Notes 3.6 - Limits and Continuity

* WARM UP *

Evaluate each limit.

$\lim_{x\to -2} x^{-3} = -\frac{1}{8}$

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

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

$$\frac{x-1}{(x-1)(x+3)}$$

Notes 3.6 - Limits and Continuity

Special Trig Limits

$$f(x) = \frac{\sin x}{x}$$

$$\lim_{x \to 0} \left(\frac{\sin x}{x} \right) =$$

Notes 3.6 - Limits and Continuity

$$\lim_{x\to 0}\left(\frac{\sin x}{x}\right) = 1$$

$$\lim_{x\to 0}\left(\frac{1-\cos x}{x}\right) = 0$$

$$\lim_{x\to 0}\frac{\sin^2 x}{x}$$

Notes 3.6 - Limits and Continuity

Hey, students!

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Notes 3.6 - Limits and Continuity

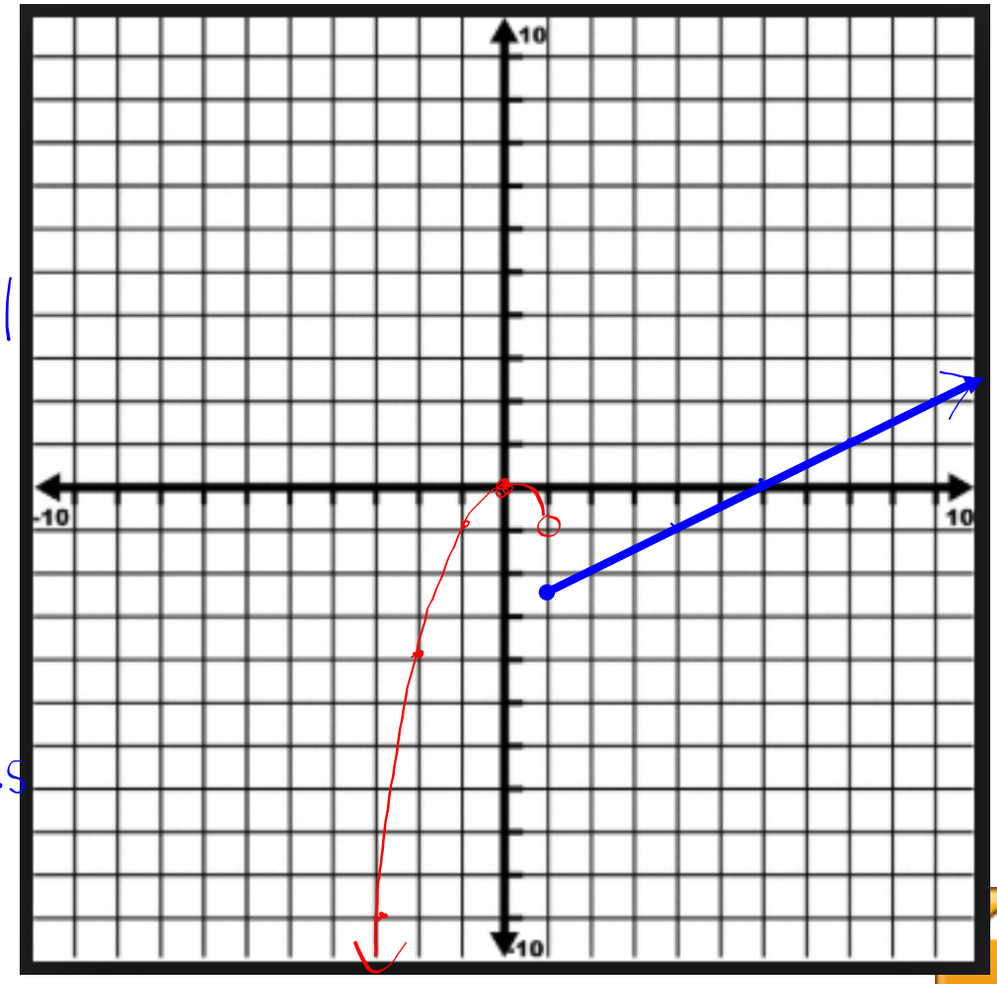
One-Sided Limits

$$\lim_{x \to 1^-} f(x),\ f(x) = \begin{cases} -x^2, & x < 1 \\ \frac{x}{2} - 3, & x \geq 1 \end{cases}$$

$= -1$

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

$= -2.5$



Notes 3.6 - Limits and Continuity

When does a limit exist?

$$\lim_{x \to c} f(x) = L \text{ , if...}$$

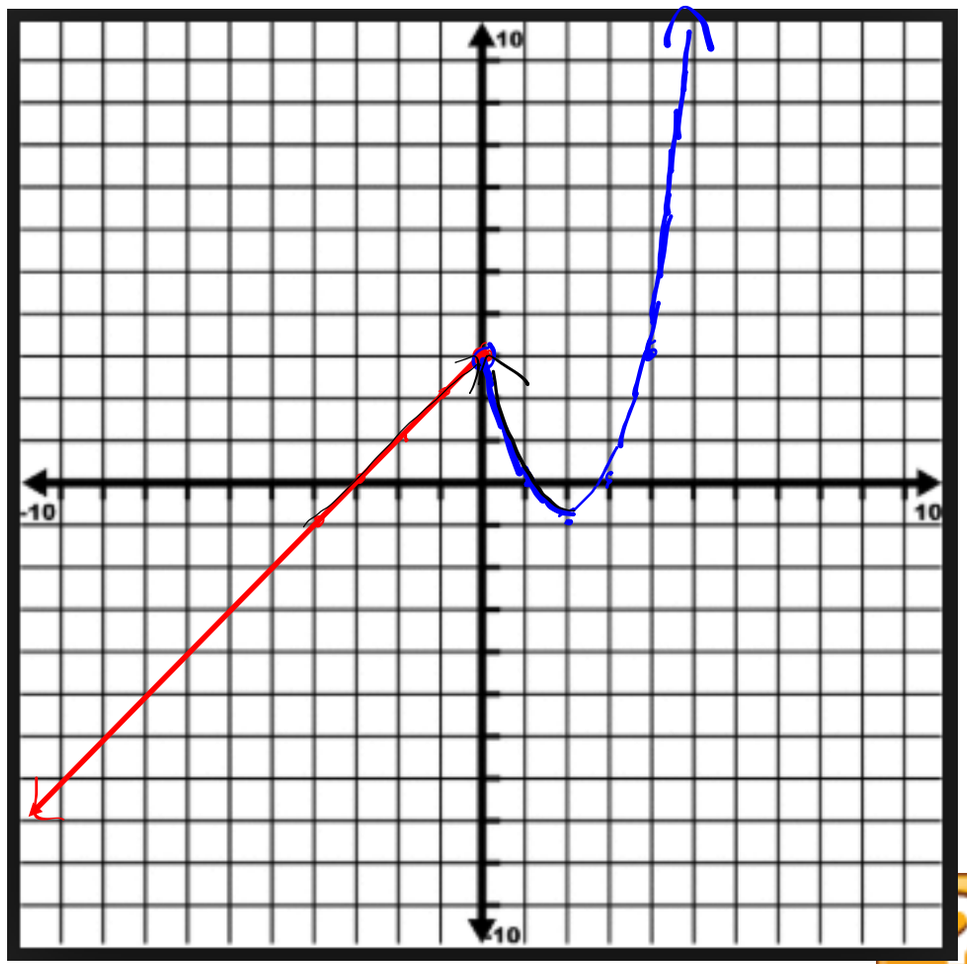
$$\lim_{x \to c^-} f(x) = L \text{ and } \lim_{x \to c^+} f(x) = L$$

Notes 3.6 - Limits and Continuity

Determining if a limit exists

$$\lim_{x \to 0} f(x),\ f(x) = \begin{cases} x + 3, & x \le 0 \\ x^2 - 4x + 3, & x > 0 \end{cases} = 3$$

$(x - 3)(x - 1)$



Notes 3.6 - Limits and Continuity

Determining continuity

A function f is continuous at x = c if...

i. $f(c)$ exists

ii. $\lim_{x \to c} f(x)$ exists

iii. $f(c) = \lim_{x \to c} f(x)$

Notes 3.6 - Limits and Continuity

1] $f(-3) =$ UND.

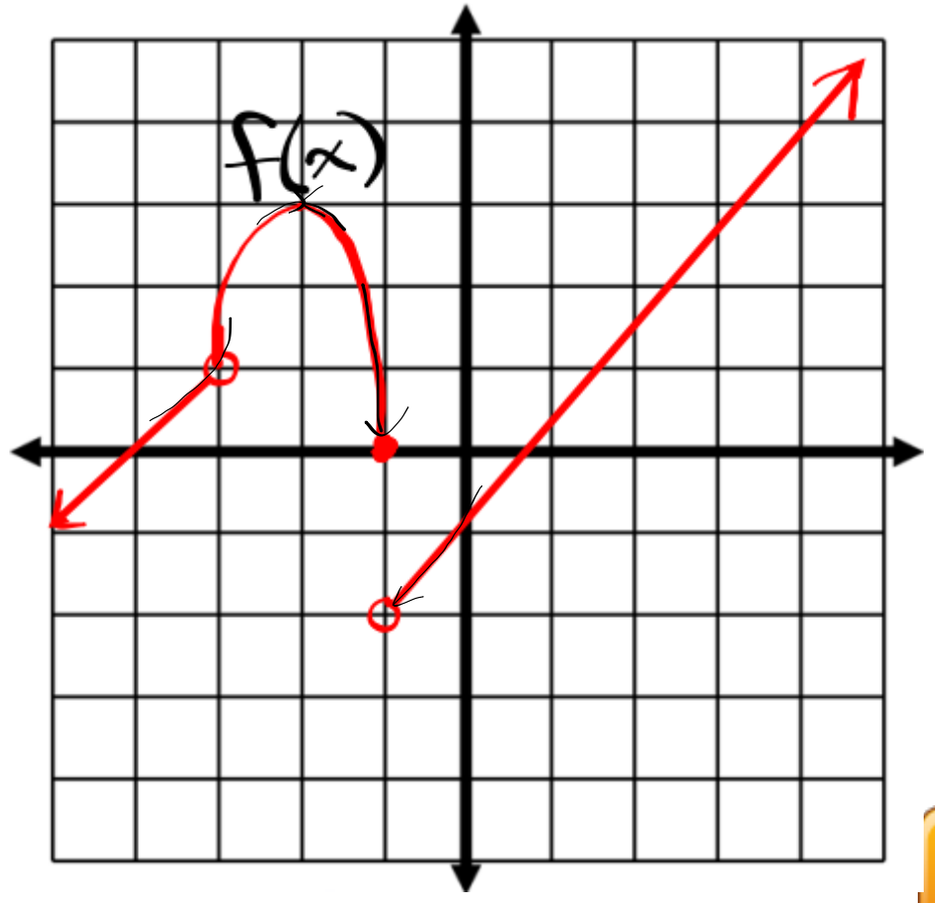
2] $\lim_{x \to -3} f(x) =$ ∞

3] $\lim_{x \to -1^-} f(x) =$ 0

4] $f(-1) =$ 0

5] $\lim_{x \to -1^+} f(x) =$ −2

6] $\lim_{x \to -1} f(x)$ DNE (DOES NOT EXIST)



Is $f(x)$ continuous at $x = -3$, $x = -2$, $x = -1$?

NO YES NO

$$1] \lim_{\theta \to 0} \frac{\cos\theta \tan\theta}{\theta} = 1$$

$$\lim_{\theta \to 0} \frac{\cancel{\cos\theta}\left(\frac{\sin\theta}{\cancel{\cos\theta}}\right)}{\theta}$$

$$\lim_{\theta \to 0} \frac{\sin\theta}{\theta} = 1$$

25] $f(x) = \begin{cases} x & x \leq 1 \\ x^2 & x > 1 \end{cases}$

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

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

c) $\lim_{x \to 1} f(x) =$ 1

d) $f(1) =$ 1