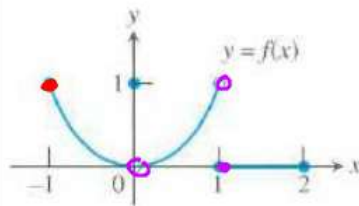


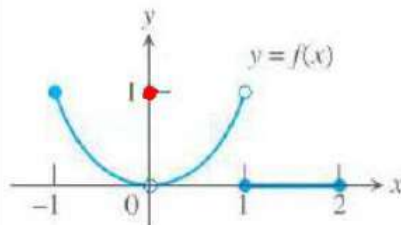
What you'll Learn About

- Continuity at a point
- Continuous Functions
- Intermediate Value Theorem for Continuous Functions

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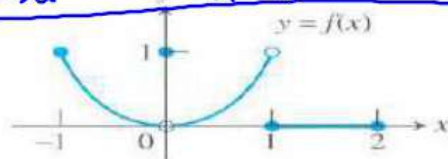


- 1a. Does $f(-1)$ exist? *yes*
 1b. Does $\lim_{x \rightarrow -1^+} f(x)$ exist? *yes*
 1c. Does $\lim_{x \rightarrow -1^+} f(x) = f(-1)$ *yes*
 1d. Is f continuous at $x = -1$? *yes*



- 2a. Does $f(0)$ exist? *yes*
 2b_i. Does $\lim_{x \rightarrow 0^+} f(x)$ exist? *yes*
 2b_{ii}. Does $\lim_{x \rightarrow 0^-} f(x)$ exist? *yes*
 2c. Does $\lim_{x \rightarrow 0^+} f(x) = \lim_{x \rightarrow 0^-} f(x) \neq f(0)$ *NO*
 2d. Is f continuous at $x = 0$? *NO (Removable)*

A function is continuous at $x=a$ if $\lim_{x \rightarrow a^+} f(x) = \lim_{x \rightarrow a^-} f(x) = f(a)$ *



3a. Does $f(1)$ exist? $3b_i$. Does $\lim_{x \rightarrow 1^+} f(x)$ exist?

yes $f(1) = 0$

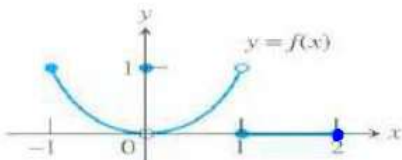
yes

3b_{ii}. Does $\lim_{x \rightarrow 1^-} f(x)$ exist? 1

yes

3c. Does $\lim_{x \rightarrow 1^+} f(x) = \lim_{x \rightarrow 1^-} f(x) = f(1)$ NO

3d. Is f continuous at $x=1$? NO Jump



4a. Does $f(2)$ exist? $4b$. Does $\lim_{x \rightarrow 2^-} f(x)$ exist?

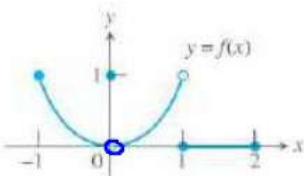
yes

yes

4c. Does $\lim_{x \rightarrow 2^-} f(x) = f(2)$ yes

$0 = 0$

4d. Is f continuous at $x=2$? yes



5. For what values is the function continuous $x \neq 0, 1$

6a. Is it possible to extend f to be continuous at $x=0$? If so, what value should the extended function have? If not, why not? $f(0) = 0$

6b. Is it possible to extend f to be continuous at $x=1$? If so, what value should the extended function have? If not, why not?

Not a jump

Determine the type of discontinuity

Removable
Jump
Vertical asy

Left

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

Right

~~Removable~~ Jump
(If limits are diff)

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

$$5 \neq 1 = 1$$

$$B) f(x) = \begin{cases} \frac{1}{x-2} & x < 2 \\ x^2 + 5x & x > 2 \end{cases}$$

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

v.a

$$\frac{1}{0} \neq 14 \neq DNE$$

$$C) f(x) = \begin{cases} 9-x^2 & x \neq 3 \\ 5 & x = 3 \end{cases}$$

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

Removable

$$0 = 0 \neq 5$$

$$D) f(x) = \begin{cases} 6-x & x < 3 \\ 2x-3 & x > 3 \end{cases}$$

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

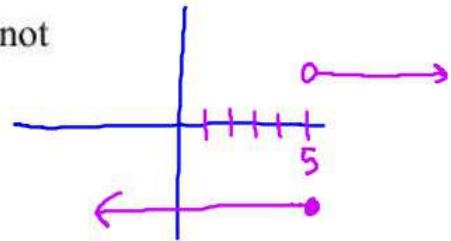
$$3 = 3 \neq DNE$$

Hole
Removable

Given the following information, sketch a graph of $f(x)$

A) $f(x)$ exists, but $\lim_{x \rightarrow 5}$ does not

Jump

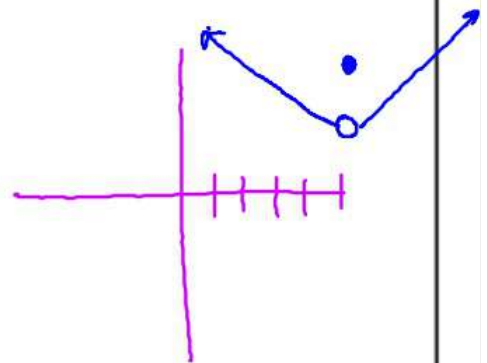


B) $f(5)$ exists

$\lim_{x \rightarrow 5}$ exists

Hole

f is not continuous at $x = 5$



Find a value for a so that the function is continuous

$$47) f(x) = \begin{cases} x^2 - 1 & x < 3 \\ 2ax & x \geq 3 \end{cases}$$

At $x=3$ both functions
have to have the same y -value
(Both functions = to each other)

$$x=3$$

$$x^2 - 1 = 2ax$$

$$9 - 1 = 6a$$

$$\frac{8}{6} = \frac{6a}{6}$$

$$\frac{8}{6} = a$$