Concepts to know Exam 3: Math 142

Sections 5.1 - 5.5, 6.1, 6.2, 6.4, and 6.5
Section 6.3 will be on the final.

- Section 5.1: First derivative and graphs
  - Finding critical values.
    * MUST be in the domain
    * where $f'(x) = 0$ or $f'(x) DNE$
  - Classifying critical values as
    * Relative maximum
    * relative minimum
    * neither
  - Finding intervals where $f(x)$ is increasing/decreasing
  - first derivative test using a sign chart
- Section 5.2: Second derivative.
  - higher order derivatives: second derivative $f''(x)$, third derivative $f'''(x)$, fourth derivative $f^{(4)}(x)$
  - Finding possible inflection values
    * MUST be in the domain
    * where $f''(x) = 0$ or $f''(x) DNE$
  - Finding the intervals of concavity
    *
    * Concave up means first derivative is increasing and second derivative is positive
    * concave down means first derivative is decreasing and second derivative is negative.
  - inflection points.
  - interpretation of the inflection point.
- Section 5.3: Graphical analysis and curve sketching
  - Second derivative test
  - Curve Sketching Strategy(these steps do not need to be memorized)
    1. Domain
    2. intercepts
    3. asymptotes

4. first derivative information
   * critical values
   * increasing/decreasing
   * relative min/max
5. second derivative information
   * concave up/down
   * inflection points
6. Sketch the graph
  - If given the information about a function, sketch a graph.
- Section 5.4 and 5.5: Optimizing functions
  - Absolute maximum/minimum
    * If the interval is a closed interval and the function is continuous on the interval,
      1. find critical values
      2. check the critical values in the interval and the ends of the interval to find the abs max and abs min
    * if the interval is not closed OR the function is not continuous on the interval, then do curve sketching strategy to find abs max/min.
  - Word problems. All of the problems covered in class are fair game.
  - The second derivative test (page 332)
- Section 6.1: Indefinite integral
  - Integration rules
  - Find $f(x)$ if given $f'(x)$ and a point on the function.
- Section 6.2: Area and the definite integral
  - Riemann sum (by hand or by calculator)
    * Left sum
    * Right sum
    * midpoint
  - When a Riemann sum is an over or under estimate.
  - The definite integral, $\int_a^b f(x)dx$, means to perform a Riemann sum with an infinite number of rectangles.
  - If $f(x) \geq 0$ on the interval $[a, b]$ then $\int_a^b f(x)dx$ represents area

- If $f(x) \not\geq 0$ on the interval $[a, b]$ then $\int\limits_a^b f(x)dx$ represents a difference of area.
- Area below the x-axis is counted as negative area by the Riemann sum.
- Integration addition rule (page 372)

- Section 6.4: Integration by u-substitution

  - indefinite integrals with u-sub.
  - definite integrals with u-sub.

- Section 6.5: More Integration Rules

  - Rule for $\int e^x dx$ and $\int \frac{1}{x} dx$

- Any additional topics discussed in class