Instructions: Do the assigned reading and practice problems on your own. Then submit complete written solutions to the five graded problems during the discussion on 10/15/2015. No late homeworks will be accepted.

**Reading:** Sections 2.8 (Through example 2), 3.1

**Practice Problems:**

2.8: 3, 11, 13, 15
3.1: 7, 11, 13, 35, 37, 39, 41, 43, 45, 57

**Graded Homework problems:**

1.) Find the linear approximation at \( a = 0 \) and use it to estimate the requested value

   a.) \( f(x) = (1 + x)^{1/2} \). Estimate \( \sqrt{0.98} \)

   b.) \( f(x) = (x + 81)^{1/4} \). Estimate \( (85)^{1/4} \)

   c.) \( f(x) = \frac{(1 - x)^2}{1 + (1 + x)^2} \). Estimate \( \frac{0.99^2}{1+1.01^2} \)

2.) Suppose we wish to estimate \( \sqrt{9.1} \) using a linear approximation of the form \( f(x) = \sqrt{mx + b} \) with \( m \neq 0 \). We would like to know if there is a “best” choice of \( m \) and \( b \) to give the best approximation.

   a.) Which value of \( x \) should you linearize around? (Your answer should depend on \( m \) and \( b \))

   b.) Find the linear approximation around the value in (a). Simplify the answer as much as possible.

   c.) Use your answer from (b) to estimate \( \sqrt{9.1} \). What impact does your choice of \( m \) and \( b \) have on the answer?

3.) Find the absolute minimum and maximum of \( f(x) = \sin(x) - \cos(x) \) on the interval \([0, 2\pi]\).

   a.) Explain why the absolute minimum and maximum of \( f(x) \) would be the same on the interval \((-\infty, \infty)\). What property of sine and cosine are you using?

   b.) Conclude that \( |\sin(x) - \cos(x)| \leq \sqrt{2} \)
4.) Let a rectangle have its lower left corner at the origin and its upper right corner at \((x, 12 - x^2)\) for some value of \(x\) between 1 and 3.

a.) Write a formula for the area of the rectangle as a function of \(x\).

b.) Find the largest and smallest possible area of the rectangle for \(1 \leq x \leq 3\).

5.) Find the absolute minimum and maximum of

\[
f(x) = \frac{1}{1 + |x|} + \frac{1}{1 + |x - 2|}
\]

on the interval \([-1, 3]\). (Hint: Break the interval \([-1, 3]\) into three appropriately chosen smaller intervals and find the absolute min/max on each of these intervals).