

Chapter 6(I) Rational Expressions

6.3a Adding & Subtracting Rational Expressions

Adding Rational Expressions

We add or subtract rational expressions together the same way we add or subtract fractions together.

- LCM (lowest common denominator) is the highest power of each prime factor.

$$\text{Ex. } \frac{2}{3} + \frac{1}{4} = \frac{8+3}{12} = \frac{11}{12}$$

Ex. Simplify. State the non-permissible values for the variable.

$$\text{a) } \frac{5a}{3w} + \frac{2x}{3w} = \frac{5a+2x}{3w} \quad \begin{array}{l} 3w \neq 0 \\ w \neq 0 \end{array}$$

$$\text{b) } \frac{41m^2}{3t^2} - \frac{2m^2}{3t^2} = \frac{41m^2-2m^2}{3t^2} = \frac{39m^2}{3t^2} = \frac{13m^2}{t^2} \quad \begin{array}{l} 3t^2 \neq 0 \\ t \neq 0 \end{array}$$

$$\text{c) } \frac{7}{x-5} + \frac{2}{x-5} = \frac{7+2}{x-5} = \frac{9}{x-5} \quad \begin{array}{l} x-5 \neq 0 \\ x \neq 5 \end{array}$$

$$\text{d) } \frac{7x}{x-2} + \frac{14}{2-x} = \frac{7x}{x-2} - \frac{14}{x-2} = \frac{7x-14}{x-2} = \frac{7(\cancel{x-2})}{\cancel{x-2}} = 7 \quad \begin{array}{l} x-2 \neq 0 \\ 2-x \neq 0 \\ x \neq 2 \end{array}$$

$$\text{e) } \frac{5x}{y} + \frac{3y}{x} = \frac{5x(x)+3y(y)}{xy} = \frac{5x^2+3y^2}{xy} \quad \begin{array}{l} x \neq 0 \\ y \neq 0 \end{array}$$

$$\text{f) } \frac{3}{5x} - \frac{5y}{2x^2} + \frac{2}{1} = \frac{3(2x) - 5y(5) + 2(10x^2)}{10x^2} = \frac{6x - 25y + 20x^2}{10x^2} \quad \begin{array}{l} 5x \neq 0 \\ 2x^2 \neq 0 \\ x \neq 0 \end{array}$$

$$g) \frac{4a}{3b} + \frac{2a-9b}{4a} = \frac{4a(3b) + (2a-9b)(3b)}{12ab} = \frac{12ab + 6ab - 27b^2}{12ab} = \frac{18ab - 27b^2}{12ab}$$

$$= \frac{\overset{3}{\cancel{18}}(\overset{1}{\cancel{2a}} - 3b)}{\overset{4}{\cancel{12}}ab} = \frac{3(2a-3b)}{4a} \quad \begin{array}{l} 3b \neq 0 \quad 4a \neq 0 \\ b \neq 0 \quad a \neq 0 \end{array}$$

$$h) \frac{5}{x-3} - \frac{3}{2} = \frac{5(2) - 3(x-3)}{2(x-3)} = \frac{10 - 3x + 9}{2(x-3)} = \frac{-3x + 19}{2(x-3)} \quad \begin{array}{l} x-3 \neq 0 \\ x \neq 3 \end{array}$$

$$i) \frac{3}{x-5} - \frac{7}{x-1} = \frac{3(x-1) - 7(x-5)}{(x-5)(x-1)} = \frac{3x-3-7x+35}{(x-5)(x-1)} = \frac{-4x+32}{(x-5)(x-1)} = \frac{-4(x-8)}{(x-5)(x-1)}$$

$$\begin{array}{l} x-5 \neq 0 \quad x-1 \neq 0 \\ x \neq 5 \quad x \neq 1 \end{array}$$

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

$$\begin{array}{l} x-1 \neq 0 \quad x-3 \neq 0 \\ x \neq 1 \quad x \neq 3 \end{array}$$

$$= \frac{x^2 - 8x + 15 - x^2 + 1}{2(x-1)(x-3)} = \frac{-8x + 16}{2(x-1)(x-3)} = \frac{-8(x-2)}{2(x-1)(x-3)}$$

Remember:

- 1) Never expand the denominator (keep factored)
- 2) The numerator must be expanded so that like terms can be combined
- 3) Always check to see if the numerator can be factored in an effort to simplify the rational expression.

Assignment: Adding/Subtracting Worksheet