Extra Credit

2.1 Displacement

Mechanics

- Kinematics - deals with the concepts that are needed to describe motion without any refrence to forces.
- Dynamics - deals with the effect that forces have on motion

$\Delta \vec{x}$ = displacement
$\vec{x}$ = final
$\vec{x}_0$ = initial

$$\Delta \vec{x} = \vec{x} - \vec{x}_0 \qquad \text{Units} = m$$

The displacement is a vector that points from an objects initial position to its final position and has a magnitude that equals the shortest distance between two positions.

2.2 Speed and Velocity

$$\text{Average speed} = \frac{\text{Distance}}{\text{time}} \quad \text{or} \quad \frac{m}{s} \qquad \text{Units} = \frac{m}{s}$$

$$\text{Average Velocity} = \frac{\vec{x} - \vec{x}_0}{t - t_0} \quad \text{or} \quad \frac{\Delta \vec{x}}{\Delta t}$$

speed measures how fast (cant be negative)
velocity measures how fast and direction (can be negative)

instantaneous velocity - indicates how fast the object is moving at each instant of time
instantaneous speed - magnitude of instantaneous velocity

2.3 Acceleration - change in velocity over time

$$\text{Average acceleration} \quad \vec{a} = \frac{\vec{v} - \vec{v}_0}{t - t_0} \quad \text{or} \quad \frac{\Delta \vec{v}}{\Delta t}$$

$$\text{Units} = \frac{m}{s^2}$$

Whenever the acceleration and velocity have opposite directions, the object is said to be decelerating

2.4 Equations of Kinematics for Constant Acceleration

$V = V_0 + at$
$X = V_0 t + \frac{1}{2}at^2$
$V^2 = V_0^2 + 2ax$

X = displacement
a = acceleration
V = final velocity
V_0 = inital velocity
t = total time

Plug in and solve for missing variable

2.5 Applications of the Equations of Kinematics

Decide at the start which directions are going to be positive and negative, pick an orgin, generaly O

You might need to use one equation to solve for a varinble in the final equation needed.

Ex: In getting ready to slam dunk the ball, a basketball player starts from rest and sprints to a speed of 6 m/s in 1.5s. Assuming that the player accelerates uniformly, determine the distance he runs.

x	?
V	6 m/s
V_0	0 m/s
a	
t	1.5 s

$V = V_0 + at$
$6 = 0 + a(1.5)$
$a = 4\ m/s^2$

$X = V_0 t + \frac{1}{2}at^2$
$x = (0)(1.5) + \frac{1}{2}(4)(1.5)^2$
$x = 4.5\ m$

4.5 m