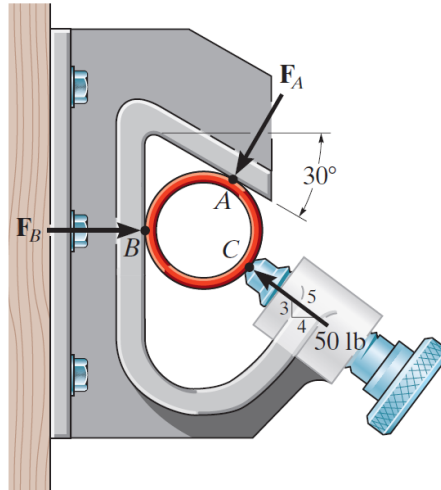


Problem R3-1

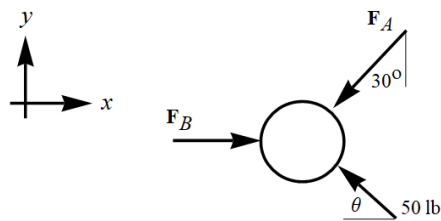
The pipe is held in place by the vise. If the bolt exerts a force of 50 lb on the pipe in the direction shown, determine the forces F_A and F_B that the smooth contacts at A and B exert on the pipe.



Prob. R3-1

Solution

Draw a free-body diagram for the pipe. Let θ be the angle that the 50-lb force makes with the horizontal.



Write each of the forces in component form.

$$\mathbf{F}_A = F_A \langle -\sin 30^\circ, -\cos 30^\circ \rangle$$

$$\mathbf{F}_B = F_B \langle 1, 0 \rangle$$

$$\mathbf{F} = 50 \langle -\cos \theta, \sin \theta \rangle \text{ lb} = 50 \left\langle -\frac{4}{5}, \frac{3}{5} \right\rangle \text{ lb} = \langle -40, 30 \rangle \text{ lb}$$

For the pipe to be in equilibrium, the sum of the forces must be zero.

$$\mathbf{F}_A + \mathbf{F}_B + \mathbf{F} = \mathbf{0}$$

$$F_A \langle -\sin 30^\circ, -\cos 30^\circ \rangle + F_B \langle 1, 0 \rangle + \langle -40, 30 \rangle \text{ lb}$$

$$\langle -F_A \sin 30^\circ + F_B - 40, -F_A \cos 30^\circ + 30 \rangle \text{ lb} = \langle 0, 0 \rangle$$

Match the components to get a system of equations.

$$\left. \begin{aligned} -F_A \sin 30^\circ + F_B - 40 &= 0 \\ -F_A \cos 30^\circ + 30 &= 0 \end{aligned} \right\}$$

Solving it yields

$$F_A = 20\sqrt{3} \text{ lb} \approx 34.6 \text{ lb}$$

$$F_B = 40 + 10\sqrt{3} \text{ lb} \approx 57.3 \text{ lb.}$$