LESSON MAKER PRO

Factor and Cancel

Simplify rational expressions while tracking excluded values.

HIGH SCHOOL · A3.A.13

A3.A.13 "Write rational expressions in simplest form. (For example $(x^3 - x^2 - x + 1)/(x^3 + x^2 - x - 1) = (x-1)/(x+1)$)."

NAME _____ DATE _____

THE BIG IDEA

Factor the numerator and denominator, then cancel factors they share. Do not cancel individual terms. A value that makes the original denominator zero stays excluded, even if its factor cancels.

WORKED EXAMPLE

Simplify $(x^2 + 9x + 20)/(x^2 + 10x + 24)$.

1. Factor the numerator: $x^2 + 9x + 20 = (x + 4)(x + 5)$.
2. Factor the denominator: $x^2 + 10x + 24 = (x + 4)(x + 6)$.
3. Cancel the shared factor $x + 4$. The original denominator is zero at $x = -4$ and $x = -6$.

Answer: $(x + 5)/(x + 6)$, where $x \neq -4$ and $x \neq -6$

PRACTICE 6 problems

1 Simplify $(x^2 - 1)/(x^2 + 2x + 1)$.

ANSWER _____

2 Simplify $(x^2 + x - 6)/(x^2 - 4)$.

ANSWER _____

3 Simplify $(x^2 - 7x + 12)/(x^2 - 16)$.

ANSWER _____

4 Simplify $(3x^2 + 15x)/(6x)$.

ANSWER _____

5 Simplify $(x^2 - 16)/(x^2 - 8x + 16)$. State the excluded x-value.

ANSWER _____

6 Simplify $(x^3 - x^2 - 2x)/(x^2 - 4)$. State all excluded x-values.

ANSWER _____

APPLY IT Show your work

1 A student edits $x + 3$ short videos in $x^2 + 7x + 12$ hours, where x is a nonnegative whole number. Write the average editing time per video in simplest form.

WORK SPACE

ANSWER _____

2 A podcast club listens for $x^2 + 5x + 6$ hours over $x^2 + 4x + 3$ weeks, where x is a nonnegative whole number. Write the average listening time per week in simplest form.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Simplify $(x^3 - x^2 - 4x + 4)/(x^3 + x^2 - 4x - 4)$. State all excluded x-values and explain how you found them.

WORK SPACE AND ANSWER

Factor and Cancel

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Simplify $(x^2 - 1)/(x^2 + 2x + 1)$.	**$(x - 1)/(x + 1)$**
2	Simplify $(x^2 + x - 6)/(x^2 - 4)$.	**$(x + 3)/(x + 2)$**
3	Simplify $(x^2 - 7x + 12)/(x^2 - 16)$.	**$(x - 3)/(x + 4)$**
4	Simplify $(3x^2 + 15x)/(6x)$.	**$(x + 5)/2$**
5	Simplify $(x^2 - 16)/(x^2 - 8x + 16)$. State the excluded x-value.	**$(x + 4)/(x - 4)$; $x \neq 4$**
6	Simplify $(x^3 - x^2 - 2x)/(x^2 - 4)$. State all excluded x-values.	**$x(x + 1)/(x + 2)$; $x \neq -2$ and $x \neq 2$**

PART 2 · APPLY IT

1. **x + 4 hours per video** Divide total hours by the number of videos. Factor the numerator as (x + 3)(x + 4), then cancel x + 3.
2. **(x + 2)/(x + 1) hours per week** Divide total hours by the number of weeks. Factor to get (x + 2)(x + 3)/((x + 1)(x + 3)), then cancel x + 3.

CHALLENGE

$(x - 1)/(x + 1)$; $x \neq -2$, $x \neq -1$, and $x \neq 2$. Factoring by grouping gives $(x - 1)(x - 2)(x + 2)/((x + 1)(x - 2)(x + 2))$. Cancel the shared factors, but exclude every zero of the original denominator.

For Problems 1 through 4, only the simplified expression is required. For the challenge, accept any correct factorization that identifies all three excluded values.