Fall 2004 Calculus I, sections 4, 5, 6, Courant Institute of Mathematical Sciences, NYU.

# Homework 2, due September 20

**Self check** (not to hand in, answers are in the back of the book):

**Section 3.1**: 1, 9, 17, 23.

**Section 3.2**: 3, 9, 13, 25, 29, 31, 37, 39, 43, 65, 67.

**Section 3.3**: 3, 7, 11, 19, 27, 39.

## To hand in:

**Section 3.1**: 2, 6, 14, 18, 26, 32, 60.

**Section 3.2**: 4, 8, 14, 20, 28, 34, 36, 42, 44, 66.

**Section 3.3**: 4, 8, 16, 28, 40.

**More problems** (to hand in)

**1.** Make a careful graph[1] of the function $f(x) = -x^2+4x-1$. Call this parabola $Q$ (for "quadratic").

**a.** Use a ruler to draw the line, $L$ through the origin tangent to $Q$ at some positive $x$. You can see from that graph that there is only one such line. Let $P$ be the point where $L$ touches $Q$.

**b.** Use algebra and calculus to the coordinates of $P = (x, y)$. The slope of the line is $y/x$, which is supposed to equal $f'(x)$.

**c.** How well did you draw the graph? How close is the calculated $P$ from part b. to the point you drew on part a?

**2.** Find the formula $q(x) = ax^2 + bx + c$ for the quadratic that has $q(1) = f(1)$, $q'(1) = f'(1)$, and $q''(1) = f''(1)$, for $f(x) = 1/x$. This means that you should find appropriate values for $a$, $b$, and $c$. Also find values for $d$ and $e$ so that $l(x) = dx + e$ has the same value and derivative as $f(x)$ when $x = 1$. Use a calculator to make a table of $f(x) - l(x)$ and $f(x) - q(x)$ for several $x$ values getting closer to $x = 1$. Which of $l(x)$ or $q(x)$ is closer to $f(x)$ when $x$ is near one?

[1] Use $x$ values separated by no more than 1/2. Use at least half a page. Choose the $x$ and $y$ axis scales so that the curve fills the space allowed. Carefully draw a smooth curve through the points respecting the symmetry of the curve – or have your roommate in Tisch draw it.