Math 1131
Autumn 2012
Final Exam
Form A

Name: ______________________________

Name.nn: ______________________________

Lecturer: ______________________________

Rec. Instructor: ______________________________

Rec. Time: ______________________________

Instructions:

- You have **1 hour and 45 minutes** to complete this exam. It consists of 12 problems on 13 pages including this cover sheet and is worth a total of 200 points. The value of each question is listed below and with each question.
- You may not use any books or notes during this exam.
- Calculators are permitted EXCEPT those calculators that have symbolic algebra or calculus capabilities. In particular, the following calculators and their upgrades are not permitted: TI-89, TI-92, and HP-49. In addition, neither PDAs, laptops nor cell phones are permitted.
- Make sure to read each question carefully.
- Please **write clearly** and make sure to **justify your answers**. Correct answers with no supporting work may receive no credit. Unless otherwise stated, solutions found by graphing will receive no credit.
- Please write your answers on the indicated lines.

Problem	Point Value	Score	Problem	Point Value	Score
1	12		7	30	
2	8		8	20	
3	11		9	18	
4	14		10	15	
5	22		11	15	
6	15		12	20	
			Total	200	

(1). Find the following limits:

(a) (3 points) $\lim_{x \to 9} \dfrac{5x^2 + 9x + 5}{x^2 - 18x + 81} =$ ____________

(b) (3 points) $\lim_{x \to 4^+} \dfrac{6x^2 - 13x - 63}{x^2 - 2x - 8} =$ ____________

(c) (3 points) $\lim_{x \to -6} \dfrac{3x^2 + 16x - 12}{x^2 + 2x - 24} =$ ____________

(d) (3 points) $\lim_{x \to \infty} \dfrac{3x^2 - 7x^5 + 4x^3}{5x^5 + 9x^3 - 3x^2} =$ ____________

(2). Given

$$f(x) = \begin{cases} \dfrac{5-x}{x^2-3x-10} & \text{if } x \le 5 \\[2ex] \dfrac{x-5}{x^2-17x+60} & \text{if } x > 5 \end{cases}$$

(a) (2 points) $\lim_{x \to 5^-} f(x) =$ ____________

(b) (2 points) $\lim_{x \to 5^+} f(x) =$ ____________

(c) (4 points) Find all points of discontinuity for $f(x)$ ____________

(3). Given $y = e^{4x^2-5x-75} + 8$

(a) (8 points) Find the slope of the tangent line to the graph of this equation when $x = 5$.

Answer (3a): slope = ________________________

(b) (3 points) Find an equation of the tangent line to the graph of this equation when $x = 5$.

Answer (3b): $y =$ ________________________

(4). (14 points) Use the definition of the derivative given below to find $f'(x)$ where $f(x) = \dfrac{2x}{x+1}$

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

Answer (4): $f'(x) =$ ______________________

(5). Find the following derivatives (You do not need to simplify your answers).

(a) (4 points) $f(x) = 13^{3x^2-8x+5}$

Answer (5a): $f'(x) =$ ____________________________

(b) (4 points) $g(x) = \dfrac{e^{3x} - 7x^8}{x^3}$

Answer (5b): $g'(x) =$ ____________________________

(c) (4 points) $f(x) = (5x^6 + 3)^5(3 - \ln x)$

Answer (5c): $f'(x) =$ ____________________________

(Problem (5) cont.)

(d) (5 points) $f(x) = \sqrt[3]{(x+2)^{15}(x-5)^6}$

Answer (5d): $f'(x) =$ ____________________

(e) (5 points) $y = \log_{13}\left[(4x-5)^6\right]$

Answer (5e): $y' =$ ____________________

(6). Let $f(x) = 2x^3 - 3x^2 - 72x + 16$.

(a) (10 points) Use the Second Derivative Test to find where the relative maximum(s) and the relative minimum(s) of $f(x)$ occur.

Answer (6a): rel. max(s). at $x =$ ____________________

rel. min(s). at $x =$ ____________________

(b) (5 points) Find where the absolute maximum and absolute minimum for $f(x)$ occur over the interval $[-7, 3]$.

Answer (6b): absolute max(s). at $x =$ ____________________

absolute min(s). at $x =$ ____________________

(7). Let $f(x) = 3x^4 - 3x^3 + 3$.

(a) (15 points) Use derivatives and a sign graph to determine the interval(s) on which $f(x)$ is increasing and on which $f(x)$ is decreasing AND indicate where $f(x)$ has relative maximum and relative minimum points. (If there are none, please say so).

Answer (7a): increasing: ____________________

decreasing: ____________________

rel. max. points(s) at $x =$ ____________________

rel. min. point(s) at $x =$ ____________________

(b) (15 points) Use derivatives and a sign graph to determine the interval(s) on which $f(x)$ is concave up and on which $f(x)$ is concave down AND indicate where $f(x)$ has inflection point(s). (If there are none, please say so).

Answer (7b): concave up: ____________________

concave down: ____________________

inflection point(s) at $x =$ ____________________

(8). A company manufactures and sells q headphones per month. The monthly demand function is

$$p = 95 - 0.05q$$

and monthly cost function is

$$c = 700 + 35q$$

(a) (5 points) Find the profit $P(q)$ from producing q headphones in a given month.

Answer (8a): $P(q) =$ ____________________

(b) (12 points) How many headphones should be produced to maximize the monthly profit?

Answer (8b): headphones: ____________________

(c) (3 points) What is the maximum monthly profit?

Answer (8c): maximum profit: ____________________

(9). Find the indefinite or definite integral:

(a) (8 points)

$$\int \frac{1}{5+2x^6}(12x^5)\,dx$$

Answer (9a): __________________________

(b) (10 points)

$$\int_0^4 28x^3 e^{x^4}\,dx$$

Answer (9b): __________________________

(10). (15 points) A manufacturer's marginal-cost function is

$$\frac{dc}{dq} = 0.008q^2 - 0.7q + 80$$

If c is in dollars, determine the cost involved to increase production from 90 to 180 units.

Answer (10): Change in cost: ______________________________

(11). (15 points) Set-up, but DO NOT EVALUATE, an integral to find the area of the region bounded by the given curves. Be sure to find any needed points of intersection.

$$y = 8 + 4x - x^2 \text{ and } y = x^2 - 2x$$

Answer (11): area: ____________________________

(12). The demand equation for a product is

$$p = 0.01q^2 - 1.1q + 30$$

and the supply equation is

$$p = 0.01q^2 + 8$$

(a) (5 points) Find the equilibrium point (p_0, q_0).

Answer (12a): $p_0 =$ ____________________

$q_0 =$ ____________________

(b) (15 points) Determine the consumer's surplus under market equilibrium.

Answer (12b): consumer's surplus: ____________________