EXAM 3 - MATH 112
DATE: Tuesday, November 6
INSTRUCTOR: George Voutsadakis

Read each problem very carefully before starting to solve it. Each question is worth 5 points. It is necessary to show your work. Correct answers without explanations are worth 0 points.

GOOD LUCK!!

1. (a) Find the absolute min and the absolute max of the function $f(x) = xe^{-x}$ in the closed interval $[0, 2]$. (For the purpose of this problem you may assume $e \cong 3$). (3 points)

   (b) Use the second derivative test to find the relative maxima and relative minima of the function $f(x) = x + \frac{4}{x}$. (2 points)

2. Determine the dimensions of a rectangular solid with square base and surface area 160 square centimeters if it has maximum volume. (5 points)

3. Find the intervals of monotonicity and the intervals of concavity of the function $f(x) = x^4 - 4x^3 + 5$. (3 points) Then roughly sketch its graph. (2 points)

4. (a) Sketch the graph of the function $f(x) = 2^{-x}$. (2 points)

   (b) Use your basic knowledge of the graphs of exponentials and transformations to obtain the graph of the function $f(x) = 3^{1-x} - 2$. (3 points)

5. (a) Find the points on the graph to $y = 4x^3 e^{-x}$, where the tangent to the graph is horizontal. (3 points)

   (b) How long does it take for a deposit P at a bank account with continuous compounding offering annual interest rate 8 % to quintuple? (Quintuple: Become 5 times as much.) (2 points)

6. Find the following derivatives:

   (a) $f(x) = \frac{e^{5x}}{x^2+7}$ (2 points)

   (b) $x^2 e^y + 3ye^{-x} = 2$ (3 points)