MATHEMATICS 1000 (Calculus I)
Table of Derivatives

- Properties of Derivatives
  - The Constant Multiple Rule: $[kf(x)]' = kf'(x)$ for any constant k
  - The Sum Rule: $[f(x) + g(x)]' = f'(x) + g'(x)$
  - The Difference Rule: $[f(x) - g(x)]' = f'(x) - g'(x)$
  - The Product Rule: $[f(x)g(x)]' = f'(x)g(x) + g'(x)f(x)$
  - The Quotient Rule: $\left[\dfrac{f(x)}{g(x)}\right]' = \dfrac{f'(x)g(x) - g'(x)f(x)}{[g(x)]^2}$
  - The Chain Rule: $[f(g(x))]' = f'(g(x))g'(x)$
- Derivatives of Algebraic, Exponential and Logarithmic Functions
  - The Constant Rule: $(k)' = 0$ for any constant k
  - The Power Rule: $(x^r)' = rx^{r-1}$ for any real number r
  - $(e^x)' = e^x$
  - $(b^x)' = b^x \ln(b)$ for any real number $b > 0$, $b \neq 1$
  - $[\ln(x)]' = \dfrac{1}{x}$
  - $[\log_b(x)]' = \dfrac{1}{x \ln(b)}$ for any real number $b > 0$, $b \neq 1$
- Derivatives of Trigonometric Functions
  - $[\sin(x)]' = \cos(x)$
  - $[\cos(x)]' = -\sin(x)$
  - $[\tan(x)]' = \sec^2(x)$
  - $[\cot(x)]' = -\csc^2(x)$
  - $[\sec(x)]' = \sec(x)\tan(x)$
  - $[\csc(x)]' = -\csc(x)\cot(x)$

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- Derivatives of Inverse Trigonometric Functions
  - $[\arcsin(x)]' = \dfrac{1}{\sqrt{1-x^2}}$
  - $[\arccos(x)]' = \dfrac{-1}{\sqrt{1-x^2}}$
  - $[\arctan(x)]' = \dfrac{1}{x^2+1}$
  - $[\text{arccot}(x)]' = \dfrac{-1}{x^2+1}$
  - $[\text{arcsec}(x)]' = \dfrac{1}{x\sqrt{x^2-1}}$
  - $[\text{arccsc}(x)]' = \dfrac{-1}{x\sqrt{x^2-1}}$
- Derivatives of Hyperbolic Functions
  - $[\sinh(x)]' = \cosh(x)$
  - $[\cosh(x)]' = \sinh(x)$

What proofs do I need to know?

The eight derivatives highlighted in red are those results which you may be asked to prove, using the limit definition of the derivative, on Test #2 or the Final Exam.

In addition to these, you should also understand other proofs given in class (or similar to those given in class), such as the proof of the derivative of $\tan(x)$ using the Quotient Rule, the proof of the derivative of $\arcsin(x)$ using Implicit Differentiation, or the proof of the derivative of $\cosh(x)$ by rewriting in terms of exponential functions.

Finally, you are expected to be familiar with the proof of the theorem which states that differentiability implies continuity.