MATH 211, Fall, 1999

Holland, EXAM III

NAME _____

SIGNATURE _____

SSN _____

SECTION _____

INSTRUCTIONS:

1. ALL WORK should be organized to be readable and must be of sufficient depth to justify your answer. Correct answers with incorrect work or insufficient justification will receive no credit.
2. Print your name and social security number.
3. Make certain that your test has all four (4) different sheets (including the cover page).
4. Put your answers in the boxes, where provided.
5. The point value of each problem is given in the brackets at the right of the problem number.

1. (24 points) Differentiate the following functions. SIMPLIFY, where possible.

   - $f(x) = 4e^{3x^5-6x}$

   - $f(x) = \dfrac{e^x}{e^x+6}$

   - $f(x) = (x^3+x)\ln(x)$

   - $f(x) = 3^x$

2. (10 points) Differentiate $y = \ln\left(\dfrac{e^{3x}x^4\sqrt{2x+3}}{(5x+1)^7}\right)$. Do not simplify.

3. (22 points) Find the x-coordinates of all relative extrema of the following functions. Determine whether each extremum is a relative maximum or a relative minimum.

   - $f(x) = (x^2 - 2x)e^x$

   - $g(x) = 2 + 3x + 5e^{-2x}$.

4. Calculate the following antiderivatives.

   - (15 points) $\int \left(\frac{3}{2x} + \sqrt{x} + \frac{5}{x^2} - 4x^3 + 1 \right) dx$

   - (5 points) $\int 6e^{5x} dx$

5. (12 points) A colony of bacteria grows at a rate proportional to the number of bacteria present. At the beginning of an experiment, there are 10 thousand bacteria. After 3 hours, the population has grown to 50 thousand.

   (a) Find the formula for $P(t)$, the number of bacteria (in thousands) present in the culture t hours after the experiment begins.

   (b) How many hours after the experiment begins will the population of bacteria reach 80 thousand?

6. (12 points) The decay constant for the radioactive substance UGoBald-47 is $\ln 3$ when time is measured in years. Find the half-life of UGoBald-47.