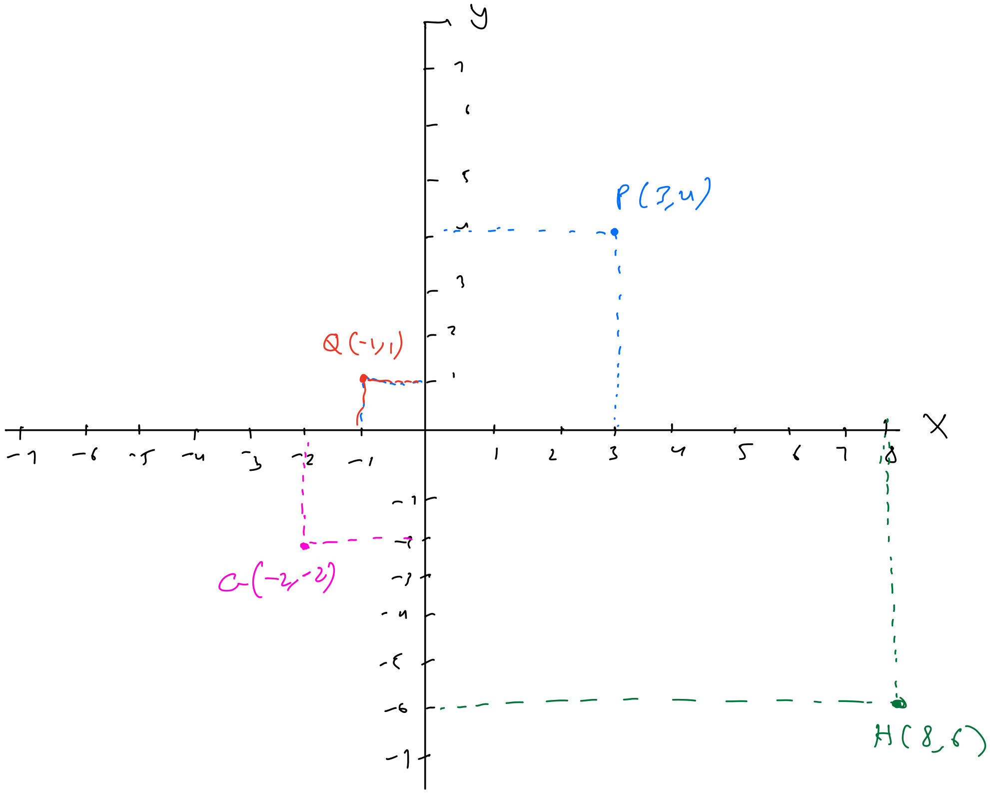
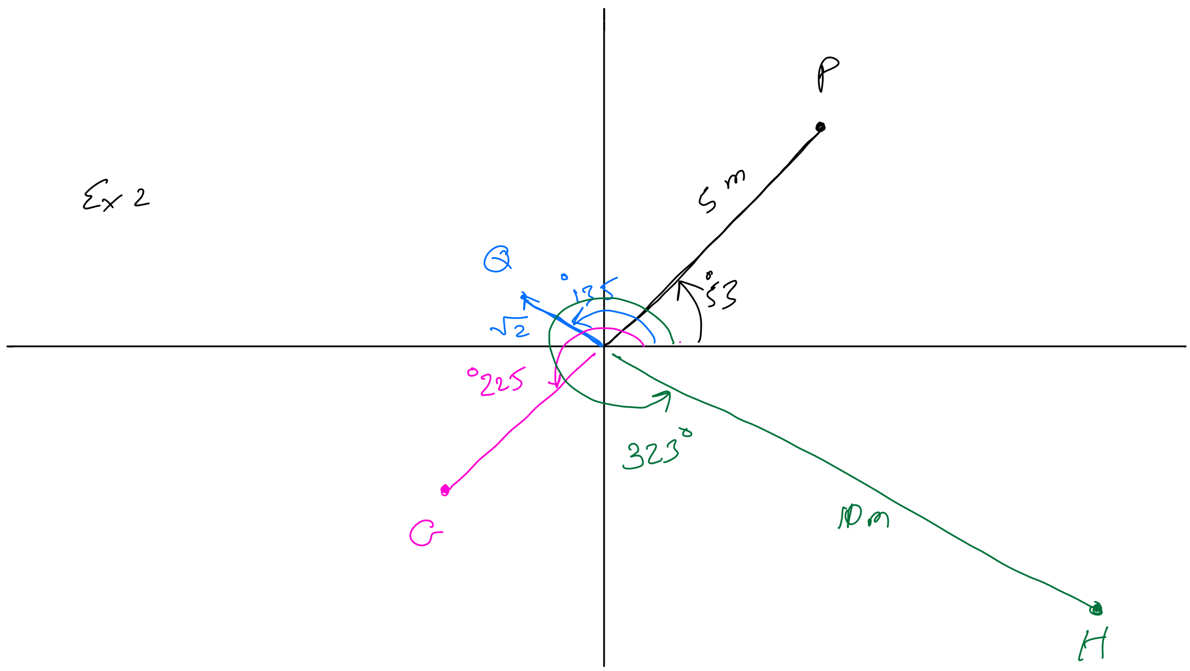
Ex1



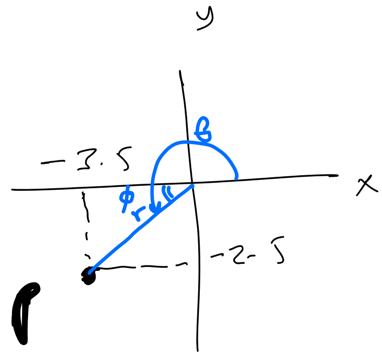
Ex 2



Ex 3.1
P. 54 $\quad P(-3.5, -2.5)\,m \longrightarrow P(r, \theta)$?

$\Rightarrow \quad x = -3.5 \quad m$

$y = -2.5 \quad m$



$r = \sqrt{x^2 + y^2}$

$= \sqrt{(-3.5)^2 + (-2.5)^2}$

$= 4.3 \quad m$

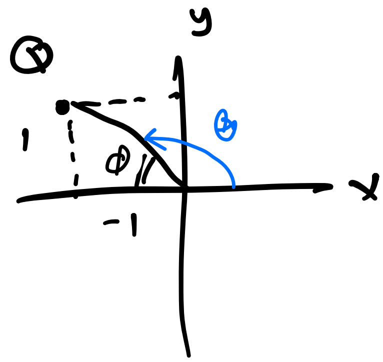
$\tan\phi = \frac{y}{x} = \frac{2.5}{3.5} = 0.714$

$\phi = 35.54 \longrightarrow \theta = 180^\circ + \phi$
$\approx 36 \qquad\qquad = 180 + 36$

$\therefore \quad P(-3.5, -2.5) \Rightarrow P(4.3\,m, 216^\circ)$

Ex 3

$Q(-1, 1)\,m \longrightarrow \begin{array}{l} x = -1 \ m \\ y = 1 \ m \end{array}$



$$r = \sqrt{x^2 + y^2}$$
$$= \sqrt{-1^2 + 1^2}$$
$$= \sqrt{2} \ m$$

$\tan \phi = \frac{1}{1} = 1 \rightarrow \phi = \tan^{-1} 1 = 45^{\circ}$

$$\theta = 180 - \phi$$
$$= 180 - 45$$

$\therefore \quad Q(-1, 1)\,m \longrightarrow Q(\sqrt{2}\,m, 135^{\circ})$

Ex 4 $\quad C(\sqrt{8}\,m,\ 225^\circ)$

$r = \sqrt{8}\ m \qquad \theta = 225^\circ$

$x = r\cos\theta \Rightarrow r = \sqrt{8}\cos 225^\circ$

$= 2\cancel{\sqrt{2}}\left(-\frac{1}{\cancel{\sqrt{2}}}\right)$

$= -2\ m$

$y = r\sin\theta$

$= 2\sqrt{2}\ \sin 225^\circ$

$= 2\cancel{\sqrt{2}}\ \frac{1}{\cancel{\sqrt{2}}} = 2\ m$

$\therefore\ C(\sqrt{8}\,m,\ 225^\circ) \Rightarrow C(-2, 2)\,m$

Ex 6

$r = 10\ mm$

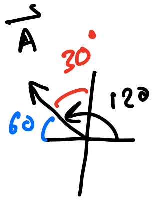
$\theta = 37^\circ + 270 = 323^\circ$

or $\theta = 360 - 37 = 323^\circ$

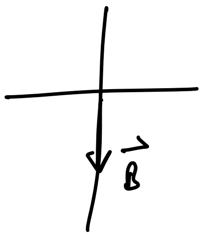
$x = r\cos\theta$	$y = r\sin\theta$
$= 10 \cos 323$	$= 10 \sin 323$
$= (10)(0.8)$	$= 10(-0.6)$
$= 8\ mm$	$= -6\ mm$

$\therefore\ H(10mm, 323^\circ) \longrightarrow H(8, -6)\,mm.$

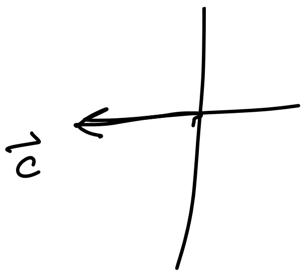
Ex 6



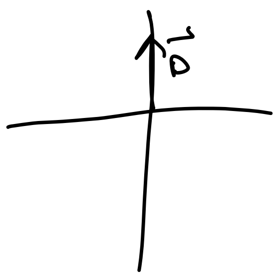
١- المتجه $\vec{A}$ يمثل ازاحه مقدارها 5m باتجاه 120° بالنسبه للمحور السيني الموجب (او 30° غرب الشمال)
(او 60° شمال الغرب)



٢- المتجه $\vec{B}$ يمثل تسارعاً مقداره 10 m/s^2
باتجاه الجنوب

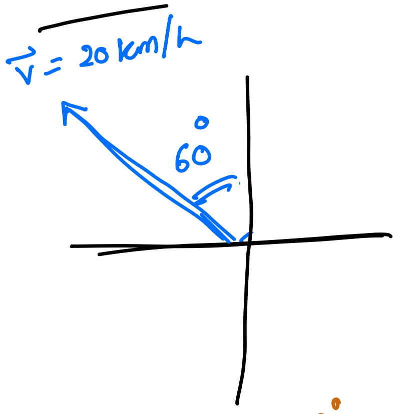


٣- المتجه $\vec{C}$ يمثل قوه مقدارها 3N
باتجاه الغرب



٤- المتجه $\vec{D}$ يمثل حركه مقدارها
7 m/s باتجاه الشمال

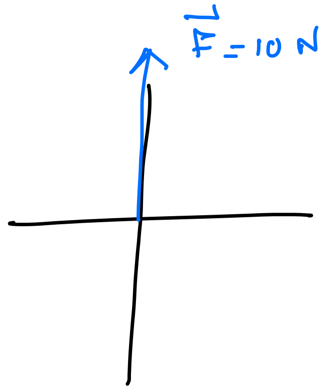
Ex 7



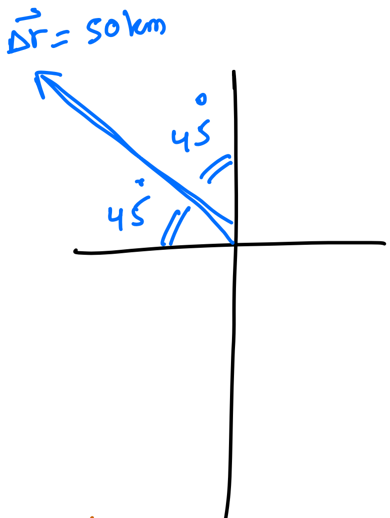
(−5)

$\vec{v} = 20$ km/h, $60°$ west of north

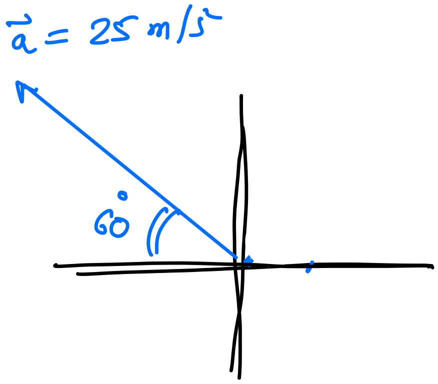
$= 20$ km/h, $150°$



(−1)



(0+2)



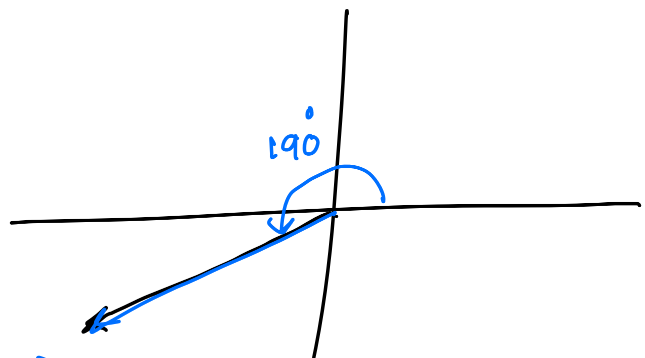
(−5)

$\vec{a} = 25\ m/s^2$, $60°$ north of west

$= 25\ m/s^2$, $120°$

$\Delta\vec{r} = 50$ km, the west of north

$= 50$ km, $135°$



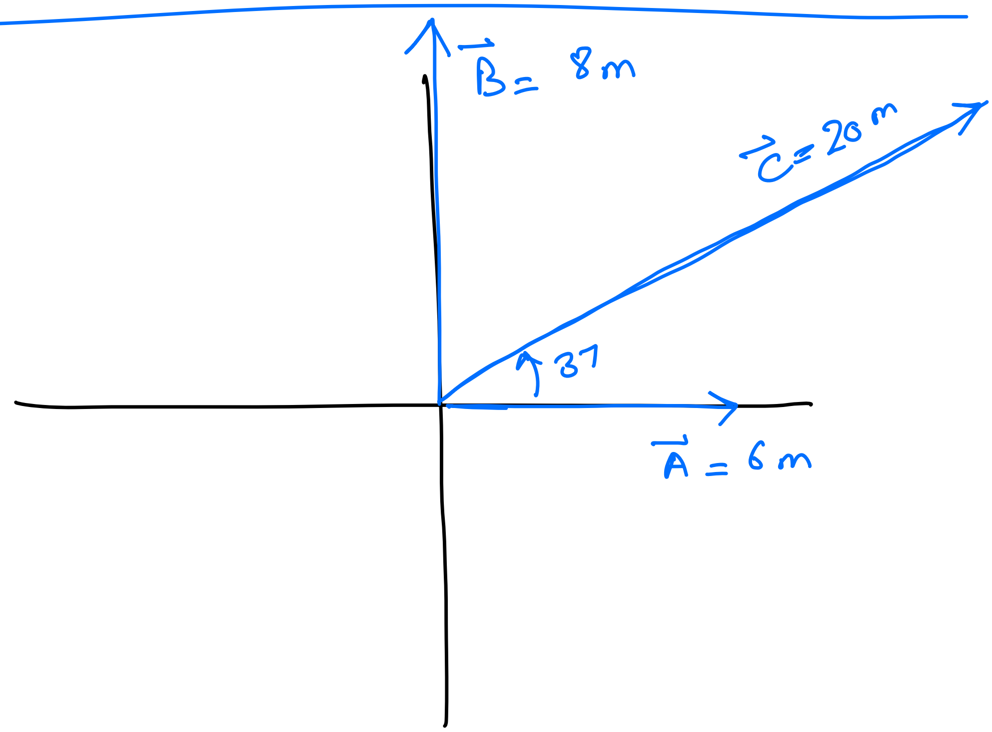
$\vec{V} = 2m/s$

$\vec{V} = 2m/s,\ 190^\circ$

$= 2m/s,\ 10^\circ$ south of west

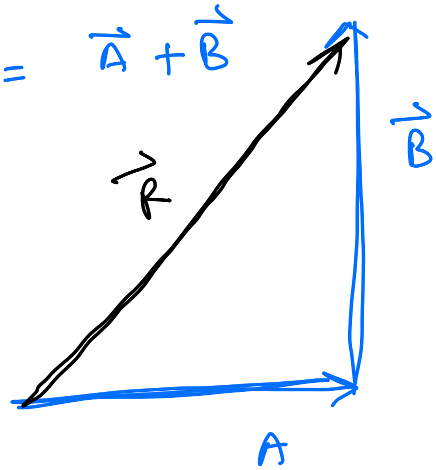
$= 2m/s,\ 80^\circ$ west of south

Ex 8



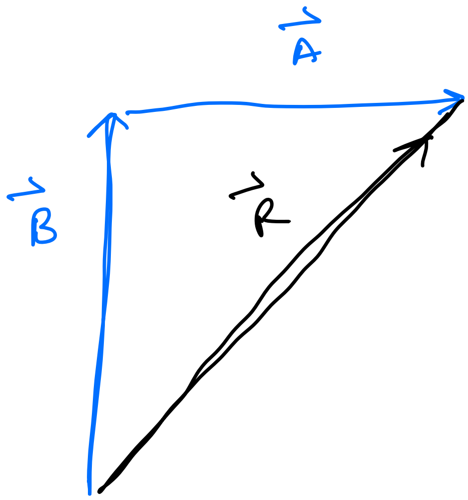
1-

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



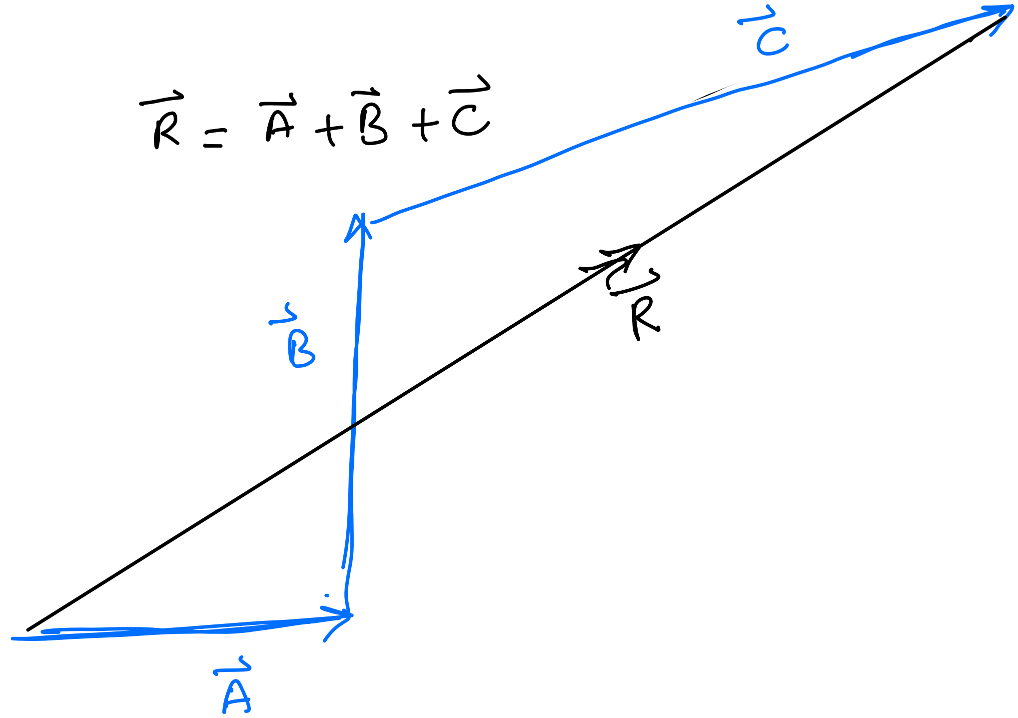
$\vec{R} = \vec{B} + \vec{A}$

2-



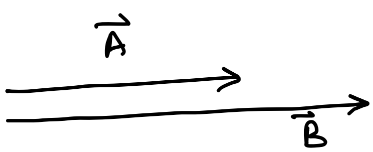
3-

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



Ex 9

١- اقصى محصلة يمكن الحصول عليها عندما يكون المتجهات متوازيان وبنفس الاتجاه (الزاوية بينهما صفراً)

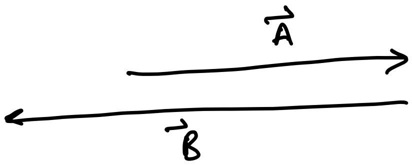


في هذه الحالة ← المحصلة تكون مجموع مقداريهما

$\vec{R} = 3+4 = 7$ units

بنفس اتجاه كل منهما

٢- ادنى محصلة ممكنة الحصول عليها عندما يكون المتجهان متوازيين ومتعاكسين (الزاوية بينهما 180°)

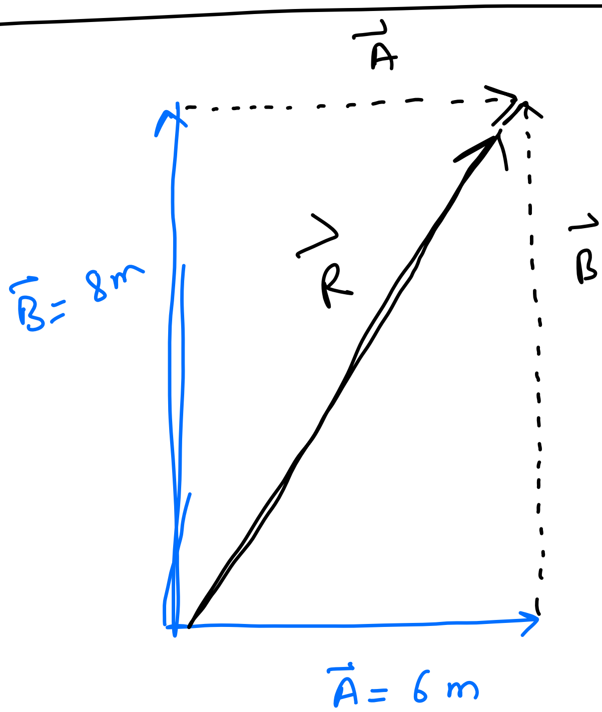


مع في هذه الحالة يكون المحصلة

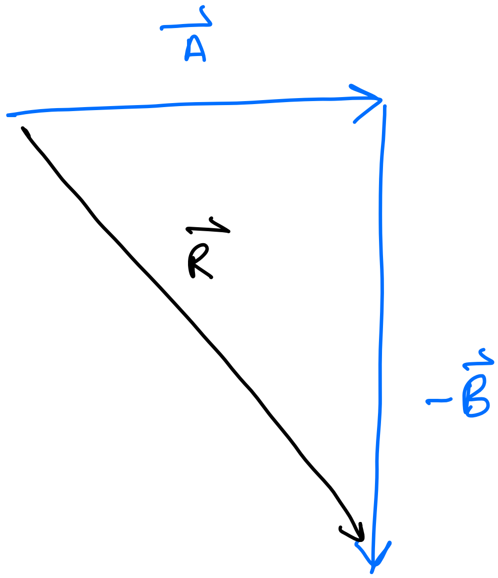
$\vec{R} = 1$ unit

وبنفس اتجاه الاكبر

Ex 10



Ex 11



Ex 12

$\vec{A} = 6\ m/s\ ,\ 0^\circ$

$\vec{B} = 8\ m/s,\ 90^\circ$

$\vec{C} = 20\ m/s\ ,\ 37^\circ$

1- $3\vec{A} = 18\ m/s\ ,\ 0^\circ$

2- $\frac{1}{2}\vec{B} = 4\ m/s\ ,\ 90^\circ$

3- $-2\vec{A} = 12\ m/s\ ,\ 180^\circ$

4- $-\frac{1}{3}\vec{A} = 2\ m/s\ ,\ 180^\circ$

5- $-\frac{1}{4}\vec{C} = 5\ m/s\ ,\ (37^\circ + 180^\circ) \rightarrow 5\ m/s,\ 217^\circ$

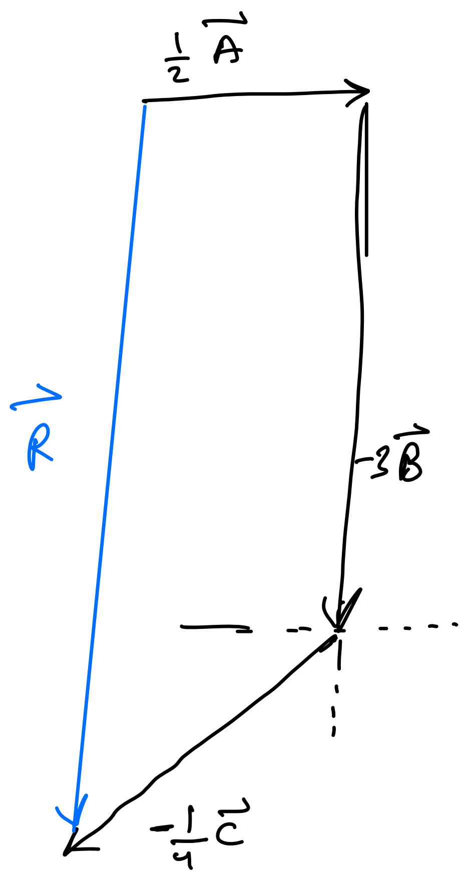
Ex 13

$\frac{1}{2}\vec{A} = 3\ m/s,\ 0°$

$3\vec{B} = 24\ m/s,\ 90° \rightarrow -3\vec{B} = 24\ m/s,\ 270°$

$\frac{1}{4}\vec{C} = 5\ m/s,\ 87° \rightarrow -\frac{1}{4}\vec{C} = 5\ m/s,\ 217°$

$$\vec{R} = \frac{1}{2}\vec{A} + (-3\vec{B}) + (-\frac{1}{4}\vec{C})$$



Ex 14

$\vec{A} = 10$ units, 37°

$A_x = A\cos 37$
$= (10)(0.8) = 8$ units

$A_y = A\sin 37$
$= (10)(0.6) = 6$ units

$\vec{B} = 100$ units, $37+90 \Rightarrow$ 100 units, 127°

$B_x = B\cos 127 = (100)(-0.6)$
$= -60$ units

or $B_x = -B\sin 37$
$= (-100)(0.6) = -60$ units

$B_y = B\sin 127 = (100)(0.8) =$
$= 80$ units

or $B_y = +B\cos 37$
$= (100)(0.8)$
$= 80$ units

$\vec{C} = 20\sqrt{2}$ units, $270-45 \rightarrow 20\sqrt{2}$ units, 225°

$\cancel{B}_x = C\cos 225$
$= 20\cancel{\sqrt{2}}\left(-\frac{1}{\cancel{\sqrt{2}}}\right) = -20$ units

or $C_x = -C\sin 45 = -20$ units

$$C_y = C \sin 225$$
$$= 20\cancel{\sqrt{2}}\left(-\frac{1}{\cancel{\sqrt{2}}}\right)$$
$$= -20 \text{ units}$$

or $C_y = -C\sin 45^\circ$
$= -20$ units

Ex 15

$\vec{A} = 50$ units, 0°

$A_x = 50 \cos 0 = 50$ units

$A_y = 50 \sin 0 = 0$

$\vec{B} = 50$ units, 90°

$B_x = B \cos 90 = 0$

$B_y = B \sin 90 = 50$ units

$\vec{C} = 50$ units, 180°

$C_x = C \cos 180 = -50$ units

$C_y = C \sin 180 = 0$

$\vec{D} = 50$ units, 270°

$D_x = 50 \cos 270^\circ = 0$

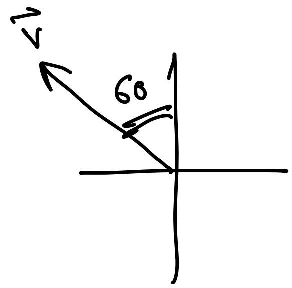
$D_y = 50 \sin 270 = -50$ units

Ex 16

1- $\vec{F} = 10\,N, 90^\circ$

$F_x = 10 \cos 90 = 0$

$F_y = 10 \sin 90 = 10\,N$



2- $\vec{v} = 20\,km/h$, 60° west of north

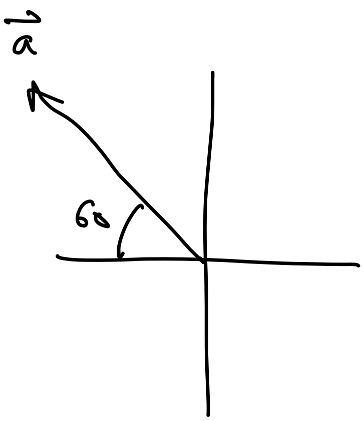
$v_x = -20 \sin 60$

$= (-20)(0.866)$

$\approx -17.3\,km/h$

$v_y = +20 \cos 60$

$= (20)(\frac{1}{2}) = 10\,km/h$



3- $\vec{a} = 25\,m/s^2$, 60° north of west

$a_x = (25)(\cos 60)$

$= (-25)(0.5)$

$= -12.5\,m/s^2$

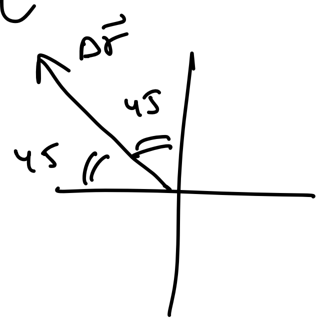
$a_y = (+25)(\sin 60)$

$= (25)(0.866)$

$\approx 21.7\,m/s^2$

4+5) $\Delta \vec{r} = 50$ km, north west

or $\Delta r = 50$ km, westnorth



$$\Delta r_x \equiv \Delta x = -50 \cos 45$$
$$= (-50)(0.7)$$
$$\simeq -35 \text{ km}$$

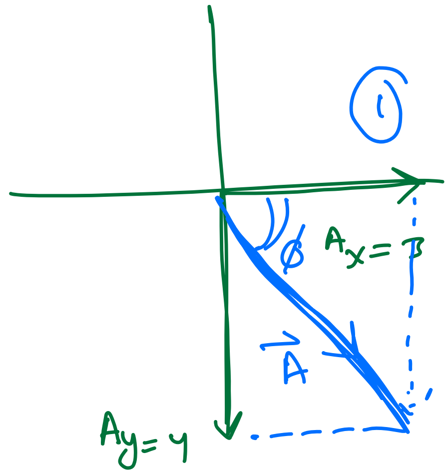
$$\Delta r_y \equiv \Delta y = 50 \cos 45$$
$$= (50)(0.7)$$
$$\simeq 35 \text{ km}$$

6 - $\vec{V} = 2\text{ m/s}, 190^\circ$

$$v_x = (2)\cos 190$$
$$= (2)(-0.98)$$
$$\simeq -1.97 \text{ m/s}$$

$$v_y = (2)\sin 190$$
$$= (2)(-0.17)$$
$$\simeq -0.35 \text{ m/s}$$

Ex 17 $\qquad \vec{A} = 3\hat{i} - 4\hat{j}$ $\begin{cases} A_x = 3\ m \\ A_y = -4\ m \end{cases}$



2

$$|\vec{A}| = \sqrt{A_x^2 + A_y^2}$$

$$= \sqrt{9+16}$$

$$= \sqrt{25} = 5\ m$$

3 $\quad \tan\phi = \frac{|A_y|}{|A_x|} = \frac{4}{3} \rightarrow \phi = \tan^{-1}$

$$\phi \simeq 53^\circ$$

$$\therefore \theta = 360 - 53$$

$$= 306^\circ$$

Ex 18 $\qquad \vec{A} = 3\hat{i} - 4\hat{j} + 3\hat{k}\ m$

$$\vec{B} = 3\hat{i} - 4\hat{j}\ m \rightarrow 2\vec{B} = 6\hat{i} - 8\hat{j}\ m$$

$$\vec{C} = -5\hat{j} - 6\hat{k} \rightarrow -3\vec{C} = 15\hat{j} + 18\hat{k}\ m$$

$$\vec{R} = \vec{A} + 2\vec{B} + {}^{-}3\vec{C} = 9\hat{i} + 3\hat{j} + 21\hat{k}$$

Ex 19

	x-comp	y-comp.	
$\vec{A}$	$A_x = 10 \cos 37$ $= (10)(0.8) = 8\,m$	$A_y = (10) \sin 37$ $= (10)(0.6) = 6m$	$\vec{A} = 8\hat{i} + 6\hat{j}\ m$
$\vec{B}$	$B_x = 5 \cos 53$ $= (5)(0.6) = 3m$	$B_y = -5 \sin 53$ $= (-5)(0.8)$ $= -4\,m$	$\vec{B} = 3\hat{i} - 4\hat{j}\ m$
$\vec{C}$	$C_x = -20\sqrt{2} \sin 45$ $= -20\cancel{\sqrt{2}}\frac{1}{\cancel{\sqrt{2}}}$ $= -20\,m$	$C_y = 20\sqrt{2} \cos 45$ $= 20\sqrt{2}\ \frac{1}{\sqrt{2}}$ $= 20\,m$	$\vec{C} = -20\hat{i} + 20\hat{j}\ m$
$\vec{D}$	$D_x = -3m$	$D_y = 0$	$\vec{D} = -3\hat{i}\ \ m$
$\vec{E}$	$E_x = 0$	$E_y = 4m$	$\vec{E} = 4\hat{j}\ m$

1- $(\vec{A} + \vec{B})_x = A_x + B_x = 8 + 3 = 11\,m$

2- $(A + B)_y = A_y + B_y = 6 + -4 = 2m$

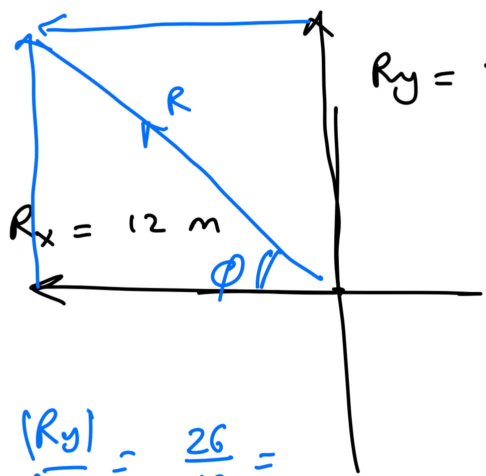
3- $\vec{R}$

$R_x = A_x + B_x + C_x + D_x + E_x$

$= 8 + 3 + -20 + -3 + 0 = -12$ m

$R_y = A_y + B_y + C_y + D_y + E_y$

$= 6 + -4 + 20 + 0 + 4 = 26$ m



$R = \sqrt{(12)^2 + 26^2}$

≈ 28.64 m

$\tan\phi = \frac{|R_y|}{|R_x|} = \frac{26}{12} =$

$\phi \approx 65.22^\circ$

$\theta = 180 - \phi = 180 - 65.22$

$\approx 114.8^\circ$

$$\boxed{\therefore \vec{R} = 28.64 \text{ m}, 114.8^\circ.}$$

Ex 20

$\vec{A} = 3\hat{i} - 4\hat{j} + 3\hat{k}$ m $\rightarrow$ $|\vec{A}| = \sqrt{9+16+9} = \sqrt{34}$ m

$\vec{B} = 3\hat{i} - 4\hat{j}$ m $\rightarrow$ $|\vec{B}| = \sqrt{9+16} = 5$ m

$\vec{C} = -5\hat{j} - 6\hat{k}$ m $\rightarrow$ $|\vec{C}| = \sqrt{25+36} = \sqrt{61}$ m

1- $\vec{A}\cdot\vec{B} = A_xB_x + A_yB_y + A_zB_z = 9 + 16 = 25$

2- $\vec{B}\cdot\vec{A} = B_xA_x + B_yA_y + B_zA_z = 9+16 = 25$

3- $\vec{A}\cdot\vec{A} = A^2 = A_xA_x + A_yA_y + A_zA_z = 9 + 16 + 9 = 34$

4- $\vec{C}\cdot\vec{B} = C_xB_x + C_yB_y + C_zB_z = 0 + 20 + 0 = 20$

5- $-2\vec{A}\cdot 3\vec{C} = (-6)(0) + (8)(15) + (-6)(-18)$

$= 0 + 120 + 108 = 228$

6- $\vec{A}\cdot\vec{B} = A\,B\cos\alpha$

$25 = (\sqrt{34})(5)\cos\alpha \rightarrow \alpha = \cos^{-1}\frac{5}{\sqrt{34}} = 31^\circ$

7- $\vec{A}\cdot\vec{C} = A\,C\cos\alpha$

$(3)(0) + (-4)(-5) + (3)(-6) = (\sqrt{34})(\sqrt{61})\cos\alpha$

$\alpha = \cos^{-1}\frac{2}{(\sqrt{61})(\sqrt{34})} = 87.5^\circ$

8- $\vec{A}\cdot\hat{k} = |\vec{A}||\hat{k}|\cos\alpha$

$3 = (\sqrt{34})(1)\cos\alpha$

$\alpha = \cos^{-1}\frac{3}{\sqrt{34}} = 59^\circ$

9- $\vec{C} \cdot -\hat{i} = |\vec{C}||-\hat{i}| \cos\alpha$

$$0 = \sqrt{61} \cos\alpha$$

$$\alpha = \cos^{-1} 0 = 90^\circ$$

10- $\vec{A} \cdot \vec{D} \Rightarrow A_x D_x + A_y D_y + A_z D_z = |A||\vec{D}| \cos 90^\circ$

$$(3)(0) + (-4)(-5) + (3)\beta = 0$$

$$0 + 20 + 3\beta = 0$$

$$\beta = -\frac{20}{3}$$

Ex 21

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

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

$\vec{C} = -5\hat{j} - 6\hat{k}$ m

1- $\vec{A} \times \vec{B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & -4 & 3 \\ 3 & -4 & 0 \end{vmatrix}$

$= \hat{i}(0+12) - \hat{j}(0-9) + \hat{k}(-12+12)$

$= 12\hat{i} + 9\hat{j}$

2- $\vec{B} \times \vec{A} = \begin{vmatrix} \hat{i} & \hat{j} & k \\ 3 & -4 & 0 \\ 3 & -4 & 3 \end{vmatrix}$

$= \hat{i}(-12-0) - \hat{j}(9-0) + \hat{k}(-12+12)$

$= -12\hat{i} - 9\hat{j}$

3- $\vec{A} \times \vec{A} = |\vec{A}|\,|\vec{A}| \sin 0 = 0$

4- $\vec{C} \times \vec{B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & -5 & -6 \\ 3 & -4 & 0 \end{vmatrix}$

$= \hat{i}(0-24) - \hat{j}(0+18) + \hat{k}(0+15)$

$= -24\hat{i} - 18\hat{j} + 15\hat{k}$

5- $3\hat{i} \times 2\vec{B} = 3\hat{i} \times [6\hat{i} - 8\hat{j}] = 0 - 24\hat{k}$

$\therefore (3\hat{i} \times 2\vec{B}) - 3\vec{C}$

$-24\hat{k} - (-15\hat{j} - 18\hat{k}) = 15\hat{j} - 6\hat{k}$