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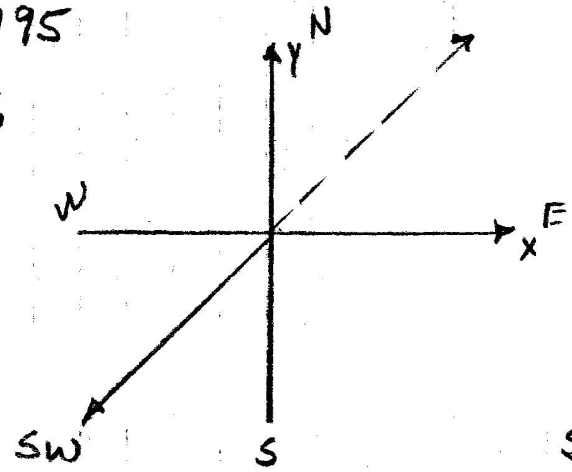
Dr. Bob

1.




SW is the same as 225° or [45° S of W]

Opposite angle would be 45° or [45° N of E]

So, B & C.

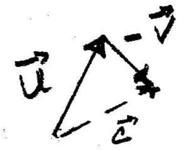
2. $\vec{a}$ & $\vec{h}$ $\quad$ $\vec{e}$ & $-\vec{c}$

$\vec{b}$ & $\vec{f}$ $\quad$ $\vec{f}$ & $\vec{b}$

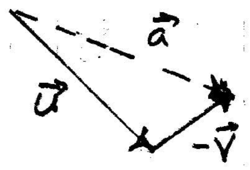
$\vec{c}$ & $-\vec{e}$ $\quad$ $\vec{g}$ & none

$\vec{d}$ & none $\quad$ $\vec{h}$ & $\vec{a}$

3.

a) 


$\vec{u} - \vec{v} = \vec{c}$

b) 


$\vec{u} - \vec{v} = \vec{a}$

4\. a) $\vec{S}_1 = 45m$ @ $135^\circ$ $\quad\quad$ $\vec{S}_2 = 20m$ @ $200^\circ$

$S_{1x} = (45m)\cos 135^\circ$
$S_{1x} = -31.82\,m$

$S_{1y} = (45m)\sin 135^\circ$
$S_{1y} = 31.82m$

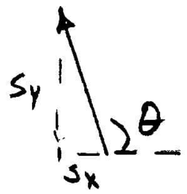
$S_{2x} = (20m)\cos 200^\circ$
$S_{2x} = -18.79\,m$

$S_{2y} = (20m)\sin 200^\circ$
$S_{2y} = -6.84m$

$S_x = S_{1x} - S_{2x} = -31.82m - {}^-18.79m = -13.03m$

$S_y = S_{1y} - S_{2y} = 31.82m - {}^-6.84m = 38.66m$

$S = \sqrt{(-13.03m)^2 + (38.66m)^2} = 40.8m$




$\theta = \tan^{-1}\left(\frac{38.66m}{-13.03m}\right) = -71.37^\circ$
wrong quadrant.

$\theta = 180^\circ - 71.37^\circ = 109^\circ$

$\vec{S} = 40.8m$ @ $109^\circ$

b) $\vec{V}_1 = 60km/h$ SE $\quad\quad$ $\vec{V}_2 = 40km/h$ NW

Since NW is 180° from SE, I can write $\vec{V}_2 = -40km/h$ SE.

In this case, since the original vectors are antiparallel I don't have to work with the components

$\vec{V} = \vec{V}_1 - \vec{V}_2 = 60km/h$ SE $- 40km/h$ NW

$= 60km/h$ SE $- (-40km/h$ SE$)$

$\boxed{\vec{V} = 100\,km/h \text{ SE or } \vec{V} = 100km/h\ 315^\circ}$

4. c) $\vec{F_1} = 24.3\,N$ [10° E of S] or $\vec{F_1} = 24.3N$ @ 280°

$\vec{F_2} = 13.7N$ [35° N of W] or $\vec{F_2} = 13.7N$ @ 145°

$F_{1x} = (24.3N)\cos 280°$
$F_{1x} = 4.22\,N$

$F_{1y} = (24.3N)\sin 280°$
$F_{1y} = -23.93N$

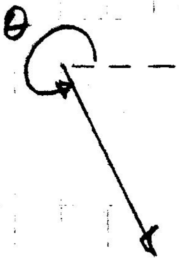
$F_{2x} = (13.7N)\cos 145°$
$F_{2x} = -11.22N$

$F_{2y} = (13.7N)\sin 145°$
$F_{2y} = 7.86\,N$

$F_x = F_{1x} - F_{2x} = 4.22N - {}^{-}11.22N = 15.44N$

$F_y = F_{1y} - F_{2y} = -23.93N - 7.86N = {}^{-}31.79N$

$F = \sqrt{(15.44N)^2 + (-31.79N)^2} = 35.3N$




$\theta = \tan^{-1}\left(\frac{-31.79N}{15.44N}\right) = -64.0°$

This is the correct quadrant.

| |
|---|
| $\vec{F} = 35.3N$ @ $-64.0°$ |
| or $\vec{F} = 35.3N$ @ 296° |

5. Reading from the graph

$V_{1x} = 2\,km/h$

$V_{1y} = -14\,km/h$

$V_{2x} = 2\,km/h$

$V_{2y} = 6\,km/h$

$V_{3x} = {}^{-}9\,km/h$

$V_{3y} = {}^{-}5\,km/h$

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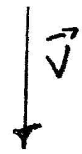
5. a) $\vec{V} = \vec{V}_1 - \vec{V}_2 = ?$

$V_x = 2\text{ km/h} - 2\text{ km/h} = 0\text{ km/h}$

$V_y = -14\text{ km/h} - 6\text{ km/h} = -20\text{ km/h}$

$V = |V_y| = 20\text{ km/h}$ since $V_x = 0$.

$\boxed{\vec{V} = 20\text{ km/h @ } 270°}$

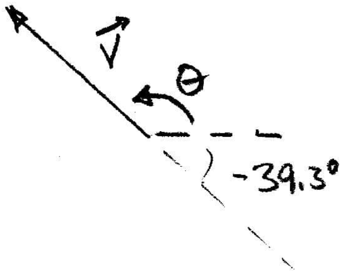



b) $\vec{V} = \vec{V}_3 - \vec{V}_1 = ?$

$V_x = -9\text{ km/h} - 2\text{ km/h} = -11\text{ km/h}$

$V_y = -5\text{ km/h} - 14\text{ km/h} = 9\text{ km/h}$

$V = \sqrt{(-11\text{ km/h})^2 + (9\text{ km/h})^2} = 14.2\text{ km/h}$




$\theta = \tan^{-1}\left(\frac{9\text{ km/h}}{-11\text{ km/h}}\right)$ $-39.3°$ wrong quadrant

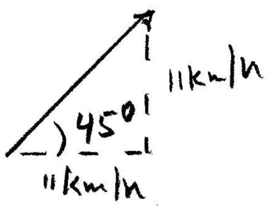
$\theta = 180° - 39.3° = 141°$

$\boxed{\vec{V} = 14.2\text{ km/h @ } 141°}$

c) $\vec{V} = \vec{V}_2 - \vec{V}_3$

$V_x = 2\text{ km/h} - (-9\text{ km/h}) = 11\text{ km/h}$
$V_y = 6\text{ km/h} - (-5\text{ km/h}) = 11\text{ km/h}$

$V\ \sqrt{(11\text{ km/h})^2 + (11\text{ km/h})^2} = 15.6\text{ km/h}$




$\boxed{\vec{V} = 15.6\text{ km/h @ } 45°}$