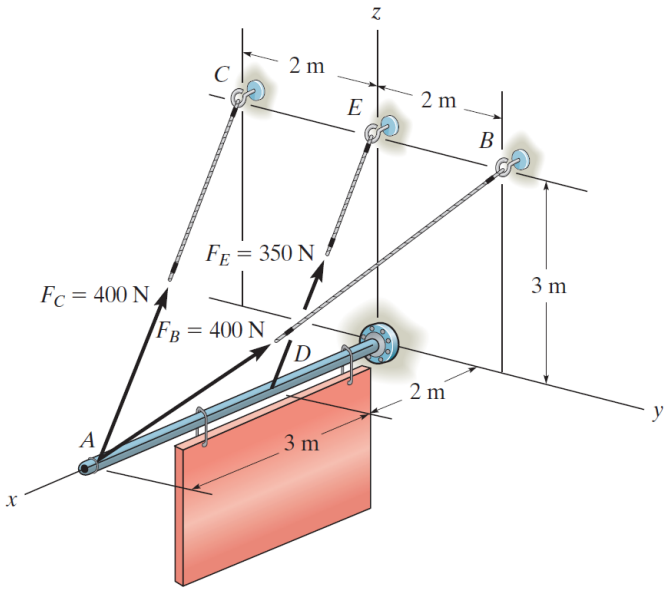
Problem 2-97

Determine the magnitude and coordinate direction angles of the resultant force of the two forces acting on the sign at point A.



Probs. 2–96/97

Solution

The forces acting on the sign at point A were found in Problem 2-96.

$$\mathbf{F}_B = 400\,\frac{\langle -5, 2, 3\rangle}{\sqrt{38}}\ \text{N} \approx \langle -324, 130, 195\rangle\ \text{N}$$

$$\mathbf{F}_C = 400\,\frac{\langle -5, -2, 3\rangle}{\sqrt{38}}\ \text{N} \approx \langle -324, -130, 195\rangle\ \text{N}$$

Add them together to get the resultant force acting at point A.

$$\begin{aligned}\mathbf{F}_A &= \mathbf{F}_B + \mathbf{F}_C \\ &= 400\,\frac{\langle -5, 2, 3\rangle}{\sqrt{38}}\ \text{N} + 400\,\frac{\langle -5, -2, 3\rangle}{\sqrt{38}}\ \text{N} \\ &= \left\langle -\frac{4000}{\sqrt{38}}, 0, \frac{2400}{\sqrt{38}}\right\rangle\ \text{N} \\ &\approx \langle -649, 0, 389\rangle\ \text{N}\end{aligned}$$

Its magnitude is

$$\begin{aligned}|\mathbf{F}_A| &\approx \sqrt{(-649)^2 + (0)^2 + (389)^2}\ \text{N} \\ &\approx 757\ \text{N}.\end{aligned}$$

Divide the resultant by its magnitude to get a unit vector in the same direction.

$$\frac{\mathbf{F}_A}{|\mathbf{F}_A|} \approx \frac{\langle -649, 0, 389 \rangle}{757}$$

The direction angles for the resultant can now be found.

$$\begin{cases} \cos\alpha \approx -\dfrac{649}{757} \\ \cos\beta \approx 0 \\ \cos\gamma \approx \dfrac{389}{757} \end{cases} \quad \rightarrow \quad \begin{cases} \alpha \approx 149^\circ \\ \beta \approx 90.0^\circ \\ \gamma \approx 59.0^\circ \end{cases}$$