CH 3. (Vectors)

1-

$$\tan\theta = \frac{B_z}{B_y} = \frac{3}{4}$$

$$\tan\theta = 0.75$$

$$\theta \approx 37^\circ$$

2- $\vec{B} = \bar{B}_x\hat{i} + B_y\hat{j}$, where $B_x = B\cos\theta$

$B_y = B\sin\theta$

$\Rightarrow B_x = 6\cos 120 = -3\ m$

$B_y = 6\sin 120 = 5.2\ m$

$\Rightarrow \vec{B} = -3\hat{i} + 5.2\hat{j}$

$\therefore \bar{A} - \bar{B} = (5\hat{i} + 3j) - (-3\hat{i} + 5.2\hat{j})$

$\bar{A} - \bar{B} = 8\hat{i} - 2.2\hat{j}$

3- To Find the angle we use scalar Product:

$\bar{a} \cdot \bar{b} = ab\cos\theta$ ... (1)

left side: $\bar{a} \cdot \bar{b} = (3\hat{i} + 4\hat{j}) \cdot (5\hat{i} - 2\hat{j})$

$= 15 - 8 = 7$

Right side:

$|a| = \sqrt{(3)^2 + (4)^2} = 5$

$|b| = \sqrt{(5)^2 + (-2)^2} = 5.4$, back to eqn (1)

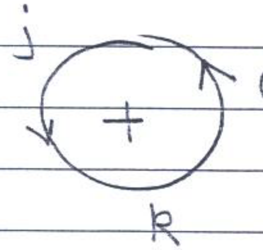
$\Rightarrow 7 = 5 \times 5.4 \times \cos\theta \Rightarrow \cos\theta = \frac{7}{5 \times 5.4} = 0.26$

$\Rightarrow \theta = \cos^{-1}(0.26) \approx 75^\circ$

$(\theta = 75^\circ)$

4- To find $\bar{A}\cdot(\bar{B}\times\bar{A})$, we will 1st find $\bar{B}\times\bar{A}$.

$$\bar{B}\times\bar{A} = (4\hat{i}+4\hat{j})\times(2\hat{i}+3\hat{j}+4\hat{k})$$



$$= 12\hat{k} - 16\hat{j} - 8\hat{k} + 16\hat{i}$$

$$\bar{B}\times\bar{A} = 16\hat{i} - 16\hat{j} + 4\hat{k}$$

Now

$$\bar{A}\cdot(\bar{B}\times\bar{A}) = (2\hat{i}+3\hat{j}+4\hat{k})\cdot(16\hat{i}-16\hat{j}+4\hat{k})$$

$$\bar{A}\cdot(\bar{B}\times\bar{A}) = 32 - 48 + 16 = 0$$

5- lets take that vector to be $\vec{A}$

$$|\vec{A}| = 25$$

$$A_x = 12$$

but $A_x = A\cos\theta$

$$\Rightarrow \cos\theta = \frac{A_x}{A} = \frac{12}{25}$$

$$\cos\theta = 0.48$$

$$\simeq(\theta = 61.3^\circ)$$

6- $\hat{j}\times\hat{k} = +\hat{i} \Rightarrow \hat{i}\cdot(\hat{j}\times\hat{k}) = \hat{i}\cdot\hat{i} = +1$

7- Perpendicular to each other means $\theta = 90$

$$\Rightarrow \bar{A}\cdot\bar{B} = 0 \Rightarrow$$

$$= (3\hat{i}+\hat{j}+2\hat{k})\cdot(2\hat{i}+4\hat{j}-q\hat{k}) = 0$$

$$6 + 4 - 2q = 0 \Rightarrow -2q = -10$$

$$\Rightarrow \boxed{q = 5}$$

8- First we have to write $\bar{B}$ in vector notations

$$\bar{B} = B_x \hat{i} + B_y \hat{j}$$

$B_x = B\cos\Theta$ $\quad$ $\Big\{ \; \Theta$ (from +ve x-axis) = 40 + 90, $\; \Theta = 130°$

$\therefore B_x = 25 \cos 130$

$B_x = -16.1$

$B_y = 25 \sin 130 = 19.2$

$\therefore \bar{B} = -16.1\,\hat{i} + 19.2\,\hat{j}$

$\therefore \bar{A} + \bar{B} = (28\hat{i} + 11\hat{j}) + (-16.1\,\hat{i} + 19.2\,\hat{j})$

$\bar{A} + \bar{B} = 11.9\,\hat{i} + 30.2\,\hat{j}$

$\Rightarrow |(\bar{A} + \bar{B})| = \sqrt{(11.9)^2 + (30.2)^2} = 32$

9- $\bar{B} = -2\bar{A}$

$= -2(-6\hat{i} + 14\hat{j})$

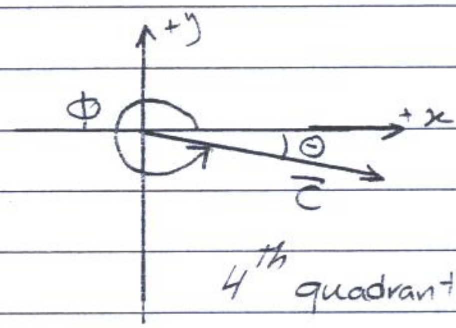
$\bar{B} = 12\hat{i} - 28\hat{j}$

10- $\bar{C} = 2\bar{A} - \bar{B} = 12\hat{i} - 14\hat{j} - (-12\hat{i} + 10\hat{j})$

$\vec{C} = 24\hat{i} - 24\hat{j}$

$\tan\Theta = \dfrac{C_y}{C_x} = \dfrac{-24}{24} = -1$

$\Theta = -45$



$\Rightarrow \Phi = 360 - 45 = 315°$

11 - $x = V + W$ (tail to head) $\Rightarrow$