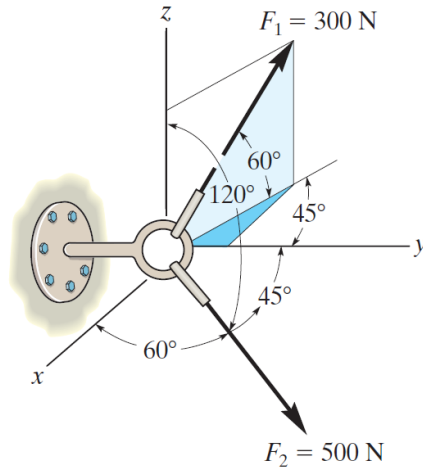


Problem 2-65

The screw eye is subjected to the two forces shown. Express each force in Cartesian vector form and then determine the resultant force. Find the magnitude and coordinate direction angles of the resultant force.



Probs. 2-65/66

Solution

Write each of the forces in component form.

$$\mathbf{F}_1 = 300 \langle -\cos 60^\circ \sin 45^\circ, \cos 60^\circ \cos 45^\circ, \sin 60^\circ \rangle \text{ N} \approx \langle -106, 106, 260 \rangle \text{ N}$$

$$\mathbf{F}_2 = 500 \langle \cos 60^\circ, \cos 45^\circ, \cos 120^\circ \rangle \text{ N} \approx \langle 250, 354, -250 \rangle \text{ N}$$

Add them together to get the resultant force.

$$\mathbf{F}_R = \mathbf{F}_1 + \mathbf{F}_2$$

$$\begin{aligned} &= \langle -300 \cos 60^\circ \sin 45^\circ + 500 \cos 60^\circ, 300 \cos 60^\circ \cos 45^\circ + 500 \cos 45^\circ, 300 \sin 60^\circ + 500 \cos 120^\circ \rangle \text{ N} \\ &\approx \langle 144, 460, 9.81 \rangle \text{ N} \end{aligned}$$

Its magnitude is

$$\begin{aligned} |\mathbf{F}_R| &\approx \sqrt{(144)^2 + (460)^2 + (9.81)^2} \text{ N} \\ &\approx 482 \text{ N}. \end{aligned}$$

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

$$\frac{\mathbf{F}_R}{|\mathbf{F}_R|} \approx \frac{\langle 144, 460, 9.81 \rangle \text{ N}}{482 \text{ N}}$$

Its direction angles are therefore

$$\left\{ \begin{array}{l} \cos \alpha \approx \frac{144}{482} \\ \cos \beta \approx \frac{460}{482} \\ \cos \gamma \approx \frac{9.81}{482} \end{array} \right. \rightarrow \left\{ \begin{array}{l} \alpha \approx 72.6^\circ \\ \beta \approx 17.4^\circ \\ \gamma \approx 88.8^\circ \end{array} \right.$$