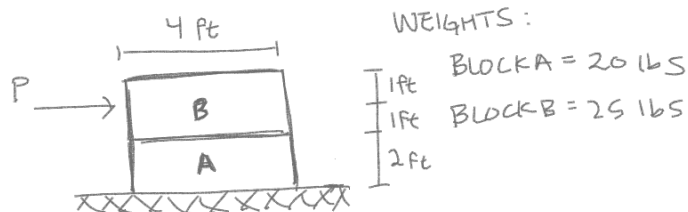


Statics
Friction
Example #3

Determine the largest force, P , can be without causing motion of the blocks in the following figure. The coefficient of friction between the floor and block A is 0.2, and the coefficient of friction between block A and block B is 0.4.



HOW MANY CASES ARE THERE THAT NEED TO BE CHECKED?

1. BLOCK B SLIDES ACROSS BLOCK A, BLOCK A DOESN'T MOVE
2. BLOCK B TIPS ON BLOCK A, BLOCK A DOESN'T MOVE
3. BLOCK A & B SLIDE ACROSS THE FLOOR TOGETHER
4. BLOCK A & B TIP TOGETHER

CASE #1

$$\begin{aligned} +\uparrow \Sigma F_y = 0 &= N - 25 \text{ lbs} \quad N = 25 \text{ lbs} \\ \rightarrow \Sigma F_x = 0 &= P - F \end{aligned}$$

ALSO, $F = \mu N$
 $P - \mu N = 0$

CASE #2

$$\begin{aligned} +\uparrow \Sigma M_o = 0 &= P(1 \text{ ft}) - 25 \text{ lbs}(2 \text{ ft}) \\ P &= \frac{25 \text{ lbs}(2 \text{ ft})}{1 \text{ ft}} = 50 \text{ lbs} \end{aligned}$$

$P_1 = 10 \text{ lbs}$

CASE #3

$$\begin{aligned} +\uparrow \Sigma F_y = 0 &= N - 20 \text{ lbs} - 25 \text{ lbs} \\ N &= 20 \text{ lbs} + 25 \text{ lbs} = 45 \text{ lbs} \\ \rightarrow \Sigma F_x = 0 &= P - F \\ P - \mu N &= 0 \\ P - 0.2(45 \text{ lbs}) &= 0 \end{aligned}$$

CASE #4

$$\begin{aligned} +\uparrow \Sigma M_o = 0 &= P(3 \text{ ft}) - 25 \text{ lbs}(2 \text{ ft}) - 20 \text{ lbs}(2 \text{ ft}) \\ P &= \frac{50 \text{ lb} \cdot \text{ft} + 40 \text{ lb} \cdot \text{ft}}{3 \text{ ft}} = 30 \text{ lbs} \end{aligned}$$

$P_3 = 9 \text{ lbs}$

THE SMALLEST P CONTROLS $\therefore P_{\text{MAX}} = 9 \text{ lbs}$, BOTH BLOCKS SLIDE

