Module #1 Motion In One Dimension

* Distance and Displacement
  + Displacement is the change in an object’s position
    - The difference between the starting and ending points
    - Includes information about direction
    - Vector quantity is a physical measurement that contains directional information
    - Scalar quantity is a physical measurement that does not contain directional information
      * Ex: Distance
    - We label displacement in one direction positive and displacement in the opposite direction as negative
      * Does not matter which way is positive/negative as long as you keep it consistent
    - Example 1.1 p.8
* Speed and Velocity
  + Velocity is the time rate of change of an object’s position
    - Tells us how quickly an object’s position is changing
    - v = Δx / Δt
      * Δ represents the capital Greek letter delta and means “change in”
      * x represents position
      * t represents time
    - Change in position means displacement
    - The SI unit for velocity is meters per second (m/s)
    - Velocity is also a vector quantity
    - Direction is indicated by positive and negative
      * Motion in one direction is positive and the opposite direction is negative
    - Time does not have a direction attached to it, a scalar quantity
  + Speed is the time rate of change of the distance traveled by an object
    - Speed = Δd / Δt
      * d represents distance
      * t represents time
      * no vector quantities
    - Speed is a scalar quantity
    - Example 1.2 p.10
    - Example 1.3 p. 12
* Average and Instantaneous Velocity
  + Instantaneous velocity is the velocity of an object at one moment in time
  + Average velocity is the velocity of an object over an extended period of time
  + Experiment 1.1 p.14
  + Position vs. Time graph
    - Can be used to estimate instantaneous velocity
    - The position of an object is plotted on the y-axis
    - Time is plotted on the x-axis
    - The curve represents an object’s position at various time intervals
    - Shows movement of object in positive and negative directions
    - Can determine velocity by interpreting the graph
      * Take the change in position (displacement) and divide it by the change in time
        + The change in y coordinates / the change in x coordinates
      * The slope of a position versus time curve is the velocity
        + We can estimate the instantaneous velocity by estimating the slope of the curve at a single point
        + The steeper the curve, the larger the slope
        + The sign (positive or negative) refers to the direction of the motion

A maximum speed can have a negative sign

* + - * + A flat curve is a slope of zero
    - Example 1.4 p19
* Velocity is Relative
  + Ex: p. 21: backing out of the driveway
  + Velocity depends on who is observing that velocity
    - Velocity can only be determined relative to an observer
  + What an observer actually sees is the difference between his velocity and the velocity of what he is observing.
    - Take the velocity of the thing being observed and subtract from it the velocity of the observer
  + Example 1.5 p.22
* Acceleration
  + Acceleration is the time rate of change of an object’s velocity
    - Measures how an object’s velocity changes with time
    - a = Δv / Δt
  + Acceleration is a vector quantity
  + SI unit of acceleration is meters per second squared (m/s2)
  + Acceleration can mean either “speed up” or “slow down”
    - If acceleration and velocity have opposite signs, the object is slowing down
    - If acceleration and velocity have identical signs, the object is speeding up
  + Experiment 1.2 p.24
  + Example 1.6 p.25
* Average and Instantaneous Acceleration
  + When the time interval is large, acceleration is an average
  + When the time interval is infinitely short, the acceleration is instantaneous
    - The only way to determine instantaneous acceleration is by studying graphs
  + Velocity vs. time graph
    - Plot velocity on the y-axis
    - Plot time on the x-axis
    - The slope of the curve will be acceleration
    - Use the same methods to analyze as with position vs. time graphs
  + Example 1.7 p.28
    - The area under the curve represents the object’s displacement
      * Learn in calculus
  + If velocity is zero, acceleration does not have to be zero
  + If acceleration is zero, velocity does not have to be zero
* Review questions p. 34
* Practice problems p.35