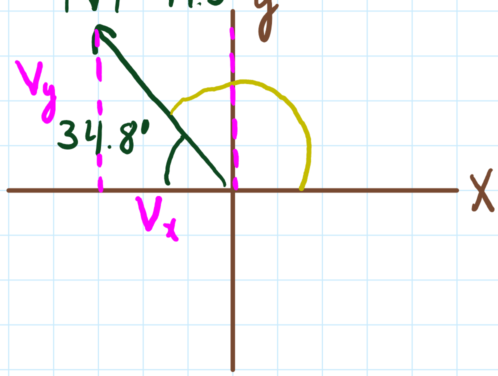
Example 1

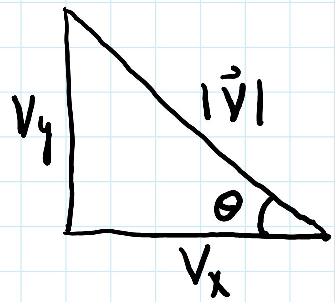
Sunday, August 23, 2015 12:46 PM

V is a vector 14.3 units in magnitude and points at an angle of 34.8 degrees above the negative x axis.
(a) sketch this vector
(b) find V_x and V_y
(c) use V_x and V_y to obtain (again) the magnitude and directions of Vector V.
NOTE: part (c) is a good way to check if you've resolved your vector correctly.

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

a)





$\sin\theta = \frac{opp}{hyp}$

$\cos\theta = \frac{adj}{hyp}$

$\tan\theta = \frac{opp}{adj}$

b)

$V_x = |\vec{V}| \cos\theta$

$V_x = (14.3)\cos(34.8°)$

$V_x = -11.7$

$V_y = |\vec{V}| \sin\theta$

$V_y = (14.3)\sin(34.8°)$

$V_y = 8.16$

c)

$|\vec{V}| = \sqrt{V_x^2 + V_y^2}$

$|\vec{V}| = \sqrt{(-11.7)^2 + (8.16)^2}$

$|\vec{V}| = 14.26$

$\tan\theta = \frac{V_y}{V_x}$

$\theta = \tan^{-1}\left(\frac{V_y}{V_x}\right)$

$\theta = \tan^{-1}\left(\frac{8.16}{-11.7}\right)$

$\theta = -34.89°$

above the -x-axis

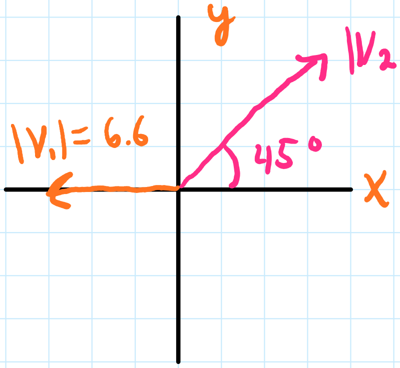
Example 2

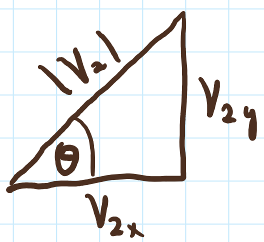
Sunday, August 23, 2015 12:47 PM

Vector V_1 is 6.6 units long and points along the negative x-axis. Vector V_2 is 8.5 units long and points at an angle of 45° to the positive x axis.

(a) What are the x and y components of each vector?

(b) Determine the sum (magnitude and angle).





$V_{1x} = -6.6$

$V_{1y} = 0$

$\vec{V}_1 = (-6.6, 0)$

$\vec{V}_1 = V_{1x}\hat{i} + V_{1y}\hat{j}$

$\vec{V}_1 = -6.6\hat{i} + 0\hat{j}$

$\vec{V}_1 = -6.6\hat{i}$

$V_{2x} = |\vec{V}_2| \cos\theta$

$V_{2x} = (8.5)\cos(45°)$

$V_{2x} = 6.01$

$V_{2y} = |\vec{V}_2| \sin\theta$

$V_{2y} = (8.5)\sin(45°)$

$V_{2y} = 6.01$

$\vec{V}_2 = (6.01, 6.01)$

$\vec{V}_2 = 6.01\hat{i} + 6.01\hat{j}$

b) $\vec{R} = \vec{V}_1 + \vec{V}_2$

$R_x = V_{1x} + V_{2x}$

$R_x = -6.6 + 6.01$

$R_x = -.589$

$R_y = V_{1y} + V_{2y}$

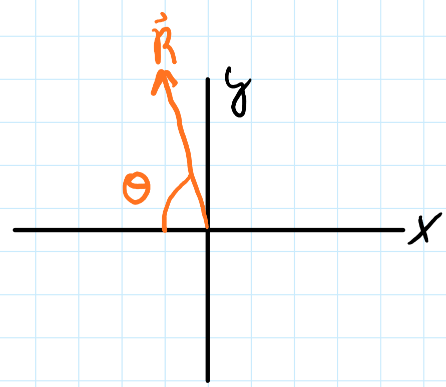
$R_y = 0 + 6.01$

$R_y = 6.01$

$\vec{R} = (-.589, 6.01)$

or

$\vec{R} = -.589\hat{i} + 6.01\hat{j}$



$|\vec{R}| = \sqrt{R_x^2 + R_y^2}$

$|\vec{R}| = \sqrt{(-.589)^2 + (6.01)^2}$

$|\vec{R}| = 6.04$

$\theta = \tan^{-1}\left(\frac{R_y}{R_x}\right)$

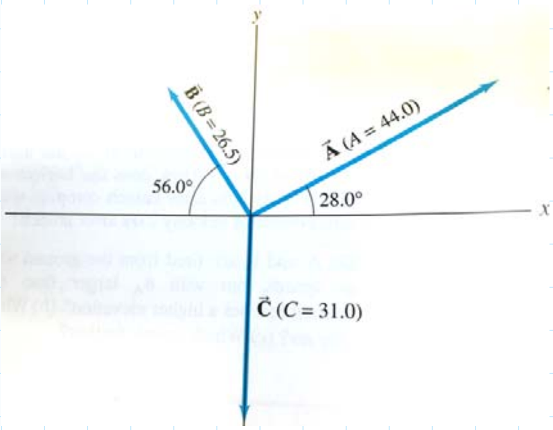
$\theta = \tan^{-1}\left(\frac{6.01}{-.589}\right)$

$\theta = -84.39°$ above the

(−)X axis

Example 3

Sunday, August 23, 2015 12:47 PM



What is the $\vec{R} = \vec{A} - 2\vec{B} + \vec{C}$ using the three vectors seen in the figure (in terms of a magnitude and direction)?

$B_x = |\vec{B}| \cos(56°)$ $\quad$ $B_y = |\vec{B}| \sin(56°)$

$B_x = (26.5)\cos(56°)$ $\quad$ $B_y = (26.5)\sin(56°)$

$\boxed{B_x = -14.82}$ $\quad$ $\boxed{B_y = 21.97}$

$A_x = |\vec{A}| \cos(28°)$ $\quad$ $A_y = |\vec{A}| \sin(28°)$

$A_x = (44)\cos(28°)$ $\quad$ $A_y = (44)\sin(28°)$

$\boxed{A_x = 38.85}$ $\quad$ $\boxed{A_y = 20.66}$

$\boxed{C_x = 0}$ $\quad$ $\boxed{C_y = -31}$

$R_x = A_x - 2B_x + C_x$

$R_x = 38.85 - 2(-14.82) + 0$

$R_x = 68.49$

$R_y = A_y - 2B_y + C_y$

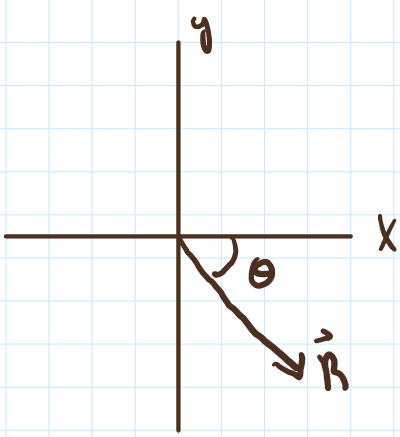
$R_y = 20.66 - 2(21.97) + (-31)$

$R_y = -54.28$

$\vec{R} = (68.49, -54.28)$

or

$\vec{R} = 68.49\hat{i} - 54.28\hat{j}$



$|\vec{R}| = \sqrt{R_x^2 + R_y^2}$

$|\vec{R}| = \sqrt{(68.49)^2 + (-54.28)^2}$

$|\vec{R}| = 87.39$

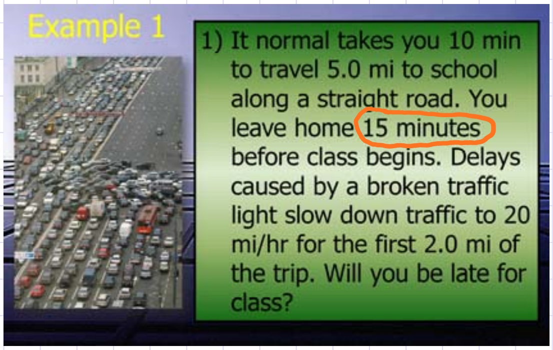
$\theta = \tan^{-1}\left(\frac{R_y}{R_x}\right)$

$\theta = \tan^{-1}\left(\frac{-54.28}{68.49}\right)$

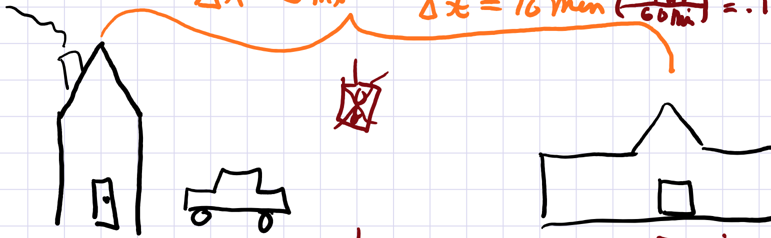
$\theta = -38.40°$ below the (+) X axis

Example 1

Sunday, August 23, 2015 12:32 PM



$\Delta X = 5\,mi$ $\quad \Delta t = 10\,min \left(\frac{1\,hr}{60\,min}\right) = .167\,min$



$V_1 = 20\,mph$

$\Delta X_1 = 2\,mi$

$V_1 = \frac{\Delta X_1}{\Delta t_1}$

$\Delta t_1 = \frac{\Delta X_1}{V_1}$

$\Delta t_1 = \frac{2\,mi}{20\,\frac{mi}{hr}}$

$\Delta t_1 = .1\,hr$

$\Delta t_1 = 6\,min$

$V_2 = \frac{\Delta X}{\Delta t} = \frac{5\,mi}{.167\,hr} = 29.94\,mph$

$\Delta X_2 = 3\,mi$

$\Delta t_2 = \frac{\Delta X_2}{V_2}$

$\Delta t_2 = \frac{3\,mi}{29.94\,\frac{mi}{hr}}$

$\Delta t_2 = .1\,hr$

$\Delta t_2 = 6\,min$

$t_{tot} = 12\,min = \Delta t_1 + \Delta t_2$