9.1: Multiply and Divide Rational Functions

Key

- I can multiply and divide rational functions and simplify the resulting expression

Vocabulary

Rational Function – A function that is the ratio of two polynomials.

*Remember that the polynomial you are dividing by cannot be zero.

Simplified Form – There can be no common factors in the numerator and denominator.

Simplifying: $\frac{a\cancel{c}}{b\cancel{c}} = \frac{a}{b}$ **Multiplying:** $\frac{a}{b}\cdot\frac{c}{d} = \frac{ac}{bd}$ **Dividing:** $\frac{a}{b}\div\frac{c}{d} = \frac{a}{b}\cdot\frac{d}{c} = \frac{ad}{bc}$

Ex 1: Simplify $\frac{40x^2+20x}{10x-30} = \frac{\overset{2}{\cancel{20}}x(2x+1)}{\underset{1}{\cancel{10}}(x-3)}$

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

Steps:

either order

1. Factor
2. Multiply/Divide if necessary
3. Cancel out common factors

Ex 2: Simplify $\frac{x^2-2x-15}{x^2-9} = \frac{(x-5)\cancel{(x+3)}}{(x-3)\cancel{(x+3)}} = \boxed{\frac{x-5}{x-3}}$

$a^2-b^2=(a+b)(a-b)$

Ex 3: Simplify $\frac{8x^3y}{2xy^2}\cdot\frac{7x^4y^3}{4y} = \frac{\overset{7}{\cancel{56}}x^7y^4}{\underset{1}{\cancel{8}}xy^3} = \boxed{7x^6y}$

Quick Check

Simplify:

$\frac{x^2-2x-3}{x^2-8x+15} = \frac{\cancel{(x-3)}(x+1)}{(x-5)\cancel{(x-3)}} = \boxed{\frac{x+1}{x-5}}$

Ex 4: $\dfrac{3x-3x^2}{x^2+4x-5}\cdot\dfrac{x^2+x-20}{3x} = \dfrac{\cancel{3x}(1-x)}{\cancel{(x+5)}(x-1)}\cdot\dfrac{\cancel{(x+5)}(x-4)}{\cancel{3x}} = \dfrac{-1\cancel{(x-1)}(x-4)}{\cancel{(x-1)}}$

$= -(x-4) = \boxed{-x+4}$

Divide

Ex 5: $\dfrac{6x^2+x-15}{4x^2}\div(3x^2+5x) = \dfrac{(2x-3)\cancel{(3x+5)}}{4x^2}\cdot\dfrac{1}{x\cancel{(3x+5)}} = \boxed{\dfrac{2x-3}{4x^3}}$

	$2x$	-3
$3x$	$6x^2$	$-9x$
5	$10x$	-15

$=x$

Do and Discuss

Divide and simplify: $\dfrac{7x}{2x-10}\div\dfrac{x^2-6x}{x^2-11x+30} = \dfrac{7x}{2x-10}\cdot\dfrac{x^2-11x+30}{x^2-6x}$

$\dfrac{7x}{2\cancel{(x-5)}}\cdot\dfrac{\cancel{(x-6)}\cancel{(x-5)}}{\cancel{x}\cancel{(x-6)}} = \boxed{\dfrac{7}{2}}$

Additional resources:

- Textbook Section 8.4 (pg. 574)
- www.khanacademy.org/math/algebra2/rational-expressions-equations-and-functions/multiplying-and-dividing-rational-expressions