Unit 1 – Polynomial and Rational Expressions

2.4: Simplifying Rational Expressions

Learning Goal: We are learning the definition of a Rational Expression and how to simplify them

A **RATIONAL EXPRESSION** is constructed by "**DIVIDING**" one **POLYNOMIAL EXPRESSION** by another.

e.g. $\frac{3x^2-4x+1}{x^2-1}$ is a rational expression, but $\frac{3\sqrt{x}-4}{x^2}$ is not.

$\frac{21}{45} = \frac{(3)(7)}{(3)(15)} = \frac{7}{15}$

SIMPLIFYING RATIONAL EXPRESSIONS REQUIRES 4 THINGS:

1) Factoring any polynomials which can be factored
2) **Stating any restrictions on the variables**
3) Cancelling any common factors, top to bottom
4) Writing the rational expression in simplified form

Note that stating restrictions **MUST BE DONE BEFORE CANCELLING**!!!! If you cancel before stating the restrictions, **YOU RUN THE RISK OF EXPLODING THE UNIVERSE**. Don't do it. **FOR THE SAKE OF ALL HUMANITY, PLEASE DON'T DO CANCEL BEFORE STATING RESTRICTIONS!**

RESTRICTIONS ON A RATIONAL EXPRESSION

Consider the rational expression $\frac{2x-5}{x+2}$. Because x is a variable, we can substitute different (varying) values for it and calculate different values for the rational expression.

However, there is one value which we cannot substitute:

a restriction.

$x \neq -2$ because if it did the rational expression results in: $\frac{2(-2)-5}{-2+2} = \frac{-9}{0}$ not allowed!

Example 2.4.1

Simplify, stating any restrictions on the variable: $\dfrac{3a(a-2b)}{(a+b)(a-2b)}$

restrictions: $a+b \neq 0$, $a \neq -b$, $a-2b \neq 0$, $a \neq 2b$

$= \dfrac{3a}{a+b}$

Example 2.4.2

Simplify $\dfrac{x^2-9}{(2+x)(3-x)}$

$= \dfrac{(x-3)(x+3)}{(2+x)(3-x)}$ $\quad -1$

restrictions: $x \neq 3, -2$

$2+x \neq 0$, $x \neq -2$

$3-x \neq 0$, $3 \neq x$, $x \neq 3$

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

or $= -\dfrac{x+3}{2+x}$

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

$\dfrac{5-3}{3-5} = -1$

$\dfrac{7-4}{4-7} = -1$

$\dfrac{-3+7}{3-7} = -1$

$\dfrac{a-b}{b-a} = \dfrac{a-b}{-(-b+a)} = \dfrac{a-b}{-(a-b)} = -1$

Example 2.4.3

Simplify, stating any restrictions on the variable: $\dfrac{3t^2+t-2}{9t^3-6t^2}$.

Success Criteria:

- I can determine whether an expression is rational or not
- I can simplify rational expressions by factoring and cancelling common factors.
- I can state restriction for rational expressions by not allowing the denominator to equal zero.

Class/Homework

Pg. 112 – 114 #2, 3bc, 4acf, 5, 8a, 10, 11

$$\frac{3t^2+t-2}{9t^3-6t^2}\cdot$$

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

restriction: $t \neq 0, \frac{2}{3}$

$$\frac{t+1}{3t^2}$$

SIDE WORK

$3t^2+t-2$

x	+
-6	+1

$3, -2$

$3t^2-2t+3t-2$

$t(3t-2)+1(3t-2)$

$(3t-2)(t+1)$

$9t^3-6t^2$

$=3t^2(3t-2)$

$3t^2 \neq 0$

$t^2 \neq 0$

$t \neq 0$

$3t-2 \neq 0$

$3t \neq 2$

$t \neq \frac{2}{3}$