Math 205 Exam 3

Thursday November 13

Your name:________________________________

Instructor's name:_________________________ **Time the class meets:**_________________

Calculators are permitted. You can also use a 4×6 inches note card with formulas prepared in advance. No books are allowed. Use the back pages as sketch paper. For full credit, show your work in detail. If you use a calculator at some step, you should state that you are doing so.

Total: 100	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9
100	10	10	10	10	10	10	10	10	20

1. (10 points) Use the first derivative to find all critical points and use the second derivative to find all inflection points. Use a graph to identify each critical point as a local maximum, a local minimum, or neither.

$$f(x) = 2x^3 + 3x^2 - 36x - 5.$$

2. (10 points) Find the exact global maximum and minimum values of the function $f(x) = x - 2\ln x$ for $x > 0$.

3. (10 points) The marginal cost and marginal revenue of a company are $MC(q) = 0.03q^2 - 1.4q + 34$ and $MR(q) = 30$, where q is the number of items manufactured. To increase profits, should the company increase or decrease production from the following levels? Explain your answer.

(a) 25 items

(b) 50 items

(c) 80 items

4. (10 points) The cost of producing q items is $C(q) = 1500 + 8q$ dollars.

(a) What is the marginal cost of producing the 100^{th} item? the 1000^{th} item?

(b) What is the average cost of producing 100 items? 1000 items?

5. (10 points) The demand curve for a product is given by $q = 90 - p^2/50$. Find the elasticity of demand when $p = 50$. Is the demand elastic or inelastic at this price? If this price decreases by 2% calculate the corresponding percent change in demand. Is this percent change in demand positive or negative?

6. The following table shows the total sales, in thousands, of a new CD since it was brought to market.

(a) Plot this data and mark on your plot the point of diminishing returns.

(b) Predict total possible sales of this CD, using the point of diminishing returns.

t (months)	0	1	2	3	4	5	6	7
Total sales	0.25	1	4	16	47	129	202	248

7. (10 points) Sketch a contour diagram for the function $f(x, y) = 2x - 2y$ with at least four labeled contours.

8. (10 points) For a function $f(x,y)$, we are given $f(101,22) = 2000$, and $f_x(101,22) = -10$, and $f_y(101,22) = 7$. Estimate $f(105,20)$.

9. (20 points) For the function $f(x,y) = xy + y^2e^x$, find

(a) both partial derivatives f_x, f_y

(b) all four second order partial derivatives f_{xx}, f_{xy}, f_{yx}, f_{yy}, and confirm that the mixed partials are equal.