

Solutions

1. Simplify. State any restrictions on the variables.

a) $\frac{1}{3} + \frac{5}{4}$

No restrictions

$$= \frac{1(4)}{3(4)} + \frac{5(3)}{4(3)}$$

$$= \frac{4}{12} + \frac{15}{12}$$

$$= \frac{19}{12}$$

c) $\frac{5}{4x^2} + \frac{1}{7x^3}$

$$x \neq 0$$

$$= \frac{5(7x)}{4x^2(7x)} + \frac{1(4)}{7x^3(4)}$$

$$= \frac{35x}{28x^3} + \frac{4}{28x^3}$$

$$= \frac{35x + 4}{28x^3}$$

1. Simplify. State any restrictions on the variables.

b) $\frac{2x}{5} + \frac{6x}{2}$

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

No restrictions

$$= \frac{2x(2)}{5(2)} + \frac{6x(5)}{2(5)}$$

$$= \frac{4x}{10} + \frac{30x}{10}$$

$$= \frac{34x}{10}$$

$$= \frac{17x}{5}$$

$$x \neq 0$$

$$= \frac{2(x)}{x(x)} + \frac{6}{x^2}$$

$$= \frac{2x}{x^2} + \frac{6}{x^2}$$

$$= \frac{2x+6}{x^2}$$

2. Simplify. State any restrictions on the variables.

a) $\frac{5}{9} - \frac{2}{3}$

c) $\frac{5}{3x^2} - \frac{7}{5}$

No restrictions

$$= \frac{5}{9} - \frac{2(3)}{3(3)}$$

$$= \frac{5}{9} - \frac{6}{9}$$

$$= -\frac{1}{9}$$

$$x \neq 0$$

$$= \frac{5(5)}{3x^2(5)} - \frac{7(3x^2)}{5(3x^2)}$$

$$= \frac{25}{15x^2} - \frac{21x^2}{15x^2}$$

$$= \frac{25-21x^2}{15x^2}$$

2. Simplify. State any restrictions on the variables.

b) $\frac{5y}{3} - \frac{y}{2}$

d) $\frac{6}{3xy} - \frac{5}{y^2}$

No restrictions

$$= \frac{5y(2)}{3(2)} - \frac{y(3)}{2(3)}$$

$$= \frac{10y}{6} - \frac{3y}{6}$$

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

$$x \neq 0, y \neq 0$$

$$= \frac{6(y)}{3xy(y)} - \frac{5(3x)}{y^2(3x)}$$

$$= \frac{6y}{3xy^2} - \frac{15x}{3xy^2}$$

$$= \frac{6y - 15x}{3xy^2}$$

3. Simplify. State any restrictions on the variables.

a) $\frac{3}{x-3} - \frac{7}{5x-1}$

$$x \neq 3, \quad 5x \neq 1$$

$$x \neq \frac{1}{5}$$

$$= \frac{3(5x-1)}{(x-3)(5x-1)} - \frac{7(x-3)}{(5x-1)(x-3)}$$

$$= \frac{(15x-3) - (7x-21)}{(x-3)(5x-1)}$$

$$= \frac{15x-3-7x+21}{(x-3)(5x-1)}$$

$$= \frac{8x+18}{(x-3)(5x-1)}$$

3. Simplify. State any restrictions on the variables.

$$\text{b) } \frac{2}{x+3} + \frac{7}{x^2-9}$$

$$x \neq -3, x^2 \neq 9 \\ x \neq \pm 3$$

$$= \frac{2}{(x+3)} + \frac{7}{(x+3)(x-3)}$$

$$= \frac{2(x-3)}{(x+3)(x-3)} + \frac{7}{(x+3)(x-3)}$$

$$= \frac{2x-6+7}{(x+3)(x-3)} = \frac{2x+1}{(x+3)(x-3)}$$

3. Simplify. State any restrictions on the variables.

$$\text{c) } \frac{5}{x^2-4x+3} - \frac{9}{x^2-2x+1}$$

$$= \frac{5}{(x-3)(x-1)} - \frac{9}{(x-1)(x-1)} \quad x \neq 3, 1$$

$$= \frac{5(x-1)}{(x-3)(x-1)(x-1)} - \frac{9(x-3)}{(x-1)(x-1)(x-3)}$$

$$= \frac{(5x-5) - (9x-27)}{(x-3)(x-1)(x-1)}$$

$$= \frac{5x-5-9x+27}{(x-3)(x-1)^2} = \frac{-4x+22}{(x-3)(x-1)^2}$$

6. Simplify. State any restrictions on the variables.

$$a) \frac{7}{a-4} + \frac{2}{a}$$

$$a \neq 4, a \neq 0$$

$$= \frac{7(a)}{(a-4)(a)} + \frac{2(a-4)}{a(a-4)}$$

$$= \frac{7a}{a(a-4)} + \frac{2a-8}{a(a-4)}$$

$$= \frac{9a-8}{a(a-4)}$$

6. Simplify. State any restrictions on the variables.

$$c) \frac{5}{x+4} + \frac{7}{x+3}$$

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

$$= \frac{5(x+3)}{(x+4)(x+3)} + \frac{7(x+4)}{(x+3)(x+4)}$$

$$= \frac{5x+15}{(x+4)(x+3)} + \frac{7x+28}{(x+3)(x+4)}$$

$$= \frac{12x+43}{(x+4)(x+3)}$$

6. Simplify. State any restrictions on the variables.

$$\begin{aligned}
 \text{f) } & \frac{7}{2x-6} + \frac{4}{10x-15} && x \neq 3, 2x \neq 3 \\
 & && x \neq \frac{3}{2} \\
 = & \frac{7}{2(x-3)} + \frac{4}{5(2x-3)} \\
 = & \frac{7(2x-3)(5)}{2(x-3)(2x-3)(5)} + \frac{4(x-3)(2)}{5(2x-3)(x-3)(2)} \\
 = & \frac{70x-105}{10(x-3)(2x-3)} + \frac{8x-24}{10(2x-3)(x-3)} \\
 = & \frac{78x-129}{10(x-3)(2x-3)}
 \end{aligned}$$

7. Simplify. State any restrictions on the variables.

$$\begin{aligned}
 \text{a) } & \frac{3}{x+1} + \frac{4}{x^2-3x-4} && x \neq -1, x \neq 4 \\
 = & \frac{3}{x+1} + \frac{4}{(x-4)(x+1)} \\
 = & \frac{3(x-4)}{(x+1)(x-4)} + \frac{4}{(x-4)(x+1)} \\
 = & \frac{3x-12}{(x+1)(x-4)} + \frac{4}{(x-4)(x+1)} \\
 = & \frac{3x-8}{(x+1)(x-4)}
 \end{aligned}$$

7. Simplify. State any restrictions on the variables.

$$\begin{aligned}
 \text{c) } & \frac{3}{t^2 + t - 6} + \frac{5}{(t+3)^2} \\
 &= \frac{3}{(t+3)(t-2)} + \frac{5}{(t+3)(t+3)} \quad t \neq -3, 2 \\
 &= \frac{3(t+3)}{(t+3)(t-2)(t+3)} + \frac{5(t-2)}{(t+3)(t+3)(t-2)} \\
 &= \frac{3t+9}{(t-2)(t+3)(t+3)} + \frac{5t-10}{(t-2)(t+3)(t+3)} \\
 &= \frac{8t-1}{(t-2)(t+3)^2}
 \end{aligned}$$

7. Simplify. State any restrictions on the variables.

$$\begin{aligned}
 \text{e) } & \frac{x-1}{x^2-9} + \frac{x+7}{x^2-5x+6} \\
 &= \frac{x-1}{(x+3)(x-3)} + \frac{x+7}{(x-2)(x-3)} \quad x \neq -3, 3, 2 \\
 &= \frac{(x-1)(x-2)}{(x+3)(x-3)(x-2)} + \frac{(x+7)(x+3)}{(x-2)(x-3)(x+3)} \\
 &= \frac{x^2-3x+2}{(x+3)(x-3)(x-2)} + \frac{x^2+10x+21}{(x-2)(x-3)(x+3)} \\
 &= \frac{2x^2+7x+23}{(x+3)(x-3)(x-2)}
 \end{aligned}$$

10. Simplify. State any restrictions on the variables.

a) $\frac{3m+2}{2} + \frac{4m+5}{5}$

No restrictions

$$= \frac{5(3m+2)}{5(2)} + \frac{2(4m+5)}{2(5)}$$

$$= \frac{15m+10}{10} + \frac{8m+10}{10}$$

$$= \frac{23m+20}{10}$$

10. Simplify. State any restrictions on the variables.

b) $\frac{5}{x^2} - \frac{3}{4x^3}$ $x \neq 0$

$$= \frac{5(4x)}{x^2(4x)} - \frac{3}{4x^3}$$

$$= \frac{20x}{4x^3} - \frac{3}{4x^3}$$

$$= \frac{20x-3}{4x^3}$$

10. Simplify. State any restrictions on the variables.

$$\begin{aligned}
 \text{c) } & \frac{2}{y+1} - \frac{3}{y-2} && y \neq -1, y \neq 2 \\
 & = \frac{2(y-2)}{(y+1)(y-2)} - \frac{3(y+1)}{(y-2)(y+1)} \\
 & = \frac{(2y-4)}{(y+1)(y-2)} - \frac{(3y+3)}{(y-2)(y+1)} \\
 & = \frac{2y-4-3y-3}{(y+1)(y-2)} = \frac{-y-7}{(y+1)(y-2)}
 \end{aligned}$$

10. Simplify. State any restrictions on the variables.

$$\begin{aligned}
 \text{d) } & \frac{2x}{x^2+x-6} + \frac{5}{x^2+2x-8} && x \neq -3, 2, \\
 & && x \neq -4, 2 \\
 & = \frac{2x}{(x+3)(x-2)} + \frac{5}{(x+4)(x-2)} \\
 & = \frac{2x(x+4)}{(x+3)(x-2)(x+4)} + \frac{5(x+3)}{(x+4)(x-2)(x+3)} \\
 & = \frac{2x^2+8x}{(x+3)(x-2)(x+4)} + \frac{5x+15}{(x+4)(x-2)(x+3)} \\
 & = \frac{2x^2+13x+15}{(x+3)(x-2)(x+4)}
 \end{aligned}$$