

6.4

Solving Equations Using Algebra

**Quick Review**

When you use *algebra* to solve an equation, you always perform the same operation on both sides of the equation. That is, whatever you do to one side of an equation, you must do the same to the other side.

Five more than three times a number is 23.

What is the number?

Let x represent the number.

Then 3 times the number is: $3x$

Five more than 3 times the number is: $3x + 5$

The equation is: $3x + 5 = 23$

Here are the steps to solve this equation:

Step 1: Isolate the variable by adding to or subtracting from each side.

In this case, to remove $+5$ from the left side, subtract 5 from each side.

$$\begin{array}{r} 3x + 5 - 5 = 23 - 5 \\ 3x \qquad = 18 \end{array}$$

Step 2: Divide each side by the numerical coefficient.

In this case, divide each side by 3.

$$\frac{3x}{3} = \frac{18}{3}$$

$$x = 6$$

Step 3: Verify the solution by substitution.

$$\begin{array}{ll} \text{Left side} = 3x + 5 & \text{Right side} = 23 \\ = 3(6) + 5 & \\ = 23 & \end{array}$$

Since the left side equals the right side, $x = 6$ is correct.

The number is 6.

In some equations, such as $5x = 40$, you can omit Step 1 because the variable term is already isolated. In this case, start with Step 2 and divide each side by 5 to get $x = 8$.

ex: $x + 3x + x + 11 - 3 + 5 = 12 - 24$

Practice

1. Solve each equation.

a) $8x - 7 = 9$

b) $9 = 3n - 6$

$$8x - 7 + \underline{\hspace{2cm}} = 9 + \underline{\hspace{2cm}}$$

$$8x = \underline{\hspace{2cm}}$$

$$x = \underline{\hspace{2cm}}$$

$$n = \underline{\hspace{2cm}}$$

2. Four less than two times a number is 6.

What is the number?

Let x represent the number.

Then 2 times the number is: $\underline{\hspace{2cm}}$

Four less than 2 times the number is: $\underline{\hspace{2cm}}$

The equation is: $\underline{\hspace{2cm}}$

Solve this equation:

To remove $\underline{\hspace{2cm}}$ from the left side, add $\underline{\hspace{2cm}}$ to each side.

$$2x \underline{\hspace{2cm}} = 6 + \underline{\hspace{2cm}}$$

$$2x = 10$$

Divide each side by $\underline{\hspace{2cm}}$

$$x = \underline{\hspace{2cm}}$$

Verify the solution.

$$\text{Left side} = 2x - 4$$

$$\text{Right side} = 6$$

$$= 2(\underline{\hspace{1cm}}) - 4$$

$$= \underline{\hspace{2cm}}$$

Since the left side equals the right side, $x = \underline{\hspace{2cm}}$ is correct.

The number is $\underline{\hspace{2cm}}$.

HINT

To solve an equation,
what you do to one
side, you must also do
to the other side.



3. Write, then solve, an equation to answer each question. Verify the solution.

a) Twice a number added to 8 is 14. Let n represent the number.

Equation: _____

To verify the solution, substitute $n =$ _____ into the equation.

Left side:

Right side:

b) Fourteen less than four times a number is equal to 6.

Let y represent the number.

Equation: _____

To verify the solution, substitute $y =$ _____ into the equation.

Left side:

Right side:

4. Solve each equation. Show your steps. Verify your solution.

a) $3w = 15$

b) $2x = 28$

c) $5y = 40$

d) $8z = 56$

5. Solve each equation. Show your steps. Verify your solution.

a) $3w - 2 = 13$

b) $2x - 4 = 12$

c) $5y - 6 = 14$

d) $7z - 16 = 12$

6. Solve each equation. Show your steps. Verify your solution.

a) $2w + 5 = 11$

b) $3x + 2 = 17$

c) $5y + 6 = 26$

d) $4z + 10 = 30$

7. Solve each equation. Verify your solution.

a) $2w - 5 = 11$

b) $5x + 12 = 52$

c) $13y = 91$

d) $6z - 15 = 57$

8. Write, then solve an equation to find each number. Verify your solution.

a) Seven less than three times a number is 17.

b) Eight more than four times a number is 20.

9. For each problem, write an equation you can use to solve the problem.

Solve the equation. Verify the solution.

a) Max has \$34 in his bank account.

He plans to deposit \$12 a week until he has \$130.

How many weeks will it take him? _____

b) Kenji is saving nickels in a jar. He has \$35 in nickels.

How many nickels are in the jar? _____