Name: _____ Date: _____

Learning Goal 2.1	Finite limits and continuity.

We will apply these methods to **four** different types of limits:

1. Basic ↑ last day
2. One - Sided
3. Infinite Limits
4. Limits at Infinity.

today

One – Sided Limits

$\lim_{x \to a^-} f(x)$

- approaching a from the left
- values smaller than a

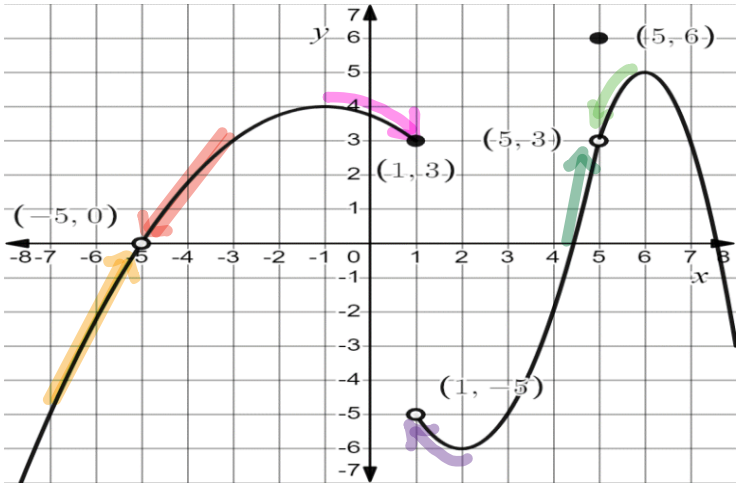
$\lim_{x \to a^+} f(x)$

- approaching a from the right
- values bigger than a

Existence of Limits

$\lim_{x \to a} f(x) = L$ iff ← if and only if $\lim_{x \to a^-} f(x) = L$ and $\lim_{x \to a^+} f(x) = L$

Example Given the following graph, compute each of the following.



a. $f(-5)$ DNE $\lim_{x \to -5^-} f(x) = 0$ $\lim_{x \to -5^+} f(x) = 0$ $\lim_{x \to -5} f(x) = 0$

b. $f(1) = 3$ closed dot $\lim_{x \to 1^-} f(x) = 3$ $\lim_{x \to 1^+} f(x) = -5$ $\lim_{x \to 1} f(x)$ DNE

c. $f(5) = 6$ $\lim_{x \to 5^-} f(x) = 3$ $\lim_{x \to 5^+} f(x) = 3$ $\lim_{x \to 5} f(x) = 3$

Assignment # 11 – 14, 23 – 37 Quiz Next Day!

Infinite Limits

WHEN $\lim_{x\to a} f(x) = \infty$ OR $\lim_{x\to a} f(x) = -\infty$

* INFINITY IS A CONCEPT NOT A NUMBER *

the function increases positively (or negatively) without bound as x approaches a.

Example Find each limit.

a. $\lim_{x\to 2^-} \frac{x}{x-2} = -\infty$

x	$f(x)$
1.9	-19
1.99	-199
1.999	-1999

b. $\lim_{x\to 2^+} \frac{x}{x-2} = \infty$

x	$f(x)$
2.1	21
2.11	211
2.111	2111

c. $\lim_{x\to 2} \frac{x}{x-2}$ DNE

as the left and right limits don't match.

* Good way to look for vertical asymptotes!

Example Graph the function and determine the following limits.

$$f(x) = \frac{x^2-9}{x^2-x-6}$$

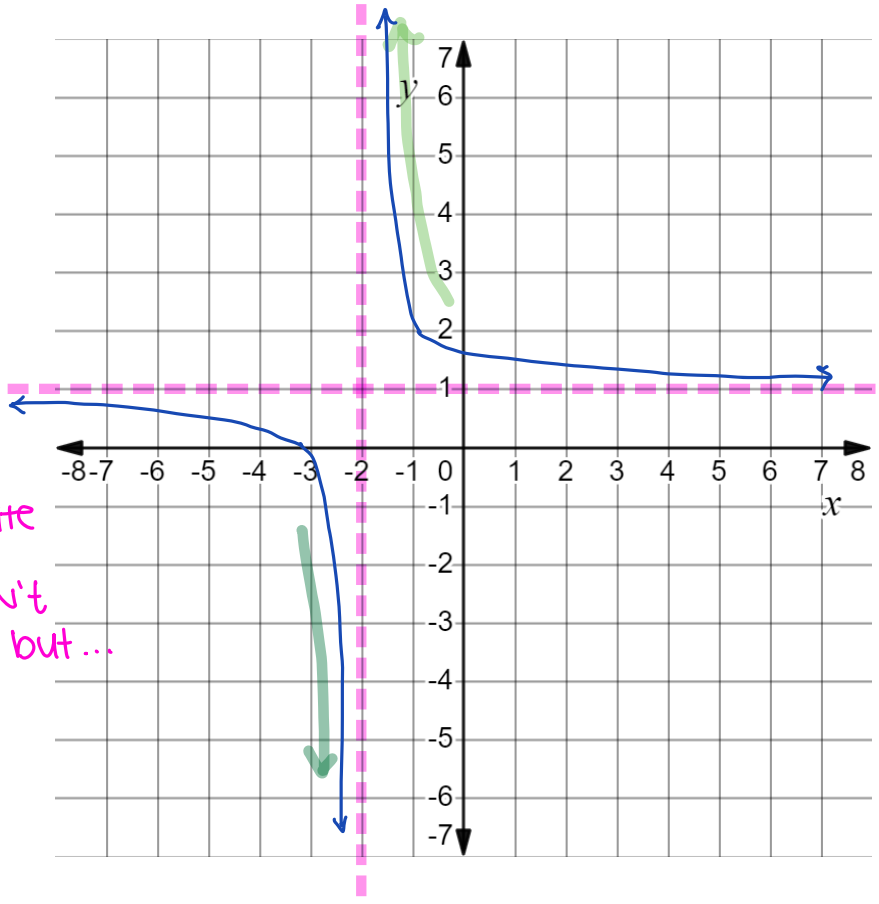
$f(x) = \frac{(x+3)(x-3)}{(x+2)(x-3)}$

NPV: $x \neq -2, 3$

$= \frac{x+3-1+1}{x+2}$

$= \frac{x+2}{x+2} + \frac{1}{x+2}$

$= 1 + \frac{1}{x+2}$



a. $\lim_{x\to -2^-} f(x) = -\infty$

b. $\lim_{x\to -2^+} f(x) = +\infty$

so the limit doesn't exist but...

c. Vertical asymptotes? $x = -2$

Assignment # 11 – 14, 23 – 37 Quiz Next Day!