

Name: \_\_\_\_\_

## Notesheet. Section 2.4 Part I

Math 1210

**Challenge 1.** Consider the function  $f(x) = \frac{x^2 - 1}{x + 1}$ . What is the domain of this function? What is  $f\left(-\frac{9}{10}\right)$ ? What about  $f\left(-\frac{99}{100}\right)$ ? Can you find an  $x$  such that  $f(x) - (-2) = \frac{1}{10^3}$ ? (Hint: if necessary, use  $99^2 = 9801$ ).

**Definition 2.** We say the function  $f$  has the right-handed limit  $L$  as  $x \rightarrow a$  from the right if

**Challenge 3.** Consider  $f(x) = \frac{x^2 - 1}{x + 1}$ . What is  $\lim_{x \rightarrow -1^+} f(x)$ ? Consider

$$g(x) = \begin{cases} x^{3/2} & x \neq 4 \\ -1 & x = 4 \end{cases}$$

What is  $\lim_{x \rightarrow 4^+} g(x)$ ?

**Challenge 4.** Consider

$$f(x) = \begin{cases} -6 & -\infty < x < -3 \\ x & -3 \leq x \leq 3 \\ 6 & x > 3 \end{cases}$$

What is  $\lim_{x \rightarrow -3^-} f(x)$ ,  $\lim_{x \rightarrow -3^+} f(x)$ ,  $\lim_{x \rightarrow 3^-} f(x)$ , and  $\lim_{x \rightarrow 3^+} f(x)$ ?

**Definition 5.** We say the function  $f$  has the (two-sided) limit  $L$  as  $x \rightarrow a$  if

**Challenge 6.** Consider

$$f(x) = \begin{cases} -10 & x \leq -5 \\ x & -5 < x < -2 \\ \frac{1}{x+1} & -2 \leq x < -1 \text{ or } -1 < x \leq 0 \\ x+1 & 0 < x < 5 \\ -2 & x = 5 \\ x^2 & x > 5 \end{cases}$$

What are  $\lim_{x \rightarrow -5} f(x)$ ,  $\lim_{x \rightarrow -2} f(x)$ ,  $\lim_{x \rightarrow -1} f(x)$ ,  $\lim_{x \rightarrow 0} f(x)$ , and  $\lim_{x \rightarrow 5} f(x)$ ? Note that “does not exist (DNE)” is an acceptable answer.