

# Lesson 1.2:

## Solving Multi-Step Equations

### Essential Question

How can you solve a multi-step equation? How can you check the reasonableness of your solution?



## Key Idea

### Solving Multi-Step Equations

To solve multi-step equations, use inverse operations to isolate the variable.

1. Combine like terms (variables on one side, numbers on the other)
2. Solve like a 1-step equation.
3. Check your answer.

The height (in feet) of a tree after  $x$  years is  $1.5x + 15$ .  
After how many years is the tree 24 feet tall?

$$\begin{array}{r}
 \underline{\underline{1.5x + 15}} = \underline{24} \\
 -15 \quad -15 \\
 \hline
 1.5x = 9 \\
 \div 1.5 \quad \div 1.5 \\
 \hline
 x = 6
 \end{array}$$

Combine like terms by getting numbers all on one side.

$$1.5(6) + 15 = 24$$

$$9 + 15 = 24$$

$$24 = 24 \checkmark$$

Solve  $8x - 6x - 25 = -35$ .

$$\begin{array}{r}
 8(-5) - 6(-5) - 25 = -35 \\
 -40 - (-30) - 25 = -35 \\
 -40 + 30 - 25 = -35 \\
 -10 - 25 = -35 \\
 -35 = -35 \checkmark
 \end{array}$$

$$\begin{array}{r|l}
 2x - 25 = -35 & \\
 +25 & +25 \\
 \hline
 2x = -10 & \\
 \div 2 & \div 2 \\
 \hline
 x = -5 &
 \end{array}$$

Solve the equation. Check your solution.

1.  $-3z + 1 = 7$

$$\begin{array}{r|l}
 -1 & -1 \\
 \hline
 -3z = 6 & \\
 \div -3 & \div -3 \\
 \hline
 z = -2 &
 \end{array}$$

$$\begin{array}{l}
 -3(-2) + 1 = 7 \\
 6 + 1 = 7 \checkmark
 \end{array}$$

2.  $\frac{1}{2}x - 9 = -25$

$$\begin{array}{r|l}
 +9 & +9 \\
 \hline
 \frac{1}{2}x = -16 & \\
 \cdot 2 & \cdot 2 \\
 \hline
 x = -32 &
 \end{array}$$

$$\begin{array}{l}
 \frac{1}{2}(-32) - 9 = -25 \\
 -16 - 9 = -25
 \end{array}$$

3.  $-4n - 8n + 17 = 23$

$$\begin{array}{r|l}
 -12n + 17 = 23 & \\
 -17 & -17 \\
 \hline
 -12n = 6 & \\
 \div -12 & \div -12 \\
 \hline
 n = -\frac{1}{2} &
 \end{array}$$

$$\begin{array}{l}
 -4(-\frac{1}{2}) - 8(-\frac{1}{2}) + 17 = 23 \\
 2 - (-4) + 17 = 23 \\
 6 + 17 = 23 \checkmark
 \end{array}$$

Solve  $2(1 - 5x) + 4 = -8$ .

$$2(1-5x)+4=-8$$

$$2-10x+4=-8$$

$$\begin{array}{r|l} 6-10x & = -8 \\ -6 & -6 \\ \hline -10x & = -14 \\ \div -10 & \div -10 \\ \hline x & = 1.4 \end{array}$$

$$\begin{array}{r|l} 2(1-5x)+4 & = -8 \\ -4 & +4 \\ \hline 2(1-5x) & = -12 \\ \div 2 & \div 2 \end{array}$$

$$\begin{array}{r|l} 1-5x & = -6 \\ -1 & +1 \\ \hline -5x & = -7 \\ \div -5 & \div -5 \end{array}$$

$$x = 1.4$$

If you are unsure if you can divide by the number that would be distributed, don't use that method and start by applying the Distributive Property (just to be safe).

Use the table to find the number of miles  $x$  you need to run on Friday so that the mean number of miles run per day is 1.5.

Day	Miles
Monday	2
Tuesday	0
Wednesday	1.5
Thursday	0
Friday	$x$

$$(2+0+1.5+0+x)/5 = 1.5$$

$$\begin{array}{r|l} 2+0+1.5+0+x & = 7.5 \\ -5 & -5 \\ \hline 2+1.5+x & = 7.5 \end{array}$$

$$\begin{array}{r|l} 3.5+x & = 7.5 \\ -3.5 & -3.5 \\ \hline x & = 4 \end{array}$$

$$\begin{aligned} (2+0+1.5+0+x)/5 & \\ & = 7.5/5 \\ & = 1.5 \end{aligned}$$

Solve the equation. Check your solution.

4.  $-3(x+2) + 5x = -9$

$$\begin{array}{r|l} -3x-6+5x & = -9 \\ +6 & +6 \\ \hline -3x+5x & = -3 \\ 2x & = -3 \\ \div 2 & \div 2 \\ \hline x & = -1.5 \end{array}$$

5.  $5 + 1.5(2d - 1) = 0.5$

$$\begin{array}{r|l} -5 & -5 \\ \hline 1.5(2d-1) & = -4.5 \\ 1.5 & 1.5 \\ \hline 2d-1 & = -3 \\ +1 & +1 \\ \hline 2d & = -2 \\ \div 2 & \div 2 \\ \hline d & = -1 \end{array}$$

6. You scored 88, 92, and 87 on three tests. Write and solve an equation to find the score you need on the fourth test so that your mean test score is 90.

$$(88+92+87+x)/4 = 90$$

$$(267+x)/4 = 90$$

93%

$$\begin{array}{r|l} \cdot 4 & \cdot 4 \\ \hline 267+x & = 360 \\ -267 & -267 \\ \hline x & = 93 \end{array}$$

Solve  $8x + 9 - 4x = 25$ . Check your solution.

$$8x - 4x + 9 = 25$$

$$4x + 9 = 25$$

$$\begin{array}{r|l} -9 & -9 \\ \hline 4x & = 16 \end{array}$$

$$4x = 16$$

$$\div 4 \quad \div 4$$

$$x = 4$$

$$8(4) - 4(4) + 9 = 25$$

$$32 - 16 + 9 = 25$$

$$16 + 9 = 25$$

$$25 = 25 \checkmark$$