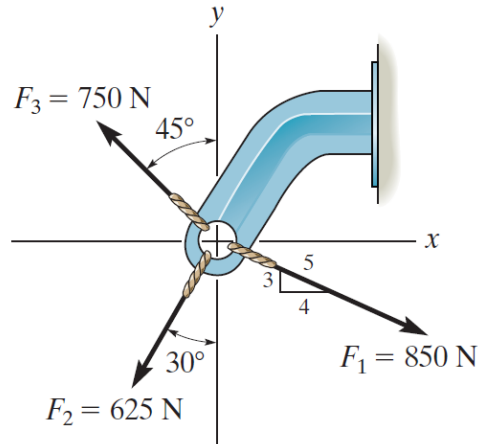


### Problem 2-43

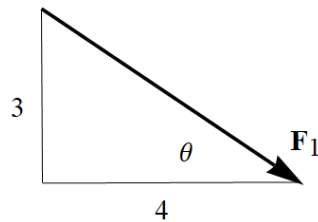
Determine the magnitude of the resultant force and its direction, measured counterclockwise from the positive  $x$  axis.



#### Probs. 2–42/43

#### Solution

Begin by finding the angle  $\mathbf{F}_1$  makes with the horizontal.



$$\tan \theta = \frac{3}{4} \rightarrow \theta = \tan^{-1} \left( \frac{3}{4} \right) \approx 36.9^\circ$$

Write each of the forces in component form.

$$\mathbf{F}_1 = 850 \langle \cos \theta, -\sin \theta \rangle \text{ N} = 850 \left\langle \frac{4}{5}, -\frac{3}{5} \right\rangle \text{ N} = \langle 680, -510 \rangle \text{ N}$$

$$\mathbf{F}_2 = 625 \langle -\sin 30^\circ, -\cos 30^\circ \rangle \text{ N}$$

$$\mathbf{F}_3 = 750 \langle -\sin 45^\circ, \cos 45^\circ \rangle \text{ N}$$

Add them together to get the resultant force.

$$\begin{aligned} \mathbf{F}_R &= \mathbf{F}_1 + \mathbf{F}_2 + \mathbf{F}_3 \\ &= \langle 680 - 625 \sin 30^\circ - 750 \sin 45^\circ, -510 - 625 \cos 30^\circ + 750 \cos 45^\circ \rangle \text{ N} \\ &\approx \langle -163, -521 \rangle \text{ N} \end{aligned}$$

Its magnitude is

$$\begin{aligned} |\mathbf{F}_R| &= \sqrt{(680 - 625 \sin 30^\circ - 750 \sin 45^\circ)^2 + (-510 - 625 \cos 30^\circ + 750 \cos 45^\circ)^2} \text{ N} \\ &\approx 546 \text{ N}, \end{aligned}$$

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

$$\tan \phi = \frac{-510 - 625 \cos 30^\circ + 750 \cos 45^\circ}{680 - 625 \sin 30^\circ - 750 \sin 45^\circ} \rightarrow \phi \approx 180^\circ + \tan^{-1} \left( \frac{-521}{-163} \right) \approx 253^\circ.$$