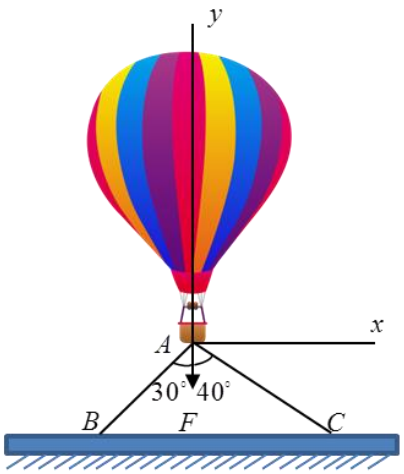
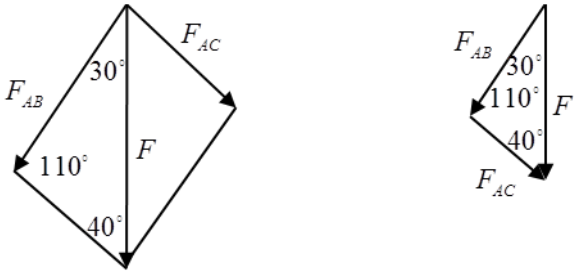
4. The vertical resultant force, which holds the balloon in place, follows a normal distribution $F \sim N(400,5^2)$ N. Resolve this force into components along the tether lines *AB* and *AC*, and determine the distribution of each component.



Solution



From the figure shown, we have

$$\frac{F_{AC}}{\sin 30^\circ} = \frac{F}{\sin 110^\circ},\ F_{AC} = \frac{\sin 30^\circ}{\sin 110^\circ} F$$

$$\frac{F_{AB}}{\sin 40^\circ} = \frac{F}{\sin 110^\circ},\ F_{AB} = \frac{\sin 40^\circ}{\sin 110^\circ} F$$

Considering $F \sim N(400,5^2)$ N, we have

$$\mu_{F_{AC}} = \frac{\sin 30^\circ}{\sin 110^\circ}\mu_F = \frac{\sin 30^\circ}{\sin 110^\circ}(400) = 212.84 \text{ N}$$

$$\sigma_{F_{AC}} = \frac{\sin 30^\circ}{\sin 110^\circ}\sigma_F = \frac{\sin 30^\circ}{\sin 110^\circ}(5) = 2.66 \text{ N}$$

$$\mu_{F_{AB}} = \frac{\sin 40^\circ}{\sin 110^\circ}\mu_F = \frac{\sin 40^\circ}{\sin 110^\circ}(400) = 273.62 \text{ N}$$

$$\sigma_{F_{AB}} = \frac{\sin 40^\circ}{\sin 110^\circ}\sigma_F = \frac{\sin 40^\circ}{\sin 110^\circ}(5) = 3.42 \text{ N}$$

Thus, we conclude the distribution of each component is

$$F_{AB} \sim N(273.62, 3.42^2) \text{ N}$$ **Ans.**

$$F_{AC} \sim N(212.84, 2.66^2) \text{ N}$$ **Ans.**