$y = 2x + 1 \Rightarrow$ linear: gra $= 2$, y-int $= 1$

Limits

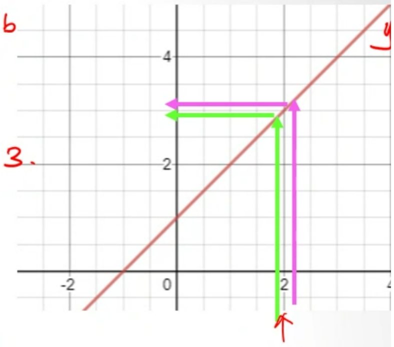
$$\boxed{\lim_{x\to a} f(x) = b}$$

$$\lim_{x\to 2}\underbrace{(x+1)}_{f(x)} = 3 \leftarrow b$$

As $x \to a$, $f(x) \to b$

As $x \to 2$, $x+1 \to 3$.

- The limit of $f(x)$ as x approaches a, $\lim_{x\to a} f(x)$ is the value of $f(x)$ approaches as x gets closer and closer to a.
- The actual value of $f(x)$ at a is not considered.
- The important thing is what happens to $f(x)$ as x get nearer and nearer to a.



As $x \to 2$, $x^2 - x + 2 \to$?

Find $\lim_{x\to 2} (x^2 - x + 2)$

$\lim_{x\to a} f(x) = b$

As $x \to a$, $f(x) \to b$

x	f(x)	x	f(x)
1.0	2.000000	3.0	8.000000
1.5	2.750000	2.5	5.720000
1.8	3.440000	2.2	4.640000
1.9	3.710000	2.1	4.310000
1.95	3.852500	2.05	4.152500
1.99	3.970100	2.01	4.030100
1.995	3.985025	2.005	4.015025
1.999	3.997001	2.001	4.003001

$1.999 \to 1.999$

$$\lim_{x\to 2^-} x^2 - x + 2 = 4$$

$$\lim_{x\to 2^-} x^2 - x + 2 = 4$$

2.001

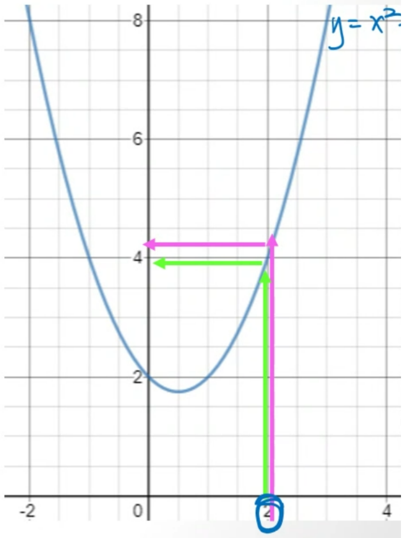
$$\lim_{x\to 2^+} x^2 - x + 2 = 4$$

$$\lim_{x\to 2^+} x^2 - x + 2 = 4$$

$$\lim_{x\to 2} x^2 - x + 2 \text{ exist} \Rightarrow \lim_{x\to 2} x^2 - x + 2 = 4$$

$\therefore$ Limit exists, $\lim_{x\to 2} x^2 - x + 2 = 4$

$$\boxed{\lim_{x\to a^-} f(x) = \lim_{x\to a^+} f(x) \Rightarrow \lim_{x\to a} f(x) \text{ exist}}$$



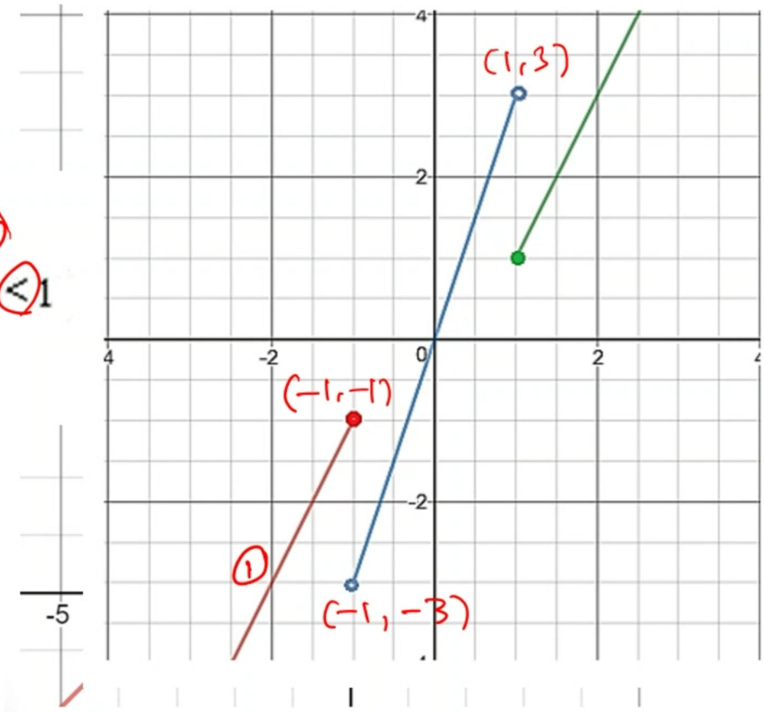
Pre-class

Sketch:

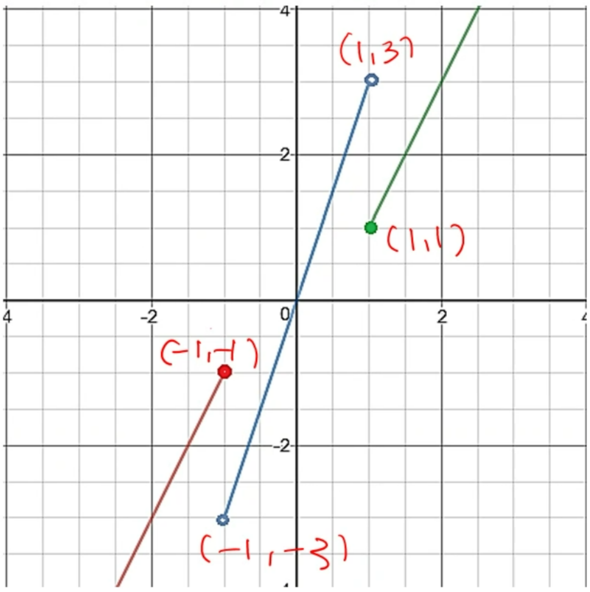
1) $f(x) = \frac{x^2-9}{x-3}$

2)

$$f(x) = \begin{cases} 2x+1, & \text{if } x \le -1 \\ 3x, & \text{if } -1 < x < 1 \\ 2x-1 & \text{if } x \ge 1 \end{cases}$$



b) $$f(x) = \begin{cases} 2x+1, & \text{if } x \le -1 \\ 3x, & \text{if } -1 < x < 1 \\ 2x-1 & \text{if } x \ge 1 \end{cases}$$



For x=-1:

S1: $f(-1) = -1$

S2: $\lim_{x\to -1^-}(2x+1) = -1$; $\lim_{x\to -1^+} 3x = -3$

$\lim_{x\to -1^-} f(x) \neq \lim_{x\to -1^+} f(x) \Rightarrow$

$\lim_{x\to -1} f(x)\, does\ not\ exist$

$\therefore \boldsymbol{There\ is\ a\ point\ of\ discontinuity\ at\ x = -1}$

For x=1:

S1: $f(1) = 1$

S2: $\lim_{x\to 1^-} 3x = 3$; $\lim_{x\to 1^+}(2x-1) = 1$

$\lim_{x\to 1^-} f(x) \neq \lim_{x\to 1^+} f(x) \Rightarrow \lim_{x\to 1} f(x)\, does\ not\ exist$

$\therefore \boldsymbol{There\ is\ a\ point\ of\ discontinuity\ at\ x = 1}$

$\therefore f(x)$ is not a continuous function. $f(x)$ is discontinuous at $\boldsymbol{x = \pm 1}$