

## Section 8-4 Rational Expressions

Students will be able to:  
 -simplify rational expressions  
 -multiply and divide rational expressions

A rational expression is the quotient of 2 polynomials.

It is in simplest form when its numerator and denominator are polynomials that have no common divisors.

To simplify, start by factoring:

Also, state any restrictions on the functions

$$\frac{x^2 - x - 6}{x^2 + x - 2} = \frac{(x-3)(x+2)}{(x+2)(x-1)}$$

$$x \neq -2, 1$$

$$\frac{x-3}{x-1}$$

No  $\frac{10-3}{10-1} = -3$   
 Yes  $\frac{10-3-7}{10-1} = \frac{0}{9}$

For review:

$$\frac{1}{5} \cdot \frac{1}{10} = \frac{1}{50}$$

Now try:

$$\frac{1}{3x} \cdot \frac{1}{5x} = \frac{1}{15x^2}$$

To multiply two rationals, factor all polynomials, multiply the two numerators and the two denominators and then reduce.

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

$$x \neq -4$$

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

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

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

Another way to multiply is to first factor and cross reduce, then multiply anything remaining.

$$\frac{q^2-1}{q^2} \cdot \frac{q}{q+1}$$

$$\frac{(q+1)(q-1)}{q^2} \cdot \frac{q}{(q+1)} \xrightarrow{x \neq -1, 0} \frac{q-1}{q}$$

Division by a fraction is the same as multiplication by the reciprocal.

Divide:

$$x \neq 8, 5$$

$$\frac{c+5}{c-8} \div \frac{c-5}{c-8}$$

$$\frac{c+5}{c-8} \cdot \frac{c-8}{c-5} = \frac{c+5}{c-5}$$

$$\frac{(x+1)(x+4)}{x^2+5x+4} \cdot \frac{(x+1)(x-1)}{x^2-1}$$

$$\frac{(x+4)(x-3)}{2x(x-3)} \quad x \neq 3, -4, 0$$

$$\frac{(x+1)(x+4)}{(x+4)(x-3)} \cdot \frac{2x(x-3)}{(x+1)(x-1)} = \frac{2x}{x-1}$$

Complex Fractions: a quotient containing one or more fractions in the numerator, denominator, or both.

Start by setting up and factoring.

$$\frac{x^2 - 9x + 14}{x^2 - 6x + 5} = \frac{(x-7)(x-2)}{(x-5)(x-1)}$$

$$\frac{x^2 - 8x + 7}{x^2 - 7x + 10} = \frac{(x-7)(x-1)}{(x-2)(x-5)}$$

$$\frac{(x-7)(x-2)}{(x-5)(x-1)} \cdot \frac{(x-2)(x-5)}{(x-7)(x-1)} = \frac{(x-2)^2}{(x-1)^2}$$

$x \neq 5, 1, 2, 7$

#37.  $\frac{x+3}{x-1}$

$\frac{x(x-1)^{-1}}{(x-1)^1}$   $(x-1)^{-1}$  is  $\frac{1}{(x-1)}$

$$\frac{x+3}{x-1} \cdot \frac{x-1}{x} = \frac{x+3}{x}$$

$x \neq 1, 0$

Hwk: pg. 531 - 532  
 #8 - 24 evens, 28,  
 31 - 33 all, 36, 42,  
 48, 49