Math 265A: Final Exam Review

Limits and Continuity

- Find the limit of a function from a table of data, from a graph or by using algebraic techniques
- Identify indeterminate form for limits (the cases are $\frac{0}{0}$, $\frac{\infty}{\infty}$ or $0 \cdot \infty$) and be able to apply L'Hopital's Rule in evaluating these limits
- Know the definition of continuity and what the 3 criteria a function must satisfy at a point x = a in order to be continuous
- Identify points at which a function is discontinuous and be able to say which of the 3 criteria is not satisfied.

Derivatives

- Find a derivative at a point using the limit definition of the $f'(a)$ (You won't have to write down this definition from memory, but be able to apply it in finding a derivative.
- Find or estimate (give the best estimate) the value of the derivative of a function at a point
  - given a table of data. Remember that $f'(a) = \frac{dy}{dx} \cong \frac{\Delta y}{\Delta x}$
  - given the graph of the function. Remember that $f'(a) = m_{\tan}\Big|_{x=a}$
- Use the rules of differentiation to find the derivative a a function analytically. You'll need to be able to recognize when to use the Chain Rule, the Product Rule and the Quotient Rule as well as apply the rules for all of the functions whose differentiation rules we've studied.
- Use implicit differentiation to find a derivative.

Applications of differentiation

- Find the equation of the tangent line at a given point, x = a. This is called the "Local Linearization of f " and is denoted $y = L(x)$
  - Use the Local Linearization of f to estimate the value of the function: $f(a) \approx L(a)$
  - Determine the error in the estimation: $Error = y_{actual} - y_{estimated}$
- Use the first and second derivatives to analyze where a function is increasing, decreasing or level and what the concavity is. Find local max's and min's and points of inflection. Also, find critical points of a function, using the derivative. (Note: remember that a critical point is an x-value that makes $f'(x)$ equal to zero OR MAKES IT UNDEFINED.)
- Set up and solve an optimization problem. Be sure to verify that a critical point does locate a max or min value based on either a sign chart on the derivative or using the Second Derivative Test.

- Analyze the motion of a particle whose path is given by parametric equations, specifically analyze the velocity and when the particle has stopped moving in the x-direction and/or y-direction.

- Know the derivative relationship between position, velocity, acceleration and use to solve application problems.

Integration

- Know the definition of the definite integral and be able explain the meaning of the notation

- Be able to use a Right Sum or Left Sum to estimate the value of a definite integral.

- Evaluate a definite integral
    - Using the Fundamental Theorem of Calculus
    - Using geometry
    - Using a calculator

- Find anti-derivatives (a.k.a. "indefinite integrals") using the rules of integration (including substitution)

- The Second Fundamental Theorem of Calculus: Construct the anti-derivative from the graph of a derivative function given an initial value for the function

Applications of integration:

- Use integrals to find the area between the graph of a function and the x-axis, including areas positioned below and above the x-axis

- Find equations of motions (solutions to simple differential equations); specifically,
    - Find a velocity function, given an initial velocity and the acceleration
    - Find a position function, given an initial position and the velocity

- Interpret a definite integral as a net change in some quantity