } \vec{A} = \frac{3}{4}\hat{i} - 2\hat{j}$$

$$\text{now } |\vec{A}| = \sqrt{A_x^2 + A_y^2} = \sqrt{\left(\frac{3}{4}\right)^2 + (2)^2} = \sqrt{\frac{9}{16} + 4} = \sqrt{\frac{9+64}{16}} = \sqrt{\frac{73}{16}} = \boxed{2.736}$$

$$\theta = \tan^{-1}\left(\frac{2}{\frac{3}{4}}\right) = \tan^{-1}(2.66) = 69.44^\circ \text{ but } \theta = 2\pi - \phi = 360^\circ - 69.44^\circ$$

$$\theta = \boxed{290.55^\circ}$$

Q2: Two vectors are presented as

$$\vec{a} = 3\hat{i} + 5\hat{j} \text{ and,}$$

$$\vec{b} = 2\hat{i} + 4\hat{j}$$

Find (a) $(\vec{a} + \vec{b}) \cdot \vec{b}$, and (b) $\vec{a} \times \vec{b}$. [5 Marks]

Solution:

$$(a) \vec{a} + \vec{b} = 3\hat{i} + 5\hat{j} + 2\hat{i} + 4\hat{j} = 5\hat{i} + 9\hat{j}$$

$$\text{now } (\vec{a} + \vec{b}) \cdot (\vec{b}) = (\vec{a} + \vec{b})(\vec{b}) = (5\hat{i} + 9\hat{j}) \cdot (2\hat{i} + 4\hat{j}) = (5)(2) + (9)(4) = 10 + 36 = \boxed{46}$$

$$(b) \vec{a} \times \vec{b} = (3\hat{i} + 5\hat{j}) \times (2\hat{i} + 4\hat{j}) = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & 5 & 0 \\ 2 & 4 & 0 \end{vmatrix} = \hat{i}(0) - \hat{j}(0) + \hat{k}(12 - 10) = \boxed{2\hat{k}}$$

Quiz Chapter # 03 (Vectors)

Topics Included:

- Addition of Vectors
- Components of vectors
- Unit Vector
- Scalar and Vector Product