MATH 205 EXAM 3

Thursday July 12, 2007

Instructor's Name:_____ **Name:**_____

Calculators are encouraged, but no books or formula sheets are allowed. Use the back pages as sketch paper. For full credit, show your work in detail.

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

1 (16 pts). For the function

$$f(x) = x^4 - 2x^2,$$

find all critical points and inflection points. Identify each critical point as a local maximum, local minimum, or neither.

2 (12 pts). Find the exact global maximum and minimum values of the function

$$f(x) = x^3 - 3x^2 - 9x + 15$$

on the closed interval $-5 \leq x \leq 4$.

3 (12 pts). The demand equation for a quantity q of a product at a price p, in dollars, is $p = -4q + 4004$. The company producing the product reports the cost C, in dollars, to produce a quantity q is $C = 4q + 5$ dollars.

(a) (4 pts). Express the company's profit, in dollars, as a function of q.

(b) (4 pts). What production level earns the largest possible profit?

(c) (4 pts). What is the largest possible profit?

4 (12 pts). You are the manager of a company that produces slippers that sell for \$20 per slipper. You are producing 1200 slippers each month, at an average cost of \$2 per slipper. The marginal cost at a production level of 1200 is \$3 per slipper.

(a) (4 pts). Are you making or losing money?

(b) (8 pts). Will increasing production increase or decrease your average cost?

5 (12 pts). The demand for yams is given by $q = 5000 - 10p^2$, where q is in pounds of yams and p is the price, in dollars, of a pound of yams.

(a) (4 pts). If the current price of yams is \$2 per pound, how many pounds will be sold?

(b) (8 pts). Is the demand at \$2 per pound elastic or inelastic?

6 (12 pts). In the spring of 2003, the disease SARS spread in accordance with the logistic function

$$P = \frac{1760}{1 + 17.53e^{-0.1408t}}$$

where $P = P(t)$ is the total number of SARS cases reported in Hong Kong t days after March 17, 2003.

(a) (4 pts). How many SARS cases were reported in Hong Kong on March 17, 2003?

(b) (4 pts). What limiting value of P does this function predict?

(c) (4 pts). How many days after March 17, 2003, was the disease spreading most rapidly?

7 (12 pts). The temperature adjusted for wind-chill is a temperature which tells you how cold it feels, as a result of the combination of wind and temperature. See the following table.

		temperature (^{o}F)							
		35	30	25	20	15	10	5	0
	5	31	25	19	13	7	1	-5	-11
wind	10	27	21	15	9	3	-4	-10	-16
speed	15	25	19	13	6	0	-7	-13	-19
(mph)	20	24	17	11	4	-2	-9	-15	-22
	25	23	16	9	3	-4	-11	-17	-24

For example, if the temperature is 0 ^{o}F and the wind speed is 15 mph, then it feels like -19 ^{o}F.

(a) (3 pts). If the temperature is 35 ^{o}F, what wind speed makes it feel like 24 ^{o}F?

(b) (3 pts). If the temperature is 20 ^{o}F, what wind speed makes it feel like 9 ^{o}F?

(c) (3 pts). If the wind is blowing at 15 mph, what temperature feels like 0 ^{o}F?

(d) (3 pts). If the wind is blowing at 20 mph, what temperature makes it feel like -15 ^{o}F?

8 (12 pts). Sketch a contour diagram for the function $f(x, y) = y - x^2$ with at least four labeled contours.