Things to Memorize: Motion in One Dimension

Vectors and Scalars

- **Magnitude** is a number that measures how big or strong something is.
- A **vector** has both magnitude and direction.
- A **scalar** has magnitude only (no direction).
- Vectors are written with lines over them ($\vec{A}$). Scalars are not (A).

Speed and Velocity

- **Distance** (d) is a scalar that tells you how far something moved.
- **Displacement** ($\vec{d}$) is a vector that tells you how far it is from where something started to where it ended up, regardless of its path.
- **Speed** (v) is a scalar that tells you how fast something is going.
- **Velocity** ($\vec{v}$) is a vector that tells you how fast something is going and in what direction.
- Speed and velocity tell you how far an object travels in one second.

Frames of Reference and Relative Motion

- Relative motion problems can be solved by changing your frame of reference:
  1. Instead of seeing the problem from a 3rd person point of view, put yourself in the situation.
     - Velocities that are directed in opposite directions in the 3rd person point of view will add.
     - Velocities that are in the same direction in the 3rd person point of view will subtract.
  2. Calculate the time in the 1st person point of view.
  3. Use the time to calculate distances in the 3rd person point of view.
- Relative motion problems can be solved by graphing.
- Relative motion problems can be solved by solving a system of equations.

Acceleration

- **Acceleration** tells you how much an object's speed changes in one second. **Speeding up**, **slowing down**, and **changing direction** are all forms of acceleration.
- When an object speeds up, its acceleration is in the same direction as its motion.
- When an object slows down, its acceleration is in the direction opposite to its motion.
- **Average speed** (v_{avg}) and **average velocity** ($\vec{v_{avg}}$) tell how fast something was moving during a period of time.
- **Instantaneous speed** (v) and **instantaneous velocity** ($\vec{v}$) tell you how fast something is moving at a specific time.

The Kinematic Equations

- There are 5 kinematic variables and 4 kinematic equations. If you know 3 of the variables, you can find the other 2. Which makes for 1 happy physics student.[1]
- To solve an algebraic kinematic equation:
  1. Draw a diagram.
  2. Define a positive direction. Label that direction clearly with an arrow: $\longrightarrow +$
  3. Indicate in words what portion of motion your are considering, (like "motion from launch to the peak of the flight.")
  4. Fill out a chart, including signs and units, of the five kinematics variables:

d or Δx	
v_i or v_0	
v_f or v	
a	
t	

  5. Pick an equation that has only **ONE** unknown variable.
  6. Manipulate the equation to isolate the unknown variable (if needed).
  7. Plug in the numbers.
  8. Write your final answer with units.

[1] [Flipping Physics]. (2015, March 2) *AP Physics 1: Kinematics Review* [Video File] retrieved from https://www.youtube.com/watch?v=8G1oc5Qq90U

Vertical Motion

- An object is in **free fall** when gravity is the only force acting on it.
  - Objects that are falling under the influence of gravity are in free fall.
  - Objects that are *rising* can be in free fall if the only force on them is gravity.
- The acceleration of objects in free-fall is g.
  - On earth $g_{earth} = 9.81 m/s^2$
  - Other planets, moons, asteroids, comets, etc. have their own gravity. Don't use g_{earth} for them.
- If an object lands at the same height it was launched from, the rising time is equal to the falling time.