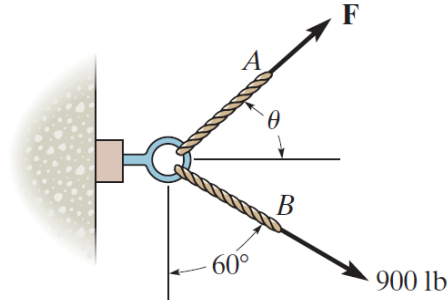


Problem 2-9

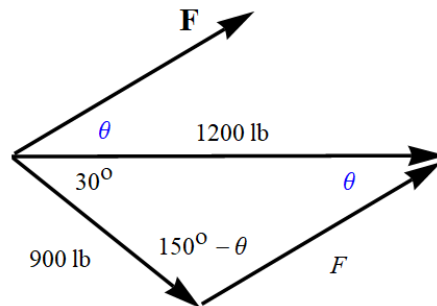
If the resultant force acting on the support is to be 1200 lb, directed horizontally to the right, determine the force \mathbf{F} in rope A and the corresponding angle θ .



Prob. 2-9

Solution

Draw the triangle that the 1200 lb force and \mathbf{F} make with the resultant. Use geometry to determine its angles.



Use the law of sines to determine θ .

$$\frac{1200 \text{ lb}}{\sin(150^\circ - \theta)} = \frac{900 \text{ lb}}{\sin \theta}$$

$$\frac{4}{3} \sin \theta = \sin(150^\circ - \theta)$$

$$\frac{4}{3} \sin \theta = \sin 150^\circ \cos \theta - \cos 150^\circ \sin \theta$$

$$\frac{4}{3} \sin \theta = \frac{1}{2} \cos \theta + \frac{\sqrt{3}}{2} \sin \theta$$

$$\left(\frac{4}{3} - \frac{\sqrt{3}}{2} \right) \sin \theta = \frac{1}{2} \cos \theta$$

$$\tan \theta = \frac{3}{8 - 3\sqrt{3}} \rightarrow \theta \approx 46.9^\circ$$

Use the law of sines again to find F .

$$\frac{F}{\sin 30^\circ} = \frac{900 \text{ lb}}{\sin \theta}$$

Solve for F .

$$\begin{aligned} F &= \frac{900 \text{ lb}}{\sin \theta} \sin 30^\circ \\ &= 150(8 - 3\sqrt{3}) \sqrt{1 + \frac{9}{(8 - 3\sqrt{3})^2}} \text{ lb} \\ &\approx 616 \text{ lb} \end{aligned}$$