Dr. Bob

1.

a) The price of a car is a scalar. It has the units of currency (e.g. $) & a magnitude. The price does not have a direction.

b) Time is a scalar quantity with magnitude & units(s). The acceleration & velocity (100 km/h) could be vector quantities, but not time.

c) The speed (really a velocity, here) is a vector quantity, because it has a magnitude (90), units (km/h), and a direction (east).

d) Volumes in general are scalars with only magnitude & units in this case 38L.

e) Displacements are generally vectors with magnitude, units & direction. For example the displacement from city to the other could be 200km NE.

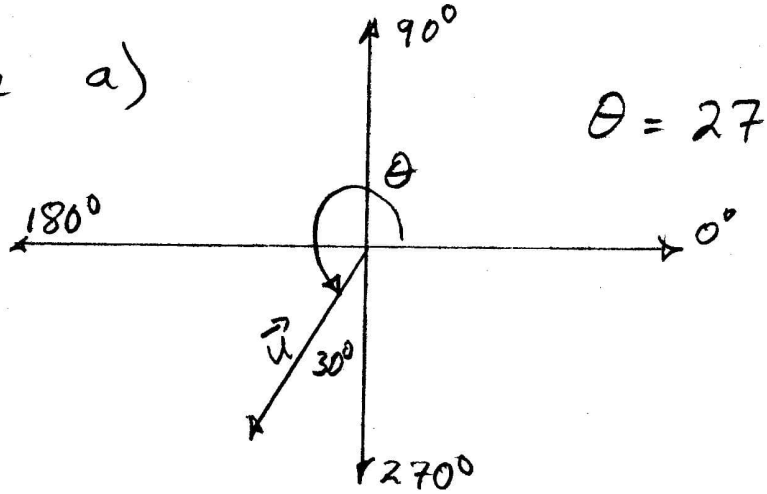
2.

a) $\vec{u} = u\,[240^\circ] = u\,[-120^\circ]$

b) $\vec{v} = v\,[340^\circ] = v\,[-20^\circ]$

c) $\vec{w} = w\,[130^\circ] = w\,[-230^\circ]$

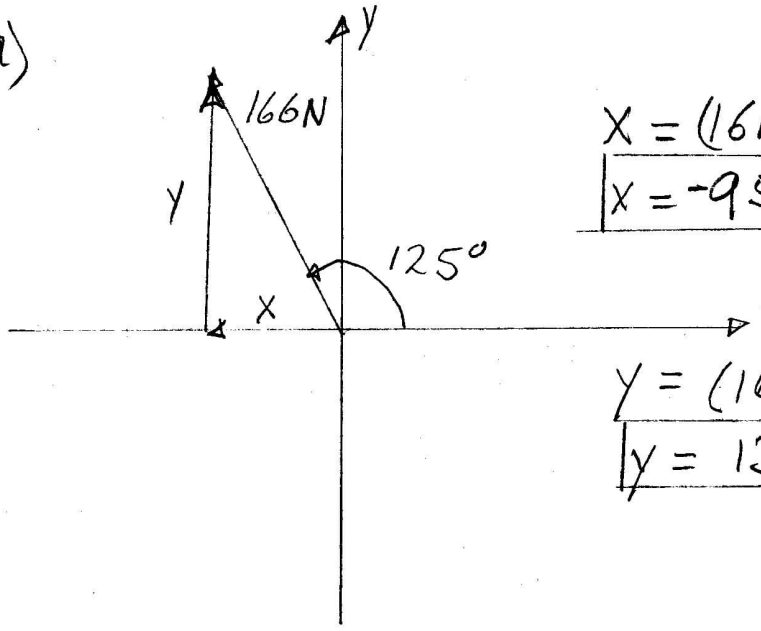
Example a)



$\theta = 270^\circ - 30^\circ$

3.

a)



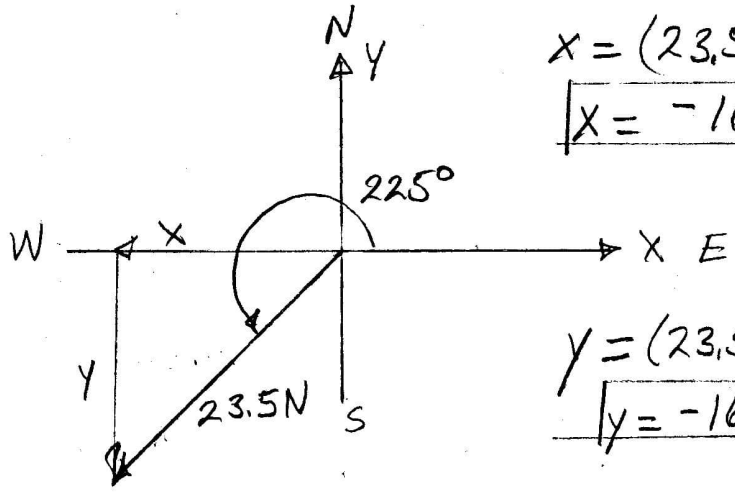
$X = (166N)\cos 125°$

$\boxed{x = -95.2\,N}$

$Y = (166N)\sin 125°$

$\boxed{y = 136°\,N}$

b)



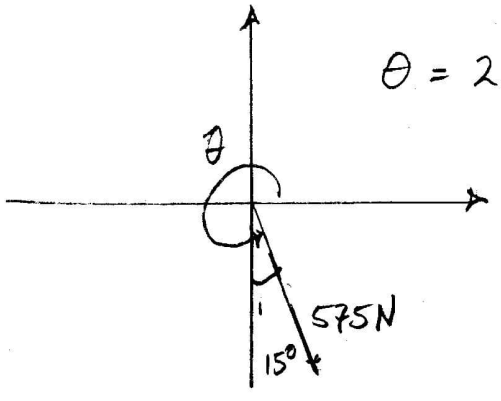
$x = (23.5N)\cos 225°$

$\boxed{x = -16.6\,N}$

$y = (23.5N)\sin 225°$

$\boxed{y = -16.6\,N}$

c)



$\theta = 285°$

$X = (575N)\cos 285°$

$\boxed{x = 149N}$

$y = (575N)\sin 285°$

$\boxed{y = -555\,N}$

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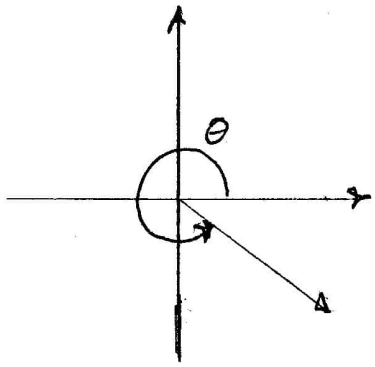
4. $V_{1x} = 8.4\ m/s$ $\quad V_{1y} = -5.9\ m/s$

a)

$$V = \left((8.4\ m/s)^2 + (-5.9\ m/s)^2 \right)^{1/2}$$

$$V = 10\ m/s$$



$$\theta = \tan^{-1}\left(\frac{V_{1y}}{V_{1x}}\right) = \tan\left(\frac{-5.9\ m/s}{8.4\ m/s}\right)$$

$$\theta = -35^\circ \text{ or } 325^\circ$$

$$\boxed{\vec{V} = 10\ m/s \text{ at } -35^\circ}$$

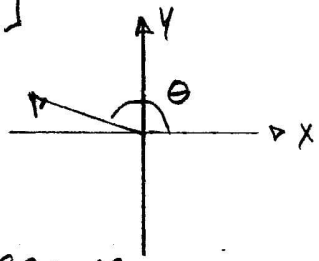
or

$$\boxed{\vec{V} = 10\ m/s \text{ at } 325^\circ}$$

b) $V_{2x} = -881\ m/s$ $\quad V_{2y} = 302\ m/s$

$$V = \left[(-881\ m/s)^2 + (302\ m/s)^2 \right]^{1/2}$$

$$V = 931\ m/s$$



$$\theta = \tan^{-1}\left(\frac{302\ m/s}{-881\ m/s}\right) = -18.9^\circ$$

This is not the correct angle, because this is the IV quadrant not the II quadrant as it should be.

So, $\theta = 180^\circ - 18.9^\circ = 161.1^\circ$

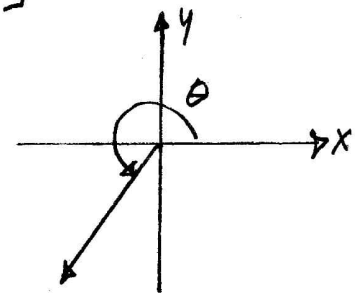
$$\boxed{\vec{V} = 931\ m/s \text{ at } 161^\circ}$$

4. (cont'd.)

c) $V_{3x} = -55.1\ m/s$ $\quad V_{3y} = -87.5\ m/s$

$$V = \left[(-55.1\ m/s)^2 + (-87.5\ m/s)^2\right]^{1/2}$$

$$V = 103\ m/s$$



$$\theta = \tan^{-1}\left(\frac{V_{3y}}{V_{3x}}\right) = \tan^{-1}\left(\frac{-87.5\ m/s}{-55.1\ m/s}\right)$$

$$\theta = 57.8°$$

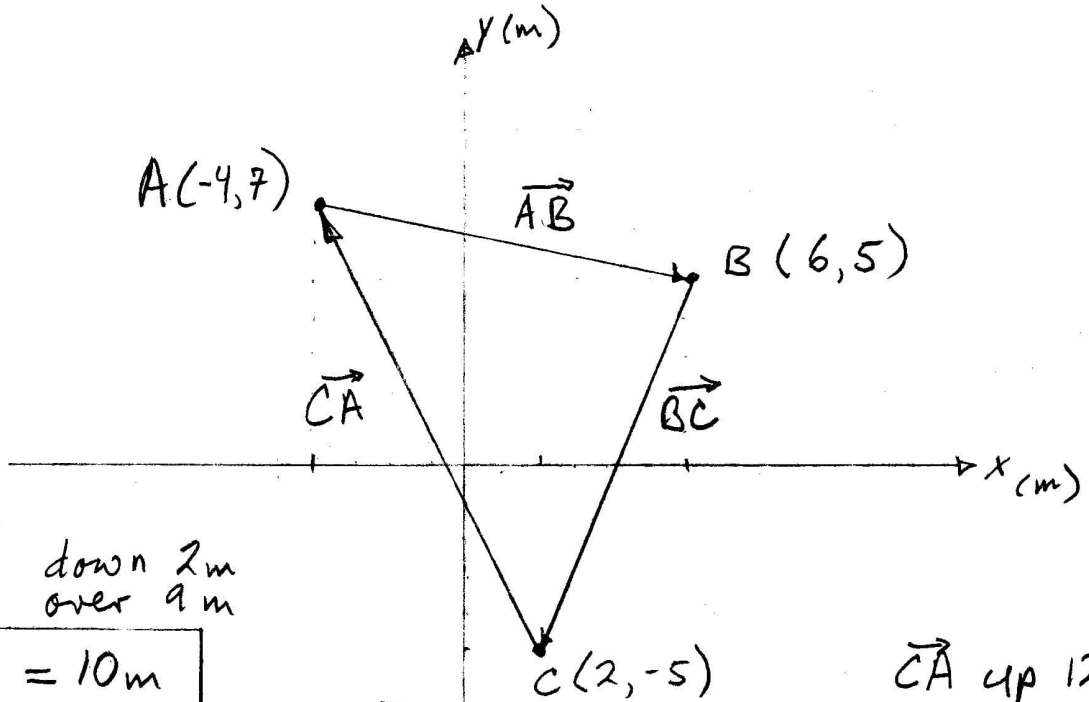
Again, this is in the wrong quadrant: I not III.

So, add $180°$

$$\theta = 180° + 57.8° = 237.8°$$

$$\boxed{\vec{V} = (103\ m/s)\ @\ 237.8°}$$

5.



$\vec{AB}$ down 2m over 9m

$$\boxed{\begin{aligned} AB_x &= 10\ m \\ AB_y &= -2\ m \end{aligned}}$$

$\vec{BC}$ down 10m over -4m

$$\boxed{\begin{aligned} BC_x &= -4\ m \\ BC_y &= -10\ m \end{aligned}}$$

$\vec{CA}$ up 12m over -6m

$$\boxed{\begin{aligned} CA_x &= -6\ m \\ CA_y &= 12\ m \end{aligned}}$$

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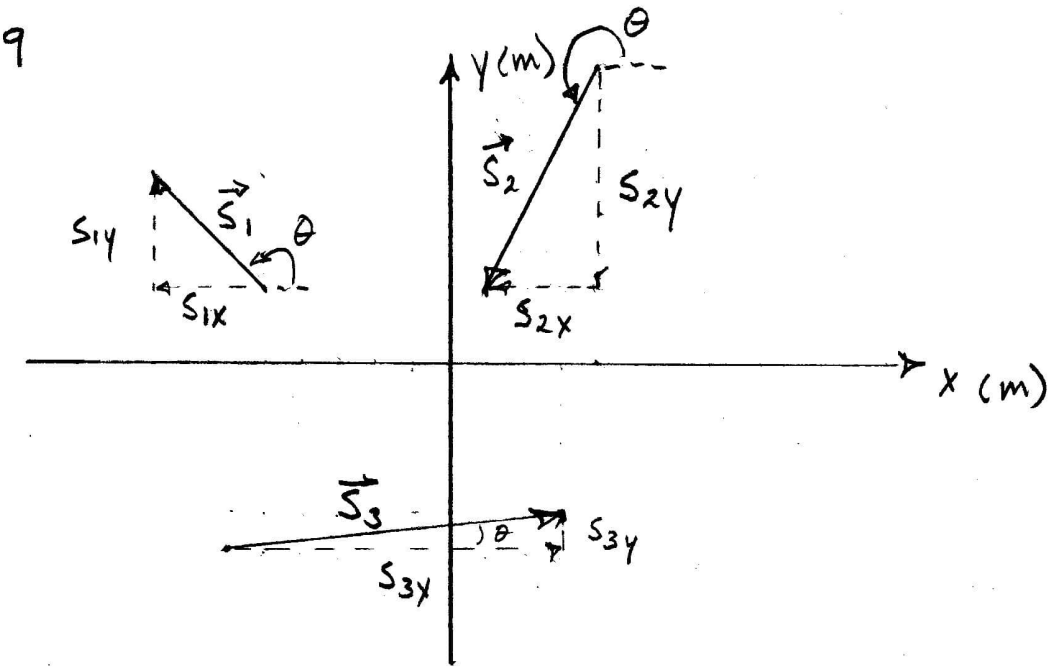
6.



$\underline{S_1}$

$S_{1x} = -3m$

$S_{1y} = 3m$

$S = \sqrt{(-3m)^2 + (3m)^2} = 4.24m$

$S = 4.24m$

$\theta = 90° + 45° = 135°$

$\theta = 135°$

$\underline{S_2}$

$S_{2x} = -3m$

$S_{2y} = -6m$

$S = [(-3m)^2 + (-6m)^2]^{1/2}$

$S = 6.7m$

$\theta = \tan^{-1}\left(\frac{-6m}{-3m}\right) = 63.4°$ wrong quadrant

$\theta = 180° + 63.4°$

$\theta = 243.4°$

$\underline{S_3}$

$S_{3x} = 9m$

$S_{3y} = 1m$

$s = [(1m)^2 + (9m)^2]^{1/2}$

$s = 9.05m$

$\theta = \tan^{-1}\left(\frac{1m}{9m}\right) = 6.3°$

$\theta = 6.3°$