Math 205 Exam I

7:15p.m.–8:15p.m., Thursday, February 16, 2006

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 (total points: 13). The cost in dollars for a mining company to dig for gold is given by the cost function $C(q) = 720,000 + 2\,q^2$, where q is the amount of gold produced, measured in kilogram. The company can sell the gold for \$4,000 per kilogram.

(a)**(7 points)** Find the break-even point(s) and use one sentence to explain the economic significance of your result.

(b)**(6 points)** Estimate the marginal cost and the marginal revenue for the production levels $q = 500$ and $q = 1500$. Decide if the company should decrease or increase the production at those two production levels. Explain.

2 (total points: 12). In each of the items (a)–(d), determine if the function is a power function. If it is a power function, write it in the form $y = k\,x^p$ and give the values of the coefficient k and the exponent p.

(a)**(3 points)** $y = \ln(e^{-x^2})$.

(b)**(3 points)** $y = 2(3^x)$.

(c)**(3 points)** $y = x^2 \cdot (4x)^3$.

(d)**(3 points)** $y = (x-3)^2$.

3 (total points: 13). The demand and supply curves for a certain product are given in terms of price, p dollars per unit, by $D(p) = 100 - 2\,p$ and $S(p) = 3\,p - 50$.

(a)**(5 points)** Find the equilibrium price and quantity.

(b)**(5 points)** If a specific tax of $\$\,5$ is imposed on the producers, find the new equilibrium price and quantity.

(c)**(3 points)** How much in total will the government collect in tax for the product?

4 (total points: 12). Information about the total population in Thailand, $P(t)$, is given in the following table:

year	1910	1937	1947	1980	2000
total population (millions)	8.1	14.5	17.4	44.8	60.9

(a)**(6 points)** Estimate the growth rate per year of the population for the year 1947. Give units.

(b)**(6 points)** If $P'(2000) = 0.4$, give an estimation for the population in the year 2006.

5 (total points: 13). (a)**(7 points)** An account at bank A is compounded continuously with a nominal annual interest rate of 5%. How long does a customer have to wait until an amount of $\$\,10,000$ on the bank account has doubled? (You should use your calculator to find a decimal approximation.)

(b)**(6 points)** Bank B offers an account with a nominal interest rate of 6% and monthly compounding. Which amount does a customer have to put in this account if in 10 years the future value of his investment should be $\$\,20,000$?

6 (total points: 12). For each of the following tables decide if the data can represent a linear function, an exponential function or neither. In case of a linear or exponential function, find a formula of the form $y = m\,x + b$ or $y = P_0 \cdot a^x$, respectively.

(a)**(3 points)**

x	3	4	5	6
y	-14	-7	-3.5	-1.75

(b)**(3 points)**

x	-0.9	0.1	2.71	3.14
y	1.7	1.7	1.7	1.7

(c)**(3 points)**

x	27	28	29	30
y	14	28	42	63

(d)**(3 points)**

x	5	6	8	9
y	2.1	1.3	-0.3	-1.1

7 (total points: 12) A function $f(x)$ is given by the following graph:

(a)**(6 points)** Draw the graph of $-2\,f(x)$.

(b)**(6 points)** Draw the graph of $f(x+1)+1$.

8 (total points: 13). Sketch the graph of a function $f(x)$ on the interval $-5 \leq x \leq 8$ which satisfies the following conditions:

- $f(x) < 0$ for $x < 0$,
- $f(3) = 1$,
- $f'(x) < 0$ for $x < -1$,
- $f'(x) = 0$ for $x = -1$,
- $f'(x) > 0$ for $x > -1$,
- $f''(x) < 0$ for $x > 5$.