Math 205 Exam III

7:15–8:15pm, Thursday April 7, 2005

Instructor:________________ **Class Time:**____________ **Name:**____________________

No books or notes are allowed. Please read the problems carefully and do **all** you are asked to do. **You must show your work!** You can use the back page as a scratch paper. Do the problems at the space provided.

Total/100	#1	#2	#3	#4	#5	#6	#7	#8

1(12 total points). Find (a) all critical points and (b) inflection points of

$$f(x) = xe^{-x}.$$

(a)(6 points)

(b)(6 points)

2(13 total points). Find the global maxima and minima of $f(x) = xe^{-0.05x}$ on

(a)(7 points). $2 \leq x \leq 40$

(b)(6 points). $2 \leq x \leq 80$

3(13 total points). The total cost, in dollars, for producing a product is given by $C(q) = 0.002q^3 - 0.6q^2 + 120q + 5000$, where $0 \leq q \leq 500$. Assume that the product can be sold at a constant price of \$75 per unit.

(a)(8 points). Determine the level of production q that will maximize the profit.

(b)(5 points). Find the maximum profit.

4(13 total points). If the **average** cost in thousands of dollars per unit of a goods is

$$a(q) = 0.01q^2 - 0.6q + 13,$$

where q is the number of units produced.

(a)(6 points). Find the formula for the marginal cost when q units are produced.

(b)(7 points). Find the minimum average cost.

5(12 total points). Given $f(x, y) = xy^2 + 3e^y$, find the following partial derivatives:
(a)(6 points). $f_x(x, y)$

(b)(6 points). $f_y(x, y)$

6(12 total points). Given $f(x, y) = x^2e^{2y}$, find $f_{xy}(x, y)$.

7(13 total points). The research group of a wireless phone company estimates that the number of subscribers of a phone plan t weeks after the plan is initiated in a city follows a logistic model:

$$N(t) = \frac{5000}{1 + 1249e^{-0.6t}}.$$

(a)(6 points) Predict the number of subscribers 10 weeks after the plan is initiated in the city.

(b)(7 points) Approximately, when will the number of subscribers grow the fastest?

8(12 total points). A function $f(x, y)$ satisfies that $f(10, 20) = 325$, $f_x(10, 20) = -2$ and $f_y(10, 20) = 5$. Estimate $f(9.5, 18.8)$.