

MATH 211, Spring, 2002

NAME _____

Holland, EXAM III

SIGNATURE _____

SSN _____

SECTION _____

INSTRUCTIONS:

1. ALL WORK should be organized to be readable and must be of sufficient depth to justify your answer. You must **SHOW CORRECT WORK** in order to get credit.
2. Put your final answer in the box, when one is provided.

1. (40 points) Differentiate the following functions.

(a) $y = \frac{e^{3x}}{x^5 + 7}$

(b) $y = (e^{x^2} - 2)^4$

(c) $y = x^5 \ln x$

(d) $y = \ln(x^4 + 5x^2 + 1)$

(e) $y = \ln\left(\frac{\sqrt{x+1}(x^2-7)}{x^4}\right)$

2. (12 points) A certain population of bacteria grows at a rate proportional to the number of bacteria present. At the beginning of an experiment, there are 500 bacteria present. Seven hours later, the population has grown to 2,000.

(a) Find the formula for $P(t)$, the size of the population t hours into the experiment.

(b) How many hours does it take the population to triple?

3. (12 points) A certain radioactive substance has a half-life of 35 years. How long does it take a sample of the substance to decay to one tenth its original mass?
4. (12 points) Find all critical numbers for the function $f(x) = x^2e^{3x+1}$.

5. (12 points) Find the absolute maximum and absolute minimum of the function $f(x) = 2x^3 - 3x^2 - 12x$ on the interval $[0, 3]$.

6. (12 points) A local sculptor is marketing tacky yard ornaments. In order to sell x yard ornaments, the price *per yard ornament* must be $p = 28 - 0.4x$ dollars. The total cost of producing x yard ornaments is given by $C(x) = 5000 + 0.6x^2$ dollars

(a) Find the total revenue function $R(x)$.

(b) Find the total profit function $P(x)$.

(c) How many yard ornaments must the sculptor produce and sell in order to maximize profit?