Name: _____ Date: _____ # ____

Section 8-5 Adding and Subtracting Rational Expressions

Learning Goal: To understand how to add and subtract rational expressions

Essential Questions: Are two quantities inversely proportional if an increase in one corresponds to a decrease in the other?

What kinds of asymptotes are possible for a rational function?

Are a rational expression and its simplified form equivalent?

Warm Up:

1. What is $\frac{x^2+x-12}{x^2+2x-8}$ in simplest form? State any restrictions on the variable.

2. What is the product $\frac{x+3}{x^2-9} \bullet \frac{x^2+2x-15}{x^2-2x+1}$ in simplest form? State any restrictions on the variable.

3. What is the quotient $\frac{16-x^2}{x^2+2x-3} \div \frac{x-4}{x^2+4x+3}$ in simplest form? State any restrictions on the variable.

4. Add or subtract:

a) $\frac{5}{19}+\frac{7}{38}$ b) $\frac{2}{15}+\frac{3}{25}$ c) $\frac{7}{24}-\frac{5}{36}$

Vocabulary:

Note: You use common multiples of polynomials to add and subtract rational expression.

<u>Least Common Multiple (LCM) of an expression:</u> The smallest expression that is divisible by each of the given expressions.

What is the LCM of $12x^2y(x^2+2x+1)$ and $18xy^3(x^2+5x+4)$?

1. Find the prime factors of each expression.

2. Write the product of the prime factors, each raised to the greatest power that occurs in either expression.

You Try:

What is the LCM of the expressions?

1. $2x+4$ and x^2-x-6

2. x^2+3x-4, x^2+2x-8, and x^2-4x+4

3. $x^2+4x-12$ and x^2-6x+8

Adding Rational Expressions

Note: The LCM of the denominators or two rational expressions is also the Least Common Denominator (LCD) of the rational expressions.

What is the sum of the two rational expressions in simplest form? State any restrictions on the variable.

$$\frac{x}{x-1}+\frac{2x-1}{x^2-3x+2}$$

Steps:	Work
1. **Factor** the denominators.	
2. **Rewrite** each expression with the LCD.	
3. **Add** the numerators. Combine like terms. (Remember order of operations!)	
4. **Factor** the numerator if possible.	
5. Determine **restrictions** on the variable. (What value for the variable will make the denominator equal to zero?)	
6. **Divide** out common factors. (Do not cancel across addition or subtraction signs.)	

You Try:

What is the sum of the expression in simplest form? State any restrictions on the variable.

4. $\frac{x+1}{x-1}+\frac{-2}{x^2-x}$

5. $\frac{x}{x^2-4}+\frac{1}{x+2}$

6. $\frac{4}{x^2+3x}+\frac{x-2}{x^2+6x+9}$

Subtracting Rational Expressions

What is the difference of the two rational expressions in simplest form? State any restrictions on the variable.

$$\frac{x+2}{x^2-2x}-\frac{x+2}{2x-4}$$

Steps	Work
1. **Factor** the denominators.	
2. **Rewrite** each expression with the LCD.	
3. **Subtract** the numerators. Combine like terms. (Remember to distribute the negative sign when distributing!)	
4. **Factor** the numerator if possible.	
5. Determine **restrictions** on the variable. (What value for the variable will make the denominator equal to zero?)	
6. **Divide** out common factors. (Do not cancel across addition or subtraction signs.)	

You Try:

What is the each product in simplest form? State any restrictions on the variable.

7. $\dfrac{x+3}{x-2}-\dfrac{6x-7}{x^2-3x+2}$

8. $\dfrac{x-1}{x+5}-\dfrac{x+3}{x^2+6x+5}$

9. $\dfrac{x+1}{x^2+2x-8}-\dfrac{x}{4x-8}$

Complex Fractions - a rational expression that has at least one fraction in its numerator or denominator or both.

Examples:

$\dfrac{\frac{1}{x}+\frac{1}{y}}{\frac{1}{xy}}$	$\dfrac{\frac{x+3}{2}}{\frac{2}{x-4}}$	$\dfrac{\frac{x+3}{x^2-2x+1}+\frac{x}{x^2-3x+2}}{\frac{x}{x^2-4x+4}-\frac{2}{x^2-4}}$

Steps to Simplify Complex Fractions

1. Find a common denominator
2. Add/subtract fractions in the numerator
3. Add/ subtract fractions in the denominator
4. Determine restrictions (need to check 3 places)
5. Flip fraction in the denominator and multiply (multiply the reciprocal)
6. Simplify

What is a simpler form of the complex fraction?

$$\dfrac{\frac{1}{x}+\frac{x}{y}}{\frac{1}{y}+1}$$

You Try:

What is a simpler form of the complex fraction?

10. $\dfrac{x}{\frac{1}{x}+\frac{1}{y}}$

11. $\dfrac{\dfrac{x-2}{x}+\dfrac{2}{x+1}}{\dfrac{3}{x-1}-\dfrac{1}{x+1}}$

12. $\dfrac{3x-\dfrac{1}{y}}{\dfrac{y^2}{x}+x}$

Closure: Why should you find the least common denominator when adding or subtracting rational expressions?

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Assignment: section 8.5 # 9,11,13,15,19,21,22,27,28,32,34,35,42,44 (14 problems)