MATH 191, Sections 1 and 3
Calculus I
Fall 2009

Practice Exam 2

This practice exam is similar in length, content, and format to the actual exam. This is not to say that the problems given here represent *all* of the concepts you will encounter on the actual exam, since it's difficult to "cover" all possible subjects in such a short exam! However, if you feel confident on your performance on this practice exam and you've gone over all homeworks and quizzes, you should feel confident about your upcoming performance on the actual exam.

In order to save paper, I have not included space for you to work out your solutions. (The actual exam will provide such space.) Rather, please complete solutions to the below problems on your own paper.

The practice exam is worth a total of 100 points; the point value of each question is provided with that question.

1. (35 points total; 7 points each) Find the derivative of each of the following functions. You may use any shortcut formula you would like.
   (a) $f(x) = x\cos(x)$
   (b) $g(t) = \frac{\tan(t)}{e^{t^2}}$
   (c) $H(x) = \sin(\cos(\tan(x)))$
   (d) $F(z) = \ln(z^2) + ze^z$
   (e) $f(x) = \sec(5^x)$ (You can use the formula $\frac{d}{dx}\sec(x) = \sec(x)\tan(x)$.)
2. (10 points) Find the equation of the tangent line to the graph of the expression $y^3 = (x+y)^2$ at the point $(0, 1)$.
3. (10 points) Compute $\frac{d}{dx}(\frac{1}{x^2})$ using the *definition* of the derivative (and *not* shortcuts!)
4. (10 points) Find the all values of x at which the tangent line to the graph of the function $g(x) = x^2e^x$ is horizontal.
5. (10 points) Use logarithmic differentiation to find the derivative of $f(x) = x^{\sin(x)}$ at $x = \pi$.
6. (15 points) Suppose that water is being drained from a conical tank with its vertex pointing downward. The tank has a base radius of 2 meters and a height of 5 meters. If the water is drained at a rate of 1 m^3 per minute, how fast is the water level falling when the water is 3 meters deep in the tank? (*Hint:* use similar triangles to determine a relationship between radii and heights...)
7. (10 points) True or false: if a function is continuous, then it is differentiable. (Please explain your answer carefully, using examples when appropriate.)