6-1 Multiplying and Dividing Rational Expressions

- I can multiply and divide rational expression and simplify using factoring.
- I can simplify a rational expression.
- Find excluded values

Multiply Rational Numbers

How do you multiply $\frac{4}{5} \cdot \frac{5}{6}$?

$$\frac{4 \times 5}{5 \times 6} = \frac{20}{30} = \frac{2}{3}$$

$$\frac{4}{6} = \frac{2 \cdot 2}{2 \cdot 3}$$

To multiply rational expressions:

0. Factor everything
1. Find the excluded values after factoring
2. Multiply the numerators
3. Multiply the denominators
4. Simplify the product by reducing common factors

Excluded Values: any x-value that makes bottom = 0

finding zeros of denominator

Reduce the following expressions. List excluded values first.

$$\frac{x(x+3)}{(x-2)(x+3)} = \frac{x}{x-2}$$

$x \neq 2, -3$

$$\frac{(x+5)}{x} \cdot \frac{2x^3}{(x+5)(x+1)} = \frac{2x^2}{x+1}$$

$2 \cdot x \cdot x \cdot x$

$x \neq 0, -5, -1$

Find the products and any excluded values.

$$\frac{3x^2}{x^2-2x-8} \cdot \frac{2x^2-6x-20}{x^2-3x-10}$$

$2(x^2-3x-10)$

$(x-4)(x+2)$ $\quad$ $(x-5)(x+2)$

$$\frac{3x^2}{(x-4)(x+2)} \cdot \frac{2(x-5)(x+2)}{(x-5)(x+2)}$$

$x \neq 4, -2, 5$

$$\frac{6x^2}{(x-4)(x+2)}$$

$$\frac{x^2-8x}{14(x^2+8x+15)} \cdot \frac{7x+35}{(x+8)}$$

$x \neq -5, -3, -8$

$$\frac{x(x-8)}{4(x+5)(x+3)} \cdot \frac{7(x+5)}{(x+8)}$$

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$$\frac{x(x-8)}{2(x+3)(x+8)}$$

Dividing Fractions Video

Reflect

1. **Discussion** Multiplying rational expressions is similar to multiplying rational numbers. Likewise, dividing rational expressions is similar to dividing rational numbers. How could you use the steps for dividing rational numbers to divide rational expressions?

Steps for dividing polynomials

1. Find the excluded values (after factoring). Look at both denominators as well as the numerator of the divisor.
2. Change to multiplication.
3. Multiply the numerators.
4. Multiply the denominators.
5. Simplify the product by reducing common factors.

Find the quotients and any excluded values.

$$\frac{(x+7)^2}{x^2} \div \frac{x^2+9x+14}{x^2+x-2}$$

$(x+2)(x+7)$

$(x+2)(x-1)$

$x \neq 0, -2, 1, -7$

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$$\frac{(x+7)^2}{x^2} \cdot \frac{(x+2)(x-1)}{(x+2)(x+7)}$$

$$\frac{(x+7)(x-1)}{x^2}$$

$$\frac{6x}{3x-30} \div \frac{9x^2-27x-36}{x^2-10x}$$

$3(x-10)$ $\quad$ $9(x+1)(x-4)$ $\quad$ $x(x-10)$

$x \neq 10, 0, -1, 4$

$$\frac{6x}{3(x-10)} \cdot \frac{x(x-10)}{9(x+1)(x-4)}$$

$$\frac{6x^2}{27(x+1)(x-4)}$$

$\div 3$ $\quad$ $\div 3$

$$\frac{2x^2}{9(x+1)(x-4)}$$

12. $\dfrac{x^2 - 10x + 9}{3x} \div \dfrac{x^2 - 7x - 18}{x^2 + 2x}$

13. $\dfrac{8x + 32}{x^2 + 8x + 16} \div \dfrac{x^2 - 6x}{x^2 - 2x - 24}$

2.