

2.3. Solving 1-Step Equations

Solving 1-Step Equations with Adding and Subtracting

Example 1: Solve $x + 5 = 9$ using the opposite operation.

Solution:

Solve for x

$$\begin{array}{ccc} x + 5 & & 9 \\ \hline & \triangleq & \\ & = & \end{array} \quad LS = RS$$

Subtract 5 from x

$$\begin{array}{ccc} x + 5 - 5 & & 9 \\ \hline & \triangle < & \\ & < & \end{array} \quad LS < RS$$

Now, the left side is less than the right side:

$$\begin{array}{ccc} x & & 9 \\ \hline & \triangle < & \\ & < & \end{array}$$

Subtract 5 from the right side:

$$\begin{array}{ccc} x & & 9 - 5 \\ \hline & \triangleq & \\ & = & \end{array} \quad LS = RS$$

$x = 4$

$$\begin{array}{ccc} x & & 4 \\ \hline & \triangleq & \\ & = & \end{array}$$

Numerical solution:

$$\begin{array}{ll} x + 5 = 9 & | \text{subtract 5 from each side} \\ x + 5 - 5 = 9 - 5 & \\ x = 4 & \end{array}$$

Check:

$$\begin{array}{ll} x + 5 = 9 & | \text{replace the } x \text{ with } 4 \\ 4 + 5 = 9 & \\ 9 = 9 & \\ \text{Left Side} = \text{Right Side} & \text{Ok!} \end{array}$$

Example 2: Solve for x :

$$x + 2 = 5$$

Solution:

$$\begin{aligned}x + 2 &= 5 && | \text{subtract 2 from each side} \\x + 2 - 2 &= 5 - 2 \\x &= 3\end{aligned}$$

Check:

$$\begin{aligned}x + 2 &= 5 && | \text{substitute the } x \text{ with } 3 \\(3) + 2 &= 5 \\ \text{Left Side} &= \text{Right Side}\end{aligned}$$

Practice 1: Solve the equations. Check your solutions.

a) $x + 8 = 6$

b) $a + 4 = 4$

c) $6 + x = 8$

d) $3 + x = 20$

Example 3: Solve for x :

$$x - 4 = 10$$

Solution:

$$\begin{aligned}x - 4 &= 10 && | \text{add } 4 \text{ to each side} \\x - 4 + 4 &= 10 + 4 \\x &= 14\end{aligned}$$

Check:

$$\begin{aligned}x - 4 &= 10 && | \text{substitute the } x \text{ with } 14 \\(14) - 4 &= 10 \\10 &= 10 \\ \text{Left Side} &= \text{Right Side}\end{aligned}$$

Practice 2: Solve the equations. Check your solutions.

a) $x - 5 = 4$

b) $x - 3 = -10$

c) $-4 + x = -2$

d) $-12 + x = 24$

Solving 1-Step Equations with Multiplying and Dividing

Example 4: Solve $3x = 9$ using the opposite operation. Check to show that the left side (LS) equals the right side (RS).

Solution:

Solve for x

$$\begin{array}{ccc} 3x & & 9 \\ \hline & \triangleq & \\ & = & \end{array} \quad LS = RS$$

Divide $3x$ by 3

$$\begin{array}{ccc} 3x \div 3 & & 9 \\ \hline & \triangle < & \\ & < & \end{array} \quad LS < RS$$

Now, the left side is less than the right side:

$$\begin{array}{ccc} x & & 9 \\ \hline & \triangle < & \\ & < & \end{array}$$

Divide the other side by 3:

$$\begin{array}{ccc} x & & 9 \div 3 \\ \hline & \triangleq & \\ & = & \end{array} \quad LS = RS$$

$x = 3$

$$\begin{array}{ccc} x & & 3 \\ \hline & \triangleq & \\ & = & \end{array}$$

Numerical solution:

$$\begin{array}{ll} 3x = 9 & | \text{divide each side by 3} \\ 3x \div 3 = 9 \div 3 & \\ x = 3 & \end{array}$$

Check:

$$3x = 3(3) = 9 \quad \text{Ok!}$$

Example 5: Solve for x :

$$2x = 6$$

Solution:

$$\begin{array}{l} 2x = 6 \quad | \text{divide each side by } 2 \\ \frac{2x}{2} = \frac{6}{2} \\ x = 3 \end{array}$$

Check:

$$\begin{array}{l} 2x = 6 \quad | \text{substitute the } x \text{ with } 3 \\ 2(3) = 6 \\ 6 = 6 \\ \text{Left Side} = \text{Right Side} \end{array}$$

Practice 3: Solve the equations. Check solutions.

a) $4x = 12$

b) $-2z = 12$

c) $-3x = -18$

d) $15x = 45$

Example 6: Solve for x : $\frac{x}{2} = 4$

Solution:

$$\frac{x}{2} = 4$$

|multiply each side by 2

$$\frac{x}{2} \cdot 2 = 4 \cdot 2$$

$$x = 8$$

Check: $\frac{x}{2} = 4$

|substitute the x with 8

$$\frac{(8)}{2} = 4$$

$$4 = 4$$

Left Side = Right Side

Practice 4: Solve the equations. Check solutions.

a) $\frac{x}{2} = -5$

b) $\frac{x}{3} = 4$

c) $\frac{a}{5} = -3$

d) $\frac{a}{3} = 9$

Solving 1-Step Equations with Exponents and Roots

Example 7: Solve for x : $x^2 = 4$

Solution:

$$\begin{aligned}x^2 &= 4 && \text{|take the square root of each side} \\ \sqrt{x^2} &= \sqrt{4}\end{aligned}$$

We get 2 solutions:

$$x = 2 \quad \text{and} \quad x = -2$$

Check:

$$x^2 = 4 \quad \text{|substitute the } x \text{ with } 2$$

$$2^2 = 4$$

$$4 = 4$$

Left Side = Right Side

$$x^2 = 4 \quad \text{|substitute the } x \text{ with } -2$$

$$(-2)^2 = 4$$

$$4 = 4$$

Left Side = Right Side

Practice 5: Solve the equations. Check solutions.

a) $x^2 = 100$

b) $x^2 = \frac{16}{25}$