

Name: _____

Date: _____ # _____

Section 8-4 Rational Expressions

Learning Goal: To understand how to simplify rational expressions; to understand how to multiply and divide 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. Factor each expression.

a) $2x^2 - 3x + 1$

b) $4x^2 - 9$

c) $5x^2 + 6x + 1$

d) $10x^2 - 10$

e) $4x^2 - 34x + 16$

f) $9x^2 + 6x$

Vocabulary:

Rational Expression: The quotient of two polynomials.

Sometimes it will be helpful to think of rational expressions as ratios, fractions, or as quotients.

Simplest form: When the numerator and denominator are polynomials that have no common divisors.

To simplify a rational expression, it is helpful, to factor the numerator and denominator to help find common divisors.

Simplest Form	Not in Simplest Form
$\frac{x+1}{x-1} \cdot \frac{x^2+3x+2}{x+3}$	$\frac{x}{x^2}, \frac{3(x-3)}{x-3}, \frac{x^2-x-6}{x^2+x-2}$

Simplifying a Rational Expression

What is $\frac{x^2 + 7x + 10}{x^2 - 3x - 10}$ in simplest form? State any restrictions of the variable.

Restrictions: Domain: \mathbb{R} except $x =$ and $x =$

You Try:

What is the rational expression in simplest form? State any restrictions on the variables.

1. $\frac{24x^3y^2}{-6x^2y^3}$

2. $\frac{x^2 + 2x - 8}{x^2 - 5x + 6}$

3. $\frac{12 - 4x}{x^2 - 9}$

4. $\frac{9x^2 + 6x}{36x + 24}$

5.
$$\frac{x+2}{x^2+5x+6}$$

6.
$$\frac{x^2+2x-15}{x^2+x-12}$$

Multiplying Rational Expressions

What is the product $\frac{x^2+x-6}{x-5} \cdot \frac{x^2-25}{x^2+4x+3}$ in simplest form? State any restrictions on the variable.

Steps	Work
1. Factor all polynomials	
2. Determine domain restricts. <i>Restrictions include any real number that will make the denominator equal to zero!</i> <i>Remember that you cannot divide by zero!</i> <i>This is always done before you cancel!</i>	
3. Divide out common factors. (Cancel)	
4. Simplify. <i>Remember that you must state the domain and any restrictions on the problem.</i>	

You Try:

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

$$7. \quad \frac{2x-8}{x^2-16} \cdot \frac{x^2+5x+4}{x^2+8x+16}$$

$$8. \quad \frac{x^2-3x+2}{x+2} \cdot \frac{x^2-36}{x^2+5x-6}$$

Dividing Rational Expressions

To divide rational expressions, you must multiply by the reciprocal of the divisor.

*Note: When simplifying a rational expression or performing any operation (adding, subtracting, multiplying or dividing), a **restriction** on a variable is any real number that you plug in for a variable that will make the denominator equal to zero.*

*When you divide fractions, you flip the second fraction (the reciprocal) and multiply. Therefore, you need to include the restrictions from the divisor (the fraction that you flip) when it is set up as division **AND** the restriction(s) from the denominator in that same fraction after you flip it.*

Example: $\frac{x+2}{x-1} \div \frac{x-3}{x+4}$

What is the quotient $\frac{2-x}{x^2+2x+1} \div \frac{x^2+3x-10}{x^2-1}$ in simplest form? State any restrictions on the variable.

You Try:

9. $\frac{x^2+5x+4}{x^2+x-12} \div \frac{x^2-1}{2x^2-6x}$

10. $\frac{6x-3x^2}{36-x^2} \div \frac{x^3-x^2-2x}{x^2-5x-6}$

Closure: Why is it important to examine the factors of the original problem to determine variable restrictions?

Assignment: section 8.4 # 8,9,14,15,19,20,21,22,25,29,32,33,34,35 (14 problems)