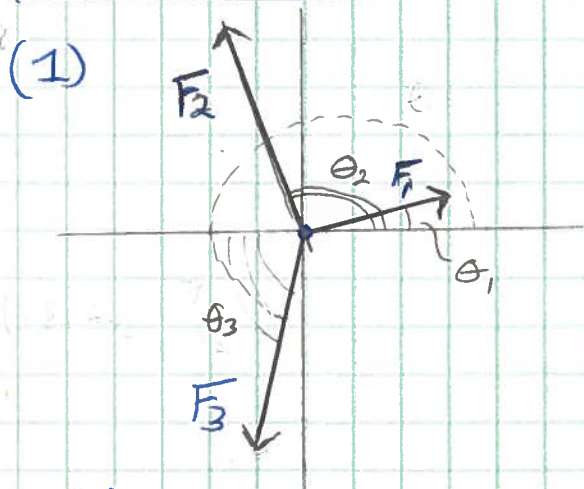


Example Setup for Vector Addition with Force table.

Mengyan - 1/2

- Hang: $m_1 = 0.50 \text{ kg}$ at 15° , $m_2 = 0.80 \text{ kg}$ at 110°
- Experimentally determine m_3 and θ_3 to Balance. $\rightarrow m_3 = 0.905 \text{ kg}$ at 257°
 $\theta_3 = 257^\circ$

Setup \emptyset



(2) Forces

$$|\vec{F}_1| = m_1 g = (0.50 \text{ kg})(9.80 \frac{\text{m}}{\text{s}^2}) = 4.90 \text{ N}$$

$$|\vec{F}_2| = m_2 g = (0.80 \text{ kg})(9.80 \frac{\text{m}}{\text{s}^2}) = 7.84 \text{ N}$$

$$|\vec{F}_3| = m_3 g = (0.90 \text{ kg})(9.80 \frac{\text{m}}{\text{s}^2}) = 8.82 \text{ N}$$

(3) Experimental Resultant

$$|\vec{R}_3| = F_3 = 8.82 \text{ N}$$

$$\theta_{R_{\text{exp}}} = \theta_3 - 180^\circ = (257^\circ) - 180^\circ = 77^\circ = \theta_{R_{\text{exp}}}$$

(4) Theoretical Resultant.

\hat{x} :

$$F_{1x} = F_1 \cos(\theta_1) = (4.90 \text{ N}) \cos(15^\circ) = 4.74 \text{ N} = F_{1x}$$

$$F_{2x} = F_2 \cos(\theta_2) = (7.84 \text{ N}) \cos(110^\circ) = -2.68 \text{ N} = F_{2x}$$

$$R_x = F_{1x} + F_{2x} = [4.74 \text{ N}] + [-2.68 \text{ N}] = 2.06 \text{ N} = R_{x_{\text{th}}}$$

Setup ϕ (Conti)

Mengyan - 2/2

$$y: F_{1y} = F_1 \sin(\theta_1) = (4.90 \text{ N}) (\sin(15^\circ)) = \boxed{1.27 \text{ N} = F_{1y}}$$

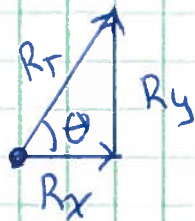
$$F_{2y} = F_2 \sin(\theta_2) = (7.84 \text{ N}) \sin(110^\circ) = \boxed{7.37 \text{ N} = F_{2y}}$$

$$R_y = F_{1y} + F_{2y} = \boxed{1.27 \text{ N}} + \boxed{7.37 \text{ N}} = \boxed{8.64 \text{ N} = R_{y,th}}$$

(5) Theoretical Result:

$$|\vec{R}| = \sqrt{R_{x,th}^2 + R_{y,th}^2} = \sqrt{(2.06 \text{ N})^2 + [8.64 \text{ N}]^2}$$

$$\boxed{R_T = 8.88 \text{ N}}$$



$$\theta_{th} = \tan^{-1} \left[\frac{R_y}{R_x} \right] = \tan^{-1} \left(\frac{8.64 \text{ N}}{2.06 \text{ N}} \right) = \boxed{76.6^\circ = \theta_{th}}$$

(6) % Diff in Resultant

$$\% \text{ Diff}_R = \frac{R_{exp} - R_{th}}{R_{th}} \cdot 100\% = \frac{8.82 \text{ N} - 8.88 \text{ N}}{8.88 \text{ N}} \cdot 100\%$$

$$\boxed{\% \text{ Diff}_R = -0.68\%}$$

(7) % Diff, θ

$$\% \text{ Diff}_\theta = \frac{\theta_{exp} - \theta_{th}}{180^\circ} \cdot 100\% = \frac{77^\circ - 76.6^\circ}{180^\circ} \cdot 100\%$$

$$\boxed{\% \text{ Diff}_\theta = 0.22\%}$$