4-03

Newton’s Laws & resolving force vectors

"If a" you gonna remember **Newton's laws**, you gotta have a way to remember

- Inertia – resistance to change in motion (AKA, mass)
  - A body in motion tends to stay in motion; a body at rest, tends to stay at rest (**1st law**)
- F_{net} = ma **(2nd law)**
  - Rock star in the world of physics formulas
  - Understand all it implies: Bigger forces make bigger accelerations
  - For a given force, bigger masses mean less acceleration
  - Everything is linear (nothing squared)
  - Zero acceleration doesn't mean zero force…zero NET force
- Action/reaction pairs (**3rd law**)
  - The fun one….walls and floors can push you…what the????
  - For every action, there is an equal and opposite reaction
- You will need to memorize which law is which

Newton's laws examples

- You want to go left:
  - What way do you push on the ground?
  - What pushes YOU left?
- The lazy horse and his cart
- It's hard to stop/start a train, easy to stop/start a cart
- To produce an acceleration of 5 m/s^2 on a 60 kg mass, what force needs to be exerted?

Review what force and acceleration are

- A force is a push or pull that makes something accelerate (measured in Newtons)
- Acceleration is rate of change in velocity
  - What is velocity?
  - Does an object moving at constant speed:
    - In a straight line accelerate?
    - in a circle accelerate? (apply what you know carefully)

Resolving vectors & finding resultant net force

- Same as last unit
- Resolving:
  - Net force is hypotenuse
  - X & Y components use trig, same as before
- Resultant
  - Resolve all forces, Sum in X and in Y, “Anti-resolve” (same as before)
  - Free body diagram may be useful to picture all forces

Example

- A postal worker pulls on a bag of mail on a floor. If he pulls with a force of 250 N 30° above horizontal and there is a frictional force of 120 N. The bag's mass is 80 kg. What is the net force on the bag