Adeel

(1) Data:

(a)
$a = 5\hat{i} + 4\hat{j} - 6K$
$b = -2i + 2\hat{j} + 3K$
$c = 4i + 3\hat{j} + 2K$
$r = a + b + C$

Solution:

To find r:

$r = (5\hat{i} + 4\hat{j} - 6\hat{K}) + (-2i + 2j + 3K) + (4i + 3j + 2k)$
$r = 7\hat{i} + 9\hat{j} - \hat{k}$

To find θ:

$\vec{r} \cdot \vec{z} = |\vec{r}||\vec{z}| \cos\theta$
$(7\hat{i} + 9\hat{j} - \hat{k}) \cdot k = \sqrt{49+81+1}\ (1) \cos\theta_1$

$-1 = \sqrt{131} \cos\theta_1$ $\quad\quad \because k \cdot k = 1$

$\cos\theta_1 = \frac{-1}{\sqrt{131}}$

$\theta_1 = \cos^{-1}\left(\frac{-1}{\sqrt{131}}\right)$

$\boxed{\theta_1 = 95.01^\circ}$ Ans

(b) Solution:

$\vec{a} \cdot \vec{b} = |a| \cdot |b| \cos\theta_2$
$(5\hat{i} + 4\hat{j} - 6K)(-2i + 2\hat{j} + 3k) = (\sqrt{77})(\sqrt{17}) \cos\theta_2$

$-10 + 8 - 18 = (\sqrt{77})(\sqrt{17}) \cos\theta_2$

$\theta = \cos^{-1} \frac{-20}{(\sqrt{77})(\sqrt{17})}$

$\boxed{\theta = 123.55^\circ}$ Ans

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(2)

(a) Data:

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

$B = -3\hat{i} + 2\hat{j}$

$\hat{a} + \hat{b} = ?$

Solution:

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

$$\hat{a} = \frac{5i + 3\hat{j}}{\sqrt{34}}$$

$$\hat{b} = \frac{\vec{B}}{|B|}$$

$$b = \frac{-3i + 2\hat{j}}{\sqrt{13}}$$

Now,

$$\hat{a}+\hat{b} = \frac{5i+3j}{\sqrt{34}} + \frac{-3i+2\hat{j}}{\sqrt{13}}$$

$$\hat{a}+\hat{b} = \frac{\sqrt{13}(5i+3\hat{j}) - (3i+2j)(\sqrt{34})}{(\sqrt{34})(\sqrt{13})}$$

$$\boxed{\hat{a}+\hat{b} = \frac{\sqrt{13}(5i+3\hat{j}) - (3i+2j)(\sqrt{34})}{442}}$$

(b)

$A + B = C$

$C = 2\hat{i} + 5\hat{j}$

$|C| = \sqrt{29}$

$\vec{C} \cdot \vec{x} = |C||x| \cos\theta$

$(2i+5j)(\hat{i}) = (\sqrt{29})(1) \cos\theta$

$2 = \sqrt{29} \cos\theta$

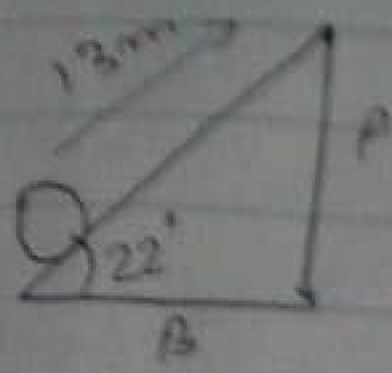
$\frac{2}{\sqrt{29}} = \cos\theta$

$\theta = \cos^{-1}\left(\frac{2}{\sqrt{29}}\right)$

$\boxed{\theta = 68.198^\circ}$ Ans

③ Data:

(a)



let: $p = x$.

Solution:

$$\sin\theta = \frac{x}{13}$$

$$\sin 22^\circ = \frac{x}{13}$$

$$x = (13)(\sin 22^\circ)$$

$$\boxed{x = 4.86\ m}$$ Ans!

(b) Solution:

$$\tan\theta = \frac{P}{B}$$

$$\tan 22^\circ = \frac{4.86}{B}$$

$$B = \frac{4.86}{\tan 22^\circ}$$

$$\boxed{B = 12.02\ m}$$

④ Data:

(a) $A = 20$ units

$B = 40$ units

$C = 30$ units.

for x – component :-

$$F_x = F_1\cos\theta_1 + F_2\cos\theta_2 + F_3\cos\theta_3$$

$$F_x = 20\cos 90^\circ + 40\cos 45 + 30\cos 45$$

$$F_x = 0 + 28.28 + 21.21$$

$$\boxed{F_x = 49.49}$$

Aded

For y-component:

$$F_y = 20\sin 90^\circ + 40\sin 45^\circ - 30\sin 45^\circ$$

$$F_y = 20 + (20)(\sqrt{2}) - 15(\sqrt{2})$$

$$\boxed{F_y = 27.07}$$

(b)

For magnitude:

$$F = \sqrt{(F_x)^2 + (F_y)^2}$$

$$F = \sqrt{(49.49)^2 + (27.07)^2}$$

$$\boxed{F = 56.97}$$

For Direction:

$$\tan\theta = \frac{F_y}{F_x}$$

$$\tan\theta = \frac{27.07}{49.49}$$

$$\theta = \tan^{-1}\frac{27.07}{49.49}$$

$$\boxed{\theta = 28.67^\circ}$$ Ans!

(5) (a) Data:

$\theta = 252^\circ$

$A = 7.34$ units.

$A_x = ?$

$A_y = ?$

Solution:

For A_x:

$A_x = A\cos\theta$

$A_x = (7.34)(\cos 252^\circ)$

$\boxed{A_x = -2.26}$

For A_y:

$A_y = A\sin\theta$

$A_y = (7.34)(\sin 252^\circ)$

$\boxed{A_y = -6.98}$

(b)

$B_x = -25$

$B_y = 43.$

$B = ?$

Solution:

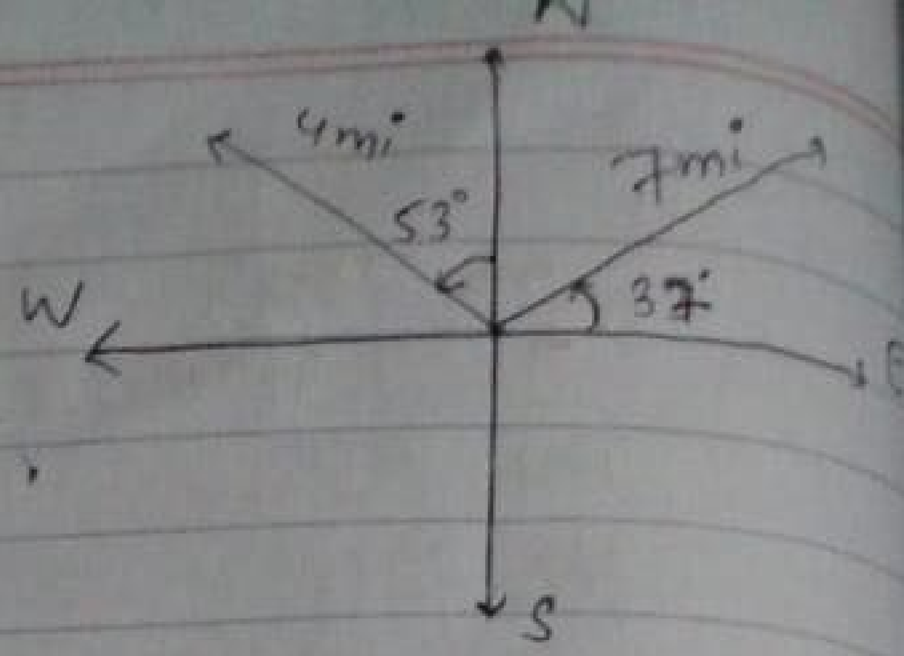
$B = \sqrt{(B_x)^2 + (B_y)^2}$

$\boxed{B = 49.73}$

$\tan\theta = \dfrac{B_y}{B_x}$

$\theta = \tan^{-1}\dfrac{43}{-25}$ $\Rightarrow$ $\boxed{\theta = -59.82^\circ}$ Ans

⑥ Data:



Solution:

$A_x = A_1 \cos\theta_1 + A_2 \cos\theta_2$

$A_x = (7)(\cos 37°) + (7)(\cos 53°)$

$\boxed{A_x = 9.802}$

$A_y = A_1 \sin\theta_1 + A_2 \sin\theta_2.$

$A_y = (4)(\sin 37°) + (4)(\sin 53°)$

$A_y = 5.59$

$\boxed{A_y = 5.59}$

$A = \sqrt{(A_x)^2 + (A_y)^2}$

$A = \sqrt{(9.802)^2 + (5.59)^2}$

$\boxed{A = 11.28}$

$\tan\theta = \dfrac{A_y}{A_x}$

$\tan\theta = \dfrac{5.59}{9.802}$

~~tanθ~~

$\theta = \tan^{-1}\left(\dfrac{5.59}{9.802}\right)$

$\boxed{\theta = 29.69°}$ Ans!

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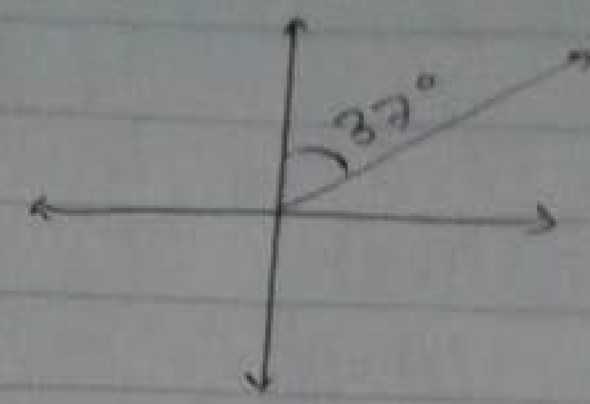
(7) Data:

$A_x = 10m$

$\theta = 37°$

$A = ?$



Solution:

$\because A_x = A\cos\theta.$

$10 = A\cos 37°$

$$A = \frac{10}{\cos 37°}$$

$\boxed{A = 12.52}$ Ans!

(8) (a) Data:

$|\vec{A}| = 3m.$

$|\vec{B}| = 4m$

$\theta_1 = 30°.$

$\theta_2 = 137°$

$A.B = ?$

$|A \times B| = ?$

Solution:

$|A \times B| = A.B \sin 30°$

$|A \times B| = (3)(4)(0.5).$

$\boxed{|A \times B| = 6}$

$\vec{A}.\vec{B} = A.B \cos 30°.$

$= (3)(4)\left(\frac{\sqrt{3}}{\cancel{2}}\right)$

$\boxed{\vec{A}.\vec{B} = 6\sqrt{3}}$

(b)

$|A \times B| = A.B \sin\theta.$

$|A \times B| = (3)(4)\sin 137^\circ$

$|A \times B| = 8.18$

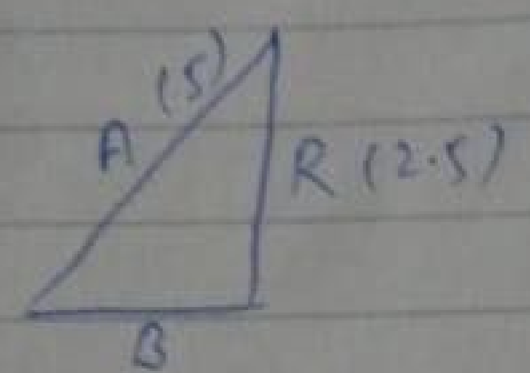
$\vec{A}.\vec{B} = A.B\cos 137^\circ.$

$= (3)(4)\cos 137^\circ.$

$\boxed{\vec{A}.\vec{B} = -8.77}$ Ans!

(9) (a)

Data:



Solution:

Acc. to given condition:

$R = \frac{A}{2}$

$R = \frac{5}{2} \Rightarrow 2.5.$

Now,

By using pythagorean theorem:-

$(Hyp)^2 = (Perp)^2 + (base)^2.$

$(5)^2 = (2.5)^2 + (base)^2.$

$25 = 6.25 + base.$

$18.75 = (B)^2.$

$\boxed{B = 4.3}$

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For angle:

$\sin\theta = \frac{P}{h}$

$\sin\theta = \frac{2.5}{5}$

$\sin\theta = \frac{1}{2}$

$\theta = \sin^{-1}(\frac{1}{2})$

$\boxed{\theta = 30^\circ}$

(10) Data:

$A = 2\hat{i} - 3\hat{j} + 5\hat{k}$.

Solution:

=> from x:

$(2i - 3j + 5k) \cdot x = (\sqrt{38})(1)\cos\theta$.

$\frac{2}{\sqrt{38}} = \cos\theta$.

$\theta = \cos^{-1}\left(\frac{2}{\sqrt{38}}\right)$

$\boxed{\theta = 71.068^\circ}$

=> from y:

$(2i - 3j + 5k) \cdot y = (\sqrt{38})(1)\cos\theta$.

$-3 = \sqrt{38}\cos\theta$.

$\theta = \cos^{-1}\left(\frac{-3}{\sqrt{38}}\right)$

$\boxed{\theta = 119.12^\circ}$

from z:

$(2i - 3j + 5k) \cdot z = (\sqrt{38})(1)\cos\theta$.

$\theta = \cos^{-1}\frac{5}{\sqrt{38}}$

$\boxed{\theta = 35.79^\circ}$ Ans