

Adding and Subtracting Rational Expressions

Same Denominators

$$\frac{2}{15} + \frac{7}{15} = \frac{9 \div 3}{15 \div 3} = \frac{3}{5}$$

Step 1: Add or subtract the numerators and write as one fraction.

Step 2: Factor numerator and denominator completely.

Step 3: Cancel common factors.

1. Add or subtract the rational expressions.

$$\text{a) } \frac{5}{6x} + \frac{11}{6x} = \frac{16 \div 2}{6x \div 2} = \boxed{\frac{8}{3x}}$$

$$\text{b) } \frac{5}{x+2} - \frac{3}{x+2} = \boxed{\frac{2}{x+2}}$$

$$c) \frac{x^2}{x+3} + \frac{3x}{x+3} = \frac{x^2 + 3x}{x+3} = \frac{x(x+3)}{\cancel{x+3}} = \boxed{x}$$

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

$$e) \frac{x^2 - 4x}{x^2 - 9} - \frac{3x - 12}{x^2 - 9} = \frac{x^2 - 4x - (3x - 12)}{x^2 - 9} = \frac{x^2 - 4x - 3x + 12}{x^2 - 9}$$

$$= \frac{x^2 - 7x + 12}{x^2 - 9} = \frac{(x-4)(\cancel{x-3})}{(x+3)(\cancel{x-3})} = \boxed{\frac{x-4}{x+3}}$$

Different Denominators

$$\frac{8 \cdot 2}{8 \cdot 7} - \frac{3 \cdot 7}{8 \cdot 7} = \frac{16}{56} - \frac{21}{56} = \frac{-5}{56}$$

LCD = 56

- Step 1: Find the LCD and multiply each fraction by what is missing in the LCD.
Step 2: Add or subtract the numerators and write as one fraction.
Step 3: Factor numerator and denominator completely.
Step 4: Cancel common factors.

2. Add or subtract the rational expressions.

$$\text{a) } \frac{5 \cdot 2}{5 \cdot x} + \frac{3}{5x} = \frac{10}{5x} + \frac{3}{5x} = \boxed{\frac{13}{5x}}$$

LCD = 5x

$$\text{b) } \frac{(a+1) \cdot 5}{a} + \frac{3 \cdot a}{(a+1) \cdot a}$$

LCD = a(a+1)

$$\frac{5(a+1)}{a(a+1)} + \frac{3a}{a(a+1)} = \frac{5(a+1) + 3a}{a(a+1)} = \frac{5a+5+3a}{a(a+1)} = \boxed{\frac{8a+5}{a(a+1)}}$$

$$\frac{(y-4) \cdot \frac{2y}{y+3} + \frac{y-1}{y-4} \cdot (y+3)}{(y-4)(y+3)}$$

$$\text{LCD} = (y+3)(y-4)$$

$$\frac{2y(y-4)}{(y-4)(y+3)} + \frac{(y-1)(y+3)}{(y-4)(y+3)} = \frac{2y(y-4) + (y-1)(y+3)}{(y-4)(y+3)}$$

FOIL

$$\frac{2y^2 - 8y + y^2 + 3y - y - 3}{(y-4)(y+3)} = \frac{3y^2 - 6y - 3}{(y-4)(y+3)} = \frac{3(y^2 - 2y - 1)}{(y-4)(y+3)}$$

GCF = 3

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

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

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

$$e) \frac{2}{x-5} - \frac{5x-3}{x^2+x-30} = \frac{(x+6) \cdot 2}{(x+6)(x-5)} - \frac{5x-3}{(x-5)(x+6)} = \frac{2(x+6) - 5x-3}{(x-5)(x+6)}$$

$1 \cdot 30$
 $2 \cdot 15$
 $3 \cdot 10$
 $5 \cdot 6$

$$\text{LCD} = (x-5)(x+6)$$

$$\frac{2(x+6) - (5x-3)}{(x-5)(x+6)} = \frac{2x+12-5x+3}{(x-5)(x+6)} = \frac{-3x+15}{(x-5)(x+6)} \quad \text{GCF} = -3$$

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