All About Friction

- Friction tends to oppose movement sliding on a surface
- Two types: static & kinetic
  - Static: objects stuck, frictional force just enough to cancel other forces' components parallel to surface, preventing acceleration
  - Kinetic: objects sliding, frictional force opposes motion (opposite velocity)

Static Friction

- Always just enough to cancel
  - But there's a limit beyond which the object starts moving: $f_{s,max} = \mu_s n$
  - Note this equation is a scalar equation
    - It relates magnitude of normal force to magnitude of frictional force—you have to figure out directions!
  - After motion starts frictional force drops a bit, uses slightly different equation

Kinetic (Sliding) Friction

- If objects sliding against one another, the frictional force is:
  - Constant
  - Different magnitude than max static frictional force: $f_k = \mu_k n$
  - Still parallel to surface, always opposite velocity

Calculus Review

- Min/max of function: $\frac{df}{dx} = 0$
- Chain rule: $\frac{d}{dx}(f(g(x))) = \frac{df}{dg}\frac{dg}{dx}$