Math 2215 - Calculus 1

Homework #2

Assigned - 2011.01.24

Name: _____

Textbook problems:

Section 2.1 - 1-4 all, 7, 13, 17, 20, 25, 27, 31

Section 2.2 - 13-18 all, 23, 24, 25, 28, 41, 55, 57

Section 2.3 - 1, 6, 10, 18, 20, 23, 28, 41, 42, 45, 63

Section 2.4 - 1, 2, 5, 12, 16, 17, 24, 40, 43

Section 2.5 - 1, 3, 5, 10, 21, 22, 23, 35, 36, 39, 40, 43, 50

Section 2.6 - 3, 10, 15, 16, 20, 25, 28, 37, 38, 41, 43, 45, 46

Section 2.7 - 1, 3, 5, 9, 12, 16, 17, 20, 23, 29, 31, 34

Section 2.8 - 1, 6, 7, 9, 12, 17, 21, 23, 27, 39, 40, 41

Fun Problems:

1. The following figure shows a circle of radius 1 inscribed in the parabola $y = x^2$. Locate the center of this circle.

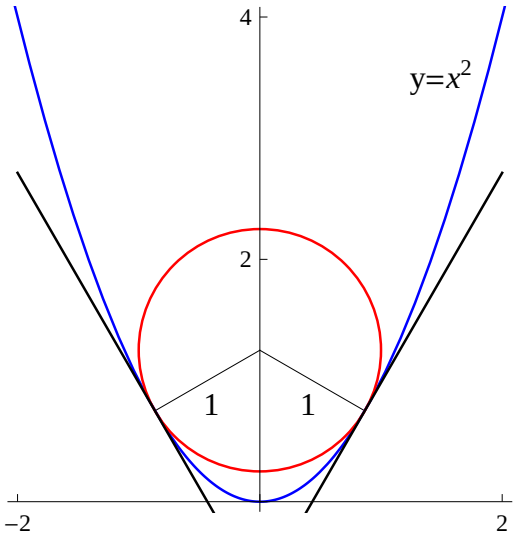

FIGURE 1. The lines of length 1 are perpendicular to the tangent lines

2. There are exactly two points on the function $y = x^4 - 2x^2 - x$ which share a common tangent line. Find these two points. Be sure to graph the function and the tangent line you found.

3. Consider the function:
$$g(x) = \begin{cases} x^2 - 2, & x \leq 1 \\ mx^2 + bx, & x > 1 \end{cases}$$
a) Find values for the constants m and b such that $g(x)$ has a tangent line at $x = 1$.

b) Find the equation of the tangent line at $x = 1$ for the values of m and b found in part a).

c) Graph $g(x)$ about $x = 1$ and describe why the tangent line should exist for your specified value of m and b.

4. Evaluate the following limit:
$$\lim_{x \to 1} \frac{x^{1000} - 1}{x - 1}$$
5. Find $f'(x)$ if $f(x) = |x|$. At what points is this function not differentiable?

6. If $f(x) = (x - a)(x - b)(x - c)$, show that
$$\frac{f'(x)}{f(x)} = \frac{1}{x - a} + \frac{1}{x - b} + \frac{1}{x - c}$$

Mathematica Problem: Construct a *Mathematica* manipulation which will graph a function $f(x)$ on an interval $[a, b]$ along with the polynomial
$$T_n(x) = f(c) + \sum_{k=1}^{n} \frac{f^{(k)}(c)}{k!}(x - c)^k$$
where $a < c < b$. Here, you should animate the graph in terms of n, for positive values of n (how large n grows is up to you).