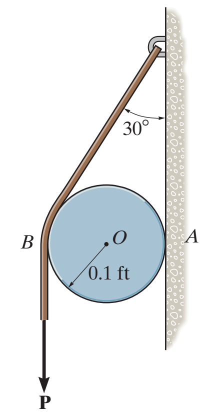
8–94.

A minimum force of $P = 50$ lb is required to hold the cylinder from slipping against the belt and the wall. Determine the weight of the cylinder if the coefficient of friction between the belt and cylinder is $\mu_s = 0.3$ and slipping does not occur at the wall.



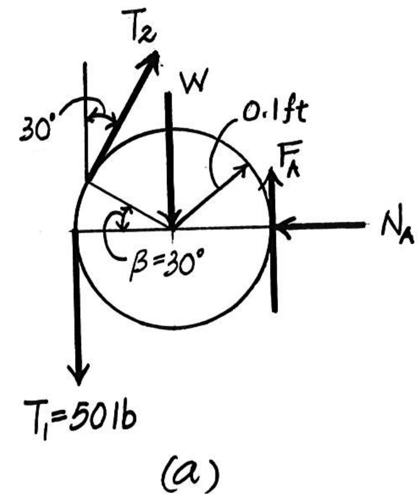
SOLUTION

Equations of Equilibrium: Write the moment equation of equilibrium about point A by referring to the FBD of the cylinder shown in Fig. a,

$$\circlearrowleft + \Sigma M_A = 0; \quad 50(0.2) + W(0.1) - T_2 \cos 30°(0.1 + 0.1 \cos 30°) - T_2 \sin 30°(0.1 \sin 30°) = 0 \quad \textbf{(1)}$$

Frictional Force on Flat Belt: Here, $T_1 = 50$ lb, $\beta = \left(\frac{30°}{180°}\right)\pi = \frac{\pi}{6}$ rad. Applying Eq. 8–6

$$T_2 = T_1 e^{\mu\beta}$$
$$= 50e^{0.3\left(\frac{\pi}{6}\right)} = 58.50 \text{ lb}$$

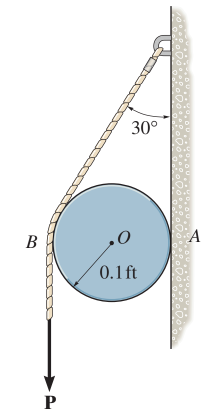


Substitute this result into Eq. (1),

$$W = 9.17 \text{ lb} \qquad \textbf{Ans.}$$

8–95.

The cylinder weighs 10 lb and is held in equilibrium by the belt and wall. If slipping does not occur at the wall, determine the minimum vertical force P which must be applied to the belt for equilibrium. The coefficient of static friction between the belt and the cylinder is $\mu_s = 0.25$.



SOLUTION

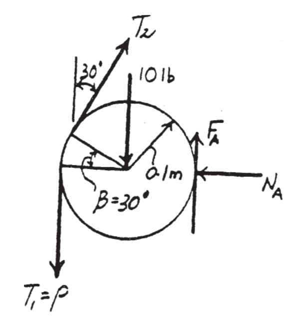
Equations of Equilibrium:

$$\circlearrowleft + \Sigma M_A = 0; \qquad P(0.2) + 10(0.1) - T_2 \cos 30°(0.1 + 0.1 \cos 30°)$$

$$- T_2 \sin 30°(0.1 \sin 30°) = 0 \qquad \textbf{(1)}$$

Frictional Force on Flat Belt: Here, $\beta = 30° = \dfrac{\pi}{6}$ rad and $T_1 = P$. Applying Eq. 8–6, $T_2 = T_1\, e^{\mu\beta}$, we have

$$T_2 = Pe^{0.25(\pi/6)} = 1.140P \qquad \textbf{(2)}$$



Solving Eqs. (1) and (2) yields

$$P = 78.7 \text{ lb} \qquad \textbf{Ans.}$$

$$T_2 = 89.76 \text{ lb}$$