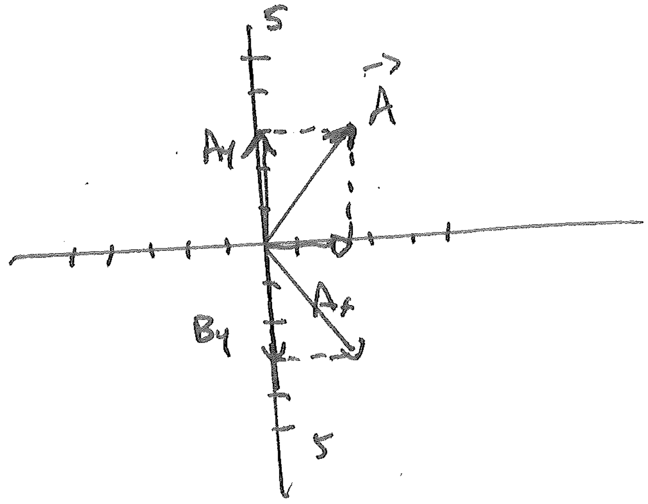
Physics 160

Extra Credit #7

~~[illegible]~~ Components

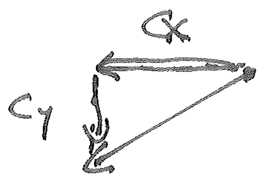


A_x appears to be 2.5 units while A_y is 3

B_y is 3 units down $\Rightarrow B_y = -3$

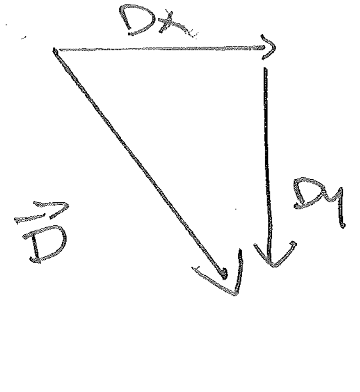
B_x is 2 units right $\Rightarrow B_x = +2$

For clarity, I'll redraw $\vec{C}$



C_x is 2 units to left, C_y is 1 unit down

$\Rightarrow \; C_x = -2, \; C_y = -1$



D_x is 2 units to right, D_y is 3 units down

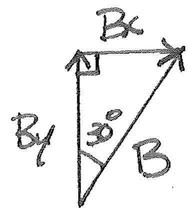
$D_x = +2, \; D_y = -3$

Notice that $B_x = D_x$, $B_y = D_y \Rightarrow \vec{B} = \vec{D}$

Now using Triangles, Trig, & Brains.

$\vec{A}$: A vector straight down has no x-component and a negative y-component $\Rightarrow A_x = 0$

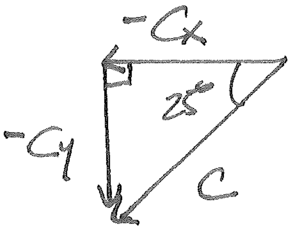
$A_y = -8m$



$\vec{B}$ in First Quad $\Rightarrow B_x > 0,\ B_y > 0$

$\sin 30° = \frac{B_x}{B} \Rightarrow B_x = B\sin 30° = 15m \sin 30° = 7.5m$

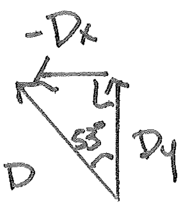
$\cos 30° = \frac{B_y}{B} \Rightarrow B_y = B\cos 30° = 15m \cos 30° = 13m$



$\vec{C}$ in 3rd Quad $\Rightarrow C_x < 0,\ C_y < 0$

$\cos 25° = \frac{-C_x}{C} \Rightarrow C_x = -C\cos 25° = -12m \cos 25° = -10.9m$

$\sin 25° = \frac{-C_y}{C} \Rightarrow C_y = -C\sin 25° = -12m \sin 25° = -5.07m$



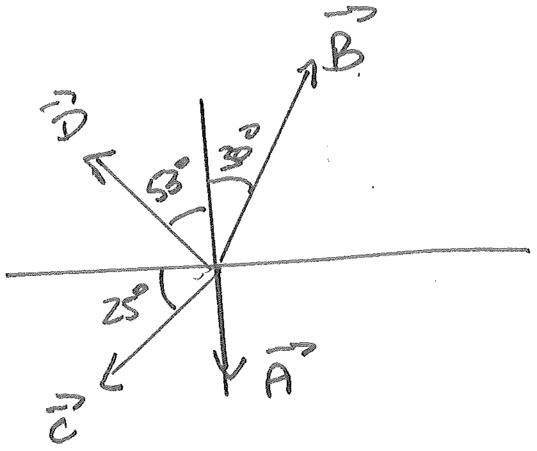
$\vec{D}$ in 2nd Quad $\Rightarrow D_x < 0,\ D_y > 0$

$\sin 53° = \frac{-D_x}{D} \Rightarrow D_x = -D\sin 53° = -10m \sin 53°$

$= -7.99m$

$\cos 53° = \frac{+D_y}{D} \Rightarrow D_y = +D\cos 53° = 10m \cos 53°$

$= +6.02m$



$A = 8m$, $B = 15m$, $C = 12m$, $D = 10m$

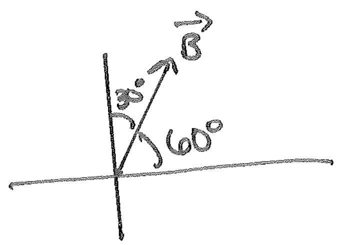
Find Components

First using standard Angles: $\vec{A}$ at 270°

$\Rightarrow A_x = 8m \cos 270^\circ = 0$

$A_y = 8m \sin 270^\circ = -8m$

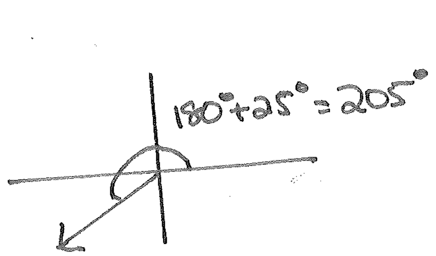
$\vec{B}$



$B_x = 15m \cos 60^\circ = 7.5m$

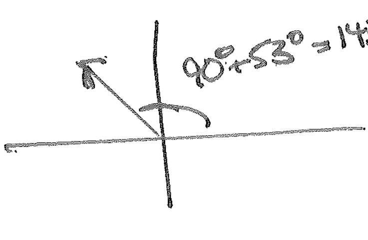
$B_y = 15m \sin 60^\circ = 12.99m = 13.0m$

$\vec{C}$



$C_x = 12m \cos 205^\circ = -10.8757m = -10.9m$

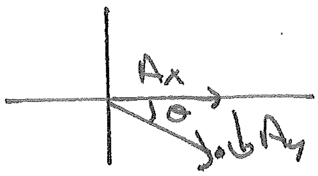
$C_y = 12m \sin 205^\circ = -5.07m$



$D_x = 10m \cos 143^\circ = -7.986m = -7.99m$

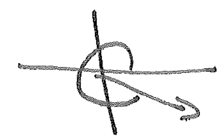
$D_y = 10m \sin 143^\circ = 6.01815m = 6.02m$

1.30 $A_x = 3.1\,m,\ A_y = -1.3\,m \Rightarrow 4^{th}$ QUAD, Calculator OK



$\theta = \tan^{-1}\left(\frac{A_y}{A_x}\right) = \tan^{-1}\left(\frac{-1.3}{3.1}\right) = -22.75°$

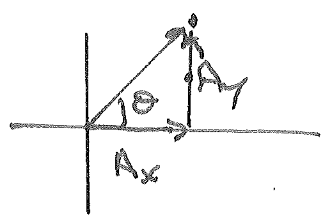
, the standard Angle is $-22.75°$ but Mastering wants A counter-clockwise Angle



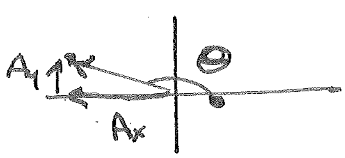
$\Rightarrow 360° - 22.75° = 337°$

$A_x = 3\,m;\ A_y = 3.5\,m \Rightarrow 1^{st}$ QUAD, Calc. OK

$\theta = \tan^{-1}\left(\frac{3.5}{3}\right) = 49.4°$

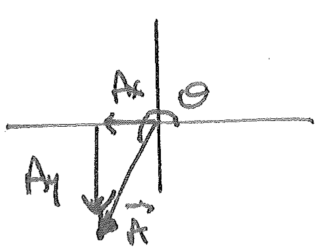


$A_x = -3.8\,m,\ A_y = 1.1\,m \Rightarrow 2^{ND}$ QUAD. $\Rightarrow$ ADD 180°



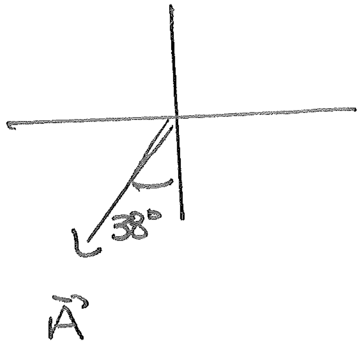
$\theta = \tan^{-1}\left(\frac{1.1}{-3.8}\right) + 180° = -16.1° + 180° = 163.8° = 164°$

$A_x = -1.3\,m,\ A_y = -4.8\,m \Rightarrow 3^{RD}$ QUAD $\Rightarrow$ ADD 180°



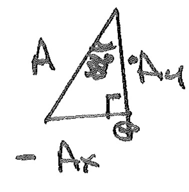
$\theta = \tan^{-1}\left(\frac{-4.8}{-1.3}\right) + 180° = 74.8° + 180° = 254.8° = 255°$

1.32



$A_x = -18\text{m}$

Triangle WAY:



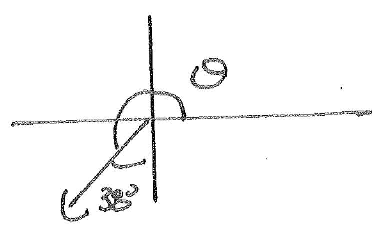
3RD QUAD SO

$A_x < 0,\ A_y < 0$

$$\tan 38^\circ = \frac{-A_x}{-A_y} \Rightarrow A_y = \frac{A_x}{\tan 38^\circ} = \frac{-18\text{m}}{\tan 38^\circ} = -23\text{m}$$

then $A = \sqrt{A_x^2 + A_y^2} = \sqrt{(18\text{m})^2 + (23\text{m})^2} = \sqrt{853\text{m}^2} = 29.2\text{m}$

Standard Angle WAY:



$\theta = 270^\circ - 38^\circ = 232^\circ$

$$A_x = A\cos\theta \Rightarrow A = \frac{A_x}{\cos\theta} = \frac{-18\text{m}}{\cos 232^\circ} = +29.2\text{m}$$ (solve for magnitude First)

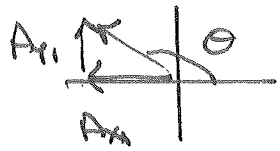
$A_y = A\sin\theta = 29.2\text{m}\sin 232^\circ = -23\text{m}$

1.36 $A_{x_1} = -8.3\,cm,\ A_{y_1} = 5.5\,cm$

$$A_1 = \sqrt{A_{x_1}^2 + A_{y_1}^2} = \sqrt{(8.3\,cm)^2 + (5.5\,cm)^2} = \sqrt{99.14\,cm^2} = 9.96\,cm$$

CAN use any unit

Find Counter clockwise Angle for $\vec{A}_1$:

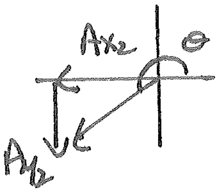


2ND QUAD $\Rightarrow$ $\theta = \tan^{-1}\left(\frac{A_{y_1}}{A_{x_1}}\right) + 180°$

$= \tan^{-1}\left(\frac{5.5}{-8.3}\right) + 180° = -33.53° + 180° = 146.47°$

$= 146°$

$A_{x_2} = -5.7\,m,\ A_{y_2} = -3.5\,m \qquad A_2 = \sqrt{(5.7\,m)^2 + (3.5\,m)^2} = \sqrt{44.74\,m^2} = 6.69\,m$

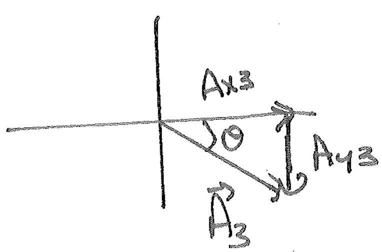


3RD QUAD $\Rightarrow$ $\theta = \tan^{-1}\left(\frac{A_{y_2}}{A_{x_2}}\right) + 180° = \tan^{-1}\left(\frac{-3.5}{-5.7}\right) + 180°$

$= 31.551° + 180° = 211.551° = 212°$

$A_{x_3} = 7.7\,km,\ A_{y_3} = -3.2\,km \qquad A_3 = \sqrt{(7.7\,km)^2 + (3.2\,km)^2} = \sqrt{69.53\,km^2}$

$= 8.34\,km$



4th QUADRANT, so Calc. is OK (IF I WAS asking)

$\theta = \tan^{-1}\left(\frac{A_{y3}}{A_{x3}}\right) = \tan^{-1}\left(\frac{-3.2}{7.7}\right) = -22.567°$

But to get A Counter-clockwise Angle: $360° - 22.567° =$

$337.43° = 337°$