Math 111 – Spring 2014
Examination 3

Please complete the following problems. All work must be shown in order to receive full credit. Answers without explanation will receive *no* credit. The use of books, notes, calculators, or any other external sources of information is not allowed during this examination.

1.(15 pts.) Find the most general antiderivative for the following:

a. $f(x) = e^{-x} + \sec^2(2x)$

b. $f(x) = \left(1 - \dfrac{1}{x}\right)^2$

c. $f(x) = \dfrac{x^e - \sqrt{x}}{x}$

2.(15 pts.) Evaluate the following limits:

a. $\displaystyle\lim_{x\to 0^+} \left(\frac{1}{x} - \frac{1}{e^x - 1}\right)$

b. $\displaystyle\lim_{x\to 0} \frac{\tan(x)}{\arctan(x)}$

c. $\displaystyle\lim_{x\to 0^+} (1+x)^{\frac{1}{x}}$

3.(7 pts.) Use Newton's method to find $\sqrt[3]{4}$ by estimating the zeros of $f(x) = x^3 - 4$. Start with $x_0 = 1$ and find x_2.

4.(7 pts.) Find the linearization of $f(x) = \sqrt{1+x}$ about $a = 3$.

5.(8 pts.) An open-top rectangular tank with a square base and a volume of 32 ft^3 is to be built. What dimensions minimize the amount of material required to build this tank? Show that your result is a minimum.

6.(12 pts.) Find the absolute maximum and absolute minimum values of each function on the given interval.

a. $y = x\sqrt{18 - x^2}, \qquad 0 \le x \le 4$

b. $y = \sqrt[3]{x^2 - 1}, \qquad -3 \le x \le 3$

7.(16 pts.) Consider the function $y = 2 + 3x^2 - x^3$.

a. Find the intervals on which this function is increasing or decreasing.

b. Find the intervals on which this function is concave up or concave down.

c. Determine the points at which this function has a local maximum, a local minimum, or a point of inflection.

d. Sketch a graph of this function making sure to label the points found in part **c**.

8.(20 pts.) Consider the function $y = \dfrac{x}{1-2x}$.

a. Find all asymptotes of this function.

b. Find the intervals on which this function is increasing or decreasing.

c. Find the intervals on which this function is concave up or concave down.

d. Determine the points (if any) at which this function has a local maximum, a local minimum, or a point of inflection.

e. Sketch a graph of this function making sure to label the asymptotes from part **a** and the points found in part **d**.