

## 9.5 Adding & Subtracting Rational Expressions

**Objective:**

- Be able to add and subtract rational expressions with common denominators and uncommon denominators.

Adding/Subtracting with **Common Denominators**:

\* add the numerators, denominators remain the same ex  $\frac{2}{3} + \frac{5}{3} = \frac{7}{3}$

Examples.

1.  $\frac{3}{2x} + \frac{5}{2x}$  denominator remains the same

add numerators →  $= \frac{8}{2x}$

simplify →  $= \boxed{\frac{4}{x}}$

Factor out a negative 1

2.  $\frac{2}{x-2} - \frac{x}{x-2}$

$= \frac{2-x}{x-2}$

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

$= \frac{-1(x-2)}{x-2} = \boxed{-1}$

3.  $\frac{5}{x-3} - \frac{x+1}{x-3}$

$= \frac{5-(x+1)}{x-3}$

$= \frac{5-x-1}{x-3}$

$= \boxed{\frac{-x+4}{x-3}}$

Your turn:

4.  $\frac{4}{x} + \frac{7}{x}$

$= \boxed{\frac{11}{x}}$

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

$= \boxed{\frac{x-2}{x+3}}$

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

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

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

$= \boxed{\frac{x+3}{x+4}}$

$$\text{LCD} = 6$$

Adding/Subtracting with *Uncommon Denominators*:

\* First find a common denominator,  
then add numerators

$$\text{ex. } \frac{3}{3} \cdot \frac{1}{2} + \frac{2}{3} \cdot \frac{2}{2}$$

$$= \frac{3}{6} + \frac{4}{6}$$

$$= \boxed{\frac{7}{6}}$$

Finding the LCD:

$$7. \quad \frac{2}{3x}, \frac{1}{9x^2}$$

$$\text{LCD} = 9x^2$$

$$8. \quad \frac{3}{x-2}, \frac{x}{x^2-4}$$

$$(x-2)(x+2)$$

$$\text{LCD} = (x-2)(x+2)$$

$$9. \quad \frac{x}{2x+1}, \frac{x-1}{x+1}$$

$$\text{LCD} = (2x+1)(x+1)$$

Examples:

$$\text{LCD} = 3x^2 \quad 10. \quad \frac{x}{x} \cdot \frac{4}{3x} + \frac{5}{x^2} \cdot \frac{3}{3}$$

$$= \frac{4x}{3x^2} + \frac{15}{3x^2}$$

$$= \boxed{\frac{4x+15}{3x^2}}$$

$$\text{LCD} = (x-2)(x+2)$$

$$11. \quad \frac{(x+2)}{(x+2)} \frac{1}{x-2} - \frac{2}{x^2-4}$$

$$(x-2)(x+2)$$

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

$$= \boxed{\frac{x}{(x+2)(x-2)}}$$

$$12. \quad \frac{(x+1)}{(x+1)} \frac{x}{3x-15} - \frac{2x+2}{x^2-4x-5} \cdot \frac{3}{3}$$

$$3(x-5) \quad (x-5)(x+1)$$

$$= \frac{x^2+x}{3(x-5)(x+1)} - \frac{6x+6}{3(x-5)(x+1)}$$

$$= \frac{x^2-5x-6}{3(x-5)(x+1)}$$

$$= \frac{(x-6)(x+1)}{3(x-5)(x+1)} = \boxed{\frac{x-6}{3(x-5)}}$$

check to see if you can simplify

$$13. \quad \frac{(x+1)}{(x+1)} \frac{3}{x-1} + \frac{x}{x+1} \frac{(x-1)}{(x-1)}$$

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

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

cannot be factored