Math 205 Exam II

7:15p.m.–8:15p.m., Thursday, March 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: 12). Differentiate:

(a)**(6 points)** $f(x) = 5^x + x^{1/3} - 2\ln x$.

(b)**(6 points)** $g(t) = C\,t^2 - 7\,t^5 - 1/\sqrt{t}$.

2 (total points: 12). (a)**(4 points)** Find the derivative of $f(x) = (1 + x^2)^{2006}$.

(b)**(4 points)** Find the derivative of $f(x) = e^{x^3-1}$.

(c)**(4 points)** Find the derivative of $f(x) = 8\sqrt{\ln(x)}$.

3 (total points: 12). (a)**(6 points)** Differentiate $P(t) = e^{2t} \cdot \ln(t)$ and simplify.

(b)**(6 points)** Find the derivative of $y = \dfrac{x+10}{1-x^2}$ and simplify it.

4 (total points: 12). Find the value of a so that the function $f(x) = x \cdot e^{ax}$ has a critical point at $x = 3$.

5 (total points: 13). Find the global maxima and global minima of the function $f(x) = x^5 - 2 \cdot x^3$ on the interval $[-1, 2]$.

6 (total points: 13). The total cost in dollars of producing q units of a laptop is given by $C(q) = q^3 - 60\,q^2 + 1400\,q + 1000$ for $0 \leq q \leq 50$.

(a)**(2 points)** What are the fixed costs?

(a)**(4 points)** Determine the profit function $\pi(q)$ if the laptop sells for \$788 per unit.

(a)**(7 points)** Find the production level for which the profit is maximized and give the corresponding profit.

7 (total points: 13). The average cost in euros for producing a certain product is given by $a(q) = q^2 - 6\,q + 15$, where q is in thousands and $0 \leq q \leq 5$.

(a)**(4 points)** Determine the total cost function $C(q)$.

(b)**(9 points)** Find the minimum average cost and the corresponding value of q.

8 (total points: 13). The bird flu has reached Germany after 100 infected swans arrived at the island of Ruegen. It is expected that the number of birds infected can be modeled by a logistic growth function $P(t) = \frac{2{,}500{,}000}{1+C\,e^{-3t}}$, where t is the number of weeks since the arrival of the swans.

(a)**(3 points)** How many birds will become infected in the long run under this model?

(b)**(5 points)** Determine the remaining parameter C of $P(t)$.

(c)**(5 points)** When is the rate of newly infected birds expected to be the highest?