

# Mr. Ward Answer Key

## Adding & Subtracting Rational Expressions

**\*\*When we have Common Denominators\*\***

Step 1: Add or Subtract the Numerators

Step 2: Simplify the Numerator by Combining Like Terms

Step 3: Simplify if necessary and check the denominator for any values that would make it zero.

### Example #1

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

Step 1: Since we have common denominators already, we can go straight to adding the numerators. Afterwards we will have just a single fraction.

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

Step 2: Now we will simplify the numerator by combining like terms. Combine the squared terms, the linear terms, etc.

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

Step 3: The numerator cannot be simplified any further, so now we check the denominator for any values that make it zero. The value  $x = 4$  would make the denominator zero, so we will exclude it from our final answer.

### Practice Problem #1

$$\frac{3x + 8}{x - 1} - \frac{5x + 2}{x - 1}$$

Step 1: Since we have common denominators, we can go straight to subtracting the numerators. **\*\* Be Careful! Because we are subtracting you must remember to distribute the negative sign to both the 5x AND the 2. \*\*** Show your work below.

$$\frac{3x + 8 - 5x - 2}{x - 1}$$

Step 2: Simplify the numerator by combining like terms.

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

Step 3: Check the denominator for any values that make it zero.

$$x \neq \underline{1}$$

**\*\*When we DON'T have Common Denominators\*\***

Step 1: Find the Common Denominator. This is done by finding the Least Common Multiple (LCM).

Step 2: Rewrite each fraction with the new numerator and common denominator.

Step 3: Add or Subtract the Numerators.

Step 4: Simplify the numerator by combining like terms.

Step 5: Identify values that cause the denominator to equal zero.

### Example #1

$$\frac{x-1}{x^2+3x+2} + \frac{x}{x+1}$$

Step 1: Find the Common Denominator

Since we do not have a common denominator we need to find out what it is. To begin this process we must first factor the denominator of the first fraction. It is a trinomial so we will use reverse FOIL to factor it.

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

Now that the rational expression is factored we can easily see what the common denominator will be,  $(x+1)(x+2)$ .

Step 2: Rewrite each fraction with the new numerator and common denominator.

In order to get this denominator in the second fraction we have to multiply both the top and the bottom by  $(x+2)$ .

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

Step 3: Add the Numerators

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

Step 4: Simplify the numerator by combining like terms

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

Step 5: Identify values that cause the denominator to equal zero

The values  $x = -1$  and  $x = -2$  cause the denominator to be zero. ( $x \neq -1$  and  $x \neq -2$ )

### Practice Problem #1

$$\frac{3x-2}{2x+5} - \frac{2}{5x-2}$$

Step 1: Find the Common Denominator

$$\text{Common Denominator} = (2x+5)(5x-2)$$

Step 2: Rewrite each fraction with the new numerator and common denominator

$$\frac{(3x-2)(5x-2)}{(2x+5)(5x-2)} - \frac{2(2x+5)}{(5x-2)(2x+5)} = \frac{15x^2 - 16x + 4}{(2x+5)(5x-2)} - \frac{4x + 10}{(2x+5)(5x-2)}$$

Step 3: Subtract the numerators

$$\frac{15x^2 - 16x + 4 - 4x - 10}{(2x+5)(5x-2)}$$

Step 4: Simplify the numerator by combining like terms

$$\frac{15x^2 - 20x - 6}{(2x+5)(5x-2)}$$

Step 5: Identify values that cause the denominator to equal zero

$$x \neq -\frac{5}{2}, \frac{2}{5}$$

Assignment: pg 588 #2-12, #17-27