Flipping Physics Lecture Notes:
AP Physics 1 Review of *Dynamics*
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- Inertial Mass vs. Gravitational Mass
  - Inertial mass: the measure of an object's inertia or a measure of its resistance to acceleration.
  - Gravitational Mass: used to determine the force of gravity or weight of an object. $\vec{F}_g = m\vec{g}$
  - Inertial Mass and Gravitational Mass are experimentally identical.
- Newton's First Law: "An object at rest will remain at rest and an object in motion will remain at a constant velocity unless acted upon by a net external force."
  - Common mistake: "an object in motion will remain in *motion*" is wrong. It will remain at a constant velocity which means it will have a constant speed and a constant direction.
  - Common mistake: "unless acted upon by an external force." Do **not** leave out the word "*net*". It is the *sum of all the forces* that needs to be zero for an object to remain at rest or at a constant velocity.
- Newton's Second Law: $\sum \vec{F} = m\vec{a}$
  - It is arranged differently on the equation sheet: $\vec{a} = \dfrac{\sum \vec{F}}{m}$, but it is the same equation.
  - When you use Newton's Second Law, you must identify object(s) and direction.
  - Free Body Diagrams: always draw them to use Newton's Second Law.
    - On the AP Test, do ***NOT*** break forces in to components in your initial Free Body Diagram.
- The Force of Gravity or Weight of an object is always down. $\vec{F}_g = m\vec{g}$
- The Force Normal is caused by a surface, is normal or perpendicular to the surface and always a push.
- Dimensions for Force are Newtons, N: $\sum \vec{F} = m\vec{a} \Rightarrow N = \dfrac{kg \cdot m}{s^2}$
- The Force of Friction is parallel to the surface, opposes motion and independent of the direction of the force applied. On equation sheet: $\left|\vec{F}_f\right| \le \mu \left|\vec{F}_n\right|$, which works out to be three equations because we have two types of friction.
  - Static or non-moving friction: the two surfaces do *not* slide relative to one another. $\vec{F}_{sf} \le \mu_s \vec{F}_n$ and $\vec{F}_{sf_{\max}} = \mu_s \vec{F}_n$
  - Kinetic or moving friction: the two surfaces *do* slide relative to one another. $\vec{F}_{kf} = \mu_k \vec{F}_n$
  - For two surfaces, the coefficient of kinetic friction is always less that the coefficient of static friction. $\mu_k < \mu_s$
- Newton's Third Law: $\vec{F}_{12} = -\vec{F}_{21}$, For every force from object one on object two there is an equal but opposite force from object two on object one where both forces are vectors.
- Newton's Third Law Force Pairs or Action-Reaction Pairs:
  - Act on two different objects and act simultaneously.
- Inclines: Break the Force of Gravity in to its components that are parallel and perpendicular to the incline. $F_{g_\parallel} = mg\sin\theta$ & $F_{g_\perp} = mg\cos\theta$
- Translational Equilibrium: $\sum \vec{F} = 0 = m\vec{a} \Rightarrow \vec{a} = 0$
  - The object is either at rest or moving with a constant velocity.