Math 180 E

SECOND HOUR EXAM

NAME_____

General Notes:

1. Show work.
2. Look over the test first, and then begin.
3. Calculators are not permitted on this exam.

Friday, Oct. 19, 2012
100 pts

I. Limits

1. (10 pts.) Give a formal (ε - δ) definition of $\lim_{x \to a} f(x) = L$

2. (15 pts.) Show that $\lim_{x \to 1}(2x + 7) = 9$ by finding an appropriate δ for $\varepsilon = \frac{1}{10} (= 10^{-1})$, showing why the δ you chose works. Be sure to show your work. Just writing down a δ is not sufficient.

II. Differentiation

1. (10 pts.) Give a formal definition of the derivative of a function **f(x)**.

2. (15 pts.) **Use the definition** of the derivative to calculate $f'(x) = \frac{d}{dx} f(x)$ for $f(x) = x^2 - 3x + 2$

3. (5 pts each) In each of the following, calculate the derivative of the given function using the rules for calculating derivatives (i.e., you don't need to use the definition in these problems). Carry your answer to the point where there are no more derivatives to be taken (but you do not need to simplify further).

   a. $f(x) = 2x^3 + 3x^2 - 7x + 1$

   b. $f(x) = x^2 \sin(x)$

   c. $f(x) = \dfrac{(2x^2 + 1)}{(x^3 + 2x)}$

(problem 3 continued)

d. $f(x) = \dfrac{1}{1+e^{-x}}$

e. $f(x) = (2x^3 + 3x^2 - 7x + 1)^{14}$

4.

a. (10 pts.) The graph of the curve $y = x^2 - 3x + 2$ passes through the point (3, 2). Find the equation of the line tangent to the curve at that point.

b. (5 pts.) A line is normal (perpendicular) to another line if the slope is the negative reciprocal of the other (that is if the first line has slope n, then the perpendicular (normal) line has slope $\frac{-1}{n}$. A line is normal to a curve at a point if it passes through that point and is normal (perpendicular) to the tangent line at that point. What is the equation of the line normal to the curve above at the point (3, 2)?

5. (10 pts.) A particle moves along the x-axis according to the equation of motion $x(t) = 2t^2 + t + 1$, with x measured in feet and time measured in seconds. **When t = 1**,

   a. What is its position?

   b. What is its velocity?

   c. What is its acceleration?