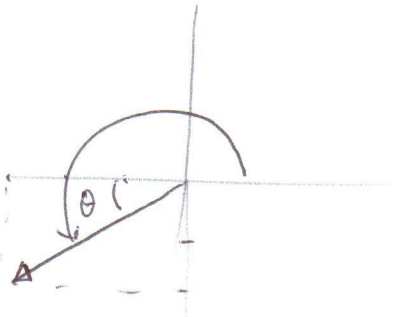
QUIZ#3- CHAPTER 3
DATE: 30/09/19

Name: Key Id#: Sect.#:

(a) Two vectors are given by: $\vec{P} = -1.5\,\mathbf{i} + 2.0\,\mathbf{j}$, $\vec{Q} = +2.0\,\mathbf{j}$. Find the angle the vector $2\vec{P} - 3\vec{Q}$ makes with the positive x-axis.

$2\vec{P} = -3\hat{i} + 4\hat{j} \qquad 3Q = +6\hat{j}$

$2\vec{P} - 3\vec{Q} = (-3\hat{i} + 4\hat{j}) - (+6\hat{j}) = \boxed{-3\hat{i} - 2\hat{j}}$



$\tan\theta = \left(\frac{-2}{-3}\right) = 0.667 \qquad \theta = 33.7°$

the angle with positive $x-$axis $= \boxed{213.7°}$

(b) Find $\vec{P} \times \vec{Q}$

$$\vec{P} \times \vec{Q} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -1.5 & 2 & 0 \\ 0 & 2 & 0 \end{vmatrix} = 0\hat{i} - 0\hat{j} + (-3)\hat{k}$$

$$\boxed{\vec{P} \times \vec{Q} = -3\hat{k}}$$

(c) Find $\vec{P} \cdot \vec{Q}$

$\vec{P} \cdot \vec{Q} = (-1.5\hat{i} + 2\hat{j}) \cdot (+2\cdot\hat{j})$

$= \boxed{4}$

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(a) Two vectors $\vec{A}$ and $\vec{B}$ have the components in meters, $A_x = -4.0$, $A_y = 3.0$, and $B_x = 5.0$, $B_y = 12$. Find the angle between the directions of $\vec{A}$ and $\vec{B}$.

$$\vec{A} \cdot \vec{B} = AB\cos\theta$$

$$A = \sqrt{(-4)^2 + (3)^2} = 5 \qquad B = \sqrt{(5)^2 + (12)^2} = 13$$

$$\vec{A} \cdot \vec{B} = (-4\hat{i} + 3\hat{j}) \cdot (5\hat{i} + 12\hat{j}) = -20 + 36 = 16$$

$$16 = 13 \times 5 \cos\theta \Rightarrow \boxed{\theta = 75.7^\circ}$$

(b) Find the component of $\vec{A}$ along the direction of $\vec{B}$.

$$A\cos\theta = \frac{\vec{A} \cdot \vec{B}}{B} = \frac{16}{13} = \boxed{1.23\,m}$$

(c) Find the component $\vec{B}$ along the direction of $\vec{A}$.

$$B\cos\theta = \frac{\vec{A} \cdot \vec{B}}{A} = \frac{16}{5} = \boxed{3.2\,m}$$

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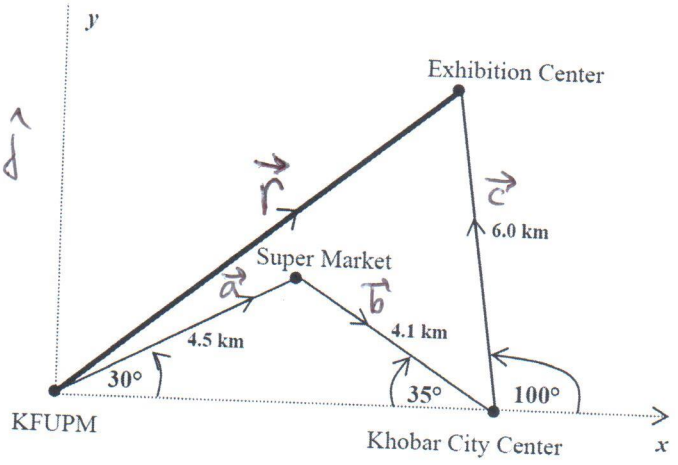
A student makes the journey from KFUPM to a Super Market and then to Khobar City Center and finally to Exhibition Center. The magnitude and the direction of each of these displacements are indicated in the figure. Find the magnitude and direction of the resultant displacement from KFUPM to the Exhibition Center in unit vector notation.



$$\vec{r} = \vec{a} + \vec{b} + \vec{c}$$

$$= (a_x + b_x + c_x)\hat{i} + (a_y + b_y + c_y)\hat{j}$$

$$\vec{a} = 4.5\cos 30^\circ \hat{i} + 4.5 \sin 30^\circ \hat{j}$$

$$= 3.9\hat{i} + 2.3\hat{j}$$

$$\vec{b} = 4.1\cos 35^\circ \hat{i} - 4.1 \sin 35^\circ \hat{j}$$

$$= 3.4\hat{i} - 2.4\hat{j}$$

$$\vec{c} = -6\cos 80^\circ \hat{i} + 6 \sin 80^\circ \hat{j}$$

$$= -1.\hat{i} + 5.9\hat{j}$$

$$\vec{r} = (3.9 + 3.4 - 1)\hat{i} + (2.3 - 2.4 + 5.9)\hat{j} = \boxed{6.3\hat{i} + 5.8\hat{j} \text{ km}}$$

$$r = \sqrt{(6.3)^2 + (5.8)^2} = \boxed{8.5 \text{ km}}$$

$$\theta = \tan^{-1}\left(\frac{5.8}{6.3}\right) = \boxed{42.6^\circ}$$