Topics for the Fall Final Exam

1) Limits, Continuity, and Differentiability

   a. As x approaches 0; remember $\lim\limits_{x \to 0} \dfrac{\sin x}{x} = 1$

   b. As x approaches a; _proving continuity_

   c. Proving differentiability

   d. Finding the slope _and_ equation of a tangent line

2) Basic rules of Differentiation

   a. Power Rule $\quad \dfrac{d}{dx} x^n = nx^{n-1}$

   b. Product Rule $\quad \dfrac{d}{dx}(fg) = f'g + g'f$

   c. Quotient Rule $\quad \dfrac{d}{dx}\left(\dfrac{f}{g}\right) = \dfrac{f'g - g'f}{g^2}$

3) Both versions of the Chain Rule

   a. Chain Rule #1: $\quad \dfrac{d}{dx} f(g(x)) = f'(g(x)) \cdot g'(x)$

   b. Chain Rule #2 $\quad \dfrac{dy}{dx} = \dfrac{dy}{du}\dfrac{du}{dx}$

   c. Implicit Differentiation(for first _and_ second derivatives)

   i. When taking the derivative of y, add a y' at the end.
   ii. Solve for y'

4) Derivatives of Inverse Trig, Log, and Exponential Functions

   a. Derivative of $\sin^{-1}(x)$, $\cos^{-1}(x)$, and $\tan^{-1}(x)$

   b. Derivative of a^x, $\log_a x$, $\ln x$, and e^x.

5) Rates of Change

    a. Position, velocity, and acceleration

    b. Other rate of change problems; Quantities, etc. (Section 3.4), <u>not</u> including marginal cost.

6) Behavior of Functions

    a. The Mean Value Theorem $f'(c) = \dfrac{f(b) - f(a)}{b - a}$

$$m_t \quad = \quad m_s$$

    b. Finding relative and absolute extrema

    c. Finding points of inflection

    d. Using the graph of f' to interpret f

7) Related Rates; *of all kinds*
    a. Establish an equation that you will use to find the rate of change
    b. Eliminate any "third" variables(can you make a substitution?)
    c. Remember, every rate of change is with respect to t so use the chain rule when differentiating.

Whole front and back note sheets are allowed with the same rules applying as on previous tests. Calculators are allowed.