

6.3 Adding and Subtracting Rational Expressions

Adding and subtracting rational expressions is similar to adding and subtracting rational numbers. We need to find a common denominator (preferably the lowest common denominator) and identify non-permissible values.

Example: Simplify each expression. Identify all non-permissible values

** Factor first!*

a) $\frac{8}{3x-12} + \frac{3}{x-4}$

$= \frac{8}{3(x-4)} + \frac{3 \cdot 3}{(x-4) \cdot 3}$ LCD: $3(x-4)$
 $x \neq 4$

$= \frac{8+9}{3(x-4)}$

$= \frac{17}{3(x-4)}, x \neq 4$

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

$= \frac{4}{(x+1)(x-1)} + \frac{3(x-1)}{(x+1)(x-1)}$ LCD: $(x+1)(x-1)$
Don't use $(x+1)(x^2-1)$.
 $x \neq \pm 1$

$= \frac{4+3x-3}{(x+1)(x-1)}$

$= \frac{3x+1}{(x+1)(x-1)}, x \neq \pm 1$

$$c) \frac{x-1}{x^2+x-6} - \frac{x-2}{x^2+4x+3}$$

LCD: $(x+1)(x-2)(x+3)$

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

$$= \frac{(x^2-1) - (x^2-4x+4)}{(x+3)(x-2)(x+1)} \quad x \neq -3, 1, 2$$

$$= \frac{4x-5}{(x+3)(x-2)(x-1)}, \quad x \neq -3, 1, 2$$

$$d) \frac{2x}{x^2+5x+6} - \frac{x-6}{x^2+6x+8}$$

LCD: $(x+2)(x+3)(x+4)$

$$= \frac{2x(x+4)(x-6)(x+3)}{(x+2)(x+3)(x+4)(x+2)(x+4)(x+3)}$$

$x \neq -4, -3, -2$

$$= \frac{2x^2+8x - (x^2-3x-18)}{(x+2)(x+3)(x+4)}$$

$$= \frac{x^2+11x+18}{(x+2)(x+3)(x+4)}$$

$$= \frac{(x+2)(x+9)}{(x+2)(x+3)(x+4)}$$

$$= \frac{x+9}{(x+3)(x+4)}, \quad x \neq -4, -3, -2$$

e) $\frac{(2-\frac{4}{y})y}{(y-\frac{4}{y})y}$ ← complex or compound rational expression (ie. a fraction in a fraction)

$y \neq 0$

$$= \frac{2y-4}{y^2-4}$$

$$= \frac{2(y-2)}{(y+2)(y-2)}, \quad y \neq \pm 2$$

$$= \frac{2}{y+2}, \quad y \neq 0, \pm 2$$