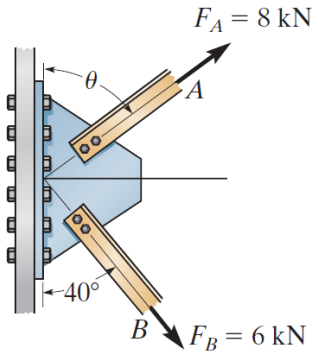
Problem 2-11

The plate is subjected to the two forces at A and B as shown. If $\theta = 60°$, determine the magnitude of the resultant of these two forces and its direction measured clockwise from the horizontal.



Probs. 2–11/12

Solution

Write each of the forces in component form.

$$\mathbf{F}_A = 8000\langle \sin 60°, \cos 60° \rangle \text{ N}$$

$$\mathbf{F}_B = 6000\langle \sin 40°, -\cos 40° \rangle \text{ N}$$

Add these vectors together to get the resultant.

$$\begin{aligned}\mathbf{F}_R &= \mathbf{F}_A + \mathbf{F}_B \\ &= \langle 8000\sin 60° + 6000\sin 40°, 8000\cos 60° - 6000\cos 40° \rangle \text{ N} \\ &\approx \langle 1.08 \times 10^4, -596 \rangle \text{ N}\end{aligned}$$

Its magnitude is

$$|\mathbf{F}_R| = \sqrt{(8000\sin 60° + 6000\sin 40°)^2 + (8000\cos 60° - 6000\cos 40°)^2} \text{ N} \approx 1.08 \times 10^4. \text{ N} = 10.8 \text{ kN},$$

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

$$\tan\phi = \frac{8000\cos 60° - 6000\cos 40°}{8000\sin 60° + 6000\sin 40°} \quad \rightarrow \quad \phi \approx -3.16°.$$

Therefore, the direction it points clockwise from the positive x-axis is 3.16°.