Warm Up

State the restrictions and simplify.

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

$x \neq -2$

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

$$= 2$$

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

$x \neq -2, 1$

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

$$= \frac{x+1}{x+2}$$

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

$$= \frac{(x-5)(x+2)}{(x-4)(x+2)}$$

$x \neq 4, -2$

$$= \frac{x-5}{x-4}$$

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Multiplying and Dividing Rational Functions

Lesson objectives

- I know how to multiply and divide rational functions
- I know how to state the restrictions when multiplying or dividing rational functions

| 1.1 | Lesson objectives | Teachers' notes | Lesson notes |

Nelson Page 121 #s 1, 5ac, 6ac, 7ad (Multiplying)

Nelson Page 121 #s 2, 4bd, 5bd, 7bc (Dividing)

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Rules for Multiplication

When we multiply fractions, our rule is to multiply the numerators and then multiply the denominators. The rule is the same for multiplying rational expressions.

When we state the restrictions, we need to make sure to state the restrictions for each of the factors.

Remember to always simplify!

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Example:

State restrictions, determine the product and simplify.

$$\left(\frac{x-2}{x+4}\right)\left(\frac{x+4}{x+1}\right)$$

$$\left(\frac{x^2+5x+6}{x^2+6x+8}\right)\left(\frac{x^2-5x-6}{x^2-7x-8}\right)$$

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

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

$$= \frac{x-2}{x+1}$$

$$\frac{(x+2)(x+3)}{(x+2)(x+4)} \times \frac{(x-6)(x+1)}{(x-8)(x+1)}$$

$$x \neq -2, -4, 8, -1$$

$$= \frac{(x+3)(x-6)}{(x+4)(x-8)}$$

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Dividing Rational Functions

Again our dividing rules are the same as working with fractions.

We take the reciprocal of the second fraction and then multiply.

When we state restrictions, we state the restrictions based on the denominator of the first fraction, but **BOTH** the numerator and denominator of the second fraction.

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Example.
State the restrictions, determine the quotient and simplify.

$$\frac{x+1}{x+3} \div \frac{x+1}{x+4} \qquad \frac{\left(\dfrac{x+1}{x+3}\right)}{\left(\dfrac{x+5}{x+3}\right)}$$

$$x \neq -3, -4, -1 \qquad\qquad x \neq -3, -5$$

$$\frac{x+1}{x+3} \times \frac{x+4}{(x+1)} \qquad\qquad \frac{x+1}{x+3} \div \frac{x+5}{x+3}$$

creates an extra restriction

$$\frac{(x+1)(x+4)}{(x+3)(x+1)} \qquad\qquad \frac{(x+1)}{(x+3)} \times \frac{(x+3)}{(x+5)}$$

creates an extra restriction

$$= \frac{x+4}{x+3} \qquad\qquad \frac{(x+1)(x+3)}{(x+3)(x+5)} = \frac{x+1}{x+5}$$

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Example.

State the restrictions, determine the quotient and simplify.

$$\frac{\left(x^2+7x+12\right)}{x^2+4x+3} \div \frac{\left(x^2+6x+8\right)}{x^2+5x+4}$$

$$x \neq -3, -1, -4, -2$$

$$\frac{(x+4)(x+3)}{(x+3)(x+1)} \div \frac{(x+2)(x+4)}{(x+4)(x+1)}$$

$$\frac{(x+4)(x+3)}{(x+3)(x+1)} \times \frac{(x+4)(x+1)}{(x+2)(x+4)}$$

creates an extra restriction

$$= \frac{x+4}{x+2}$$

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Example.

Determine a simplified expression for the area.

$$\frac{x+2}{x-1}$$ [box] $$\frac{x^2+5x-6}{x+2}$$

$$x \neq 1, -2$$

$$= \frac{x+2}{x-1} \times \frac{(x+6)(x-1)}{x+2}$$

$$= x+6$$

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