Name	

Student ID # _____

Class (circle one) 9:40 10:45

Math 1210 Fall 2009 K. M. Golden

EXAM II

Friday, October 23, 2009

Problem	Points	Score
1.	30	
2.	25	
3.	20	
4.	15	
5.	10	
	TOTAL	

(30 points) 1. Calculate the following limits, and be sure to show all of your work. If a particular limit does not exist, state this clearly and tell why.

(a)
$$\lim_{x \to 2} \frac{x^2 - x - 2}{x - 2}$$

(b)
$$\lim_{x \to +\infty} \frac{7x^5 + \pi x^4 - 10^{20}x^3 - x + 1}{(x+1)^2(x+2)^3}$$

(c)
$$\lim_{x \to 0} \frac{1 - \cos x}{x}$$

(d)
$$\lim_{x \to 0} f(x)$$
, where $f(x) = \begin{cases} \sin x, & x < 0\\ \cos x, & x \ge 0 \end{cases}$

(e)
$$\lim_{x \to 0} \frac{\sin(\pi x)}{3x}$$

(f)
$$\lim_{x \to 3} f(x)$$
, where $f(x) = \begin{cases} 1, & x \text{ rational} \\ 0, & x \text{ irrational} \end{cases}$

(25 points) 2. Find the following. Be sure to show all of your work.

(a)
$$\frac{d}{dx}(x\sin x)$$

(b)
$$\frac{d}{dx}\left(\frac{x}{1+x^2}\right)$$

(c)
$$\frac{d^2x}{dt^2}$$
 where $x(t) = \sin(\sqrt{2}t)$

(d)
$$\frac{dm}{dv}$$
 where $m(v) = m_0 \left(1 - \frac{v^2}{c^2}\right)^{-1/2}$

(e)
$$\frac{dy}{dx}$$
 where $x^2 + y^2 = 1$

(20 points) 3. Consider $f(x) = \begin{cases} |x+1|, & x \le 0\\ 5 - (x-2)^2, & x > 0 \end{cases}$, defined on all of \mathbb{R} .

(a) Sketch the graph of f(x).

(b) Sketch the graph of the derivative of f(x).

(c) Where is f(x) continuous?

(d) Where is f(x) differentiable?

(e) Use the derivative to find the maximum value of f(x) on the interval $[0, \infty)$. Where does the maximum occur? Justify your results.

(15 points) 4. A primordial lightning bolt ignites a flame in the top of a 100 foot tall Cretaceous tree. A 20 foot tall *Tyrannosaurus rex* runs away from the flame at a speed of 10 f/s. How fast is the tip of his shadow moving when he is 150 feet away from the base of the tree? Be sure to show all your work.

(10 points) 5. Use linear approximation (the differential) to estimate $\sqrt{4.25}$.