



1 Solve $\frac{x+3}{2} = 5$

(2 marks)

$$\begin{array}{rcl} \frac{x+3}{2} & = & 5 \\ \times 2 & & \\ x+3 & = & 10 \\ -3 & & \\ x & = & 7 \end{array}$$

$x = 7$

2 Solve $\frac{x}{3} + 2 = 6$

(2 marks)

$$\begin{array}{rcl} \frac{x}{3} + 2 & = & 6 \\ -2 & & \\ \frac{x}{3} & = & 4 \\ \times 3 & & \\ x & = & 12 \end{array}$$

$x = 12$

3 Solve $\frac{2x-1}{3} = 5$

(2 marks)

$$\begin{array}{rcl} \frac{2x-1}{3} & = & 5 \\ \times 3 & & \\ 2x-1 & = & 15 \\ +1 & & \\ 2x & = & 16 \\ \div 2 & & \\ x & = & 8 \end{array}$$

$x = 8$

4 Solve $\frac{x}{2} + \frac{x}{3} = 10$

(3 marks)

$$\begin{array}{rcl} \frac{x}{2} + \frac{x}{3} & = & 10 \\ \times 6 & & \times 6 \\ 3x + 2x & = & 60 \\ 5x & = & 60 \\ \div 5 & & \div 5 \\ x & = & 12 \end{array}$$

$x = 12$

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

(3 marks)

$$\begin{array}{rcl} \frac{x+4}{3} & = & \frac{2x-1}{5} \\ \times 15 & & \times 15 \\ 5(x+4) & = & 3(2x-1) \\ 5x+20 & = & 6x-3 \\ -5x & & -5x \\ 20 & = & x-3 \\ +3 & & +3 \\ 23 & = & x \end{array}$$

$x = 23$

6 Solve $\frac{12}{x-3} = 3$

(3 marks)

$$\begin{array}{rcl} \frac{12}{x-3} & = & 3 \\ \times (x-3) & & \times (x-3) \\ 12 & = & 3(x-3) \\ 12 & = & 3x-9 \\ +9 & & +9 \\ 21 & = & 3x \\ \div 3 & & \div 3 \\ 7 & = & x \end{array}$$

$x = 7$

7 Solve $\frac{x+3}{4} + \frac{x-1}{3} = 8$

(4 marks)

$$\begin{array}{rcl} \frac{x+3}{4} + \frac{x-1}{3} & = & 8 \\ \times 12 & & \times 12 \\ 3(x+3) + 4(x-1) & = & 96 \\ 3x + 9 + 4x - 4 & = & 96 \\ 7x + 5 & = & 96 \\ -5 & & -5 \\ 7x & = & 91 \\ \div 7 & & \div 7 \\ x & = & 13 \end{array}$$

$x = 13$

8 Solve $\frac{6}{x+1} = \frac{4}{x-1}$

(4 marks)

$$\begin{array}{rcl} \frac{6}{x+1} & = & \frac{4}{x-1} \\ \text{cross multiply} & & \text{cross multiply} \\ 6(x-1) & = & 4(x+1) \\ 6x - 6 & = & 4x + 4 \\ -4x & & -4x \\ 2x - 6 & = & 4 \\ +6 & & +6 \\ 2x & = & 10 \\ \div 2 & & \div 2 \\ x & = & 5 \end{array}$$

$x = 5$

9 Solve $\frac{2x+1}{3} - \frac{x-4}{2} = 2$

(4 marks)

$$\begin{array}{rcl} \frac{2x+1}{3} - \frac{x-4}{2} & = & 2 \\ \times 6 & & \times 6 \\ 2(2x+1) - 3(x-4) & = & 12 \\ 4x + 2 - 3x + 12 & = & 12 \\ x + 14 & = & 12 \\ -14 & & -14 \\ x & = & -2 \end{array}$$

$x = -2$

10

Solve

$$\frac{x+4}{3} + \frac{2x-1}{5} = 7$$

(3 marks)

Multiply every term by 15

$$5(x+4) + 3(2x-1) = 105$$

Expand

$$5x + 20 + 6x - 3 = 105$$

Simplify

$$11x + 17 = 105, \text{ so } 11x = 88$$

$$x = 8. \text{ Check: } \frac{12}{3} + \frac{15}{5} = 4 + 3 = 7$$

$$x = 8$$

11

Solve

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

(4 marks)

The original expression is defined only when $x \neq 1$ and $x \neq -2$. A denominator cannot be zero. These restrictions still apply after simplifying

$$\frac{x(x-1)(x+2)}{x(x-1)(x+2)} \cdot \frac{4(x+2) - 2(x-1)}{x(x-1)(x+2)} = \frac{(x-1)(x+2)}{x(x-1)(x+2)}$$

Expand

$$4x + 8 - 2x + 2 = x^2 + x - 2, \text{ so } 2x + 10 = x^2 + x - 2$$

Rearrange

$$x^2 - x - 12 = 0$$

Factorise

$$(x-4)(x+3) = 0, \text{ so } x = 4 \text{ or } x = -3$$

$$\text{Check } x = 4: \frac{4}{3} - \frac{2}{6} = \frac{4}{3} - \frac{1}{3} = 1. \text{ Check } x = -3: \frac{4}{-4} - \frac{2}{-1} = -1 + 2 = 1$$

$$2 = 1$$

$$x = 4 \text{ or } x = -3$$

a. Simplify fully $\frac{2x^2 + 5x - 3}{x^2 - 9}$

b. Hence, or otherwise, solve

$$\frac{2x^2 + 5x - 3}{x^2 - 9} = 5$$

(6 marks)

The original expression is defined only when $x \neq 3$ and $x \neq -3$. A denominator cannot be zero. These restrictions still apply after simplifying

a) Factorise

$$2x^2 + 5x - 3 = (2x - 1)(x + 3) \text{ and } x^2 - 9 = (x - 3)(x + 3)$$

a) Cancel $(x + 3)$ to get $\frac{2x - 1}{x - 3}$

$$\text{b) Using part a, solve } \frac{2x - 1}{x - 3} = 5$$

b) Multiply up

$$2x - 1 = 5(x - 3) = 5x - 15$$

$$\text{b) So } 14 = 3x, \text{ giving } x = \frac{14}{3}$$

b) Check

$$\text{at } x = \frac{14}{3} \text{ the original fraction is } \frac{575}{9} \frac{115}{9} = 5$$

Cancel common factors only: dividing the whole numerator and denominator by the same nonzero factor leaves the fraction unchanged. You cannot cancel individual terms joined by + or -

13

Solve

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

Give your answers in the form $a \pm \sqrt{b}$ where a and b are integers.

(5 marks)

The original expression is defined only when $x \neq 2$ and $x \neq -1$. A denominator cannot be zero. These restrictions still apply after simplifying

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

Expand

$$3x - 3 = 3(x^2 - x - 2)$$

Divide by 3

$$x - 1 = x^2 - x - 2, \text{ so } x^2 - 2x - 1 = 0$$

Complete the square

$$(x-1)^2 = 2$$

$$x = 1 \pm \sqrt{2}. \text{ Check } x = 1 + \sqrt{2}: \frac{1}{\sqrt{2}-1} + \frac{2}{2+\sqrt{2}} = (\sqrt{2}+1) +$$

$$(2 - \sqrt{2}) = 3$$

$$x = 1 + \sqrt{2} \text{ or } x = 1 - \sqrt{2}$$