Name ____

Homework #1, Math 151, Fall 2008

Instructions: Record final answers and attach pages with work. All work must be shown in order to receive credit. Exact values should be use unless stated otherwise.

1. Describe some applications of calculus in your chosen field of study. [Don't tell me there aren't any, because I know better.] Use the examples on page 63-64 to give you ideas, and feel free to Google for some. List at least 3.

2. Find the limits by the method specified if they exist.
   a. $\lim_{x\to 0}\frac{\sin x}{x}$, numerically (show table)

   b. $\lim_{x\to 0}\frac{4}{2+e^{1/x}}$, graphically

   c. $\lim_{x\to 3}(x+2)$, find L, and then use the ε-δ definition to verify that the limit L exists

3. Find the limits.
   a. $\lim_{x\to 0} e^x\cos(\pi x)$

   b. $\lim_{x\to}\ln\left(\frac{x}{e^x}\right)$

c. $\lim\limits_{x \to c} \left[\sqrt[3]{f(x)} \cdot 4g(x) \right]^{4/5}$

d. $\lim\limits_{x \to 2} \left(\dfrac{x^3 - 8}{x - 2} \right)$

e. $\lim\limits_{x \to 0} \left[\dfrac{\sqrt{x+5} - \sqrt{5}}{x} \right]$

f. $\lim\limits_{x \to 2} \left(\dfrac{x^5 - 32}{x - 2} \right)$ [Hint: use long division].

4. Use the squeeze theorem to find $\lim\limits_{x \to 0} x| \sin x$ using $y = \pm |x|$ as your comparison functions.

5. Find the limit if it exists.

a. $\lim\limits_{x \to 2^+} \left(\dfrac{2 - x}{x^2 - 4} \right)$

b. $\lim\limits_{x \to 0^-} \left(\dfrac{\dfrac{1}{x + \Delta x} - \dfrac{1}{x}}{\Delta x} \right)$

c. $\lim\limits_{x \to 1} f(x)$ where $f(x) = \begin{cases} x^3 + 1, & x < 1 \\ x + 1, & x \geq 1 \end{cases}$

6. Determine if the function is continuous. If not, find the discontinuities. Are the discontinuities removable?

a. $f(x) = \dfrac{1}{x^2+1}$

b. $g(x) = \dfrac{x-1}{x^2+x-2}$

c. $h(x) = \begin{cases} \csc\left(\dfrac{\pi x}{6}\right), & |x-3| \le 2 \\ 2, & |x-3| > 2 \end{cases}$

[Hint: start by translating these intervals into something more obvious.]

7. Find the constant a, b that will make the function continuous on the entire real line.

$$f(x) = \begin{cases} 4, & x \le -1 \\ ax+b, & -1 < x < 3 \\ -4, & x \ge 3 \end{cases}$$