

Lesson 4: Solving Equations

Topics and Objectives:


- Algebraic Equations
 - Definition of an Algebraic Equation
 - Verify that a given value is a solution to an equation
 - Equivalent Equations
- Solving One-Step Equations
 - Properties of Equality
- Solving Two Step Equations
- Solving Multi-Step Equations
- Solving Equations – Applications


Algebraic Equations


DEFINITION: An algebraic equation is a mathematical sentence connecting an expression to a value, variable, or another expression with an equal sign (=).

Verify that a given value is a solution to an equation

DEFINITION: The solution to an equation is the value that makes the equation true.


 **Example 1:** Verify that $x = -3$ is a solution to the algebraic equation $5x - 2 = 8x + 7$.

 **Example 2:** Is $m = -1$ a solution to the algebraic equation $m + 9 = 3m + 5$?

 **Example 3:** Is $a = 5$ a solution to the algebraic equation $-4(a + 1) = 6(1 - a)$?

Equivalent Equations

DEFINITION: Equivalent equations are two or more equations having the same solution.

 **Example 4:** Verify that $x = 2$ is a solution to the following equations.

$$8x - 5 = x + 9$$

$$7x - 5 = 9$$

$$7x = 14$$

YOU TRY

1. Verify that $p = -9$ is a solution to the algebraic equation $p - 4 = 2p + 5$

2. Is $x = 2$ is a solution to the algebraic equation $2(5x - 12) = 1 - 5(x - 1)$?

Solving One-Step Equations

Properties of Equality

The Addition/Subtraction Property of Equality:

$$\text{If } a = b, \text{ then } a + c = b + c.$$

$$\text{If } a = b, \text{ then } a - c = b - c$$

The Multiplication/Division Property of Equality:

$$\text{If } a = b, \text{ then } a \times c = b \times c.$$

$$\text{If } a = b \text{ and } c \neq 0, \text{ then } \frac{a}{c} = \frac{b}{c}$$

Solving an Equation

DEFINITION: To solve an equation means to “undo” all the operations of the equation, leaving the variable by itself on one side. This is known as **isolating the variable**.

Solve for the variable in each of the following equations. Check your answers.



Example 1: $x + 7 = 18$



Example 2: $r - 4 = -5$



Example 3: $-4 + b = 45$



Example 4: $3 = 19 + m$



Example 5: $-3y = -42$



Example 6: $\frac{x}{6} = -5$

 **Example 7:** $\frac{3}{4}a = 8$

 **Example 8:** $17 = -x$

YOU TRY

3. Solve for the variable in each equation and check your answer. Show all steps as in the MiniLesson examples.

a. $12 + x = -40$

b. $\frac{3}{5}n = -2$

c. $14 = -x$

d. $-3 = \frac{w}{5}$

Solving Two-Step Equations

STEPS FOR SOLVING A LINEAR TWO-STEP EQUATION

1. Apply the Addition/Subtraction Property of Equality.
2. Apply the Multiplication/Division Property of Equality to isolate the variable.
3. Check by substituting your answer into the original equation.

Solve for the variable in each of the following equations. Check your answers.



Example 1:

Solve: $2b - 4 = 12$

Check:



Example 2:

Solve: $4 + 3r = 5$

Check:



Example 3:

Solve: $3 = 19 - 2m$


Check:



Example 4:

Solve: $11 - y = 32$

Check:

 **Example 5:** Solve: $3 + \frac{3}{5}x = 12$

Check:

YOU TRY

4. Solve for the variable in each equation and check your answer. Show all steps as in the MiniLesson examples.

a. Solve: $14 - 3x = -40$

Check:

b. Solve: $\frac{3}{4}w - 8 = -2$

Check:

c. Solve: $14 = 2 - x$

Check:

Solving Multi-Step Equations

STEPS FOR SOLVING A LINEAR EQUATION

1. Simplify each side of the equation. Remove parenthesis if necessary. Collect like terms.
2. Add or subtract terms on each side of the equation so that all terms containing the variable are on one side and all constant terms are on the other side.
3. Simplify each side of the equation by combining like terms.
4. Apply the Multiplication/Division Property of Equality to isolate the variable.
5. Check by substituting the solution into the original equation.

Solve for the variable in each of the following equations. Check your answers.




Example 1: Solve $x - 5 = 4x + 7$

Check



Example 2: Solve $3(4n - 2) = 5(n + 3)$

Check

 **Example 3:** Solve $4 - (2y - 1) = 2(5y + 9) + y$

Check:

YOU TRY

5. Solve for the variable in each equation and check your answer. Show all steps as in the MiniLesson examples.

a. Solve $m - 5 = 8m + 2$


Check:

b. Solve $2(5x - 12) = -(5x - 6)$

Check:

Solving Equations – Applications

For each problem, determine the Givens and the Goal, then form a Strategy, Solve, and Check.
Write your answer in a complete sentence.

 **Example 1:** Sean owns a business that builds computers according to a customer's specifications. His profit, P , for producing and selling n computers is given by the equation $P = 900n - 2925$. How many computers does Sean need to sell in order to break even?

GIVEN:

GOAL:

STRATEGY:

SOLUTION:

CHECK:

FINAL RESULT AS A COMPLETE SENTENCE:

YOU TRY

For each problem, underline the Givens and circle the Goal. Form a strategy, solve, check, and write your answer in a complete sentence.

6. The cost of tuition at SCC is given by the equation $C = 76n$, where C represents the total cost of tuition and n represents the number of credits taken. If you have \$800 dollars to spend on tuition, how many credits can you take?

GIVEN:

GOAL:

STRATEGY:

SOLUTION:

CHECK:

FINAL RESULT AS A COMPLETE SENTENCE: