MATHEMATICS 180

NAME _____

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TOTAL _____

Problem 1. (20 pts.) Compute the derivatives of the following functions:

a) $y(x) = x^5 + e^{5x} + x^e$,

b) $y(x) = xe^x$,

c) $y(x) = \ln(x^2 + 1)$,

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

d) $y(x) = \frac{x}{\ln x}$

Problem 2.(20 pts.) Let

$$y(x) = xe^{-x}.$$

a) Compute $y'(x)$, and find all critical points. Determine which are maxima and which are minima.

b) Find $y''(x)$, and determine the intervals where the function is concave up and the intervals the function is concave down.

c) What is the limit of $y(x)$ when $x \to \infty$ and $x \to -\infty$?

d) Graph $y(x)$.

Problem 3. (20 pts.) The population of Austin, Texas, was 200 thousand in 1980. In 1990, it was 400 thousand. Assuming the exponential model:

a) Find the value k, and write the function. Assume $P_0 = 200$.

b) Based on this model estimate the population of Austin in the year 2010.

c) What year would the population reach 2 million?

Problem 4. (20 Pt's) Compute the following integrals

a) $\int \frac{x^3+1}{x} dx$

b) $\int_0^1 3e^{-2t} dt$

c) $\int xe^{-x^2} dx$ (use substitution)

d) $\int \frac{\ln x}{x} dx$ (use substitution)

e) $\int_1^3 (x^2 - x^3) dx$

Problem 5 (20 pts.) Nina has a possibility of opening one of two accounts: first one is at 5% interest compounded annually, second - at 4.9% compounded continuously. Which one should she choose if she wants to invest $5000 for 6 years?