§ 1.8 #8

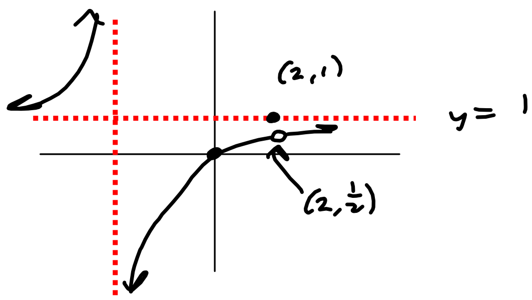
$$f(x) = \frac{x^2-2x}{x^2-4} = \frac{x(x-2)}{(x+2)(x-2)} = \frac{x}{x+2} \xrightarrow{x \to 2} \frac{2}{4} = \frac{1}{2}$$

$(x \neq 2)$

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

$$f(x) = \begin{cases} \frac{x^2-2x}{x^2-4} & x \neq 2 \\ 1 & x = 2 \end{cases}$$

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



$$|x-5| = \begin{cases} x-5 & \text{if } x-5 \geq 0 \\ -(x-5) & \text{if } x-5 < 0 \end{cases}$$

$$= \begin{cases} x-5 & \text{if } x \geq 5 \\ -(x-5) & \text{if } x < 5 \end{cases}$$

$x - 5 \geq 0 \Rightarrow$
$x \geq 5$

$\therefore \lim_{x \to 5^-} \frac{|x-5|}{3x^2-11x-20}$

$-60$

$2 \,|\, 60$
$2 \,|\, 30$
$3 \,|\, 15$
$5$

$= \lim_{x \to 5^-} \frac{-(x-5)}{3x^2-11x-20}$

$3x^2-15x+4x-20$
$= 3x(x-5)+4(x-5)$
$= (x-5)(3x+4)$

$= \lim_{x \to 5^-} \frac{-(x-5)}{(x-5)(3x+4)} = \lim_{x \to 5^-} \frac{-1}{3x+4} = \boxed{-\frac{1}{19}}$

$f(x) = \begin{cases} 2(x+2)^2-3 \\ 2x+a \end{cases}$. Want $a \ni$ this is cnts.

FROM LEFT @ $x=-1$ = FROM RIGHT @ $x=-1$

$2(-1+2)^2-3 = 2(1)-3 = -1 \overset{SET}{=} 2(-1)+a$ SOLVE FOR $a$.

$-1=-2+a$

$\boxed{1=a}$

7. (10 pts) Sketch a plausible graph of a function, $f$, that satisfies all of the properties listed.

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

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

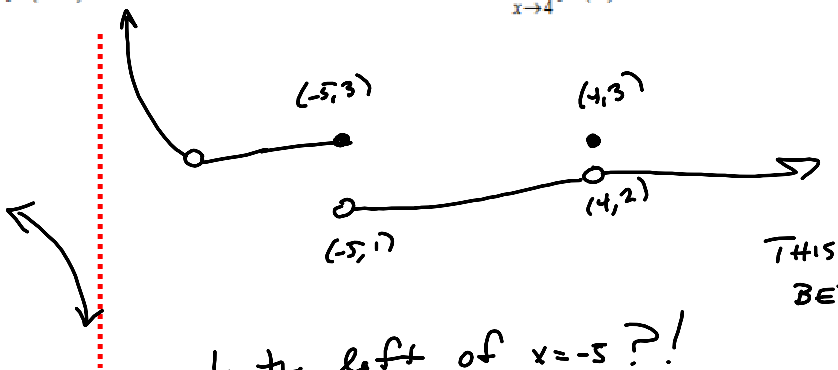
c. $f(-5) = 3$

d. $\lim_{x \to 1^-} f(x) = -\infty$

e. $\lim_{x \to 1^+} f(x) = \infty$

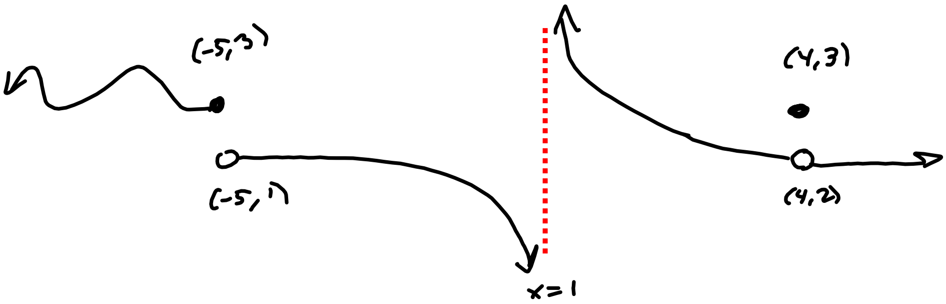
f. $\lim_{x \to 4} f(x) = 2$

g. $f(4) = 3$

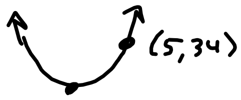



THIS IS BETTER

x=1 is to the left of x=-5?!
Teacher's off, today!



$\lim_{x \to 5} (x^2+2x-1) = 34$




We assume $\delta \le 1$.

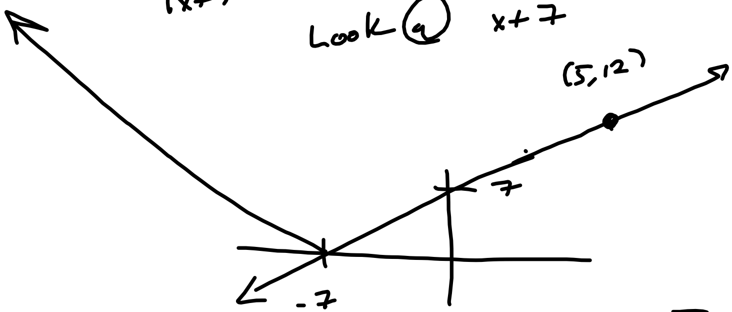
Scratch

$|x^2+2x-1-34| = |x^2+2x-35| = |x-5||x+7|$

$< |x+7|\delta$ (when we make $|x-5| < \delta$ in the proof)

Need a bound on $|x+7|$

Look @ $x+7$




$\delta \le 1 \longrightarrow$

$4 \le x \le 6$

$4+7 \le x+7 \le 13$

$11 \le x+7 \le 13$

$\delta \le 1 \Longrightarrow |x+7| \le 13$, so

$|x+7|\delta \le 13\delta$ !

Claim:

$\lim_{x \to 5} (x^2+2x-1) = 34$

Proof:

Let $\varepsilon > 0$ be given. Define $\delta = \min\{1, \frac{\varepsilon}{13}\}$. Then

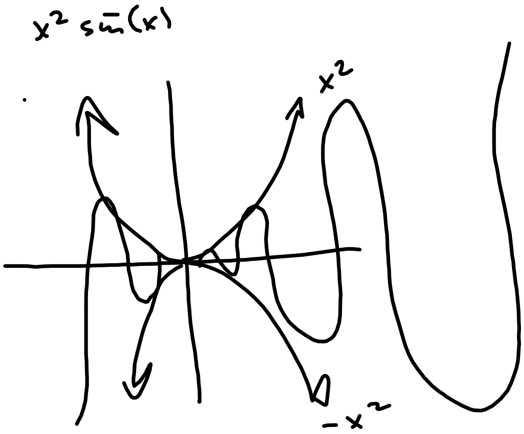
$0 < |x-5| < \delta$ implies $|x^2+2x-1-34| = |x^2+2x-35|$

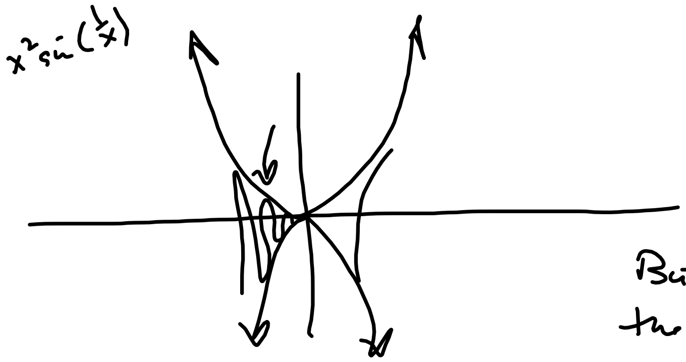
$= |x+7||x-5| \le 13|x-5| < 13\delta \le 13 \cdot \frac{\varepsilon}{13} = \varepsilon$ ■

$\delta \le 1$

$\delta = \min\{1, \frac{\varepsilon}{13}\}$

i.e. $\delta \le 1$ & $\delta \le \frac{\varepsilon}{13}$




Wiggling $\infty$ # of times in any neighborhood of $x=0$. But it's damped by the $x^2$.

**Writing this guy up will make a good Writing Project #1.**

https://harryzaims.com/public_html/201/201-fall-13/tests/201-test-1-fall-13.pdf

https://www.desmos.com/calculator

§1.7 #6 Find $\delta$ (largest) $\ni$

$|x^3 - 4x + 1 - 1| < \varepsilon$ when $|x - 2| < \delta$

$\varepsilon =$

6. [–/2 Points] DETAILS SCALC9 1.7.007.

A graphing calculator is recommended.

For the limit $\lim_{x \to 2} (x^3 - 4x + 1) = 1$, illustrate this definition by finding the largest possible values of $\delta$ that correspond to $\varepsilon = 0.2$ and $\varepsilon = 0.1$. (Round your answers to four decimal places.)

$\varepsilon = 0.2$ $\delta =$ 0.0245

$\varepsilon = 0.1$ $\delta =$ 0.0124

$\varepsilon = .2$

$f(x) = 1.2$ when $x \approx 2.0245 \longrightarrow \delta = .0245$

$f(x) = 0.8$ when $x \approx 1.9745 \Longrightarrow \delta = .0255$

$\varepsilon = .2$ means we want

$|f(x) - L| < .2$

$-.2 < f(x) - L < .2$

$L - .2 < f(x) < L + .2$

$1 - .2 = .8 < f(x) < 1 + .2 = 1.2$.

We found $f(x) = .8$ & $f(x) = 1.2$

This gives $x$ & $|x-2|$ gives $\delta$