

## Adding and Subtracting Rational Expressions

### Adding and Subtracting Rational Expressions With the Same Denominators

Step 1: Combine fractions.

Step 2: Factor and simplify.

### Adding and Subtracting Rational Expressions With Different Denominators

Step 1: Factor all numerators and denominators completely.

Step 2: Find the least common denominator (LCD).

Step 3: Multiply each fraction by what is missing in the LCD.

Step 4: Combine fractions.

Step 5: Factor and simplify.

Directions: Add or subtract and express your answer in simplest form.

$$1. \frac{3}{x-4} + \frac{x+2}{x-4} = \frac{3+x+2}{x-4} = \frac{x+5}{x-4}$$

$$2. \frac{2x^2+5}{x+3} + \frac{6x-5}{x+3} = \frac{2x^2+\cancel{5}+6x-\cancel{5}}{x+3} = \frac{2x^2+6x}{x+3}$$

$$\begin{aligned} \frac{2x^2+6x}{2x(x+3)} \quad \text{GCF} = 2x &= \frac{2x(\cancel{x+3})}{\cancel{x+3}} \\ &= \boxed{2x} \end{aligned}$$

$$3. \frac{x^2-2x+3}{x^2+7x+12} - \frac{x^2-4x-5}{x^2+7x+12} = \frac{x^2-2x+3 - (x^2-4x-5)}{x^2+7x+12}$$

$$= \frac{\cancel{x^2} - 2x + 3 - \cancel{x^2} + 4x + 5}{x^2+7x+12} = \frac{2x+8}{x^2+7x+12} = \frac{2(x+4)}{(x+3)\cancel{(x+4)}}$$

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

$$\begin{array}{l} 2x+8 \\ 2(x+4) \end{array} \quad \text{GCF}=2$$

$$\begin{array}{l} x^2+7x+12 \\ (x+3)(x+4) \end{array}$$

$$4. \frac{5}{12x^4y} - \frac{1}{5x^2y^3} = \frac{5y^2 \cdot 5}{5y^2 \cdot 12x^4y} - \frac{12x^2 \cdot 1}{12x^2 \cdot 5x^2y^3} = \frac{25y^2}{60x^4y^3} - \frac{12x^2}{60x^4y^3}$$

$$\text{LCD} = 60x^4y^3$$

$$\boxed{= \frac{25y^2 - 12x^2}{60x^4y^3}}$$

$$\begin{aligned}
 5. \quad \frac{x}{x^2-xy} - \frac{y}{xy-x^2} &= \frac{x}{\cancel{x}(x-y)} - \frac{y(-1)}{\cancel{x}(y-x)} = \frac{x}{x(x-y)} - \frac{-y}{x(x-y)} \\
 \text{GCF} &= x \quad \text{GCF} = x \\
 x(x-y) \quad x(y-x) & \quad \text{LCD} = x(x-y) \\
 &= \frac{x - (-y)}{x(x-y)} \\
 &= \boxed{\frac{x+y}{x(x-y)}}
 \end{aligned}$$

$$6. \quad \frac{5}{(x+4)^2} + \frac{2}{x+4} = \frac{5}{(x+4)(x+4)} + \frac{2 \cdot (x+4)}{x+4 \cdot (x+4)}$$

$$\text{LCD} = (x+4)^2$$

$$\begin{aligned}
 &= \frac{5}{(x+4)(x+4)} + \frac{2(x+4)}{(x+4)(x+4)} = \frac{5 + 2(x+4)}{(x+4)(x+4)} \\
 &= \frac{5 + 2x + 8}{(x+4)(x+4)} = \boxed{\frac{2x+13}{(x+4)(x+4)}} = \text{OR} \quad \boxed{\frac{2x+13}{(x+4)^2}}
 \end{aligned}$$

$$7. \frac{x}{5x^2-9x-2} - \frac{2}{3x^2-7x+2} = \frac{x \cdot (3x-1)}{(3x-1) \cdot (5x+1)(x-2)} - \frac{2 \cdot (5x+1)}{(3x-1)(x-2) \cdot (5x+1)}$$

$$\frac{5x^2-9x-2}{5 \cdot 1 \quad 1 \cdot 2}$$

$$(5x+1)(x-2)$$

$$\underbrace{\begin{array}{c} 1x \\ 10x \end{array}}_{10x}$$

$$\frac{3x^2-7x+2}{3 \cdot 1 \quad 1 \cdot 2}$$

$$(3x-1)(x-2)$$

$$\underbrace{\begin{array}{c} 1x \\ 6x \end{array}}_{6x}$$

$$LCD = (5x+1)(x-2)(3x-1)$$

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

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

$$= \frac{3x^2 - x - 10x - 2}{(5x+1)(x-2)(3x-1)} = \boxed{\frac{3x^2 - 11x - 2}{(5x+1)(x-2)(3x-1)}}$$

$$\frac{3x^2-11x-2}{3 \cdot 1 \quad 1 \cdot 2}$$

does not factor