

PHYSICS 20 - ADDING VECTORS WORKSHEET

Q1 $\vec{d}_1 = 15\text{m} [40^\circ \text{ S of W}]$

$\vec{d}_2 = 10\text{m} [20^\circ \text{ W of N}]$

What is $\vec{d}_{\text{TOT}} = ?$

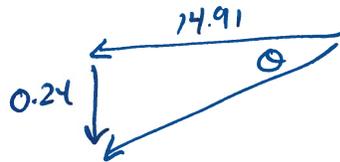


| | x-comp | y-comp |
|------------------------|---|--|
| \vec{d}_1 | $\cos \theta = \frac{a}{h}$ $\cos 40^\circ = \frac{d_{1x}}{15}$ $d_{1x} = -11.49$ | $\sin \theta = \frac{o}{h}$ $\sin 40^\circ = \frac{d_{1y}}{15}$ $d_{1y} = -9.64$ |
| \vec{d}_2 | $\sin \theta = \frac{o}{h}$ $\sin 20^\circ = \frac{d_{2x}}{10}$ $d_{2x} = -3.42$ | $\cos \theta = \frac{a}{h}$ $\cos 20^\circ = \frac{d_{2y}}{10}$ $d_{2y} = +9.40$ |
| \vec{d}_{TOT} | $d_{\text{TOT}x} = -14.91$ | $d_{\text{TOT}y} = -0.24$ |

Reconstruct vector.

$a^2 + b^2 = c^2$

$\tan \theta = \frac{o}{a}$



$a^2 + b^2 = c^2$
 $(0.24)^2 + (14.91)^2 = c^2$
 $c = 14.91$

$\tan \theta = \frac{o}{a}$

$\theta = \tan^{-1} \left(\frac{0.24}{14.91} \right)$

$\theta = 0.92$

$\vec{d}_{\text{TOT}} = 14.91 \text{ m } [0.92^\circ \text{ S of W}]$

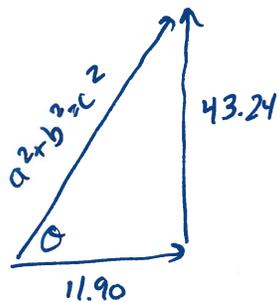
Q2

$\vec{d}_1 = 20\text{m} [26^\circ \text{ N of E}]$

$\vec{d}_2 = 35\text{m} [80^\circ \text{ N of W}]$



| | x-comp | y-comp |
|-----------------|---|---|
| \vec{d}_1 | $\cos \theta = \frac{a}{h}$ $\cos 26^\circ = \frac{d_{1x}}{20}$ | $\sin \theta = \frac{o}{h}$ $\sin 26^\circ = \frac{d_{1y}}{20}$ |
| \vec{d}_2 | $\cos \theta = \frac{a}{h}$ $\cos 80^\circ = \frac{d_{2x}}{35}$ | $\sin \theta = \frac{o}{h}$ $\sin 80^\circ = \frac{d_{2y}}{35}$ |
| | $d_{1x} = +17.98$ $d_{2x} = -6.08$ $d_{\text{TOT}x} = +11.90$ | $d_{1y} = +8.77$ $d_{2y} = +34.47$ $d_{\text{TOT}y} = +43.24$ |



$a^2 + b^2 = c^2$

$c = 44.85$

$|\vec{d}_{\text{TOT}}| = 44.85\text{m}$

$\tan \theta = \frac{o}{a}$

$\tan \theta = \frac{43.24}{11.90}$

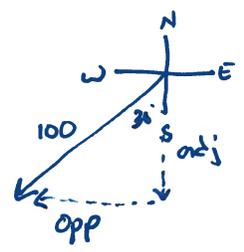
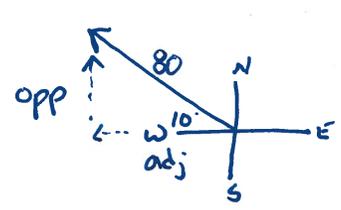
$\theta = 74.61^\circ$

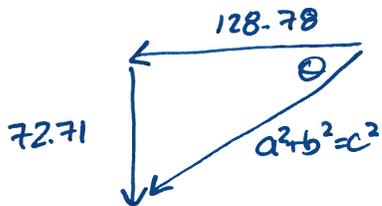
$\vec{d}_{\text{TOT}} = 44.85\text{m} [74.61^\circ \text{ N of E}]$

Q3

$\vec{d}_1 = 100 \text{ m } [30^\circ \text{ W of S}]$

$\vec{d}_2 = 80 \text{ m } [10^\circ \text{ N of W}]$

| | x-comp | y-comp |
|---|---|--|
| \vec{d}_1  | $\sin \theta = \frac{o}{h}$ $\sin 30^\circ = \frac{d_{1x}}{100}$ $d_{1x} = -50 \text{ m}$ | $\cos \theta = \frac{a}{h}$ $\cos 30^\circ = \frac{d_{1y}}{100}$ $d_{1y} = -86.60 \text{ m}$ |
| \vec{d}_2  | $\cos \theta = \frac{a}{h}$ $\cos 10^\circ = \frac{d_{2x}}{80}$ $d_{2x} = -78.78 \text{ m}$ | $\sin \theta = \frac{o}{h}$ $\sin 10^\circ = \frac{d_{2y}}{80}$ $d_{2y} = +13.89 \text{ m}$ |
| \vec{d}_{TOT} | $d_{\text{TOT}x} = -128.78 \text{ m}$ | $d_{\text{TOT}y} = -72.71$ |



$a^2 + b^2 = c^2$
 $(72.71)^2 + (128.78)^2 = c^2$
 $c = 147.89$

$|\vec{d}_{\text{TOT}}| = 147.89 \text{ m}$

$\tan \theta = \frac{o}{a}$

$\theta = \tan^{-1} \left(\frac{72.71}{128.78} \right)$

$\theta = 29.45^\circ$

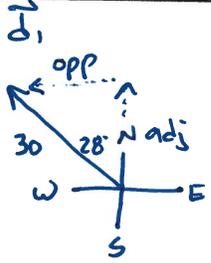
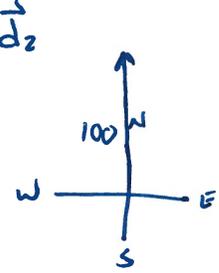
$\vec{d}_{\text{TOT}} = 147.89 \text{ m } [29.45^\circ \text{ S of W}]$

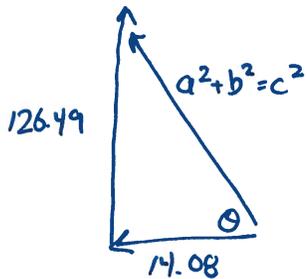
Q4

$\vec{d}_1 = 30 \text{ m } [28^\circ \text{ W of N}]$

$\vec{d}_2 = 100 \text{ m } [N]$

KEY

| | x-comp | y-comp |
|--|---|---|
|  | $\sin \theta = \frac{o}{h}$ $\sin 28^\circ = \frac{d_{1x}}{30}$ $d_{1x} = -14.08 \text{ m}$ | $\cos \theta = \frac{a}{h}$ $\cos 28^\circ = \frac{d_{1y}}{30}$ $d_{1y} = +26.49 \text{ m}$ |
|  | $d_{2x} = 0 \text{ m}$ | $d_{2y} = 100 \text{ m}$ |
| d_{TOT} | $d_{TOTx} = -14.08 \text{ m}$ | $d_{TOTy} = 126.49 \text{ m}$ |



$a^2 + b^2 = c^2$
 $(14.08)^2 + (126.49)^2 = c^2$
 $c = 127.27 \text{ m} \quad |\vec{d}_{TOT}| = 127.27 \text{ m}$

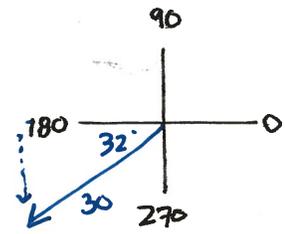
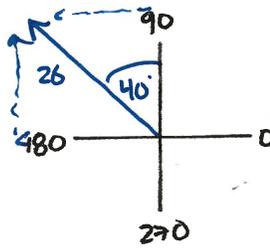
$\tan \theta = \frac{o}{a}$
 $\theta = \tan^{-1} \left(\frac{126.49}{14.08} \right)$
 $\theta = 83.65^\circ$

$\vec{d}_{TOT} = 127.27 \text{ m } [83.65^\circ \text{ N of W}]$

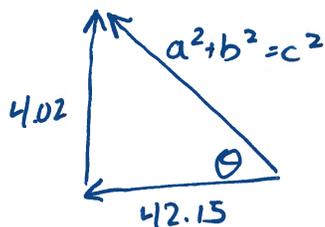
Q5

$$\vec{d}_1 = 26 \text{ m } [130^\circ]$$

$$\vec{d}_2 = 30 \text{ m } [212^\circ]$$



| | x-comp | y-comp |
|-----------------|---|---|
| \vec{d}_1 | $\sin \theta = \frac{o}{h}$ $\sin 40^\circ = \frac{d_{1x}}{26}$ $d_{1x} = -16.71$ | $\cos \theta = \frac{a}{h}$ $\cos 40^\circ = \frac{d_{1y}}{26}$ $d_{1y} = +19.92$ |
| \vec{d}_2 | $\cos \theta = \frac{a}{h}$ $\cos 32^\circ = \frac{d_{2x}}{30}$ $d_{2x} = -25.44$ | $\sin \theta = \frac{o}{h}$ $\sin 32^\circ = \frac{d_{2y}}{30}$ $d_{2y} = -15.90$ |
| \vec{d}_{TOT} | $d_{TOTx} = -42.15$ | $d_{TOTy} = +4.02$ |



$$a^2 + b^2 = c^2$$

$$(4.02)^2 + (42.15)^2 = c^2$$

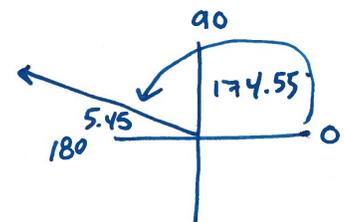
$$c = 42.34$$

$$|\vec{d}_{TOT}| = 42.34 \text{ m}$$

$$\tan \theta = \frac{o}{a}$$

$$\theta = \tan^{-1} \left(\frac{4.02}{42.15} \right)$$

$$\theta = 5.45^\circ$$

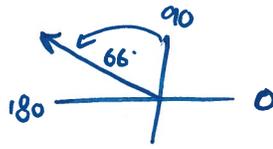


$$\vec{d}_{TOT} = 42.34 \text{ m } [174.55^\circ]$$

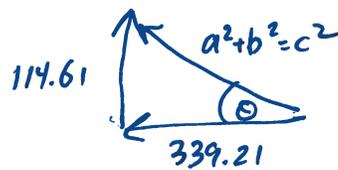
Q6

$$\vec{d}_1 = 200 \text{ m } [156^\circ]$$

$$\vec{d}_2 = 160 \text{ m } [12^\circ \text{ N of W}]$$



| | x-comp | y-comp |
|-----------|---|--|
| | $\sin \theta = \frac{o}{h}$ $\sin 66 = \frac{d_{1x}}{200}$ $d_{1x} = -182.71$ | $\cos \theta = \frac{a}{h}$ $\cos 66 = \frac{d_{1y}}{200}$ $d_{1y} = +81.35$ |
| | $\cos \theta = \frac{a}{h}$ $\cos 12 = \frac{d_{2x}}{160}$ $d_{2x} = -156.50$ | $\sin \theta = \frac{o}{h}$ $\sin 12 = \frac{d_{2y}}{160}$ $d_{2y} = +33.27$ |
| d_{TOT} | $d_{TOTx} = -339.21$ | $d_{TOTy} = +114.61$ |



$$a^2 + b^2 = c^2$$

$$c = 358.05$$

$$|\vec{d}_{TOT}| = 358.05 \text{ m}$$

$$\tan \theta = \frac{a}{b}$$

$$\theta = \tan^{-1} \left(\frac{114.61}{339.21} \right)$$

$$\theta = 2.47^\circ$$

NAVIGATION $\vec{d}_{TOT} = 358.05 \text{ m } [2.47^\circ \text{ N of W}]$

POLAR $\vec{d}_{TOT} = 358.05 \text{ m } [177.53^\circ]$