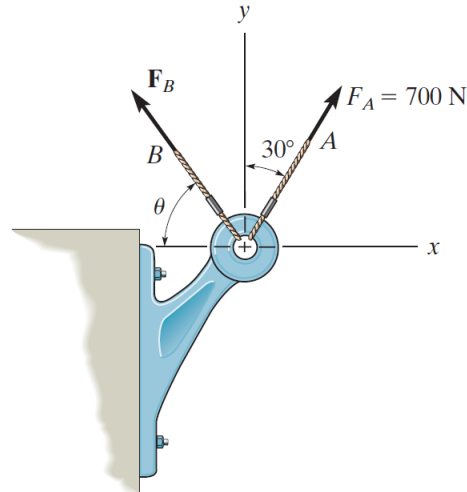


## Problem 2-47

Determine the magnitude and orientation, measured counterclockwise from the positive  $y$  axis, of the resultant force acting on the bracket, if  $F_B = 600$  N and  $\theta = 20^\circ$ .



Probs. 2-46/47

### Solution

Write each of the forces in component form.

$$\mathbf{F}_A = 700 \langle \sin 30^\circ, \cos 30^\circ \rangle \text{ N}$$

$$\mathbf{F}_B = 600 \langle -\cos 20^\circ, \sin 20^\circ \rangle \text{ N}$$

Add  $\mathbf{F}_A$  and  $\mathbf{F}_B$  together to get the resultant force  $\mathbf{F}_R$ .

$$\begin{aligned} \mathbf{F}_R &= \mathbf{F}_A + \mathbf{F}_B \\ &= \langle 700 \sin 30^\circ - 600 \cos 20^\circ, 700 \cos 30^\circ + 600 \sin 20^\circ \rangle \text{ N} \\ &\approx \langle -214, 811 \rangle \text{ N} \end{aligned}$$

Its magnitude is

$$\begin{aligned} |\mathbf{F}_R| &= \sqrt{(700 \sin 30^\circ - 600 \cos 20^\circ)^2 + (700 \cos 30^\circ + 600 \sin 20^\circ)^2} \\ &\approx 839 \text{ N} \end{aligned}$$

and the direction it points in counterclockwise from the positive  $x$ -axis is

$$\tan \phi = \frac{700 \cos 30^\circ + 600 \sin 20^\circ}{700 \sin 30^\circ - 600 \cos 20^\circ} \rightarrow \phi \approx 180^\circ + \tan^{-1} \left( \frac{811}{-214} \right) \approx 105^\circ.$$

Measuring the counterclockwise angle from the positive  $y$ -axis instead gives  $\phi - 90^\circ \approx 14.8^\circ$ .