Math 111.01 Summer 2003
Assignment #4

This assignment is due at the beginning of class on **Friday, July 18, 2003**. You are encouraged to form study groups and collaborate with others on this assignment. However, the final work you submit must be your own. You must submit all problems that are marked with an asterix (*). YOUR ASSIGNMENT MUST BE STAPLED AND PROBLEM NUMBERS CLEARLY LABELLED. UNSTAPLED ASSIGNMENTS WILL NOT BE ACCEPTED!

1. Practice problems.

- Section 3.5 #15, 21, 39, 47, 65
- Section 3.6 #9, 11, 37, 39, 43
- Section 3.7 #11, 13, 15, 29, 31, 35
- Section 2.9 #3, 5, 13
- Section 3.8 #1, 5, 19
- Section 4.1 #1, 5, 11, 15, 25
- Section 4.2 #1, 3, 7, 9, 13, 33, 39, 55
- Section 4.3 #7, 11, 25, 45, 47
- Section 4.4 #1, 5, 11, 23

2. Extra practice computing derivatives.

- Section 3.5 #7, 9, 11, 13, 17, 19, 21, 23, 25, 27, 29
- Section 3.6 #3, 5, 7
- Section 3.7 # 3, 5, 7, 9, 17, 19

3. * Problems to hand in.

- Section 3.5 #16, 24, 38, 66
- Section 3.6 #6, 14, 26, 32
- Section 3.7 #2, 16, 32, 36
- Section 2.9 #6, 12
- Section 3.8 #2, 16, 20, 22
- Section 4.1 #4, 6, 8, 14, 26, 28
- Section 4.2 #2, 6, 14, 24, 34, 48
- Section 4.3 #6, 14, 16, 26, 46
- Section 4.4 #4, 6, 10, 12

4. * On Assignment #3, you considered the function $f(x)$ defined by

$$f(x) = \begin{cases} x^2 \left|\cos \dfrac{\pi}{2x}\right| & \text{if } x \neq 0, \\ 0 & \text{if } x = 0. \end{cases}$$

In particular, you found that $f'(0) = 0$, and that $f'(1/3)$ did not exist.

Now, find **all** values of x for which $f'(x)$ does not exist.

(continued)

5. * Suppose that the function $f(x)$ satisfies

$$f(2) = 4 \quad \text{and} \quad f'(2) = -1.$$

Find the best linear (tangent line) approximation you can for the value of $f(3)$.

6. * As you know, if $a > 0$, then

$$\frac{d}{dx}a^x = a^x \ln a \quad \text{and} \quad \frac{d}{dx}x^a = ax^{a-1}.$$

However, the function x^x is ***neither*** a power function nor a polynomial, so neither of the above formulae is applicable. Compute

$$\frac{d}{dx}x^x.$$

7. * Let $f(x) = \dfrac{x+3}{\sqrt{x^2+1}}$.

(a) Evaluate $\lim\limits_{x\to\infty} f(x)$ and $\lim\limits_{x\to-\infty} f(x)$.

(b) Use the preceeding result and the fact that

$$f'(x) = \frac{-3x+1}{\sqrt{(x^2+1)^3}} \quad \text{and} \quad f''(x) = \frac{6x^2-3x-3}{\sqrt{(x^2+1)^5}}$$

to sketch the graph of $y = f(x)$. Label all local maximum and minimum points, points of inflection, and asymptotes.