

# Math 114 Practice Test 1

Instructor: Jay Daigle

**Problem 1.**

(a) Directly from the definition of a limit, compute with proof  $\lim_{x \rightarrow -2} \frac{x}{x+4}$

(b) Directly from the definition, compute with proof  $\lim_{x \rightarrow 3} \frac{2x^2 - 10x + 12}{x - 3}$ .

**Problem 2.**

(a) Directly from the definition of a limit, compute with proof  $\lim_{x \rightarrow 1^+} f(x)$  where

$$f(x) = \begin{cases} (x+3)^2 & x > 1 \\ x & x < 1 \end{cases}$$

(b) Directly from the definition of a limit, prove that  $\lim_{x \rightarrow -1} g(x)$  does not exist, where

$$g(x) = \begin{cases} 5 & x < -1 \\ 2 & x > -1 \end{cases}$$

**Problem 3.**

(a) Directly from the definition, prove that  $\lim_{x \rightarrow +\infty} x^2 + x + 1 = +\infty$ .

(b) Directly from the definition, prove that  $\lim_{x \rightarrow -2} \frac{x}{(x+2)^2} = -\infty$ .

**Problem 4.**

Compute the following limits, showing each step and naming each limit law you use.

(a)

$$\lim_{x \rightarrow 4} \sqrt{x^2 - x - 3} + \frac{2}{x}$$

(b)

$$\lim_{x \rightarrow 1} \frac{x^2 + 4x - 5}{x - 1}$$

**Problem 5.**

Compute the following limits if they exist. Show enough work to justify your computation, or your claim that the limit does not exist.

(a)

$$\lim_{x \rightarrow -2} \frac{x^2 + 6x + 8}{2(x+4)(x+2)} =$$

(b)

$$\lim_{x \rightarrow 9} \frac{3 - \sqrt{x}}{9 - x}$$

(c)

$$\lim_{x \rightarrow -\infty} \frac{3x^3 + \sqrt[3]{x}}{\sqrt{9x^6 + 2x^2 + 1} + x}$$

(d)

$$\lim_{x \rightarrow 1^+} \frac{|x-1|}{x-1} =$$