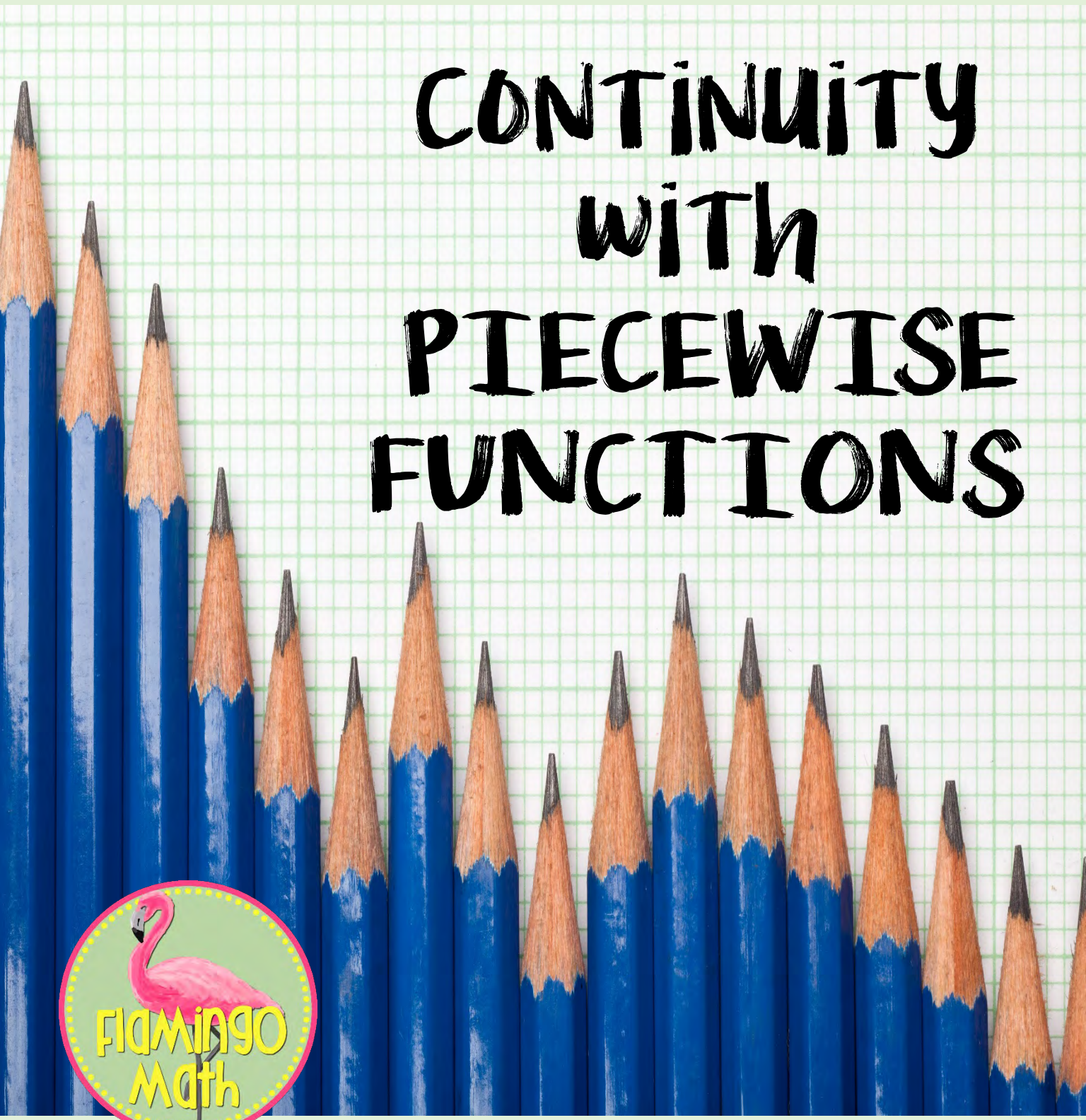
AP CALCULUS



CONTINUITY WITH PIECEWISE FUNCTIONS

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Continuity with Piecewise Functions

This FREE Item is a great *EXTRA* for the unit on *Limits & Continuity* for students enrolled in AP Calculus AB or BC, Calculus Honors, or College Calculus. Students often struggle with piecewise functions and how to analyze accurately.

Lesson Objective:
In this exercise, students will graph the functions from the given constraints and then find the limits by using the graphs. They will also be asked to defend whether or not the function is continuous, based on the three part definition of continuity.

Graph the piecewise-defined function. Then determine the left and right limits at the indicated values. Also determine if the function is continuous at the indicated value(s). If not, state why.

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

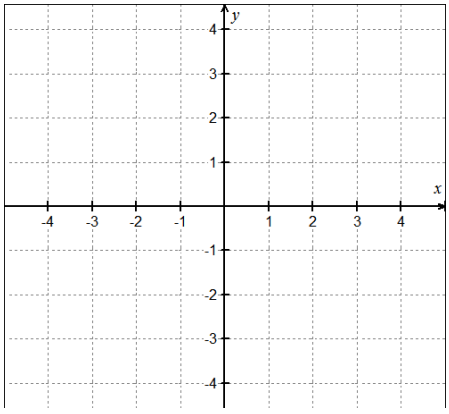
Is f continuous at $x = 1$?

Why or why not?

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

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

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



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2. $f(x) = \begin{cases} \sqrt{x+1} & , x > -1 \\ -x - 2 & , x \leq -1 \end{cases}$

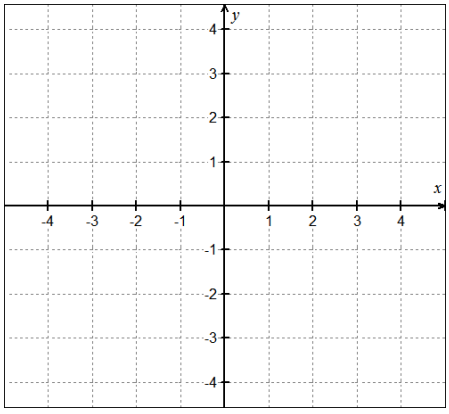
Is f continuous at $x = -1$?

Why or why not?

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

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

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



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3. $f(x) = \begin{cases} x^3 + 1 & , x \leq 0 \\ e^x & , x > 0 \end{cases}$

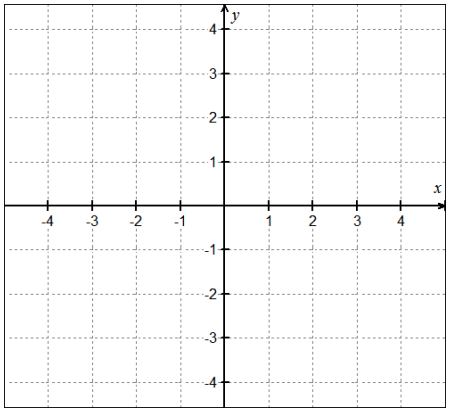
Is f continuous at $x = 0$?

Why or why not?

A) $\lim_{x \to 0^-} f(x) =$

B) $\lim_{x \to 0^+} f(x) =$

C) $\lim_{x \to 0} f(x) =$



4. $f(x) = \begin{cases} |x+2| & , x \leq 1 \\ (x-2)^2 & , x > 1 \end{cases}$

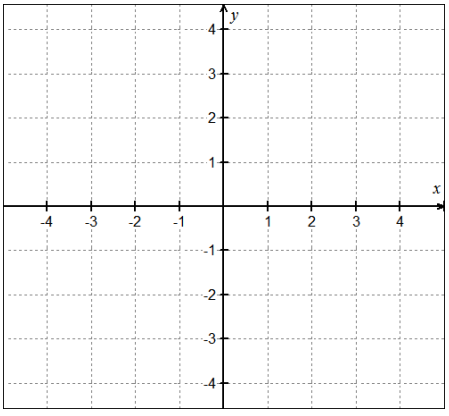
Is f continuous at $x = 1$?

Why or why not?

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

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

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



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5. $f(x) = \begin{cases} \sin x & , x > \frac{\pi}{2} \\ 3 - x^2 & , x \leq \frac{\pi}{2} \end{cases}$

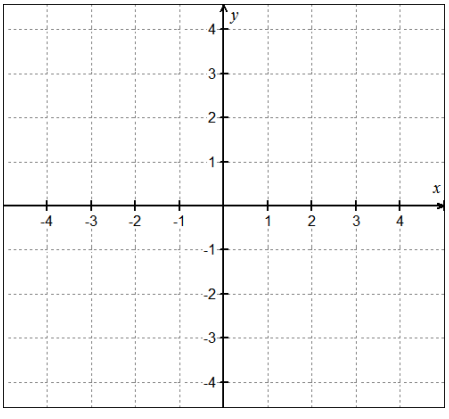
Is f continuous at $x = \frac{\pi}{2}$?

Why or why not?

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

B) $\lim_{x \to \frac{\pi}{2}^+} f(x) =$

C) $\lim_{x \to \frac{\pi}{2}} f(x) =$



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6. $f(x) = \begin{cases} 3 - x^2 & , x \leq 1 \\ 2 & , 1 < x < 3 \\ 5 - x & , x \geq 3 \end{cases}$

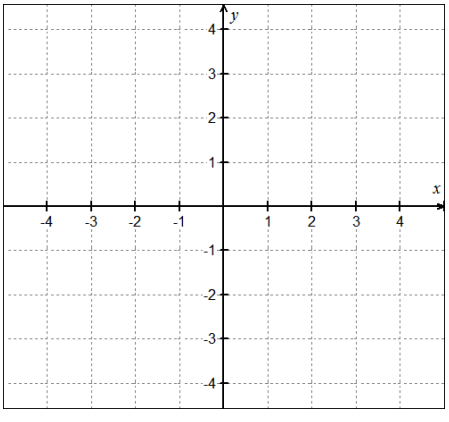
Is f continuous at $x = 1$?

Why or why not?

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

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

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



Continuity with Piecewise Funtions Homework Name Key

Graph the piecewise-defined function. Then determine the left and right limits at the indicated values. Also determine if the function is continuous at the indicated value(s). If not, state why.

1. $f(x) = \begin{cases} x^2, & x \le 1 \\ x, & x > 1 \end{cases}$

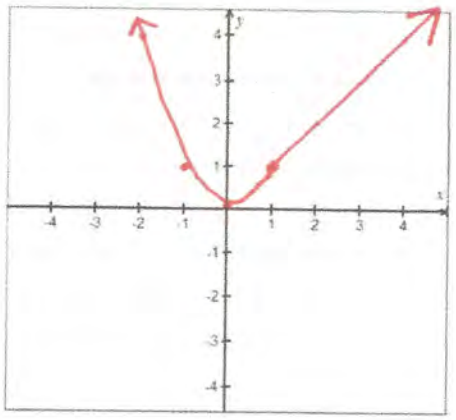
A) $\lim_{x \to 1^-} f(x) =$ 1

Is f continuous at $x = 1$?
Why or why not? Yes,
$\lim_{x \to 1} f(x) = f(1) = 1$

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

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

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



2. $f(x) = \begin{cases} \sqrt{x+1}, & x > -1 \\ -x - 2, & x \le -1 \end{cases}$

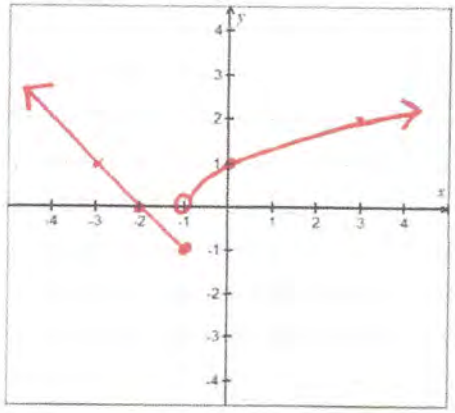
A) $\lim_{x \to -1^-} f(x) =$ -1

Is f continuous at $x = -1$?
Why or why not?

No,
$\lim_{x \to -1} f(x)$ dne.
$\lim_{x \to -1^-} f(x) \neq \lim_{x \to -1^+} f(x)$

B) $\lim_{x \to -1^+} f(x) =$ 0

C) $\lim_{x \to -1} f(x) =$ dne



3. $f(x) = \begin{cases} x^3 + 1, & x \le 0 \\ e^x, & x > 0 \end{cases}$

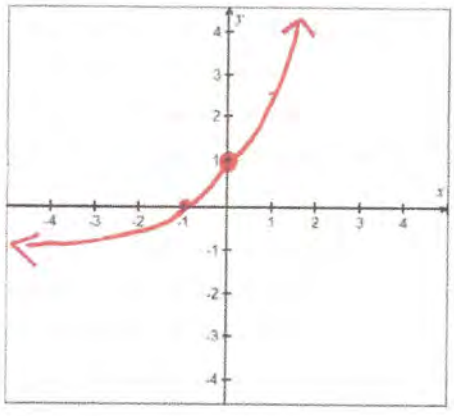
A) $\lim_{x \to 0^-} f(x) =$ 1

Is f continuous at $x =$ 0 ?
Why or why not?

Yes,
$\lim_{x \to 1} f(x) = f(0) = 1$
$\lim_{x \to 0^-} f(x) = \lim_{x \to 0^+} f(x)$

B) $\lim_{x \to 0^+} f(x) =$ 1

C) $\lim_{x \to 0} f(x) =$ 1



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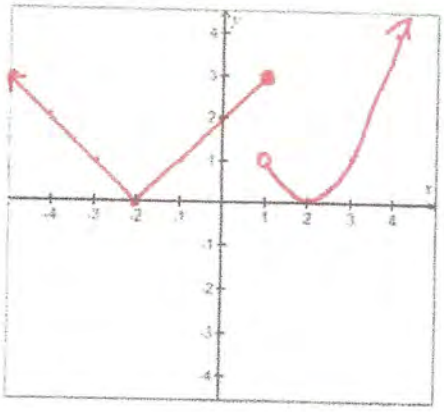
4. $f(x) = \begin{cases} |x+2| & , x \le 1 \\ (x-2)^2 & , x > 1 \end{cases}$

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

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

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



Is f continuous at $x = 1$?
Why or why not?

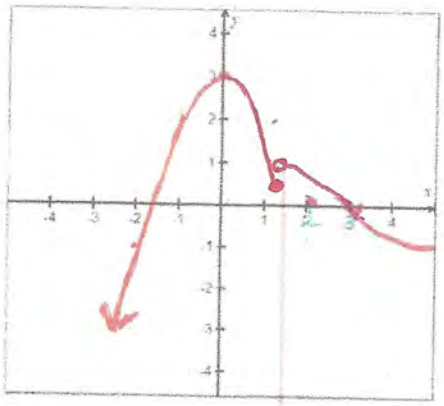
No,
$\lim_{x \to 1} f(x)$ dne
$\lim_{x \to 1^-} f(x) \neq \lim_{x \to 1^+} f(x)$

5. $f(x) = \begin{cases} \sin x & , x > \frac{\pi}{2} \\ 3 - x^2 & , x \le \frac{\pi}{2} \end{cases}$

A) $\lim_{x \to \frac{\pi}{2}^-} f(x) \doteq$ 0.5325

B) $\lim_{x \to \frac{\pi}{2}^+} f(x) \doteq$ 1

C) $\lim_{x \to \frac{\pi}{2}} f(x) =$ d.n.e.



Is f continuous at $x = \frac{\pi}{2}$?
Why or why not?

No, $\lim_{x \to \pi/2} f(x)$ dne

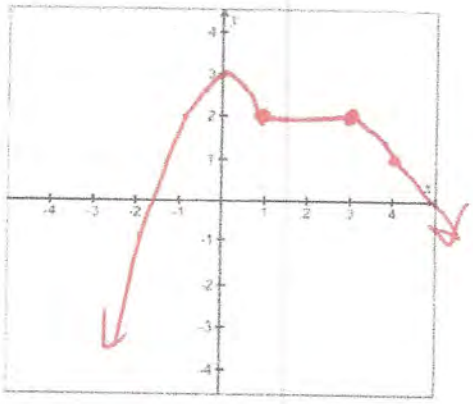
$\lim_{x \to \pi/2^-} f(x) \neq \lim_{x \to \pi/2^+} f(x)$

6. $f(x) = \begin{cases} 3 - x^2, x \le 1 \\ 2 \quad , 1 < x < 3 \\ 5 - x \quad , x \ge 3 \end{cases}$

A) $\lim_{x \to 1^-} f(x) =$ 2

B) $\lim_{x \to 1^+} f(x) =$ 2

C) $\lim_{x \to 1} f(x) =$ 2



Is f continuous at $x =$ 1?
Why or why not?

Yes, $\lim_{x \to 1} f(x) = 2$

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