Mathematics 0110A: Introductory Calculus (002) 1st Homework Due Friday, October 5th, in class

1. Find the domains of these functions:

$$f(x) = \frac{1}{x^2 - 1}, \qquad g(x) = \frac{\sqrt{x - 1}}{x^2 - 1}.$$

2. Let

$$f(x) = \frac{1}{x+2}, \qquad g(x) = x^2 - 2.$$

Find the domains and the rules of the functions $f \circ g$ and $g \circ f$.

3. Find the following limits. If the limit does not exist, explain why.

$$\lim_{x \to 4} \frac{x^2 - 2x + 1}{x - 1}, \qquad \lim_{x \to 1} \frac{x^2 - 2x + 1}{x - 1}, \\
\lim_{x \to \infty} \frac{5x^2 + x^3 + 4x + 1}{2x^3 + 4x^2 + 6}, \qquad \lim_{x \to -\infty} \frac{6x^3 + x}{x^4 + x^3 + 4}, \\
\lim_{x \to \infty} \frac{7x^3 + x^2 + 6}{x + 5}, \qquad \lim_{x \to -2} \frac{x^2 - 4}{2x^2 + x^3}, \\
\lim_{x \to 2^+} \frac{x + 4}{x^2 + 2x - 8}.$$

4. Sketch the graph of the function

$$f(x) = \begin{cases} x - 1 & \text{if } x < -1 \\ -x & \text{if } -1 \le x \le 0 \\ x^2 & \text{if } x > 0 \end{cases}$$

and explain if it is continuous at -1 and 0.

5. Find the derivative f' of the function $f(x) = 6x^2 + 5x + 2$ using the definition

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h},$$

and find the equation of the tangent line to its graph at point (-1, 3).