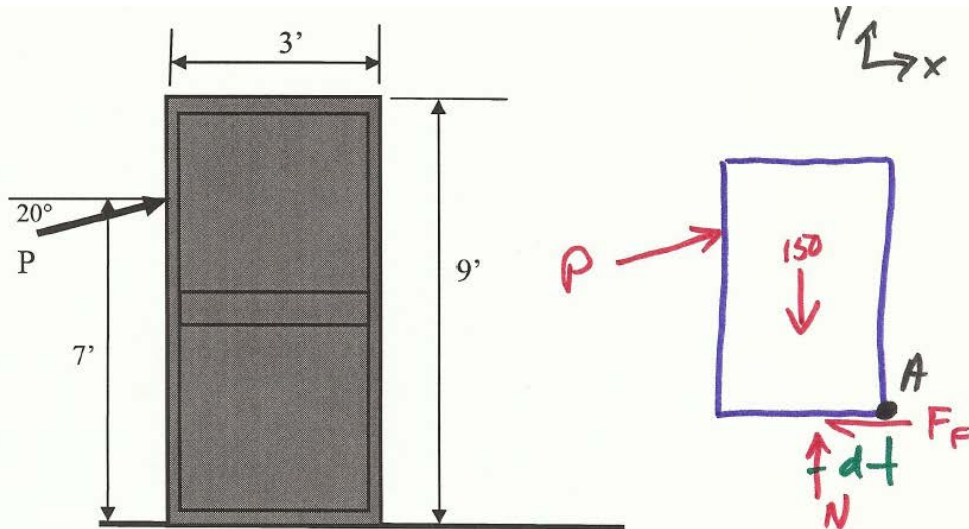


Problem 8: What is the minimum force, P , that will cause the 150 lb crate to move? The coefficient of static friction between the ground and the crate is 0.25. (You must consider both tipping and sliding)



ASSUME SLIPPING

$$F_f = F_{\max} = \mu_s N$$

$$\rightarrow \sum F_x = 0 = P \cos 20^\circ - 0.25 N$$

$$\uparrow \sum F_y = 0 = P \sin 20^\circ - 150 + N$$

$$.94 P - .25 N = 0$$

$$.342 P + N = 150$$

SOLVE SIMIL

$$P = 36.6$$

$$N = 137$$

TO SLIP

ASSUME TIPPING

$$d = 0 \quad \sum M_A = 0 = P \cos 20^\circ (7) + P \sin 20^\circ (3) - 150(1.5)$$

$$7.6 P - 225 = 0$$

$$P = 29.6$$

TO TIP

$$\therefore P_{\min} = 29.6 \text{ lbs}$$

CAUSES TIPPING

ANSWER: $P_{\min} = 29.6 \text{ lbs}$