PHYS 210 - General Physics I

FORCES

- Forces!
- Newton's Laws of Motion

Newton's Laws of Motion

Note that Newton's Second Law is a *VECTOR* equation:

$$\vec{F}_{NET} = m\vec{a} = \begin{cases} F_{NET,x} = m a_x \\ F_{NET,y} = m a_y \\ F_{NET,z} = m a_z \end{cases}$$

∀ Cartesian coordinate systems you care to define!

Some particular forces:

- Gravity near planetary surface (weight):
  - $F_g = m\,g = W$
- Normal force, N
  - (perpendicular to surfaces)
- Tension, T
  - in a cord, rope, string, cable, *etc.*
  - Assume T in a section is constant
  - "massless," "non-stretching"
- Friction - resistance to motion

NOTE: Mass is not Weight!!

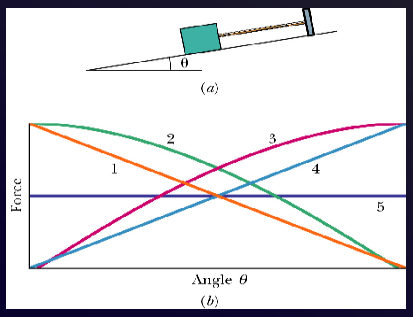
Modeling friction:

- Static friction
  - $F_s \le \mu_s N$
  - $\mu_s \equiv$ coefficient of static friction
- Kinetic friction
  - $F_k = \mu_k N$
  - $\mu_k \equiv$ coefficient of kinetic friction

Try This:

A block is attached to a rope to a bar that is itself rigidly attached to a ramp. What happens to the following as the angle θ is increased?

A. Component of gravitational force along the ramp.
B. The tension in the cord.
C. The gravitational force perpendicular to the ramp.
D. The normal force on the block from the ramp.
E. Which of the curves in the plot corresponds to each of these quantities?



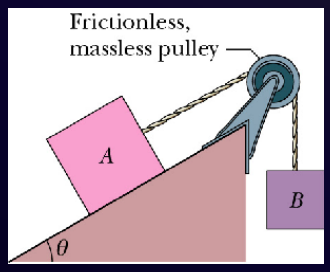
Newton's Third Law

- Applies to the interaction between masses.
- The force mass 1 exerts on mass 2 is equal in magnitude to the force exerted on mass 1 by mass 2:

$$\vec{F}_{12} = -\vec{F}_{21}$$

- "*For every action there is an equal and opposite reaction.*"

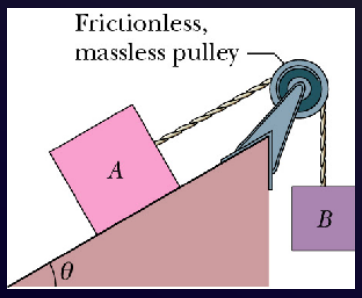
EXAMPLE: Two blocks, m_A & m_B, are connected over a frictionless, massless pulley. The mass of block A is *10 kg* and the coefficient of kinetic friction between block A and the incline is *0.20*. The angle of inclination is 30^o. Block A slides down the incline at a constant speed. Find the mass of block B.



KNOWNS:

- Massless pulley
- $m_A = 10\ kg$
- $\theta = 30^o$
- $\mu_k = 0.20$
- Block A slides down @ const velocity
- Find m_B

EXAMPLE: Two blocks, m_A & m_B, are connected over a frictionless, massless pulley. The mass of block A is *10 kg* and the coefficient of kinetic friction between block A and the incline is *0.20*. The angle of inclination is 30^o. Block A slides down the incline at a constant acceleration of magnitude $a = 1.3\ m/s^2$. Find the mass of block B.



KNOWNS:

- Massless pulley
- $m_A = 10\ kg$
- $\theta = 30^o$
- $\mu_k = 0.20$
- Block A slides down @ const acceleration, $a = 1.3\ m/s^2$.
- Find m_B


Have a great
Weekend!