MATH 133
Second Hour Exam Sample
November 3, 2008

You will be able to use your calculator. Take this as you would the real thing. Give yourself 50 minutes uninterrupted. Remember, this is a sample of the types of problems that might appear on the hour exam and should give you an idea of the length of the test. You should be sure to study from class notes, the text, quizzes and sample quizzes and homework.

1. Short answer:
   (a) True or false: If $f(x)$ is continuous at a point a, then it must also be differentiable at the point a. Explain your answer.
   (b) Suppose $f(x)$ has a jump discontinuity at the origin so that $\lim_{x\to 0+} f(x) = 1$ and $\lim_{x\to 0-} f(x) = -1$. Does $g(x) = xf(x)$ also have a jump discontinuity at the origin?
   (c) If $f(x)$ is increasing on the interval $[a, b]$, what can we say about the slope of the secant line connecting $(a, f(a))$ and $(b, f(b))$?
2. Evaluate the following limits using algebra, a graph or a table. State which you use.
   (a) $\lim_{x\to 0} \frac{e^x-1}{x}$
   (b) $\lim_{x\to\infty} \frac{2x^2+\frac{1}{x}}{3x^2-1}$
   (c) $\lim_{x\to 1+} \frac{x^2-2x+1}{x-1}$
3. Use the limit definition of the derivative to find $f'(x)$ for $f(x) = \sqrt{x+1}$.
4. Sketch the graph of a function $y = f(x)$ that satisfies the following properties:
   (a) $f(x)$ is continuous and differentiable for all $x \neq 1$.
   (b) $\lim_{x\to 1+} f(x) = \infty$.
   (c) $\lim_{x\to 1-} f(x) = -\infty$.
   (d) $\lim_{x\to\infty} f(x) = 1$.
   (e) $\lim_{x\to -\infty} f(x) = -1$.
   (f) $f(x)$ has x-intercepts at $x = -3$, $x = -1$, $x = 2$, $x = 4$ and at no other points.
   (g) $f(x)$ is concave up for $-\infty < x < -3$ and $1 < x < 4$.
   (h) $f(x)$ is concave down for $-3 < x < 1$ and $4 < x < \infty$.
5. Evaluate the following derivatives.
   (a) $f'(x)$ for $f(x) = (x^4 + 1)^{93}$.
   (b) $g'(y)$ for $g(y) = \cos(3y)\sin(y^2)$.
   (c) $h'(z)$ for $h(z) = \frac{e^{3z}}{\sqrt{z^3+1}}$.
   (d) $j''''(w)$ for $j(w) = \cos(17w)$.