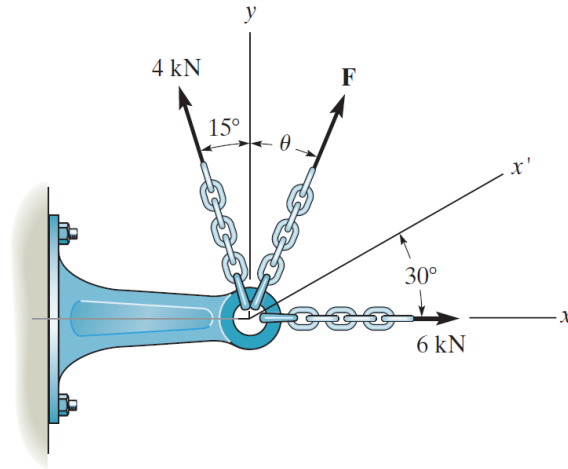


Problem 2-59

If $F = 5$ kN and $\theta = 30^\circ$, determine the magnitude of the resultant force and its direction, measured counterclockwise from the positive x axis.



Probs. 2-58/59

Solution

Write each of the forces in component form.

$$\mathbf{F}_1 = 4 \langle -\sin 15^\circ, \cos 15^\circ \rangle \text{ kN}$$

$$\mathbf{F}_2 = 6 \langle 1, 0 \rangle \text{ kN}$$

$$\mathbf{F} = 5 \langle \sin 30^\circ, \cos 30^\circ \rangle \text{ kN}$$

Add them together to get the resultant force.

$$\begin{aligned} \mathbf{F}_R &= \mathbf{F}_1 + \mathbf{F}_2 + \mathbf{F} \\ &= \langle -4 \sin 15^\circ + 6 + 5 \sin 30^\circ, 4 \cos 15^\circ + 5 \cos 30^\circ \rangle \text{ kN} \\ &\approx \langle 7.46, 8.19 \rangle \text{ kN} \end{aligned}$$

Its magnitude is

$$\begin{aligned} |F_R| &= \sqrt{(-4 \sin 15^\circ + 6 + 5 \sin 30^\circ)^2 + (4 \cos 15^\circ + 5 \cos 30^\circ)^2} \text{ kN} \\ &\approx 11.1 \text{ kN}, \end{aligned}$$

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

$$\tan \phi = \frac{4 \cos 15^\circ + 5 \cos 30^\circ}{-4 \sin 15^\circ + 6 + 5 \sin 30^\circ} \rightarrow \phi \approx 47.7^\circ.$$