LESSON MAKER PRO

Where Values Go

Find limits near a point and at infinity.

HIGH SCHOOL · PC.NQ.D.7

PC.NQ.D.7 "Determine numerically, algebraically, and graphically the limits of functions at specific values and at infinity. a. Apply limits of functions at specific values and at infinity in problems involving convergence and divergence."

NAME _____ DATE _____

THE BIG IDEA

A limit tells you what outputs approach, even when a function is not defined at the target value. Near a value, check both sides or simplify the formula. At infinity, a finite limit means convergence; values that grow without bound diverge.

WORKED EXAMPLE

Find the limit of $(x^2 - 49)/(x - 7)$ as x approaches 7.

VALUES NEAR X = 7

x	6.9	7.1
Output	13.9	14.1

1. The table shows outputs approaching 14 from both sides.
2. Factor: $x^2 - 49 = (x - 7)(x + 7)$.
3. For x not equal to 7, cancel x - 7. Then x + 7 approaches 14.

Answer: 14

PRACTICE 4 problems

1 Find the limit of $(x^2 - 9)/(x - 3)$ as x approaches 3.

ANSWER _____

2 Find the limit of $(3x + 1)/(x + 2)$ as x approaches infinity.

ANSWER _____

3 As x approaches infinity, does $(x^2 + 1)/(x + 1)$ converge or diverge?

ANSWER _____

4 As x approaches 1, what happens to $(x + 5)/(x - 1)$ from the left and from the right? Does the limit exist?

ANSWER _____

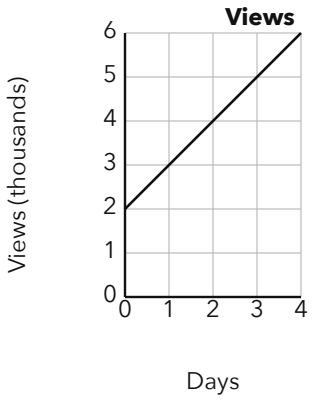
APPLY IT Show your work

1 A gaming pass costs $10 plus $1 per game. After x games, the average cost per game is A(x) = (10 + x)/x. What does A(x) approach as x grows without bound? What does that mean?

WORK SPACE

ANSWER _____

2 The graph shows a band's video views, in thousands, over time. As the time approaches 2 days, how many views does the graph suggest?



ANSWER _____

CHALLENGE One step up

For x not equal to 4, f(x) = $(x^2 - 16)/(x - 4)$. At x = 4, f(4) = 9. Find the limit as x approaches 4. Explain why it differs from f(4).

WORK SPACE AND ANSWER

Where Values Go

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find the limit of $(x^2 - 9)/(x - 3)$ as x approaches 3.	**6**
2	Find the limit of $(3x + 1)/(x + 2)$ as x approaches infinity.	**3**
3	As x approaches infinity, does $(x^2 + 1)/(x + 1)$ converge or diverge?	**Diverges to positive infinity.**
4	As x approaches 1, what happens to $(x + 5)/(x - 1)$ from the left and from the right? Does the limit exist?	**The outputs decrease without bound from the left and increase without bound from the right. The limit does not exist.**

PART 2 · APPLY IT

1. **$1 per game. The average cost per game approaches the $1 charge per game.** Rewrite A(x) as 10/x + 1. As x grows without bound, 10/x approaches 0.
2. **4,000 views** As the time approaches 2 days, the graph's height approaches 4 thousand views.

CHALLENGE

The limit is 8. For x not equal to 4, the formula simplifies to x + 4, which approaches 8. The assigned value f(4) = 9 does not change the limit.

Accept +infinity for the third practice answer. For the fourth, accept negative infinity from the left and positive infinity from the right.