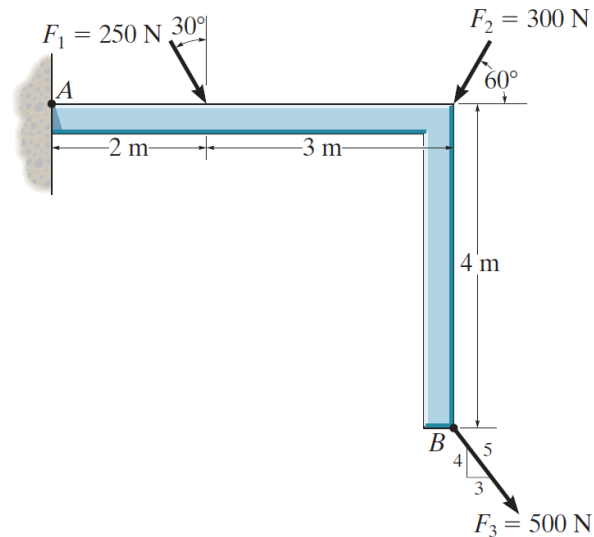


Problem 4-8

Determine the moment of each of the three forces about point B .



Probs. 4-7/8

Solution

Take point B to be the origin of an xyz -coordinate system. Then the moment of \mathbf{F}_1 about B is

$$\begin{aligned} \mathbf{M}_1 &= \mathbf{r}_1 \times \mathbf{F}_1 \\ &= \langle -3, 4, 0 \rangle \times 250 \langle \sin 30^\circ, -\cos 30^\circ, 0 \rangle \text{ N} \cdot \text{m} \\ &= \begin{vmatrix} \hat{\mathbf{x}} & \hat{\mathbf{y}} & \hat{\mathbf{z}} \\ -3 & 4 & 0 \\ 250 \sin 30^\circ & -250 \cos 30^\circ & 0 \end{vmatrix} \text{ N} \cdot \text{m} \\ &\approx (150. \text{ N} \cdot \text{m}) \hat{\mathbf{z}}, \end{aligned}$$

the moment of \mathbf{F}_2 about B is

$$\begin{aligned} \mathbf{M}_2 &= \mathbf{r}_2 \times \mathbf{F}_2 \\ &= \langle 0, 4, 0 \rangle \times 300 \langle -\cos 60^\circ, -\sin 60^\circ, 0 \rangle \text{ N} \cdot \text{m} \\ &= \begin{vmatrix} \hat{\mathbf{x}} & \hat{\mathbf{y}} & \hat{\mathbf{z}} \\ 0 & 4 & 0 \\ -300 \cos 60^\circ & -300 \sin 60^\circ & 0 \end{vmatrix} \text{ N} \cdot \text{m} \\ &\approx (600. \text{ N} \cdot \text{m}) \hat{\mathbf{z}}, \end{aligned}$$

and the moment of \mathbf{F}_3 about B is

$$\begin{aligned}\mathbf{M}_3 &= \mathbf{r}_3 \times \mathbf{F}_3 \\ &= \langle 0, 0, 0 \rangle \times 500 \left\langle \frac{3}{5}, -\frac{4}{5}, 0 \right\rangle \text{ N} \cdot \text{m} \\ &= \begin{vmatrix} \hat{\mathbf{x}} & \hat{\mathbf{y}} & \hat{\mathbf{z}} \\ 0 & 0 & 0 \\ 300 & -400 & 0 \end{vmatrix} \text{ N} \cdot \text{m} \\ &= (0.00 \text{ N} \cdot \text{m}) \hat{\mathbf{z}}.\end{aligned}$$