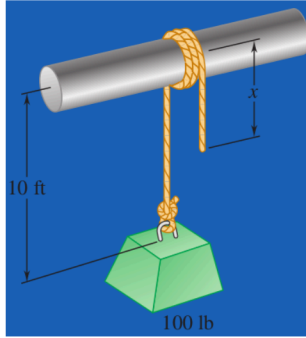


A rope having a weight per unit length of 0.4 lb/ft is wound $2\frac{1}{2}$ times around a horizontal rod. Knowing that the coefficient of static friction between the rope and the rod is 0.30 , determine the minimum length x of rope that should be left hanging if a 100-lb load is to be supported.



$$\beta = 2.5 \text{ wraps} \left(\frac{2\pi \text{ rad}}{1 \text{ wrap}} \right) = 5\pi \text{ rad}$$

$$T_1 = 100 + 0.4 \cdot 10 = 104$$

$$T_2 = x \cdot 0.4$$

$$\frac{T_1}{T_2} = e^{\mu_s \beta}$$

$$\frac{104}{0.4x} = e^{0.3 \cdot 5\pi} = 111$$

$$\frac{x \cdot 0.4}{104} = 111$$

$$\frac{104}{0.4(111)} = x = \boxed{2.3 \text{ ft}}$$

$$x = \frac{104 \cdot 111}{0.4} = 28860 \text{ ft}$$