Math 201 23 September 2008 First Midterm

NAME (Print!): \_\_\_\_\_

Check one: (1pm): \_\_\_\_\_ (2pm): \_\_\_\_\_

Problem	Points	Score
1	20	
2	20	
3	30	
4	20	
5	10	
Total	100	

- **Problem 1 (20 points):** The number of cells in a petri dish is given by an exponential:  $c(t) = ae^{bt}$ . At time 0 minutes, there were 5,000,000 cells and for the entire experiment 45% of them are dying each minute.
  - (1) Find a and b.
  - (2) Starting at what time will there be less that 1,000 cells. (Use a = 100 and b = 0.5 if you couldn't get the first part).

Problem 2 (20 points): The function

$$f(x) = \frac{2^{1/x} - 2^{-1/x}}{2^{1/x} + 2^{-1/x}}$$

is defined for  $x \neq 0$ .

(1) Investigate the left-hand and right-hand limits of f(x) as  $x \to 0$ .

(2) Sketch a graph of f(x) and describe the behavior near 0.

**Problem 3 (30 points):** Find the following limits. For each part, name the laws, theorems and/or rules that you use. (1)  $\lim_{x\to\pi/4} \frac{\sin x - \cos x}{\tan x - 1}$ 

(2)  $\lim_{x\to 0} \tan^{-1}(e^x)$ 

(3)  $\lim_{x\to 0^+} \sqrt{x} e^{\cos(\pi/x)}$ 

Problem 4 (20 points): Answer the following two questions:

(1) According to the Law of Continuity, if f(x) and g(x) are continuous at c, then f(x) + g(x) is continuous at c. Suppose that f(x) + g(x) are discontinuous at c. Is it true that f(x) + g(x) is discontinuous at c? If not, give a counterexample.

(2) Is it true that if f(x) and g(x) are continuous at x = a, then f(x)/g(x) is continuous at x = a? If not, give a counterexample.

Problem 5 (10 points): Find the domain and range for the following  $% \left( \frac{1}{2} \right) = \left( \frac{1}{2} \right) \left( \frac{1}{2} \right)$ 

$$f(x) = 2\sin^{-1}(2x+1).$$

Sketch the function.

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