Calculus I (Math 231) Exam 3

Date: April 10, 2006 Professor Ilya Kofman

Justify answers and show all work for full credit. No symbolic calculators allowed.

NAME: _____

Problem 1. *(1) Find the critical points, (2) Identify the absolute max and min.*

$h(x) = x^3 - 6x^2 + 15, \quad -5 \leq x \leq 5$

Problem 2. *(1) Find the critical points, (2) Find intervals where it is increasing or decreasing, (3) Identify all relative extrema using the First Derivative Test.*

(a) $f(x) = x^4 - 2x^2 - 3$

(b) $g(x) = x^2 - 8x + 6\ln(x), \quad x > 0$

Problem 3. *(1) Find the inflection points, (2) Find intervals where it is concave up or down, (3) Identify all relative extrema using the Second Derivative Test.*

(a) $f(x) = x^4 - 2x^2 - 3$

(b) $g(x) = x^2 - 8x + 6\ln(x), \quad x > 0$

Problem 4. Sketch $f(x)$ and $g(x)$ using your answers in Problems 2 and 3.

Problem 5. A cylindrical can with height h and radius r will hold $4\,\ell$ of soup. The material for the top and bottom costs 2 cents per square cm, and the material for the side costs 1 cent per square cm. Find h and r to minimize the cost of materials.

Problem 6. The value of e is about 2.718. Use differentials to estimate $e^{0.9}$. Simplify your answer to be in terms of e (for example, $e/2$).

Problem 7. Use Newton's Method to approximate the zero of $f(x) = x^4 - x - 1$ to one decimal place. Start with initial estimate $x = 1$.

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$