LESSON MAKER PRO

Factor, Then Simplify

Work with rational expressions and keep track of excluded values.

HIGH SCHOOL · A2.A.2.3

A2.A.2.3 "Add, subtract, multiply, divide, and simplify rational expressions."

NAME _____ DATE _____

THE BIG IDEA

Factor numerators and denominators before canceling common factors. To add or subtract, use a common denominator. To divide, multiply by the reciprocal. Exclude values that make an original denominator zero or a divisor equal to zero.

WORKED EXAMPLE

Simplify $(x^2 - 169)/(x^2 + 30x + 221)$. State the excluded values.

1. Factor: $(x - 13)(x + 13)/[(x + 13)(x + 17)]$.
2. Cancel the common factor $x + 13$: $(x - 13)/(x + 17)$.
3. The original denominator is zero when $x = -13$ or $x = -17$.

Answer: $(x - 13)/(x + 17)$; $x \neq -13, -17$

PRACTICE 6 problems

1 Simplify $(x^2 - 9)/(x^2 + 5x + 6)$. State the excluded values.

ANSWER _____

2 Add and simplify: $2/(x + 2) + 3/(x - 2)$. State the excluded values.

ANSWER _____

3 Subtract and simplify: $2/(x - 3) - 1/(x + 3)$. State the excluded values.

ANSWER _____

4 Multiply and simplify: $[(x^2 - 4)/(x^2 + 3x + 2)] \times [(x + 1)/(x - 2)]$. State the excluded values.

ANSWER _____

5 Divide and simplify: $[(x^2 - 16)/(x + 3)] \div [(x - 4)/(x + 3)]$. State the excluded values.

ANSWER _____

6 Simplify $(x^2 - 25)/(x - 5) - (x + 2)$. State the excluded values.

ANSWER _____

APPLY IT Show your work

1 A 120 GB game downloads at x GB per hour on one connection and x + 5 GB per hour on a faster connection. Write a simplified expression for how many fewer hours the faster connection takes. Assume $x > 0$.

WORK SPACE

ANSWER _____

2 A club can buy x custom stickers for $48 from one shop, or x + 4 stickers for $60 from another shop. Write a simplified expression for the second shop's price per sticker minus the first shop's price per sticker. Assume x is a positive whole number.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Simplify $[(x^2 - 9)/(x^2 - 4x + 3)] \div [(x + 3)/(x - 1)]$. State all excluded values. Explain why $x = -3$ is excluded even though it does not appear in the final expression.

WORK SPACE AND ANSWER

ANSWER KEY

Factor, Then Simplify

HIGH SCHOOL · A2.A.2.3

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Simplify $(x^2 - 9)/(x^2 + 5x + 6)$. State the excluded values.	**$(x - 3)/(x + 2)$; $x \neq -3, -2$**
2	Add and simplify: $2/(x + 2) + 3/(x - 2)$. State the excluded values.	**$(5x + 2)/(x^2 - 4)$; $x \neq -2, 2$**
3	Subtract and simplify: $2/(x - 3) - 1/(x + 3)$. State the excluded values.	**$(x + 9)/(x^2 - 9)$; $x \neq -3, 3$**
4	Multiply and simplify: $[(x^2 - 4)/(x^2 + 3x + 2)] \times [(x + 1)/(x - 2)]$. State the excluded values.	**1; $x \neq -2, -1, 2$**
5	Divide and simplify: $[(x^2 - 16)/(x + 3)] \div [(x - 4)/(x + 3)]$. State the excluded values.	**$x + 4$; $x \neq -3, 4$**
6	Simplify $(x^2 - 25)/(x - 5) - (x + 2)$. State the excluded values.	**3; $x \neq 5$**

PART 2 · APPLY IT

1. **$600/[x(x + 5)]$ hours** Subtract the faster download time from the slower one: $120/x - 120/(x + 5)$. Use $x(x + 5)$ as the common denominator.
2. **$12(x - 16)/[x(x + 4)]$ dollars per sticker** Subtract the unit prices: $60/(x + 4) - 48/x = [60x - 48(x + 4)]/[x(x + 4)]$. Factor 12 from the numerator.

CHALLENGE

1; $x \neq -3, 1, 3$. When $x = -3$, the expression being divided by equals zero, and division by zero is undefined.

Accept equivalent simplified forms with the same excluded values. In the second word problem, the signed difference may be negative for some positive values of x.