

# Limits

- find what the y-coord is approaching when the x-coord approaches a given number.

$$\lim_{x \rightarrow 4^-} f(x) = 6$$

$$\lim_{x \rightarrow 4^+} f(x) = 6$$

$$\lim_{x \rightarrow 4} f(x) = 6$$

$$f(4) = \text{undef.}$$

$$\lim_{x \rightarrow -6^-} f(x) = \infty$$

$$\lim_{x \rightarrow -6^+} f(x) = -\infty$$

$$\lim_{x \rightarrow -6} f(x) = \text{DNE}$$

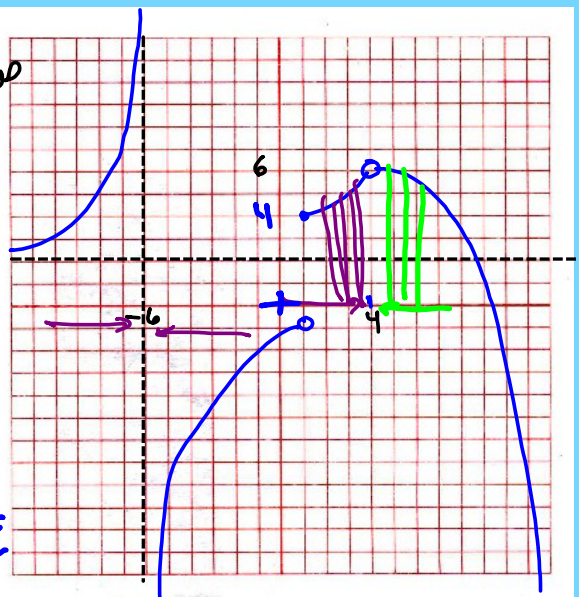
$$f(-6) = \text{undef}$$

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

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

$$\lim_{x \rightarrow 1} f(x) = \text{DNE}$$

$$f(1) = 4$$



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

$$\lim_{x \rightarrow \infty} f(x) = -\infty$$

Domain:  $[-5, \infty)$

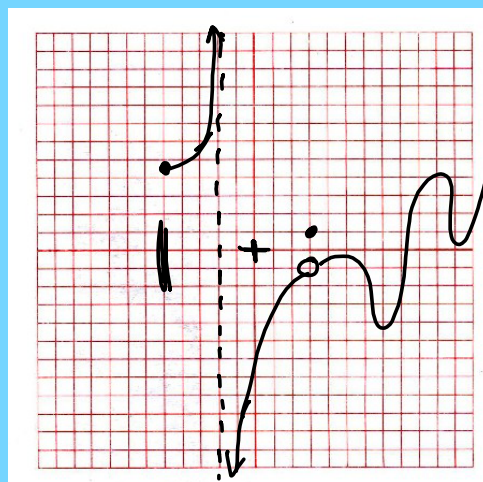
✓  $f(-2) = \text{undef}$

✓  $f(3) = 1$

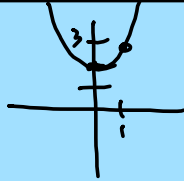
✓  $\lim_{x \rightarrow -2^-} f(x) = +\infty$

✓  $\lim_{x \rightarrow -2} f(x) = \text{DNE}$

$\lim_{x \rightarrow 3} f(x) = -1$



$$\lim_{x \rightarrow 1} x^2 + 2 = 3$$

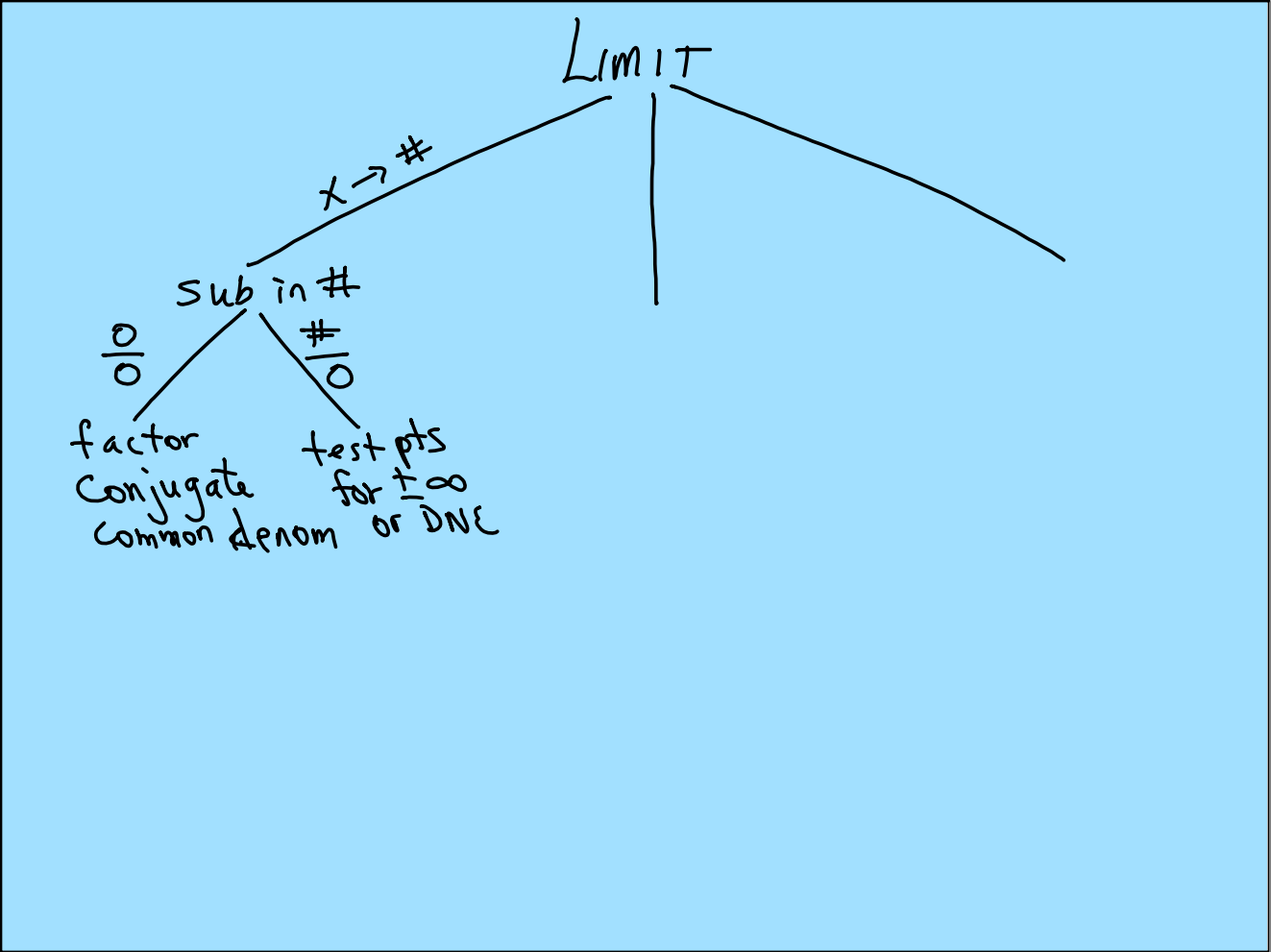


$$\lim_{x \rightarrow 2} \frac{3x^2 - 4x - 4}{x - 2} = \frac{12 - 8 - 4}{0} = \frac{0}{0} \quad \text{indeterminate form}$$

$$\lim_{x \rightarrow 2} \frac{(3x+2)(\cancel{x-2})}{\cancel{x-2}} = 3(2) + 2 = \boxed{8}$$

$$\lim_{x \rightarrow 3} \frac{x^2 - 4x + 3}{x^3 - 27} = \frac{0}{0}$$

$$\lim_{x \rightarrow 3} \frac{(x-3)(x-1)}{(x-3)(x^2+3x+9)} = \frac{2}{9+9+9} = \frac{2}{27}$$



$$\lim_{h \rightarrow 0} \frac{\sqrt{9+h} - 3}{h} \cdot (\sqrt{9+h} + 3) = \frac{0}{0}$$

$$\lim_{h \rightarrow 0} \frac{\cancel{9+h} - 9}{\cancel{h} (\sqrt{9+h} + 3)}$$

$$\frac{3}{\sqrt{x} - 4} (\sqrt{x} + 4)$$

$$\lim_{h \rightarrow 0} \frac{1}{\sqrt{9+h} + 3} = \frac{1}{3+3} = \left(\frac{1}{6}\right)$$

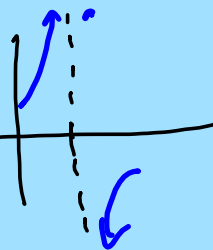
## One-Sided Limits

$$\lim_{x \rightarrow 5} \frac{2x+3}{x-1} = \frac{13}{4}$$

$$\lim_{x \rightarrow 1} \frac{2x+3}{x-1} = \frac{5}{0} \text{ DNE}$$

$$\lim_{x \rightarrow 1^-} \frac{2x+3}{x-1} = \frac{\pm}{-} = -\infty$$

$$\lim_{x \rightarrow 1^+} \frac{2x+3}{x-1} = \frac{\pm}{+} = +\infty$$



$$\lim_{x \rightarrow -3^+} \frac{8x}{(x+3)^2} = \frac{-24}{0}$$

$$\frac{-}{-} = \frac{-}{+} = \boxed{-\infty}$$

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

$$\lim_{x \rightarrow -1} f(x) = \left(\frac{1}{4}\right)$$

$$\lim_{x \rightarrow -1^-} \frac{2x+1}{3x-1} = \frac{-2+1}{-3-1} = \frac{-1}{-4} = \frac{1}{4}$$

$$\lim_{x \rightarrow -1^+} \frac{1}{(x-1)^2} = \frac{1}{(-1-1)^2} = \frac{1}{4}$$

