Math 1300-401 **Test 2 Review** **Summer 2008**

Things to keep in mind:

- On the test, I may or may not ask you to use a specific technique to differentiate a function with respect to a given variable. Always explain your reasoning and methodology. If you use implicit differentiation, or logarithmic differentiation, or whatever, just make a note about it to guide me through your solution.
- I will most likely put a true/false or multiple choice section on the test. These would be questions that are quick to answer, assuming you know your stuff.
- The problems on the test won't appear in the same order as sections in the book appear.

Product Rule / Quotient Rule / Chain Rule

1. Differentiate the following functions:

$$\text{(a) } y = \cos^2(x+2)\ln x \qquad \text{(b) } f(x) = \sin(\cos(\sin(x))) \qquad \text{(c) } g(x) = \ln\left(\frac{1}{\sqrt{x}}\right)$$

2. Differentiate the following functions:

$$\text{(a) } m(x) = \frac{(\pi x^2+2)e^{2x}}{\sin x} \qquad \text{(b) } h(x) = \left(\frac{1}{\sqrt{x+2}}\right)\cdot\left(\frac{7}{\ln x}\right)^{-1}$$

Related Rates

1. Consider a slide in the shape of a standard "hyperbola," that is, in the shape of the graph of $y = 1/x$ for $x > 0$. Assume that x and y are given in feet. A person slides along the hyperbola so that his/her x–coordinate position is increasing at a rate of $f(x)$ feet per second. If his/her y–coordinate position is decreasing at a constant rate of 1 foot per second, what is $f(x)$?
2. The screensaver on my computer displays the outline of a 3cm by 2cm rectangle and then expands the rectangle in such a way that the 2cm side is expanding at a rate of 4cm per second, and the proportions of the rectangle stay the same. How fast is the area of the rectangle increasing when its dimensions are 12cm by 8cm?

Implicit Differentiation

1. Use implicit differentiation to find the derivative $\frac{dy}{dx}$ where $y^4 + xy^2 + x = 3$.
2. Use implicit differentiation to find the derivative $\frac{dx}{dy}$ where $y\sin x + x\sin x = y$.

Logarithmic Differentiation

1. Find the derivative of
$$f(x) = \frac{x^5}{(1-10x)\sqrt{x^2+2}}$$
2. Find the derivative of
$$g(x) = (3e)^{\cos x}$$

L'Hôpital's Rule

1. Find the limit
$$\lim_{x \to 1} \frac{2\ln x}{x-1}$$
2. Find the limit: (*Hint:* $x = 1/(1/x)$ *and so rewrite the first* x *in the expression*)
$$\lim_{x \to 0} x \ln x$$