NUMBER OF SOLUTIONS Equations do not always have one solution. An equation that is true for all values of the variable is an **identity**. So, the solution of an identity is all real numbers. Some equations have no solution.

EXAMPLE 4 **Identify the number of solutions of an equation**

Solve the equation, if possible.

a. $3x = 3(x + 4)$ **b.** $2x + 10 = 2(x + 5)$

Solution

a. $3x = 3(x + 4)$ **Original equation**

$3x = 3x + 12$ **Distributive property**

The equation $3x = 3x + 12$ is not true because the number $3x$ cannot be equal to 12 more than itself. So, the equation has no solution. This can be demonstrated by continuing to solve the equation.

$3x - 3x = 3x + 12 - 3x$ **Subtract 3x from each side.**

$0 = 12$ ✗   **Simplify.**

▶ The statement $0 = 12$ is not true, so the equation has no solution.

b. $2x + 10 = 2(x + 5)$ **Original equation**

$2x + 10 = 2x + 10$ **Distributive property**

▶ Notice that the statement $2x + 10 = 2x + 10$ is true for all values of x. So, the equation is an identity, and the solution is all real numbers.

✓ **GUIDED PRACTICE** **for Example 4**

Solve the equation, if possible.

8. $9z + 12 = 9(z + 3)$ **9.** $7w + 1 = 8w + 1$ **10.** $3(2a + 2) = 2(3a + 3)$

SOLVING LINEAR EQUATIONS You have learned several ways to transform an equation to an equivalent equation. These methods are combined in the steps listed below.

CONCEPT SUMMARY   *For Your Notebook*

Steps for Solving Linear Equations

STEP 1 **Use** the distributive property to remove any grouping symbols.

STEP 2 **Simplify** the expression on each side of the equation.

STEP 3 **Use** properties of equality to collect the variable terms on one side of the equation and the constant terms on the other side of the equation.

STEP 4 **Use** properties of equality to solve for the variable.

STEP 5 **Check** your solution in the original equation.