MATH 211 FINAL EXAM NAME _____

5/4/99 NO CALCULATORS! Show all necessary work. Be neat, clear, and brief.

1. (30 points) Find the derivative of each of these functions. You do not need to simplify your answers.

(a) $f(x) = \dfrac{x}{3} + \dfrac{3}{x}$

$f'(x) =$

(b) $f(x) = 2(x^3 - 1)(3x^2 + 1)^4$

$f'(x) =$

(c) $f(x) = \ln(x^4 - e^x)$

$f'(x) =$

(d) $f(x) = \dfrac{e^{x^2 - x}}{e^x + 1}$

$f'(x) =$

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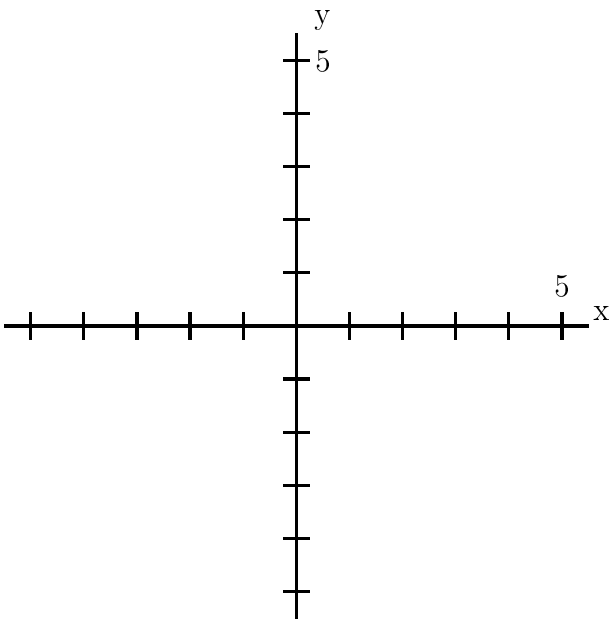
TOTAL	/ 200
GRADE	

2. (a) (7 pts) $\lim_{x \to 6} \dfrac{x^2 - 6x}{x^2 - 5x - 6} =$

(b) (8 pts) $\lim_{x \to 5} \dfrac{x^2 - 10x + 25}{x^2 - 25} =$

3. (20 pts) Using the techniques of calculus, sketch the graph of the function $f(x) = x^3 - 3x^2 + 5$. On the graph, indicate all relative extreme points (relative maximum and relative minimum points) and all points of inflection.



4. (5 pts) Let $P(t) = 500 - 100e^{-5t}$. When $t = 2$, is $P(t)$ increasing or decreasing? Explain your answer.

5. (10 pts) Find an equation for the line tangent to the curve $y = 2x(x-4)^6$ at $x = 5$.

6. (15 pts) A closed rectangular box with a square base is to be constructed using two different types of wood. The top is made of wood costing \$3 per square foot, and the remainder is made of wood costing \$1 per square foot. Suppose that \$48 is available to spend. Find the dimensions of the box of the greatest volume that can be constructed.

7. (12 pts) Ten grams of a certain radioactive material decays to three grams in five years. What is the half-life of the radioactive material?

8. (18 pts) The demand equation for a certain product is $p = 180 - 3x$, where p is the price and x is the number of units produced. The cost function is $C(x) = 60 + 80x - x^2$, where $0 \leq x \leq 40$.

(a) Determine the level of production that will maximize the profit, and determine the corresponding price.

(b) Suppose that the government imposes a tax of \$4 per unit produced, increasing the cost by \$4 per unit. Find the new price that now maximizes the profit.

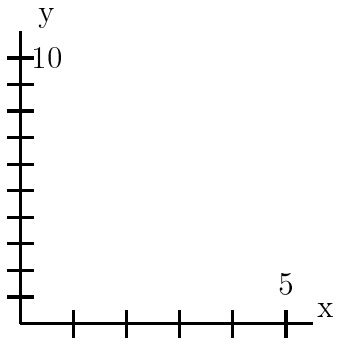
9. (30 pts) Find the following integrals.

(a) $\int_1^8 2x^{1/3}\,dx =$

(b) $\int_2^4 \left(\frac{2}{x^2} - \frac{1}{x+5}\right)\,dx =$

(c) $\int \frac{(\ln x)^3}{x}\,dx =$

10. (15 pts) Find the area bounded by the curves $y = x^2 - 4x + 4$ and $y = x^2$ (from $x = 0$ to $x = 3$). First graph the two functions.



11. (20 pts) Find the derivative of each of the following functions.

(a) $f(x) = \sqrt{xe^x + x^e}$

$f'(x) =$

(b) $f(x) = \ln\left[\dfrac{e^{4x}\sqrt{3x+1}}{1-x^2}\right]$

$f'(x) =$

12. (10 pts) Using the limit definition of the derivative (not the formulas), find $f'(x)$ for the function $f(x) = \dfrac{1}{2x+5}$.