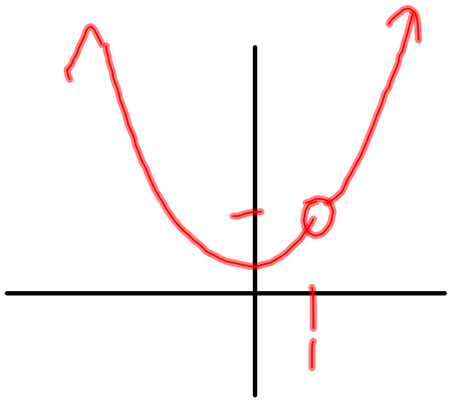
1.2 Finding Limits Graphically and Numerically

Limit -- the y-value that a function approaches as the x-value approaches a given number.

$\lim_{x \to c} f(x) = L$ "the limit of f(x) as x approaches c is L"

ex1) $f(x) = \dfrac{x^3 - 1}{x - 1}$ Find $\lim_{x \to 1} f(x) =$

Use x-values that get closer to 1 from the right and from the left.



x	.5	.75	.9	.99	1	1.01	1.1	1.25	1.5
f(x)					?				

ex2) $\lim_{x \to 2} \dfrac{x^2 - 3x + 2}{x - 2}$

ex3) $\lim_{x \to 0} \dfrac{x}{\sqrt{x + 1} - 1}$

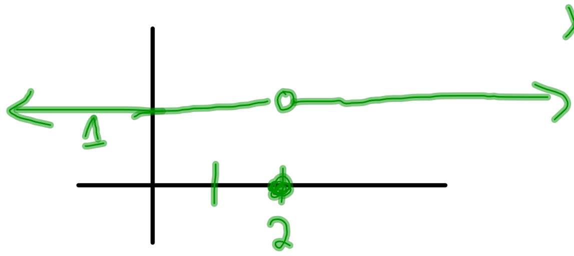
Existence of Limits

-- in order for a limit to exist, it must approach the same value from the right and the left.

ex4) Find the limit of f(x) as x approaches 2

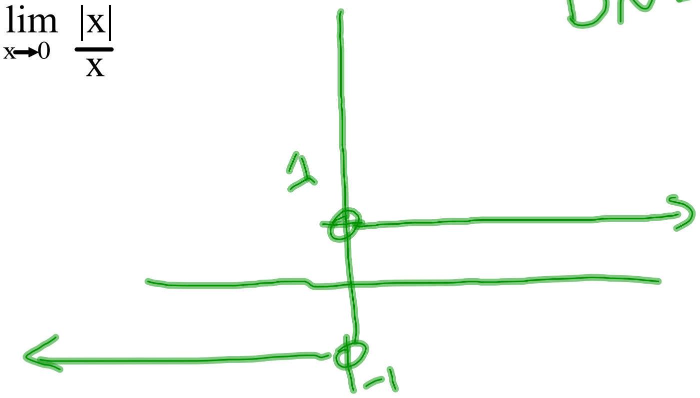
$$f(x) = \begin{cases} 1, & x \neq 2 \\ 0, & x = 2 \end{cases}$$

$\lim_{x \to 2} f(x) = \underline{1}$



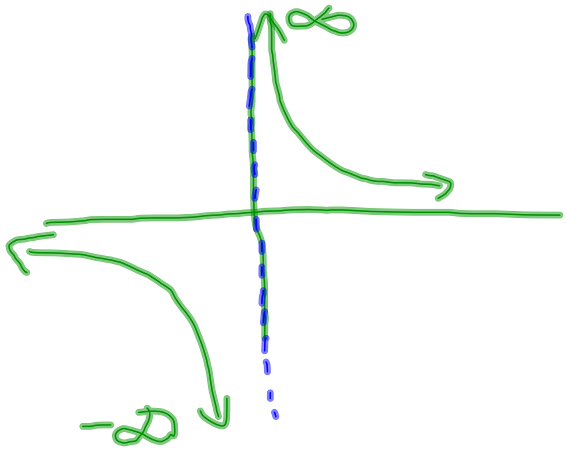
5) $\lim_{x \to 0} \frac{|x|}{x}$

DNE



Unbounded Behavior → No Limit, approaches $\pm\infty$

6) $\lim_{x \to 0} \frac{1}{x^2}$



HW1: p.53 # 3-17odd, 42-46

HW2: p 53 # 12-18e, 21-31 odd

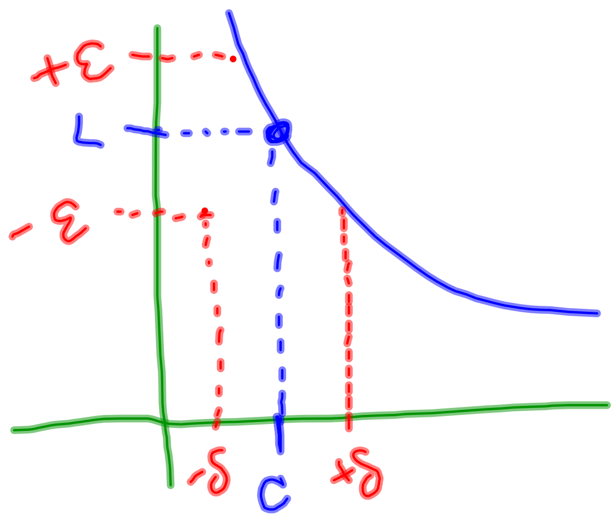
<u>Definition of a Limit</u>

If f(x) is a function on an open interval containing 'c',
Then $\lim\limits_{x \to c} f(x) = L$

ε = epsilon
δ = Delta

Means that for $\epsilon > 0$
there exists $\delta > 0$ such that:

If $0 < |x-c| < \delta$, then $|f(x) - L| < \epsilon$



ex)
$$\lim_{x \to 3} (2x-5) = 1$$

Prove the limit exists using the def. of Limits.

$0 < |x-c| < \delta$, $|f(x)-L| < \varepsilon$

$0 < |x-3| < \delta$ $\quad$ $|2x-5-1| < \varepsilon$

$|2x-6| < \varepsilon$

$|x-3| < \varepsilon/2$

$$\boxed{\delta = \varepsilon/2}$$

2) $f(x) = \begin{cases} 2x+1, & x < 3 \\ 5-x, & x \geq 3 \end{cases}$

$\lim_{x \to 3} f(x)$