

$$\text{a) } \frac{x-3}{5} - \frac{5}{x-3} = 8-x$$

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$$\begin{aligned} \frac{x-3}{5} - \frac{5}{x-3} &= 8-x && | \cdot 5(x-3) \\ (x-3)^2 - 25 &= 5(x-3)(8-x) \\ x^2 - 6x + 9 - 25 &= 5(8x - x^2 - 24 + 3x) \\ x^2 - 6x + 9 - 25 &= 40x - 5x^2 - 120 + 15x \\ 6x^2 - 61x + 104 &= 0 \end{aligned}$$

$$x_{1,2} = \frac{61 \pm \sqrt{61^2 - 24 \cdot 104}}{12} = \frac{61 \pm 35}{12}$$

$$\mathbf{x_1 = 8}$$

$$\mathbf{x_2 = \frac{13}{6}}$$

$$\text{b) } \frac{6(3x-2)}{3x-5} = 12x-13$$

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$$\begin{aligned} \frac{6(3x-2)}{3x-5} &= 12x-13 && | \cdot (3x-5) \\ 6(3x-2) &= (12x-13)(3x-5) \\ 18x-12 &= 36x^2 - 60x - 39x + 65 \\ 0 &= 36x^2 - 117x + 77 \end{aligned}$$

$$x_{1,2} = \frac{117 \pm \sqrt{117^2 - 4 \cdot 36 \cdot 77}}{72} = \frac{117 \pm 51}{72}$$

$$\mathbf{x_1 = \frac{7}{3}}$$

$$\mathbf{x_2 = \frac{11}{12}}$$

$$c) \quad \frac{5}{x+1} + \frac{6}{x+2} = \frac{14}{x+3}$$


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$$\begin{aligned} \frac{5}{x+1} + \frac{6}{x+2} &= \frac{14}{x+3} & | \cdot (x+1)(x+2)(x+3) \\ 5(x+2)(x+3) + 6(x+1)(x+3) &= 14(x+1)(x+2) \\ 5(x^2 + 5x + 6) + 6(x^2 + 4x + 3) &= 14(x^2 + 3x + 2) \\ 5x^2 + 25x + 30 + 6x^2 + 24x + 18 &= 14x^2 + 42x + 28 \\ 11x^2 + 49x + 48 &= 14x^2 + 42x + 28 \\ 0 &= 3x^2 - 7x - 20 \\ x_{1,2} &= \frac{7 \pm \sqrt{49 + 240}}{6} = \frac{7 \pm 17}{6} \\ \\ \mathbf{x_1} &= \mathbf{4} \\ \mathbf{x_2} &= \mathbf{-\frac{5}{3}} \end{aligned}$$

$$d) \quad \frac{2x-11}{x-3} + \frac{x-2}{6} + \frac{x-8}{2} = 0$$


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$$\begin{aligned} \frac{2x-11}{x-3} + \frac{x-2}{6} + \frac{x-8}{2} &= 0 & | \cdot 6(x-3) \\ 6(2x-11) + (x-2)(x-3) + 3(x-8)(x-3) &= 0 \\ 12x - 66 + x^2 - 5x + 6 + 3(x^2 - 11x + 24) &= 0 \\ x^2 + 7x - 60 + 3x^2 - 33x + 72 &= 0 \\ 4x^2 - 26x + 12 &= 0 \\ 2x^2 - 13x + 6 &= 0 \\ x_{1,2} &= \frac{13 \pm \sqrt{169 - 48}}{4} = \frac{13 \pm 11}{4} \\ \\ \mathbf{x_1} &= \mathbf{6} \\ \mathbf{x_2} &= \mathbf{\frac{1}{2}} \end{aligned}$$