$\boxed{\text{CH 1 \#30}}$

GOAL: FIND VECTOR $\vec{F_3}$ SUCH THAT

$$\vec{F_1} + \vec{F_2} + \vec{F_3} = 0 \quad \Rightarrow$$

$$\boxed{\vec{F_3} = -(\vec{F_1} + \vec{F_2})}$$

STEPS:

✓ 1) RESOLVE $\vec{F_1}$ AND $\vec{F_2}$ INTO X AND y COMPONENTS

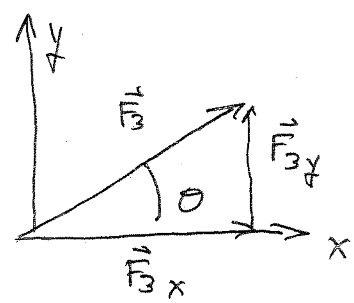
✓ 2) ADD VECTORS $\vec{F_1}$ & $\vec{F_2}$

✓ 3) $\vec{F_3} = -(\vec{F_1} + \vec{F_2}) \Rightarrow$

$$F_{3x} = -(F_{1x} + F_{2x})$$

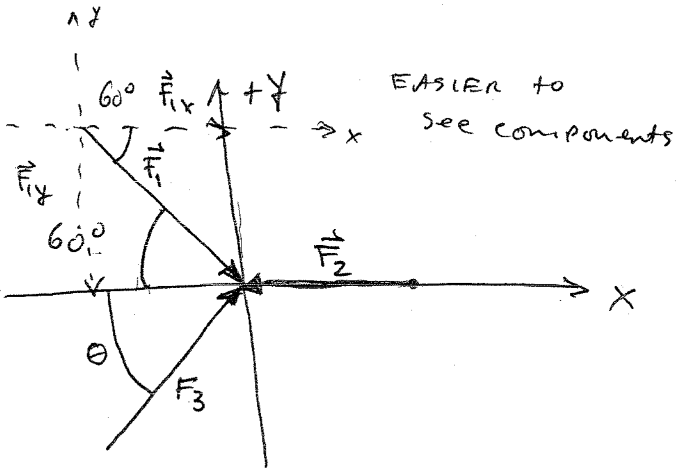
$$F_{3y} = -(F_{1y} + F_{2y})$$

4) $|\vec{F_3}| = \sqrt{F_{3x}^2 + F_{3y}^2}$



$$\tan\theta = \frac{|\vec{F_{3y}}|}{|F_{3x}|}$$

STEP 1 RESOLVE $\vec{F_1}$ AND $\vec{F_2}$ INTO x AND y COMPONENTS



$|\vec{F_1}| = 47\,N$

$|\vec{F_2}| = 79\,N$

$|\vec{F_3}| = ?$

$$\vec{F_2} = -|\vec{F_2}|\,\hat{x} + 0\,\hat{y} = -79N\,\hat{x} \quad \text{OR} \quad \vec{F_2} = \begin{array}{cc} F_{2x} & F_{2y} \\ \end{array} \left[-79N,\ 0\right]$$

$$\vec{F_1} = +|\vec{F_1}|\cos 60^\circ\,\hat{x} - |\vec{F_1}|\sin 60^\circ\,\hat{y}$$

$$\vec{F_1} = 47N\cos 60^\circ\,\hat{x} - 47N\sin 60^\circ\,\hat{y}$$

$$\vec{F_1} = 23.5N\,\hat{x} - 40.7N\,\hat{y} \quad \text{OR} \quad \vec{F_1} = \begin{array}{cc} x & y \\ \end{array} \left[23.5N,\ -40.7N\right]$$

Vector is Same, Different Notation

END OF STEP 1

$\vec{F_2} = -79N\,\hat{x}$ $\qquad \vec{F_2} = [-79N,\ 0]$

$\vec{F_1} = 23.5N\,\hat{x} - 40.7N\,\hat{y}$ $\qquad \vec{F_1} = [23.5N,\ -40.7N]$

STEP 2 ADD $\vec{F_1} + \vec{F_2}$

EASY TO DO USING $[x, y]$ NOTATION $\Rightarrow$

$$\vec{F_1}\ [23.5N, -40.7N]$$
$$\vec{F_2}\ [-79N, 0]$$

$$[\vec{F_1}+\vec{F_2}]_x = F_{1x} + F_{2x}$$

$$[F_1+F_2]_y = F_{1y} + F_{2y}$$

$$\vec{F_1}+\vec{F_2}\ [-55.5N, -40.7N]$$

$$\vec{F_1}+\vec{F_2} = [-55.5N, -40.7N]$$

$$\vec{F_3} = -(\vec{F_1}+\vec{F_2}) \quad (\text{since } \vec{F_3} + (\vec{F_1}+\vec{F_2}) \equiv 0)$$

Good for Addition/subtraction

SO $\vec{F_3} = (-1)[-55.5N, -40.7N] = [+55.5N, +40.7N]$

OR $\vec{F_3} = +55.5N\ \hat{x} + 40.7N\ \hat{y}$

IDENTICAL JUST WRITTEN Differently

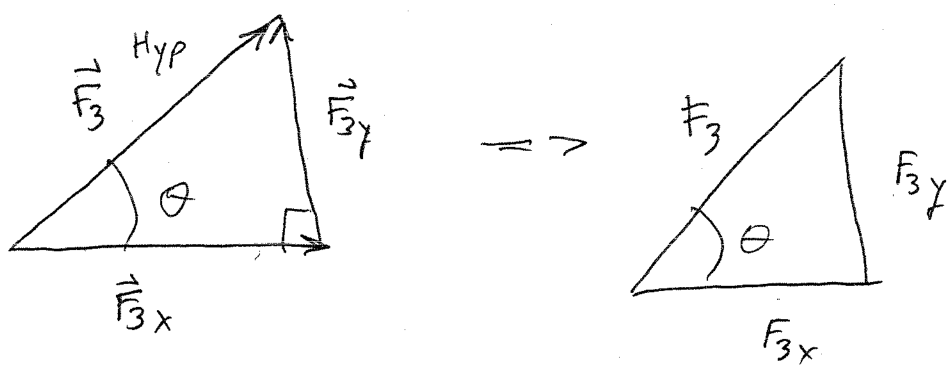
Both WAYS ARE USEFUL

$$\boxed{\vec{F_3} = +55.5N\ \hat{x} + 40.7N\ \hat{y}}$$

END OF STEP #3

STEP 4 Get $|\vec{F_3}| \equiv$ MAGNITUDE OF VECTOR $\vec{F_3}$

$\equiv$ Length OF VECTOR $\vec{F_3}$



$$F_3^2 = F_{3x}^2 + F_{3y}^2$$ PYTHAGORAS

$$F_3 \equiv |\vec{F_3}| = \sqrt{F_{3x}^2 + F_{3y}^2}$$

$F_{3x} \equiv |\vec{F_{3x}}|$ Length OF SIDE OF $\triangle$

$F_{3y} \equiv |\vec{F_{3y}}|$ "

$$\tan\theta = \frac{|\vec{F_{3y}}|}{|\vec{F_{3x}}|} = \frac{40.7N}{55.5N}$$

40.7N Y component Length

55.5N X component Length