Math 360 **Spring 2010** **Guide for the final exam**

- The exam is on Monday June 7 at 10:10am in our regular classroom.
- The deadline for any late good problems is noon on Tuesday June 8.
- The exam is cumulative. Questions on Chapters 2 and 3 will be taken directly from our first two tests.

Questions on Chapter 4 will emphasize things that you were not tested on in your first Calculus class. In particular, it will *not* include related rates, extrema word problems, or graphing problems. You should be able to prove the following; the statement of the Proposition or Theorem will be given.

1. [Power rule, Proposition 4.2.2.] If $f(x) = cx^n$ (n a positive integer), then $f'(x) = ncx^{n-1}$.
2. [Product rule, Proposition 4.2.4.] If $u = f(x)$ and $v = g(x)$ are both differentiable, then $\frac{d[uv]}{dx} = \left(\frac{du}{dx}\right) \cdot (v) + (u) \cdot \left(\frac{dv}{dx}\right)$.
3. [Derivative of sine, Proposition 4.2.8.] $\frac{d}{dx}[\sin(x)] = \cos(x)$.
4. [Derivative of the inverse Theorem 4.4.1.] Suppose f is invertible on an interval around $x = x_0$ and $f'(x_0) \neq 0$. Then $g(y) := f^{-1}(y)$ is differentiable at $y = y_0 := f(x_0)$, and $g'(y_0) = \frac{1}{f'(x_0)}$.
5. [Chain rule, Theorem 4.5.1.] Suppose f is differentiable at $x = a$ and g is differentiable at $y = b := f(a)$. Then the composition $h(x) = (g \circ f)(x) := g(f(x))$ is differentiable at $x = a$, and $h'(a) = (g \circ f)'(x) = g'(b) \cdot f'(a) = g'(f(a)) \cdot f'(a)$.
6. [Rolle's theorem, Proposition 4.9.1.] Suppose f is continuous on the nontrivial interval $[a, b]$ and differentiable on (a, b), and in addition that the endpoint values are the same: $f(a) = f(b)$. Then there exists at least one point $c \in (a, b)$ where $f'(c) = 0$.
7. [The Mean Value Theorem, Proposition 4.9.2.] Suppose f is continuous on the nontrivial interval $[a, b]$ and differentiable on (a, b). Then there exists at least one point $c \in (a, b)$ where $f'(c) = \frac{f(b)-f(a)}{b-a}$.
8. [Cauchy Mean Value Theorem, Theorem 4.9.6.] Suppose f and g are continuous on the nontrivial interval $[a, b]$ and differentiable on (a, b). Then there exists at least one point $c \in (a, b)$ where $f'(c)(g(b) - g(a)) = g'(c)(f(b) - f(a))$.
9. [L'Hôpital's rule, Proposition 4.10.1.] Suppose f and g are differentiable on the open interval (a, b) and $\lim_{x\to b^-} f(x) = \lim_{x\to b^-} g(x) = 0$, and $\lim_{x\to b^-} \frac{f'(x)}{g'(x)} = L$. Then $\lim_{x\to b^-} \frac{f(x)}{g(x)} = L$.