Concepts to know # 2
over sections 2.1–2.4, 3.1–3.5, 4.1-4.3

- Instantaneous Rate of Change
  - Estimation
    - by smaller and smaller intervals
    - from a data set.
    - by a tangent line on a graph.
  - Evaluation
    - by computing the derivative, $f'(a)$
- Interpretions of the Derivative
  - Be able to tell units
  - be able to give the sign of the derivative
  - Different notation:
    $f'(x) = \frac{dy}{dx} = \frac{d}{dx}(f(x))$
  - approximations using the derivative.
- 4 lines of information that relates the function, first derivative, and second derivative.
- Graphs
  1. given $f(x)$, sketch a graph of $f'(x)$
  2. given $f'(x)$ or $f''(x)$, read off the appropriate information about $f(x)$
- Uses of derivatives
  - Interpretations of the derivative
  - Slope of tangent line at a point
  - Be able to find equation of tangent line
  - Where $f(x)$ is increasing and decreasing.
  - Where $f(x)$ is concave up and concave down.
- Derivative shortcut rules, see chapter 3.
- First derivative test
  - Find critical values: a is a critical value if a is in the domain of $f(x)$ and $f'(a) = 0$ or $f'(a)$ dne
  - intervals where $f(x)$ is increasing or decreasing
  - classifying critical values: local max, local min or neither.
  - **Local maxima and Local minima are y values of the critical value.**
- Second Derivative test to classify critical values
- Second derivative
  - intervals of concavity
  - inflection points are the points where function changes concavity and can be found with the second derivative. Look for where $f''(x) = 0$ and $f''(x)$ dne.
  - Not every point where $f''(x) = 0$ is an inflection point (it has to change concavity.)
  - use second derivative information to sketch a graph of $f(x)$
- Know given position function $s(t)$, then the velocity function $v(t) = s'(t)$ and that the acceleration function $a(t) = v'(t) = s''(t)$
- Global (absolute) max is the largest y-value for the function.
- Global (absolute) min is the smallest y-value for the function.
- To find global (absolute) extrema on an open interval, look at graph.
- Global max/global min on a closed interval are at the critical values in the interval and at the ends of the interval.
- Any additional topic discussed in class.