LESSON MAKER PRO

Close, Not Equal

Find what a function approaches, even at a missing point.

HIGH SCHOOL · PC.NQ.D

PC.NQ.D "Understand limits of functions."

NAME _____ DATE _____

THE BIG IDEA

A limit tells you what a function approaches as x gets close to a number, even if the function is undefined at that number. Try replacing x first. If you get 0/0, factor and cancel a common factor before replacing x. A limit exists only if the function approaches the same value from both sides.

WORKED EXAMPLE

Find $\lim_{x \to 7} (x^2 - 49)/(x - 7)$.

1. Factor the numerator: $x^2 - 49 = (x - 7)(x + 7)$.
2. For x near 7, cancel $x - 7$ to get $x + 7$.
3. Replace x with 7: $7 + 7 = 14$.

Answer: 14

PRACTICE 6 problems

1 Find $\lim_{x \to 2} (3x + 2)$.

ANSWER _____

2 Find $\lim_{x \to 3} (x^2 - 9)/(x - 3)$.

ANSWER _____

3 Find $\lim_{x \to 1} (x^2 + 2x - 3)/(x - 1)$.

ANSWER _____

4 Find $\lim_{x \to -2} (x^2 - 4)/(x + 2)$.

ANSWER _____

5 Find $\lim_{x \to -1} (x^2 + 3x + 2)/(2x + 2)$.

ANSWER _____

6 Find $\lim_{x \to 0} |x|/x$, or state that it does not exist.

ANSWER _____

APPLY IT Show your work

1 A scooter's distance from its starting point is $d(t) = t^2 + 2t$ meters after t seconds. Find its speed at $t = 3$ using $\lim_{h \to 0} [d(3 + h) - d(3)]/h$.

WORK SPACE

ANSWER _____

2 During the start of a video upload, a phone has sent $D(t) = 2t^2 + t$ megabytes after t seconds. Find the upload rate at $t = 2$ using $\lim_{h \to 0} [D(2 + h) - D(2)]/h$.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Let $f(x) = (x^2 - 16)/(x - 4)$ when $x \neq 4$, and let $f(4) = 1$. Find $\lim_{x \to 4} f(x)$ and $f(4)$. Explain why they differ.

WORK SPACE AND ANSWER

Close, Not Equal

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find lim x->2 (3x + 2).	**8**
2	Find lim x->3 $(x^2 - 9)/(x - 3)$.	**6**
3	Find lim x->1 $(x^2 + 2x - 3)/(x - 1)$.	**4**
4	Find lim x->-2 $(x^2 - 4)/(x + 2)$.	**-4**
5	Find lim x->-1 $(x^2 + 3x + 2)/(2x + 2)$.	**1/2**
6	Find lim x->0 $\|x\|/x$, or state that it does not exist.	**Does not exist**

PART 2 · APPLY IT

1. **8 meters per second** The quotient simplifies to 8 + h. Its limit as h approaches 0 is 8.
2. **9 megabytes per second** The quotient simplifies to 9 + 2h. Its limit as h approaches 0 is 9.

CHALLENGE

lim x->4 f(x) = 8, while f(4) = 1. For x near 4, the fraction simplifies to x + 4, so its values approach 8 regardless of the value assigned at x = 4.

For problem 6, accept DNE. The left-hand limit is -1, and the right-hand limit is 1.