University of Washington **Department of Mathematics**

First Midterm **Math 134** **October 20, 1999** **10:30 - 11:30 AM**

Name _____

Problem	Total Points	Score
1.1	10	
1.2	10	
1.3	10	
1.4	10	
1.5	10	
2.1	15	
2.2	15	
3.1	10	
3.2	10	
Total	100	

Instructions

1. Print your name on each page of the exam as you check to see that your copy of the exam has 7 pages.

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2. Clearly state the theorems and/or homework problems that you use.
3. You are allowed to use of 1 page of notes. If you need more space to solve a problem, use the back of the page preceding that problem.
4. Read each question carefully. Be clear and concise. Show all your work.
5. NO calculators are allowed.

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Problem 1. Let r be a rational number, $r > 1$. Let f be defined by

$$f(x) = (1 + x)^r - (1 + rx) \quad \text{for} \quad x \geq -1.$$

1.1 Find the critical points of f. Determine the intervals where f is increasing and where f is decreasing.

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1.2 Determine the concavity of the graph of f.

1.3 Determine the value of f at -1. Determine the behavior of $f(x)$ as x approaches $+\infty$.

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1.4 Compile all the information on a table.

1.5 Sketch the graph of f incorporating the information above.

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Problem 2. Let $f : [0,1] \to \mathbf{R}$. Suppose that the function f has the following property

$$|f(x) - f(y)| \leq (x-y)^2 \quad \text{for all} \quad x, y \in [0,1].$$

2.1 Show that the function f is continuous on [0,1].

2.2 Show that the function f is differentiable in (0,1), and that $f'(x) = 0$ for every $x \in (0,1)$.

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Problem 3.

3.1 State the mean value theorem (make sure to include all the hypothesis).

3.2 Let f be a differentiable function on $(0, +\infty)$. Assume that $f'(x) \to 0$ as $x \to +\infty$. Let $g(x) = f(x+1) - f(x)$ show that $g(x) \to 0$ as $x \to +\infty$.