Assignment 2

Exploring the rules for derivatives

Due Monday, February 11, 2008

In each of the problems below, you are to compute the derivative of a certain function (like $f(x) = \sqrt[3]{x}(x^2 - \frac{1}{x})$ – see problem 1b) in <u>two</u> different ways. When you have done that, *please* <u>verify</u> your work by showing that your results are identical. (For example, in problem 1b, whether you use algebra or the product rule, you should eventually get the <u>same</u> derivative.)

You may gain **2 points extra credit** by sending me the solution to problem 1b by email **before 11:59 PM, Wednesday, February 6, 2008.** (You may just send me the *answer* – you don't need to send me your *work* in that email.)

1. Compute the derivative of *each* of the functions below in two different ways. First use algebra to simplify the function followed by a simple derivative rule. After getting the derivative that way, recompute the derivative by using the product rule instead.

   (a) $f(x) = x \cdot x^2$.

   (b) $f(x) = \sqrt[3]{x}(x^2 - \frac{1}{x})$.

2. Compute the derivative of *each* of the functions below in two different ways. First use the quotient rule. Then recompute the derivative by writing $\frac{1}{g(x)}$ as $(g(x))^{-1}$ and using the product rule. (I've tried to make this second method clear by rewriting the function for you in each case.)

   (a) $f(x) = \frac{\sin(x)}{x^2} = \sin x \cdot x^{-2}$.

   (b) $f(x) = \frac{x}{x^2+x} = (x) \cdot (x^2 + x)^{-1}$.

3. Compute the derivative of *each* of the functions below in two different ways. First use algebra (the "binomial theorem") to expand the expression and apply a simple derivative formula. Then recompute the derivative by using the chain rule instead.

   (a) $f(x) = (x + 2)^3$.

   (b) $f(x) = (3x^2 + 1)^4$.

Hints and Suggestions for Assignment 2

1. (a) Easy!
   (b) Write $\sqrt[3]{x}$ and $1/x$ as powers of x.
2. (a) Straightforward.
   (b) Be willing to factor.
3. (a) Use Pascal's triangle to write out $(A+B)^3$. Here $A = x$ and $B = 2$ so your answers will include powers of 2, like 4 or 8.
   (b) Use Pascal's triangle to write out $(A+B)^4$. Here $A = 3x^2$ and $B = 1$.