

# What is a limit?

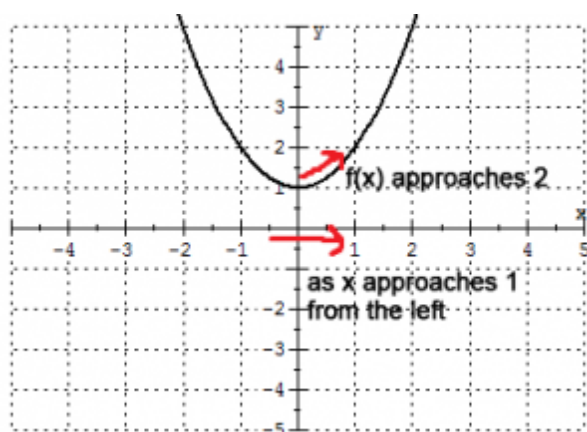
$$\lim_{x \rightarrow c} f(x) = N$$

The limit of  $f(x)$  as  $x$  approaches  $c$  equals the number  $N$

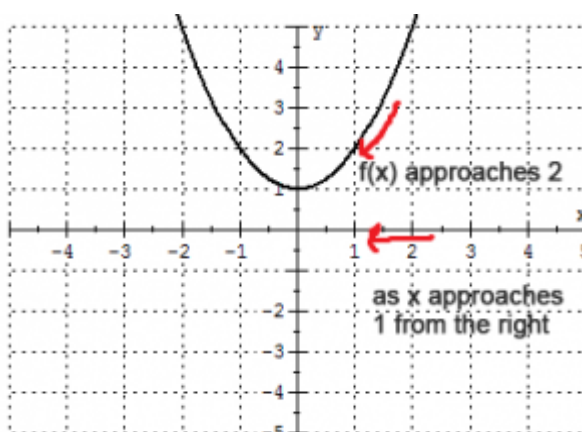
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$$f(x) = x^2 + 1$$

Find:  $\lim_{x \rightarrow 1} f(x) = 2$



$$\lim_{x \rightarrow 1^-} f(x) = 2$$



$$\lim_{x \rightarrow 1^+} f(x) = 2$$

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$f(x) = \begin{cases} -4, & x \leq -1 \\ 2, & -1 < x < 3 \\ x-1, & x > 3 \end{cases} \quad \lim_{x \rightarrow 3} f(x) = 2$

$\lim_{x \rightarrow -1^-} f(x) = -4$

$\lim_{x \rightarrow -1^+} f(x) = 2$

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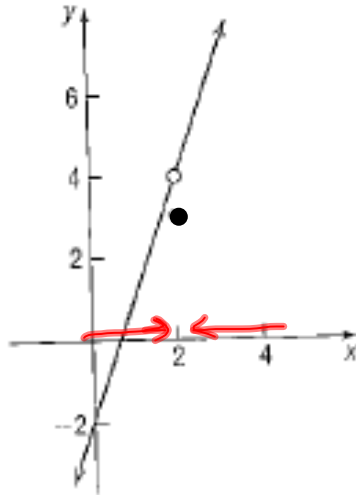
<http://www.youtube.com/watch?v=oDAKKQuBtDo>

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Find:  $\lim_{x \rightarrow 2} f(x)$  if  $f(x) = \begin{cases} 3x - 2, & x \neq 2 \\ 3, & x = 2 \end{cases}$

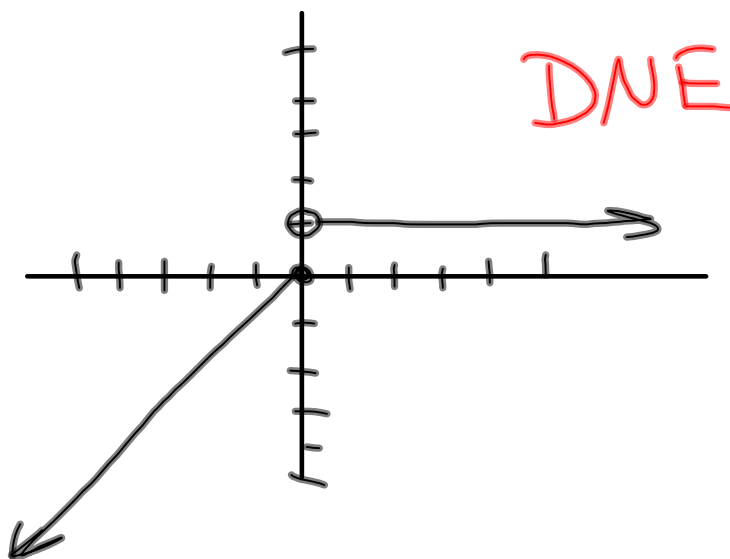
$$\lim_{x \rightarrow 2} f(x) = 4$$

$$f(2) = 3$$



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Find:  $\lim_{x \rightarrow 0} f(x)$  if  $f(x) = \begin{cases} x, & x \leq 0 \\ 1, & x > 0 \end{cases}$



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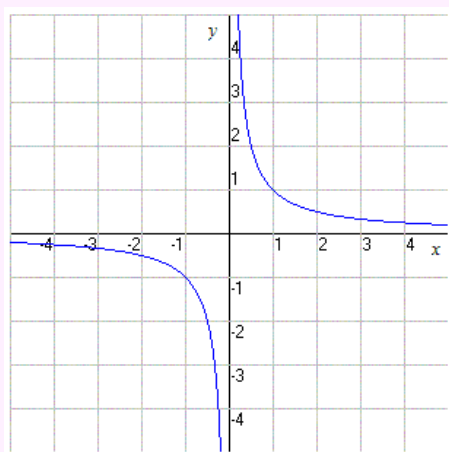
## Rational Functions may be Continuous or Discontinuous

Discontinuities may arise from:

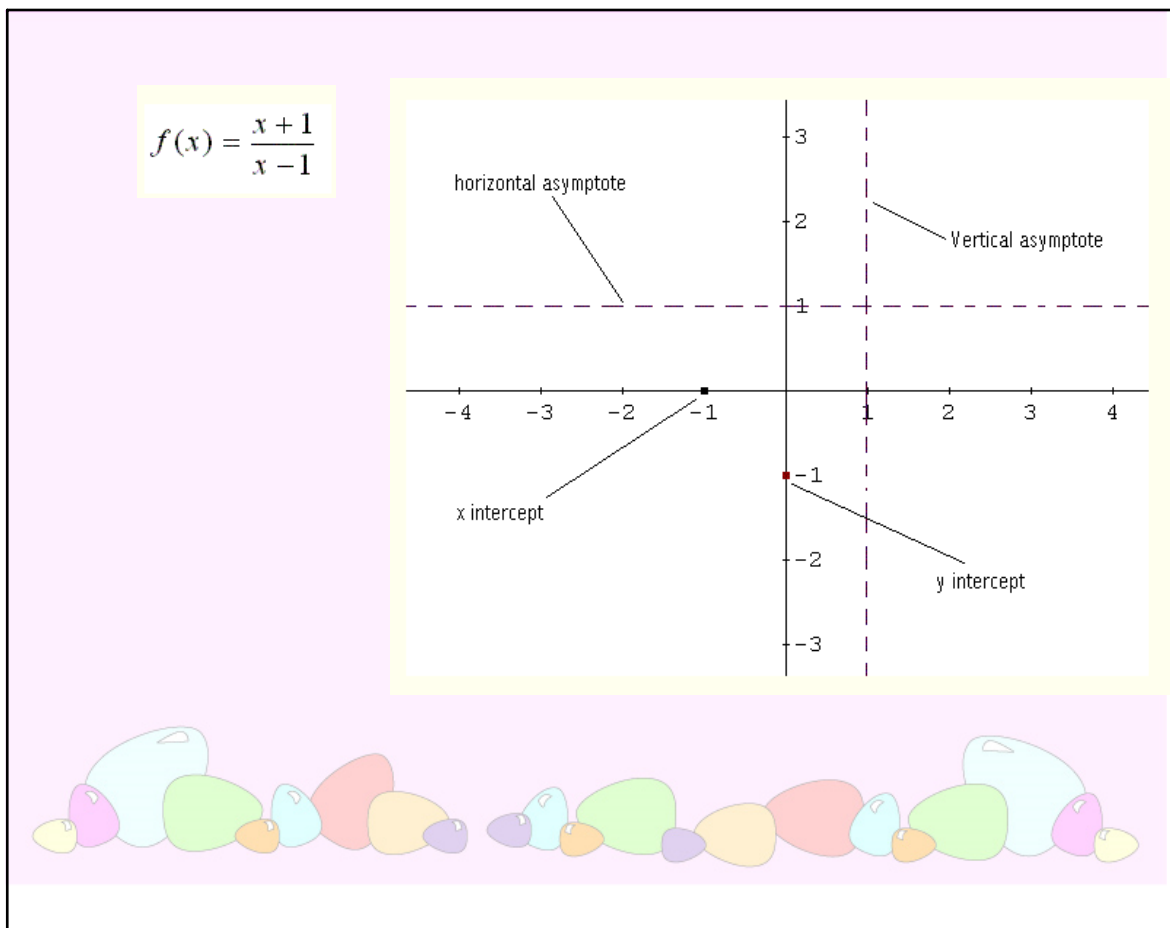
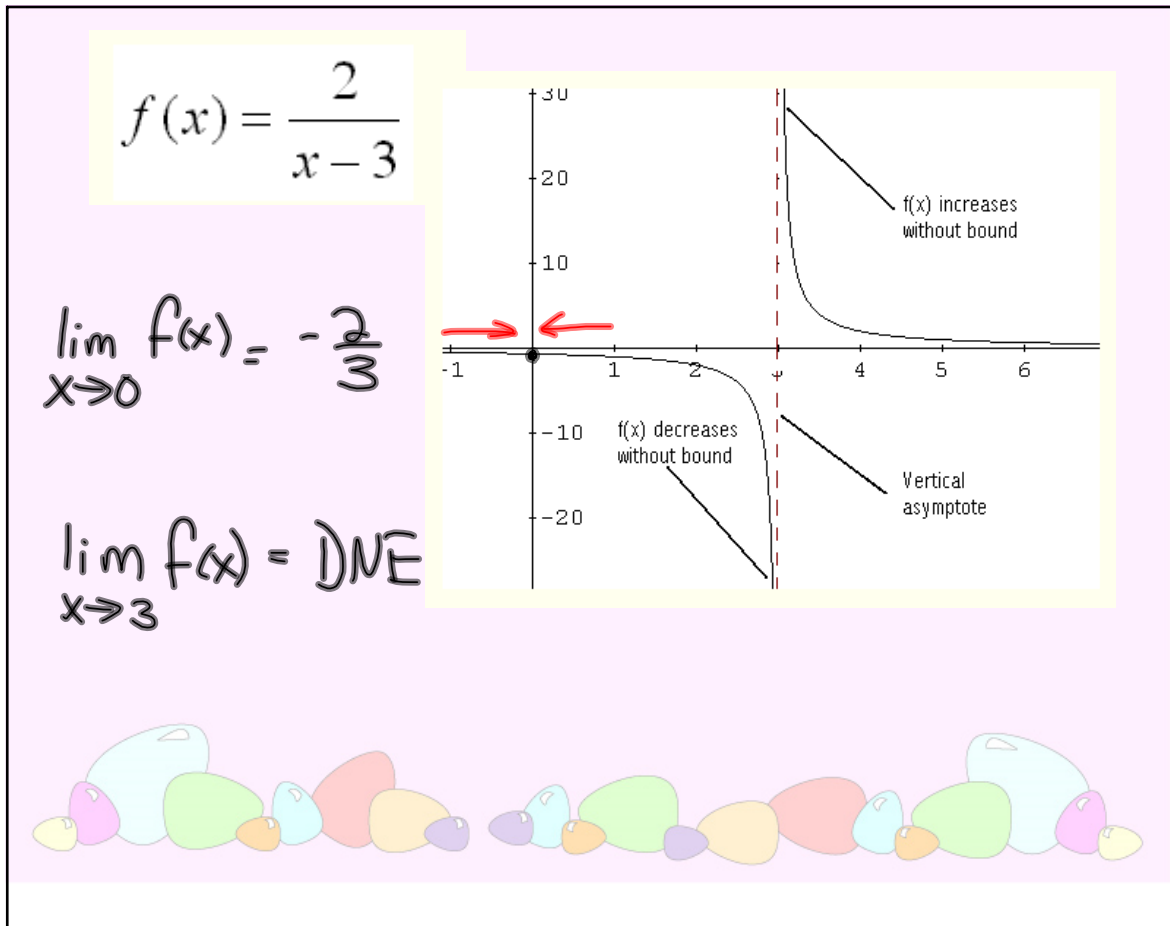
- holes (undefined in the domain, but can simplify)
- asymptotes (undefined in the domain, but cannot simplify)
- piece-wise functions that do not connect.

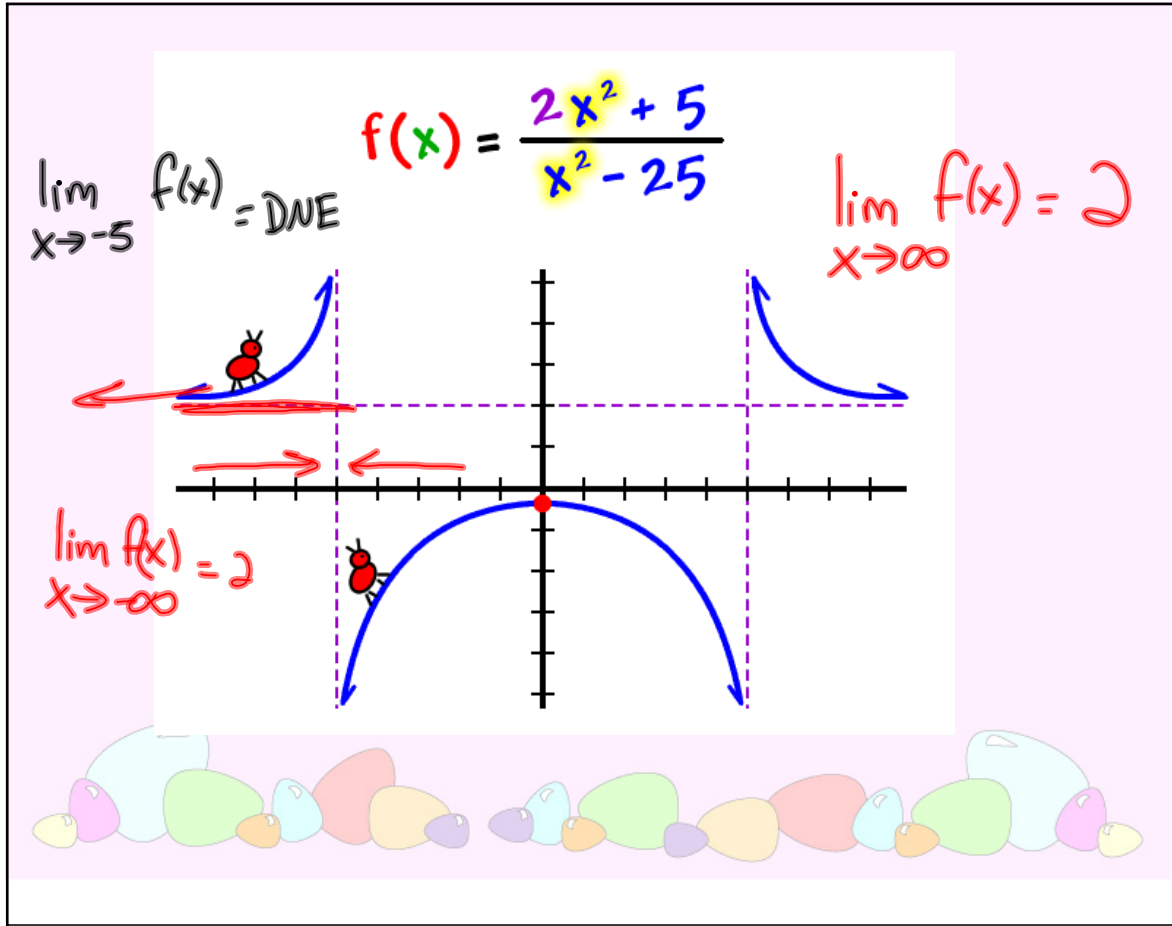


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