# Worksheet # 1

(Due Friday, August 16)

**Problem 1.** Calculate the following limits:

**a)**

$$\lim_{x\to 1} \frac{x^2+x-2}{x^2+2x-3}$$

**b)**

$$\lim_{x\to -4} \frac{x^3+4x^2+x+4}{2x^2+7x-4}$$

**c)**

$$\lim_{x\to 4} \frac{3-\sqrt{5+x}}{x^2-x-12}$$

**d)**

$$\lim_{x\to 2} \frac{\frac{1}{\sqrt{3-x}}-1}{x^2-3x+2}$$

**Problem 2.** Find the maximum domain of the following functions:

**a)**

$$f(x) = \frac{1}{\sqrt{x^3+5x^2-14x}}$$

**b)**

$$g(x) = 1-\sqrt{x^2-5x+6}$$

**Problem 3.** Find the value of $a \in \mathbb{R}$ that makes the following function continuous at $x = 0$:

$$f(x) = \begin{cases} \frac{\sqrt{x+1}-1}{x^2+2x}, x < 0 \\ x+4a, x \geq 0 \end{cases}$$

**Problem 4.** Determine the horizontal and vertical asymptotes of the following function:

$$f(x) = \frac{3x^4+x^2-1}{x^4-9x^2}$$

**Problem 5.** When selling some products, the profits per product you get don't grow as you produce more, but after some point the profits start decaying because the supply exceeds the demand. This behavior can be modelled using a quadratic equation:

$$P = an^2+bn+c$$

where $P$ is the profit per product, $n$ is the number of individual products you sell, and $a, b, c$ are parameters.

**a)** Given the setting presented, should the graph be concave up or concave down? Explain.

**b)** Suppose that after producing more than 1000 units of the product, you start seeing losses. If you know that when zero units are produced there is no profit, what could be an equation that models the profits per unit?

**c)** Based on your previous answer, what is the number of units after which your profits per product start decaying?