Unit 1 – Polynomial and Rational Expressions

2.7: Adding and Subtracting Rational Expressions

Learning Goal: We are learning how to add (subtract) rational expressions

This is it. The pinnacle of Rational Expressions. **The most difficult thing you can do with Rational Expressions is to add or subtract them**. That's right! **Adding and subtracting is the most difficult thing**. Thankfully, you all can handle it!!

COMMON DENOMINATOR

Getting a Common Denominator is the key to the whole scene. A "**COMMON**" denominator must contain enough **FACTORS** (***or better***: **THE CORRECT FACTORS**) to "**KEEP EVERYONE HAPPY**", so to speak. Keep in mind that we **STILL MUST STATE RESTRICTIONS** when faced with factors containing variables!!!

In order to simply Rational Expressions being added or subtracted, you must:

all "unique" factors

1) Factoring any polynomials which can be factored
2) **Stating any restrictions on the variable(s)**
3) Determine the **COMMON DENOMINATOR** by identifying all **needed** factors
4) Writing the rational expressions with the **needed** factors so that each expression has the same denominator.
5) Add/Subtract the numerators of the expressions (***which may require some expanding so that you can collect like terms***!)
6) Check to see if the simplified numerator can be factored, and if it can, factor it.
7) Write the sum/difference in simplified (factored) form

Example 2.7.1

Simplify, stating any restrictions.

$$\frac{3}{t^4}+\frac{1}{2t^2}-\frac{3}{5t}$$

restrictions: $t \neq 0$

CD $(t^4)(2)(5) = 10t^4$

$$= \frac{3}{t^4}\cdot\frac{10}{10} + \frac{1}{2t^2}\cdot\frac{5t^2}{5t^2} - \frac{3}{5t}\cdot\frac{2t^3}{2t^3}$$

$$= \frac{30}{10t^4} + \frac{5t^2}{10t^4} - \frac{6t^3}{10t^4}$$

$$= \frac{30+5t^2-6t^3}{10t^4}$$

//

x^2+6x+8 $\begin{array}{c|c} \times & + \\ 8 & 6 \end{array}$ $4, 2$

$1x^2-3x-10$ $\begin{array}{c|c} \times & + \\ -10 & -3 \end{array}$

$(x-5)(x+2)$ $-5, 2$

Example 2.7.2

Simplify and state any restrictions.

$$\frac{4x}{x^2+6x+8}-\frac{3x}{x^2-3x-10}$$

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

restrictions $x \neq -4, -2, 5$

CD: $(x+4)(x+2)(x-5)$

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

$$=\frac{4x^2-20x-3x^2-12x}{(x+4)(x+2)(x-5)}=\frac{x^2-32x}{(x+4)(x+2)(x-5)}=\frac{x(x-32)}{(x+4)(x+2)(x-5)}$$

Example 2.7.3

Simplify. State restrictions. BEDMAS, folks, BEDMAS!!!!!!!!!!! (Seriously…bedmas)

× before +

$$\frac{p+1}{p^2+2p-35}+\frac{p^2+p-12}{p^2-2p-24}\times\frac{\cancel{p^2-4p-12}\ p-6}{p^2+2p-15}$$

$$=\frac{p+1}{(p+7)(p-5)}+\frac{\cancel{(p+4)}\cancel{(p-3)}}{\cancel{(p-6)}\cancel{(p+4)}}\times\frac{\cancel{p-6}}{\cancel{(p-3)}(p+5)}$$

restriction $p \neq -7, 5, 6, -4, 3, -5$

$$=\frac{p+1}{(p+7)(p-5)}+\frac{1}{p+5}$$

CD: $(p+7)(p-5)(p+5)$

Success Criteria:

- I can determine the sum (difference) of two rational expressions by: determining the **LCD** (lowest common denominator) of the denominators; stating any restrictions for the expressions; rewriting each expression using that common denominator; combine the expressions into a single expression; simplifying the numerator by collecting like terms.

Class/Homework: Pg 128 – 130 #3bc, 5cd, 6abef, 7acef, 8, 9abd

$$= \frac{p+1}{(p+7)(p-5)} + \frac{1}{p+5} \qquad CD\ (p+7)(p-5)(p+5)$$

$$= \frac{p+1}{(p+7)(p-5)} \cdot \frac{(p+5)}{(p+5)} + \frac{1}{p+5} \cdot \frac{(p+7)(p-5)}{(p+7)(p-5)}$$

$$= \frac{(p+1)(p+5) + (1)(p+7)(p-5)}{(p+7)(p+5)(p-5)}$$

$$= \frac{p^2+5p+p+5 + p^2-5p+7p-35}{(p+7)(p+5)(p-5)}$$

$$= \frac{2p^2+8p-30}{(p+7)(p+5)(p-5)} = \frac{2(p^2+4p-15)}{(p+7)(p+5)(p-5)}$$