

Problem 1: Friction II

The 20-lb homogeneous object is supported at **A** and **B**. The distance $h = 4$ in, and the coefficient of static friction at **A** and **B** is $\mu_s = 0.4$. Determine if the object will slip or tip.

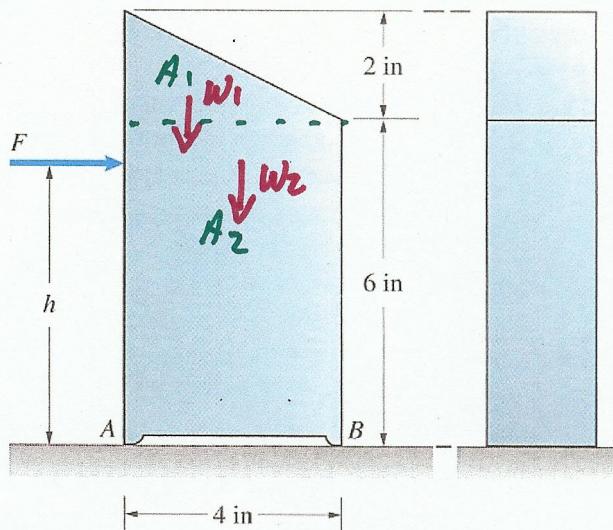
$$A_1 = 2 \times 4 \times \frac{1}{2} = 4 \text{ in}^2$$

$$A_2 = 4 \times 6 = \frac{24}{20} \text{ in}^2$$

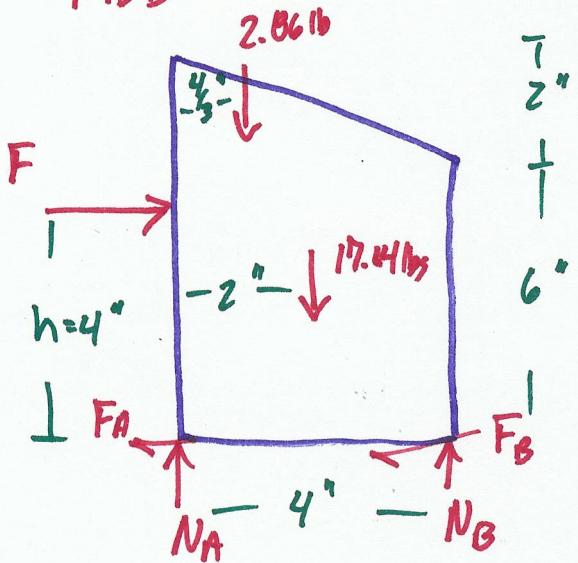
A_{TOT}

$$W_1 = \frac{4}{20} \times 20 \text{ lbs} = 2.00 \text{ lbs}$$

$$W_2 = \frac{24}{20} \times 20 = 17.14 \text{ lbs}$$



FBD



Assume Tipping About B

$$\sum M_B = 0$$

$$4F - 2.667(2.00) - 2(17.14) = 0$$

$$\underline{F = 10.48 \text{ lbs}}$$

Assume Slipping

$$\sum F_y = 0$$

$$-2.00 - 17.14 + N_A + N_B = 0$$

$$N_A + N_B = 20$$

$$\rightarrow \sum F_x = 0$$

$$F - F_A - F_B = 0$$

$$F - \mu_s N_A - \mu_s N_B = 0$$

$$F - \mu_s (N_A + N_B) = 0$$

$$F - 0.4(20) = 0$$

$$\underline{F = 8 \text{ lbs}}$$

∴ SLIPS BEFORE IT TIPS
 $8 \text{ lbs} < 10.48 \text{ lbs}$