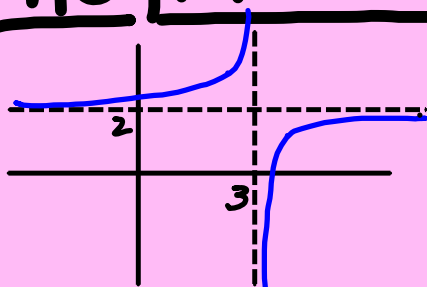


ASYMPTOTES & CONTINUITY



$$\begin{aligned}
 f(x) &= \frac{-1}{x-3} + \frac{2(x-3)}{1(x-3)} \\
 &= \frac{-1 + 2x - 6}{x-3} \\
 &= \frac{2x-7}{x-3}
 \end{aligned}$$

Vertical

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

$\uparrow$ Denom = 0

Horizontal

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

$$f(x) = \frac{x^2 - 2x}{x^2 + x - 6} = \frac{x(x-2)}{(x-2)(x+3)}$$

Hole at $x=2$

Vertical

$$\lim_{x \rightarrow -3} \frac{x}{x+3} = \frac{-3}{0}$$

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

$x = -3$

$$\lim_{x \rightarrow 2} \frac{x^2 - 2x}{x^2 + x - 6} = \frac{0}{0}$$

$$\lim_{x \rightarrow 2} \frac{x(x-2)}{(x+3)(x-2)} = \frac{2}{5}$$

Not ∞
Not a vertical asymp

Horizontal

$$\lim_{x \rightarrow \infty} \frac{x^2 - 2x}{x^2 + x - 6}$$

$$\lim_{x \rightarrow \infty} \frac{x^2}{x^2} = 1$$

$y = 1$

$$f(x) = \frac{\sqrt{36x^2 + 11}}{3x - 5}$$

Start w/
pointer/middle
finger Q

Start w/ ♥, break ♥ →
cross middle fingers
touch pointer fingers to oppo-
middle fingers ∞

Vertical ⇒ Denom = 0

$$\lim_{x \rightarrow 5/3^+} \frac{\sqrt{36x^2 + 11}}{3x - 5} = \frac{\#}{0}$$

$$= \frac{+}{+}$$

$$= +\infty$$

$$\boxed{x = 5/3}$$

Horizontal

$$\lim_{x \rightarrow +\infty} \frac{\sqrt{36x^2}}{3x}$$

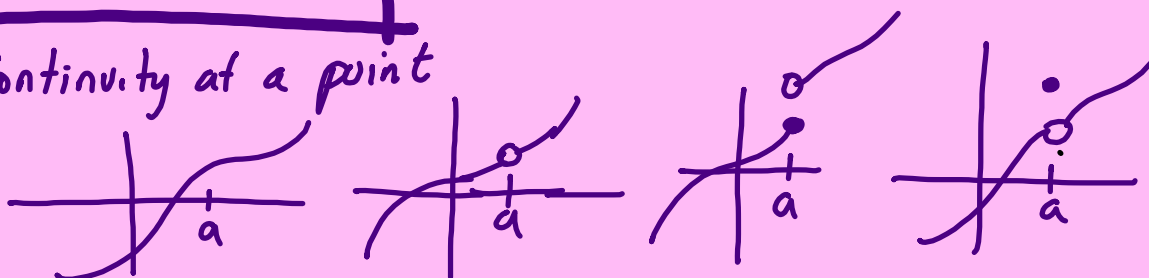
$$\lim_{x \rightarrow +\infty} \frac{6|x|}{3x} = \lim_{x \rightarrow \infty} \frac{6x}{3x} = 2$$

$$\lim_{x \rightarrow -\infty} \frac{6|x|}{3x} = \lim_{x \rightarrow \infty} \frac{-6x}{3x} = -2$$

$$\boxed{y = 2, y = -2}$$

CONTINUITY - Smooth + Unbroken

Continuity at a point



- 1) $f(a)$ is defined.
- 2) $\lim_{x \rightarrow a} f(x)$ exists.
- 3) $f(a) = \lim_{x \rightarrow a} f(x)$

$$f(x) = \begin{cases} 3x+2 & x < 1 \\ 7-2x^2 & x \geq 1 \end{cases}; a=1$$

$$1) f(1) = 7 - 2(1)^2 = 5$$

$$2) \lim_{x \rightarrow 1^-} 3x+2 = 5$$

$$\lim_{x \rightarrow 1^+} 7-2x^2 = 5$$

$$\lim_{x \rightarrow 1} f(x) = 5$$

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

Yes, $f(x)$ is continuous.

$$f(x) = \begin{cases} 3x+8 & x < -3 \\ 4 & x = -3 \\ x^2-10 & x > -3 \end{cases}$$

$$a = -3$$

$$1) f(-3) = 4$$

$$2) \lim_{x \rightarrow -3^-} 3x+8 = -1$$

$$\lim_{x \rightarrow -3^+} x^2-10 = -1$$

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

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

Not continuous



$$f(x) = \sqrt{x^2 - 4x - 21}$$

$$(x-7)(x+3)$$

$$\begin{array}{c} + \quad - \quad + \\ -3 \quad 7 \end{array}$$

$$(-\infty, -3] \quad C$$

$$(7, \infty) \quad C$$

$$(-\infty, 7] \quad D$$

$$(-3, 7) \quad D$$

