Announcements

- TAM 210 – This is the last day of class 😊
- Discussion next week is not required for TAM 210 students (but recommended)
- Exam next week is for both TAM 210 AND 211 students

☐ Upcoming deadlines:
- Monday (4/1): PrairieLearn HW9/11
Objectives

- Equilibrium of rigid bodies subjected to dry friction
- Sliding conditions
- Tipping conditions
**Given:** Fridge weight = 250 lb and 
\( \mu_s = 0.4 \)

**Find:** The maximum horizontal force \( P \) that can be applied at without causing movement of the crate.

Is \( N \) in the middle?

\[ \Sigma M_o = P(40\text{ in}) \neq 0 \]

\( \rightarrow \) \( N \) cannot be at 0 if \( P \neq 0 \)

Actual EqE:

\[ \Sigma M_o = P(40\text{ in}) - N(x) = 0 \]

\[ \Sigma F_y = N - W = 0 \]

\[ N = W \]

\[ x = \frac{40P}{N} \]

If \( x > 18\text{ in} \), the fridge will tip over.

\[ x = \frac{40P}{W} \]

\[ P_{\text{tip}} = \frac{Wx_{\text{max}}}{40} = \frac{(250\text{ lb})(18\text{ in})}{40\text{ in}} \]

\[ 112.5 \text{ lb} = P_{\text{tip}} > P_{\text{slide}} = 800 \text{ lb} \]

Sliding condition:

\[ \Sigma F_x = -P + F = 0 \]

\[ F_s = \mu_s N \]

\[ \rightarrow P_{\text{slide}} = F_s = \mu_s N \]

\[ P_{\text{slide}} = 0.4(250 \text{ lb}) \]

Will occur first, so use this for \( P_{\text{max}} \).
The bed of the dump truck is raised to move the vending machines off the bed. When the angle is at 25°, can the vending maintain equilibrium? If so, determine the static coefficient of friction between a vending machine and the surface of the truck bed.

\[ \Sigma M_o = 0 \]
\[ = -W \sin \theta_s (2.5H) + N (1.5H) \]
\[ \sin \theta_s = \frac{1.5N}{2.5W} \]

\[ \Sigma F_x = 0 \]
\[ = W \sin \theta_s - F_s \]
\[ = W \sin \theta_s - \mu_s N \]
\[ W \sin \theta_s = \mu_s N \]

Use \( \Sigma F_y = 0 \) to find \( N \): \( \Sigma F_y = -W \cos \theta + N = 0 \)
\[ \rightarrow N = W \cos \theta \]
\[ \sin \theta_1 = \frac{1.5 \sqrt{N \cos \theta_1}}{2.5} \]
\[ \rightarrow \quad \tan \theta_4 = 1.5 / 2.5 = \]
\[ \sin \theta_5 = \frac{\mu_s \sqrt{N \cos \theta_5}}{\mu_s} \]
\[ \rightarrow \quad \tan \theta_5 = \mu_s. \]

- If \( \mu_s < 0.6 \), the vending machine will slide before tipping over. If \( \mu_s > 0.6 \), tipping will occur first.