LESSON MAKER PRO

Holes and Horizons

Factor through a missing value.

HIGH SCHOOL · MA.912.C.1.3

MA.912.C.1.3 "Find limits of rational functions that are undefined at a point."

NAME _____ DATE _____

FIND THE MISSING LIMIT

If substituting the target x-value gives 0/0, factor the numerator and denominator. Cancel only factors, then substitute into the simplified expression to find the limit. The original function can be undefined at the target even when the limit exists.

WORKED EXAMPLE

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

1. Substitution gives $(49 - 49)/(7 - 7) = 0/0$.
2. Factor the numerator: $x^2 - 49 = (x - 7)(x + 7)$.
3. Cancel $(x - 7)$, so the expression is $x + 7$ for x not equal to 7.
4. Substitute 7: $7 + 7 = 14$.

Answer: 14

PRACTICE 6 problems

1 Find lim as x approaches 2 of $(x^2 - 4)/(x - 2)$.

ANSWER _____

2 Find lim as x approaches -3 of $(x^2 + 5x + 6)/(x + 3)$.

ANSWER _____

3 Find lim as x approaches 4 of $(x^2 - 16)/(x - 4)$.

ANSWER _____

4 Find lim as x approaches -1 of $(x^2 - 1)/(x + 1)$.

ANSWER _____

5 Find lim as x approaches 3 of $(x^2 - 7x + 12)/(x - 3)$.

ANSWER _____

6 Find lim as x approaches -2 of $(x^3 + 8)/(x + 2)$.

ANSWER _____

APPLY IT Show your work

1 A student models the storage used by short videos with $S(x) = x^2$ gigabytes after x weeks. The average change in storage from week 4 to week x is $(x^2 - 16)/(x - 4)$. Find the limit as x approaches 4. What does the limit mean in this model?

WORK SPACE

ANSWER _____

2 An esports team models its total points after x matches with $P(x) = x^2 + 4x$. Its average points gained per match from match 2 to match x is $(x^2 + 4x - 12)/(x - 2)$. Find the limit as x approaches 2. What does the limit estimate?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Find lim as x approaches 2 of $(x^2 - 5x + 6)/(x^2 - 4)$. Show the factors you cancel.

WORK SPACE AND ANSWER

ANSWER KEY # Holes and Horizons

HIGH SCHOOL · MA.912.C.1.3

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find lim as x approaches 2 of $(x^2 - 4)/(x - 2)$.	**4**
2	Find lim as x approaches -3 of $(x^2 + 5x + 6)/(x + 3)$.	**-1**
3	Find lim as x approaches 4 of $(x^2 - 16)/(x - 4)$.	**8**
4	Find lim as x approaches -1 of $(x^2 - 1)/(x + 1)$.	**-2**
5	Find lim as x approaches 3 of $(x^2 - 7x + 12)/(x - 3)$.	**-1**
6	Find lim as x approaches -2 of $(x^3 + 8)/(x + 2)$.	**12**

PART 2 · APPLY IT

1. **8 GB per week. The model predicts that storage use is increasing at 8 GB per week at week 4.** Factor $x^2 - 16$ as $(x - 4)(x + 4)$, then cancel $x - 4$. Evaluate $x + 4$ at $x = 4$.
2. **8 points per match. The limit estimates the team's points-gaining rate at match 2 in the model.** Factor the numerator as $(x - 2)(x + 6)$, then cancel $x - 2$. Evaluate $x + 6$ at $x = 2$.

CHALLENGE

-1/4

Accept equivalent simplified expressions and correct factorization work. For the word problems, accept equivalent statements of the correct rate with units; for the challenge, accept -1/4 with valid cancellation of $x - 2$.