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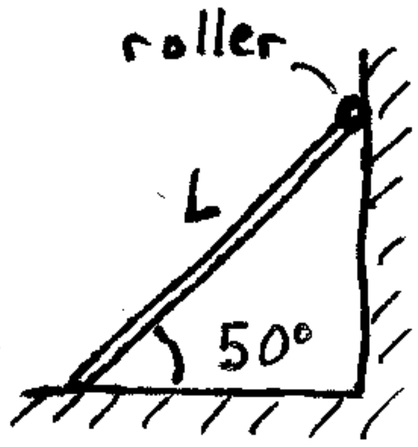
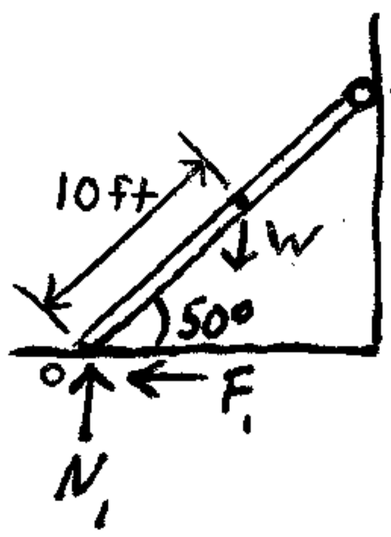
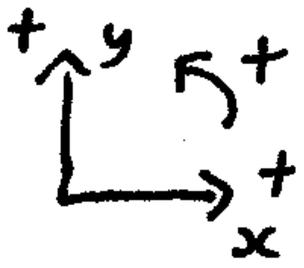
This is a problem involving statics.



A uniform board of length $L = 20$ ft is leaning against a wall, as shown. The top end of the board has a roller on it. If the board has a weight of 70 lb, what is the minimum coefficient of static friction between board and ground?

Solution:





(only a normal force is possible where there is a roller present)

$$\Sigma F_x = 0 \Rightarrow -F_1 - N_2 = 0 \Rightarrow F_1 + N_2 = 0 \quad (1)$$

$$\Sigma F_y = 0 \Rightarrow N_1 - W = 0 \quad (2)$$

$$\Sigma \tau_0 = 0 \Rightarrow -W\cos 50^\circ (10) + N_2 \sin 50^\circ (20) = 0 \quad (3)$$

From equation (3), $N_2 = \dfrac{W\cos 50^\circ}{2\sin 50^\circ}$, $W = 70$ lb

$$N_2 = 29.37 \text{ lb}$$

From equation (2), $N_1 = W = 70\ lb$

From equation (1), $F_1 = -N_2 = -29.37\ lb$

The coefficient of static friction to be calculated is the minimum value necessary to prevent slipping at the base of the board:

$$\mu_s = \frac{|F_1|}{N_1} = \frac{29.37\ lb}{70\ lb} = 0.42$$ (minimum value needed to prevent slipping at base of board and have static equilibrium)