TOPIC: CONTINUITY

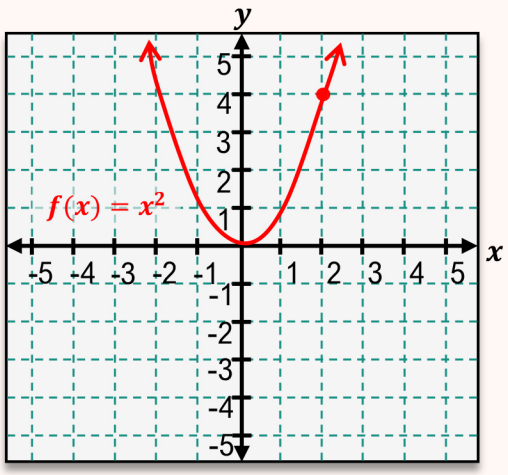
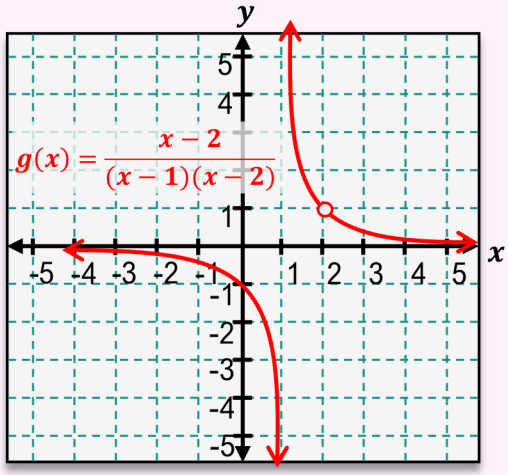
Intro to Continuity

◆ A function is **continuous** at c if the limit as $x \to c$ is the _____ as the function value.

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

(Continuous)

- Graphically, if you can trace through a point without stopping, the fcn is continuous there.

Continuous	Discontinuous
	
$\lim_{x \to 2} f(x) =$ _____ $f(2) =$ _____	$\lim_{x \to 2} g(x) =$ _____ $g(2) =$ _____

◆ **Discontinuities** occur when a function has a _____, _____, or _____.

EXAMPLE Determine if the function is continuous at each given value of c by finding $f(c)$ & $\lim_{x \to c} f(x)$.

(A) $c = -2$ $\lim_{x \to -2} f(x) =$ _____ $f(-2) =$ _____

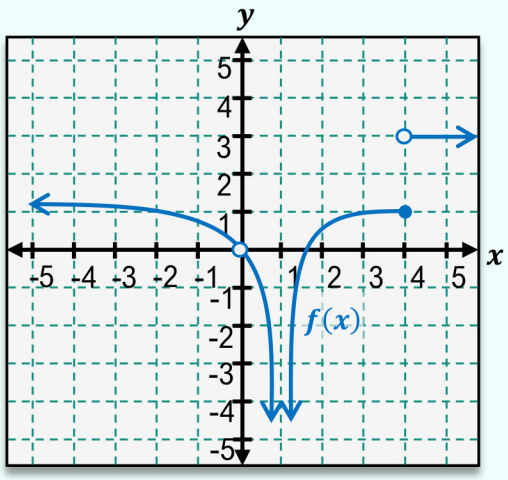
[CONTINUOUS | DISCONTINUOUS]

(B) $c = 4$ $\lim_{x \to 4} f(x) =$ _____ $f(4) =$ _____

[CONTINUOUS | DISCONTINUOUS]

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

[CONTINUOUS | DISCONTINUOUS]



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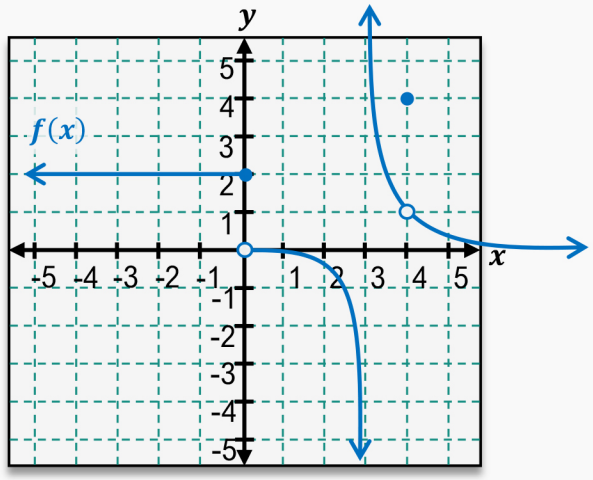
PRACTICE Use the graph of $f(x)$ to determine if the function is continuous or discontinuous at $x = c$.

$(\boldsymbol{A})$ $c = 0$



$(\boldsymbol{B})$ $c = -2$

$(\boldsymbol{C})$ $c = 3$

$(\boldsymbol{D})$ $c = 4$

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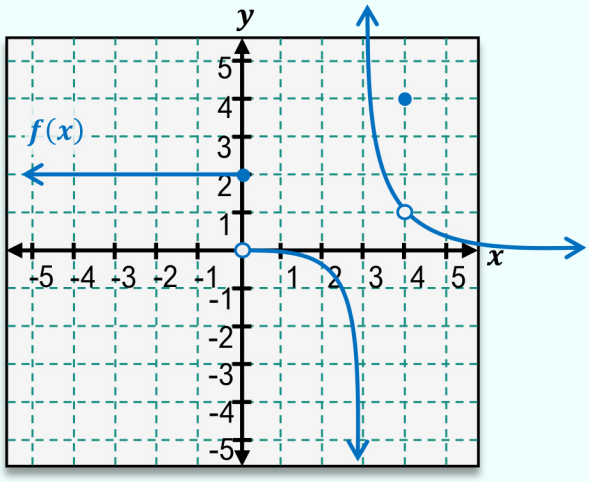
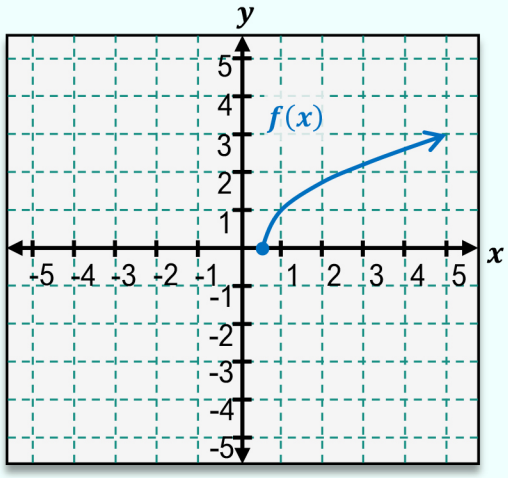
EXAMPLE State the interval(s) for which the function is continuous.



EXAMPLE State the interval(s) for which the function $f(x) = \sqrt{2x - 1}$ is continuous.



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Determine Continuity Algebraically

- Recall: Discontinuities occur when a function has a jump, hole, or asymptote (where denom. ___ for rational fcns).
  - For piecewise functions, compare the limit & function value for the _____(s) between each "piece."

EXAMPLE Determine the value(s) of x (if any) for which the function is discontinuous.

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

$(\boldsymbol{A})$

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

$(\boldsymbol{B})$

$$f(x) = \begin{cases} 4 & \text{for } x < -1 \\ x + 1 & \text{for } x \geq -1 \end{cases}$$

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PRACTICE Determine the interval(s) for which the function is continuous.

$f(x) = x^2 + 4x - 12$

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EXAMPLE Determine the value(s) of x (if any) for which the function is discontinuous.

$$f(x) = \frac{x-3}{x^2+2x-15}$$

PRACTICE Determine the value(s) of x (if any) for which the function is discontinuous.

$$f(x) = \frac{x-4}{x^2-x-12}$$

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PRACTICE Determine the interval(s) for which the function is continuous.

$$f(x) = \frac{\sin x}{2 + \cos x}$$

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EXAMPLE Determine the value(s) of x (if any) for which the function is discontinuous.

$$f(x) = \begin{cases} 5 & \text{for } x < -2 \\ x^2 + 2x + 1 & \text{for } -2 \le x \le 0 \\ x + 1 & \text{for } x > 0 \end{cases}$$

PRACTICE Determine the value(s) of x (if any) for which the function is discontinuous.

$$f(x) = \begin{cases} 3x^2 + 4x + 5 & \text{for } x < -1 \\ 4 & \text{for } x \ge -1 \end{cases}$$

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PRACTICE Determine the interval(s) for which the function is continuous.

$$f(x) = \begin{cases} \sqrt{9 - x^2} & \text{for } -3 \leq x < 0 \\ 5 & \text{for } x \geq 0 \end{cases}$$