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\footnote{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.} 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?