7.3 Adding & Subtracting with Like Denominators

Addition and subtraction of rational expressions works exactly the same as with fractions. Let $\frac{P}{R}$ and $\frac{Q}{R}$ be rational expressions for some polynomials $P(x), Q(x)$ and $R(x) \neq 0$. Then,

$$\frac{P}{R} \pm \frac{Q}{R} = \frac{P \pm Q}{R}$$

Since rational expressions are essentially fractions, treat them the same way. Combine

the numerators with either addition or subtraction into one numerator and keep the like denominator. Then simplify the numerator by combining like terms. If possible, factor both the numerator and denominator to reduce the rational expressions to a fully simplified form.

Example 7.3.1. Find the following:

$$\frac{3x-2}{5} + \frac{2x+12}{5}$$

Example 7.3.2. Find the following:

$$\frac{x^2}{x^2-25}+\frac{25-10x}{x^2-25}$$

If we are instead subtracting, distribute a -1 to the second numerator and then treat as addition.

Example 7.3.3. Find the following:

$$\frac{4x+5}{x+7}-\frac{x}{x+7}$$

Example 7.3.4. Find the following:

$$\frac{3x^2 + 4x}{x - 1} - \frac{11x - 4}{x - 1}$$

Example 7.3.5. Find the following:

$$\frac{y^2 + 3y - 6}{y^2 - 5y + 4} - \frac{4y - 4 - 2y^2}{y^2 - 5y + 4}$$

Example 7.3.6. Find the following:

$$\frac{x^2}{x-7} + \frac{4x+21}{7-x}$$

Example 7.3.7. Find the following:

$$\frac{7x-x^2}{x^2-2x-9} - \frac{5x-3x^2}{9+2x-x^2}$$