LESSON MAKER PRO

Fraction Operations Lab

Combine rational expressions and track where they are defined.

HIGH SCHOOL · PC.A.D.19.a

PC.A.D.19.a "Explain why rational expressions form a system analogous to the rational numbers, which is closed under addition, subtraction, multiplication, and division by a non-zero rational expression."

NAME _____ DATE _____

THE BIG IDEA

A rational expression is a fraction made from polynomials, and its denominator cannot be zero. Add or subtract using a common denominator, multiply across, and divide by multiplying by the reciprocal of a nonzero rational expression. These operations produce another rational expression, but you must keep any values excluded by the original expression.

WORKED EXAMPLE

Simplify x/17 + x/19.

1. Use 323 as the common denominator: x/17 = 19x/323 and x/19 = 17x/323.
2. Add the numerators: (19x + 17x)/323 = 36x/323.
3. Both original denominators are nonzero constants, so no x-values are excluded.

Answer: 36x/323; no excluded x-values

PRACTICE 6 problems

1 Simplify x/(x+1) + 3/(x+1). State the excluded x-value.

ANSWER _____

2 Simplify (x+4)/x - 4/x. State the excluded x-value.

ANSWER _____

3 Simplify ((x-5)/(x+5)) × ((x+5)/(x-6)). State all excluded x-values.

ANSWER _____

4 Simplify ((x+6)/(x-4)) ÷ ((x+6)/(x+2)). State all excluded x-values, including any value that makes the divisor zero.

ANSWER _____

5 Simplify 1/(x-3) + 1/(x+3). State all excluded x-values.

ANSWER _____

6 Simplify x/(x-8) - 5/(x-8). State the excluded x-value and explain why the result is a rational expression.

ANSWER _____

APPLY IT Show your work

1 For a game night with x friends, pizza costs $(4x+12) and snacks cost $(x+6). Everyone splits the total equally. Write a simplified expression for each friend's share, and state the possible values of x.

WORK SPACE

ANSWER _____

2 A club can order x custom shirts for a total of $(9x+6), or buy shirts for $11 each. How much less does each custom shirt cost? Write a simplified expression, then find the positive integer values of x for which custom shirts cost less per shirt.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Simplify $((x^2-25)/(x-5)) \div ((x+5)/(x-3))$. State all excluded x-values. Explain why an excluded value does not become allowed just because it is absent from the simplified result.

WORK SPACE AND ANSWER

ANSWER KEY

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Simplify x/(x+1) + 3/(x+1). State the excluded x-value.	**(x+3)/(x+1); x ≠ -1**
2	Simplify (x+4)/x - 4/x. State the excluded x-value.	**1; x ≠ 0**
3	Simplify ((x-5)/(x+5)) × ((x+5)/(x-6)). State all excluded x-values.	**(x-5)/(x-6); x ≠ -5, 6**
4	Simplify ((x+6)/(x-4)) ÷ ((x+6)/(x+2)). State all excluded x-values, including any value that makes the divisor zero.	**(x+2)/(x-4); x ≠ -6, -2, 4**
5	Simplify 1/(x-3) + 1/(x+3). State all excluded x-values.	**2x/((x-3)(x+3)); x ≠ -3, 3**
6	Simplify x/(x-8) - 5/(x-8). State the excluded x-value and explain why the result is a rational expression.	**(x-5)/(x-8); x ≠ 8. The numerator and denominator are polynomials.**

PART 2 · APPLY IT

1. **$(5x+18)/x per friend; x is a positive integer** Add the two costs, then divide by x. The number of friends must be a positive integer.
2. **$(2x-6)/x less per shirt; positive integers x ≥ 4** Subtract the custom cost per shirt, (9x+6)/x, from 11. The difference is positive when 2x-6 > 0, so a positive integer x must be at least 4.

CHALLENGE

x-3; x ≠ -5, 3, 5. The original expression is undefined at those values: a denominator is zero at x = 3 or 5, and the divisor is zero at x = -5. Simplifying cannot give the original expression a value where it was undefined.

Accept equivalent simplified forms with the correct original domain restrictions. In the challenge, accept any explanation that checks the original denominators and nonzero divisor.