# 1-9 Equations and Their Solutions

*Learn* to determine whether a number is a solution of an equation.

# Vocabulary

equation

solution

# Equations and Their Solutions

Ella has 22 CDs. This is 9 more than her friend Kay has.

This situation can be written as an *equation*. An **equation** is a mathematical statement that two expressions are equal in value.

An equation is like a balanced scale.

| Number of CDs Ella has | is equal to | 9 more than Kay has |
|---|---|---|
| **22** | **=** | $\boldsymbol{j + 9}$ |

**Left expression**

**Right expression**

# 1-9 Equations and Their Solutions

Just as the weights on both sides of a balanced scale are exactly the same, the expressions on both sides of an equation represent exactly the same value.

When an equation contains a variable, a value of the variable that makes the statement true is called a **solution** of the equation.

$22 = j + 9$ $\quad$ $j = 13$ is a solution because $22 = 13 + 9$.

$22 = j + 9$ $\quad$ $j = 15$ is not a solution because $22 \neq 15 + 9$.

**Reading Math**

The symbol ≠ means "is not equal to."

## Additional Example 1A: Determining Whether a Number is a Solution of an Equation

**Determine whether the given value of the variable is a solution of $t + 9 = 17$.**

**26**

$$t + 9 = 17$$

$$26 + 9 \stackrel{?}{=} 17 \qquad \textit{Substitute 26 for t.}$$

$$35 \stackrel{?}{=} 17 \quad ✗$$

26 **is not** a solution of $t + 9 = 17$.

## Additional Example 1B: Determining Whether a Number is a Solution of an Equation

**Determine whether the given value of the variable is a solution of $t + 9 = 17$.**

**8**

$$t + 9 = 17$$

$$8 + 9 \stackrel{?}{=} 17 \qquad \textit{Substitute 8 for t.}$$

$$17 \stackrel{?}{=} 17 \checkmark$$

8 **is** a solution of $t + 9 = 17$.

## Check It Out: Example 1

**Determine whether each number is a solution of $x - 5 = 12$.**

**A. 22**

$$x - 5 = 12$$

$$22 - 5 \stackrel{?}{=} 12 \qquad \textit{Substitute 22 for x.}$$

$$17 \stackrel{?}{=} 12 \ \times$$

22 **is not** a solution of $x - 5 = 12$.

**B. 8**

$$x - 5 = 12$$

$$8 - 5 \stackrel{?}{=} 12 \qquad \textit{Substitute 8 for x.}$$

$$3 \stackrel{?}{=} 12 \ \times$$

8 **is not** a solution of $x - 5 = 12$.

## Additional Example 2: Writing an Equation to Determine Whether a Number is a Solution

**Mrs. Jenkins had $32 when she returned home from the supermarket. If she spent $17 at the supermarket, did she have $52 or $49 before she went shopping?**

You can write an equation to find the amount of money Mrs. Jenkins had before she went shopping. If *m* represents the amount of money she had before she went shopping, then $m - 17 = 32$.

**$52**

$m - 17 = 32$

$52 - 17 \stackrel{?}{=} 32$ *Substitute 52 for m.*

$35 \stackrel{?}{=} 32$ ✗

## Additional Example 2 Continued

**Mrs. Jenkins had $32 when she returned home from the supermarket. If she spent $17 at the supermarket, did she have $52 or $49 before she went shopping?**

You can write an equation to find the amount of money Mrs. Jenkins had before she went shopping. If *m* represents the amount of money she had before she went shopping, then $m - 17 = 32$.

**$49**

$m - 17 = 32$

$49 - 17 \stackrel{?}{=} 32$ *Substitute 49 for m.*

$32 \stackrel{?}{=} 32$ ✓

Mrs. Jenkins had $49 before she went shopping.

## Check It Out: Example 2

**Mr. Rorke had $12 when he returned home from buying a hat. If he spent $47 at the hat store, did he have $61 or $59 before he bought the hat?**

You can write an equation to find the amount of money Mr. Rorke had before he purchased a hat. If *m* represents the amount of money he had before he purchased a hat, then $m - 47 = 12$.

**$61**

$m - 47 = 12$

$61 - 47 \stackrel{?}{=} 12$ *Substitute 61 for h.*

$14 \stackrel{?}{=} 12$ ✗

## Check It Out: Example 2 Continued

**Mr. Rorke had $12 when he returned home from buying a hat. If he spent $47 at the hat store, did he have $59 or $61 before he bought the hat?**

You can write an equation to find the amount of money Mr. Rorke had before he purchased a hat. If *m* represents the amount of money he had before he purchased a hat, then $m - 47 = 12$.

**$59**

$m - 47 = 12$

$59 - 47 \stackrel{?}{=} 12$ *Substitute 59 for h.*

$12 \stackrel{?}{=} 12$ ✓

Mr. Rorke had $59 before he purchased a hat.

## Additional Example 3: Deriving a Real-World Situation from an Equation

**Which problem situation best matches the equation 5 + 2x = 13?**

**Situation A:**

Admission to the county fair costs $5 and rides cost $2 each. Mike spent a total of $13. How many rides did he go on?

$5 for admission → 5 +

$2 per ride → 2*x*

Mike spent $13 in all, so 5 + 2x = 13. Situation A matches the equation.

## Additional Example 3 Continued

**Which problem situation best matches the equation $5 + 2x = 13$?**

**Situation B:**

Admission to the county fair costs \$2 and rides cost \$5 each. Mike spent a total of \$13. How many rides did he go on?

The variable $x$ represents the number of rides that Mike bought.

\$5 per ride → $5x$

Since $5x$ is not a term in the given equation, Situation B does not match the equation.

## Check It Out: Example 3

**Which problem situation best matches the equation $13 + 4x = 25$?**

**Situation A:**

Admission to the baseball game costs $4 and souvenir hats cost $13 each. Trina spent a total of $25. How many souvenir hats did she buy?

The variable $x$ represents the number of souvenir hats Trina bought.

$13 per souvenir hat → $13x$

Since $13x$ is not a term in the given equation, Situation A does not match the equation.

## Check It Out: Example 3 Continued

**Which problem situation best matches the equation 13 + 4*x* = 25?**

**Situation B:**

Admission to the baseball game costs $13 and souvenir hats cost $4 each. Trina spent a total of $25. How many souvenir hats did she buy?

$13 for admission → 13 +

$4 per souvenir hat → 4*x*

Trina spent $25 in all, so 13 + 4x = 25. Situation B matches the equation.