

13.4 Exercises

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

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

① Isolate "x" term:

$$\begin{array}{c} +2 \quad -\frac{x}{3} \quad -\frac{x}{3} \quad +2 \\ \Rightarrow 2 = \frac{x}{2} - \frac{x}{3} \Rightarrow 2 = \frac{x \cdot 3}{2 \cdot 3} - \frac{x \cdot 2}{3 \cdot 2} \end{array}$$

$$\Rightarrow 2 = \frac{3x}{6} - \frac{2x}{6} \Rightarrow 2 = \frac{3x-2x}{6} \Rightarrow 2 = \frac{x}{6}$$

$$\Rightarrow 2 \cdot 6 = \frac{x}{6} \cdot 6 \Rightarrow \boxed{12 = x}$$

2. Solve $-\frac{2}{x+2} - 3 = \frac{x}{x+2}$.

Method 1

Isolate "x" term: $+\frac{2}{x+2} \quad +\frac{2}{x+2}$

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

which is impossible! There is NO solution

Method 2

Simplify it on the both sides:

$$\text{LHS} = -\frac{2}{x+2} - 3 = -\frac{2}{x+2} - \frac{3(x+2)}{x+2} = \frac{-2-3x-6}{(x+2)} = \frac{-8-3x}{(x+2)}$$

$$\text{RHS} = \frac{x}{x+2}$$

 $\Rightarrow \text{LHS} = \text{RHS}$ we get

$$\cancel{(x+2)} \cdot \frac{-8-3x}{x+2} = \frac{x}{x+2} \cdot \cancel{(x+2)} \quad (\text{but } x+2 \neq 0 \Rightarrow x \neq -2)$$

$$\Rightarrow \begin{array}{c} -8-3x \\ +3x \quad +3x \end{array} = \begin{array}{c} x \\ -4 \quad -4 \end{array} \Rightarrow -8 = 4x \Rightarrow -2 = x$$

but x cannot be -2 \Rightarrow There is NO answer.

3. Solve $\frac{x}{x^2 - 3x + 2} = \frac{2x}{x-2} + 1$. $\Rightarrow \frac{x}{(x-2)(x-1)} = \frac{2x}{x-2} + \frac{x-2}{x-2}$

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

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

$\Rightarrow X = 3x^2 - 5x + 2 \Rightarrow 0 = 3x^2 - 6x + 2 \rightarrow 36 - 24 = 12$

By formula, $X = \frac{6 \pm \sqrt{(-6)^2 - 4 \cdot 3 \cdot 2}}{2 \cdot 3} = \frac{6 \pm \sqrt{12}}{6} = \frac{3 \pm \sqrt{3}}{3}$

$\Rightarrow X = \frac{3 \pm \sqrt{3}}{3}$

4. Suppose it takes Ariane 8 hours to row back and forth to a bridge 6 miles away from her camp when the current is 1 mile an hour. How fast would she row in still water?

Let x be the speed (mile/hour)

From camp to bridge, she needs $\frac{6}{x+1}$ hours

From bridge to camp, she needs $\frac{6}{x-1}$ hours

Totally it needs 8 hours

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

$\Rightarrow \frac{6}{x+1} + \frac{6}{x-1} = 8 \Rightarrow \frac{6}{x+1} + \frac{6}{x-1} = 8 \cdot \frac{(x+1)(x-1)}{(x+1)(x-1)}$

$\Rightarrow 6(x-1) + 6(x+1) = 8(x^2-1)$

$\Rightarrow 6x-6+6x+6 = 8x^2-8$

$\Rightarrow 12x = 8x^2-8 \Rightarrow 0 = 8x^2-12x-8$

$\Rightarrow 0 = 4(2x^2-3x-2) \Rightarrow (x-2)(2x+1) = 0$

$\Rightarrow x-2=0$ or $2x+1=0$

$\Rightarrow x=2$ or $x=-\frac{1}{2}$

