

Limit Checkpoint

Use limits to test what a function approaches and whether it is continuous.

HIGH SCHOOL • MA.912.C.1

MA.912.C.1 "Develop an understanding for limits and continuity. Determine limits and continuity."

NAME _____

DATE _____

APPROACH AND CONNECT

A limit is the value a function approaches as x gets close to a number. A function is continuous at a number when the left-hand limit, right-hand limit, and function value are all the same.

WORKED EXAMPLE

Find $\lim_{x \rightarrow 8} (x^2 - 64)/(x - 8)$.

1. Substitution gives $0/0$, so factor $x^2 - 64$ as $(x - 8)(x + 8)$.
2. Cancel $x - 8$ for $x \neq 8$.
3. Evaluate $x + 8$ at $x = 8$: $8 + 8 = 16$.

Answer: 16

PRACTICE 6 problems

1 Find $\lim_{x \rightarrow 4} (x + 5)$.

ANSWER _____

2 Find $\lim_{x \rightarrow 5} (x^2 - 25)/(x - 5)$.

ANSWER _____

3 $f(x) = (x^2 - 36)/(x - 6)$ for $x \neq 6$, and $f(6) = 12$. Is f continuous at $x = 6$?

ANSWER _____

4 $g(x) = 3x - 1$ for $x < 2$, and $g(x) = x + 3$ for $x \geq 2$. Find $\lim_{x \rightarrow 2} g(x)$.

ANSWER _____

5 $h(x) = x + 4$ for $x < 1$, and $h(x) = 2x + 3$ for $x \geq 1$. Is h continuous at $x = 1$?

ANSWER _____

6 Find $\lim_{x \rightarrow -3} 1/(x + 3)$.

ANSWER _____

APPLY IT Show your work

- 1** A game app models a bonus meter with $B(r) = (r^2 - 49)/(r - 7)$, where r is time in minutes and $r \neq 7$. Find $\lim_{r \rightarrow 7} B(r)$, the bonus-meter value the model approaches at 7 minutes.

WORK SPACE

ANSWER _____

- 2** A music-streaming app models a listener's status score by $P(m) = 2m + 3$ for $m < 4$, and $P(m) = m^2 - 5$ for $m \geq 4$, where m is time in months. Is the model continuous at $m = 4$?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

$f(x) = (x^2 - 100)/(x - 10)$ for $x \neq 10$, and $f(10) = k$. Find k so that f is continuous at $x = 10$.

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find $\lim_{x \rightarrow 4} (x + 5)$.	9
2	Find $\lim_{x \rightarrow 5} (x^2 - 25)/(x - 5)$.	10
3	$f(x) = (x^2 - 36)/(x - 6)$ for $x \neq 6$, and $f(6) = 12$. Is f continuous at $x = 6$?	Yes, f is continuous at $x = 6$.
4	$g(x) = 3x - 1$ for $x < 2$, and $g(x) = x + 3$ for $x \geq 2$. Find $\lim_{x \rightarrow 2} g(x)$.	5
5	$h(x) = x + 4$ for $x < 1$, and $h(x) = 2x + 3$ for $x \geq 1$. Is h continuous at $x = 1$?	Yes, h is continuous at $x = 1$.
6	Find $\lim_{x \rightarrow -3} 1/(x + 3)$.	DNE

PART 2 · APPLY IT

- 14** Factor $r^2 - 49$ as $(r - 7)(r + 7)$, then cancel $r - 7$. The simplified expression is $r + 7$, which approaches 14 as r approaches 7.
- Yes, the model is continuous at $m = 4$.** The left-hand limit is $\lim_{m \rightarrow 4^-} (2m + 3) = 11$. The right-hand limit and $P(4)$ are both $4^2 - 5 = 11$, so the model is continuous.

CHALLENGE

k = 20

Accept equivalent simplified expressions and clear limit notation. For problem 6, accept DNE or "does not exist" because the one-sided limits are different.