MA 125
Worksheet 1 Name: _____

Show all work clearly. Circle your final answers. Simplify as much as possible.

1. The position y (in feet) of a particle at time t (in seconds) is given by the formula

$$y = t^3 - 3t + 4.$$

(a) Find the average speed of the particle between $t = 1$ and $t = 2$ seconds. Be sure to include appropriate units.

(b) Find and simplify a formula for the average speed of the particle on the time interval $[1, 1 + h]$, $h \neq 0$. Leave your answer in terms of h.

(c) Use your formula from part (b) to compute the average speed of the particle on the time intervals $[1, 1.1]$, and $[1, 1.01]$, and $[1, 1.001]$. Round your answers to at least 3 decimal places.

(d) Using your data from part (c), what seems to be the instantaneous speed of the particle at time $t = 1$ second?

2. Sketch a graph of each of the following functions and explain why the limit does not exist.

(a) $f(x) = \dfrac{x}{|x|}$; $\lim\limits_{x \to 0} f(x)$

(b) $g(x) = \dfrac{1}{x-1}$; $\lim\limits_{x \to 1} g(x)$

3. Find and simplify the difference quotient $\dfrac{f(x+h) - f(x)}{h}$, $h \neq 0$ for the function $f(x) = \dfrac{1}{x}$. What happens to the difference quotient as $h \to 0$?

4. Evaluate the following limits.

(a) $\lim_{x \to -1} \dfrac{x^3 + 3x + 2}{x^2 - x - 2}$

(b) $\lim_{x \to -1} \dfrac{\sqrt{x^2 + 8} - 3}{x + 1}$ (Hint: Rationalize the numerator.)

5. Use the Sandwich Theorem to show that $\lim_{x \to 0} x^2 \cos(20\pi x) = 0$. (Hint: Find two functions f and g with $f(x) \leq x^2 \cos(20\pi x) \leq g(x)$ and $\lim_{x \to 0} f(x) = \lim_{x \to 0} g(x) = 0$.)