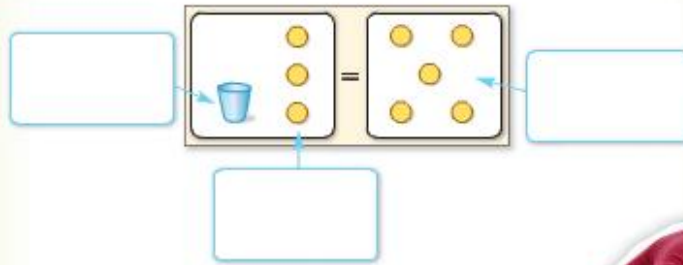# Solving One-Step Addition and Subtraction Equations

Warm-up: **Miniature Golf** On the second hole of miniature golf, it took Anne 3 putts to sink the golf ball. Her score is now 5. She represents this situation with cups and counters.

1. Fill in the boxes above using the phrases below:
   · Her score on the first hole is unknown.
   · Her score in now 5.
   · She scored a 3 on the second hole.

2. Write the addition equation shown in the figure.

   _____

3. Explain how to solve the equation.

   _____

4. What was Anne's score on the first hole? ☐

Solve an Equation By Subtracting

In Lesson 1, you mentally solved equations. Another way is to use **Inverse operations**, which *undo* each other. For example, to solve an addition equation, use subtraction.
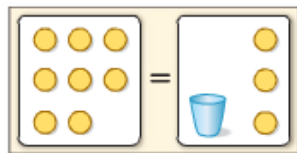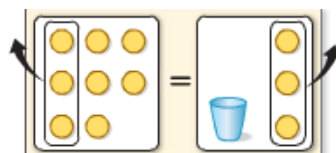
Example

1. Solve $8 = x + 3$. Check your solution.

   Method 1 Use models.

   Model the equation using counters for the numbers and a cup for the variable.

   Remove 3 counters from each side.

   There are 5 counters remaining.

Subtraction Property of Equality

Words If you subtract the same number from each side of an equation, the two sides remain equal.

Examples

Numbers	Algebra
$5 = 5$	$x + 2 = 3$
$-3 = -3$	$-2 = -2$
$2 = 2$	$x = 1$

$x = 1$

When you solve an equation by subtracting the same number from each side of the equation, you are using the **Subtraction Property of Equality**.

Method 2 Use symbols.

$8 = x + 3$	Write the equation.
$-3 = -3$	Subtract 3 from each side to "undo" the addition of 3 on the right.
$5 = x$	

Check

$8 = x + 3$	Write the equation.
$8 \overset{?}{=} 5 + 3$	Replace x with 5.
$8 = 8$ ✓	This sentence is true.

Using either method, the solution is 5.

Checking Solutions
You should always check your solution. You will know immediately whether your solution is correct or not.

Got It? Do these problems to find out.

Solve each equation. Check your solution.

$x + 5 = 6$

a. $c + 2 = 5$
$$-2 \quad -2$$
$$\boxed{c = 3}$$
$$3 + 2 = 5$$
$$5 = 5 ✓$$

b. $6 = x + 5$
$$-5 \quad -5$$
$$\boxed{1 = x}$$
$$6 = 1 + 5$$
$$6 = 6 ✓$$

c. $3.5 + y = 12.75$
$$y + 3.5 = 12.75$$
$$-3.5 \quad -3.50$$
$$\boxed{y = 9.25}$$
$$3.5 + 9.25 = 12.75$$
$$9.25 \quad 12.75 = 12.75 ✓$$
$$+3.50$$
$$\overline{12.75}$$

d. Suppose Ruben had 147.5 minutes of the 245.5 that were downloaded. Write and solve an addition equation to find how many minutes belong to Tariq.

$t = $ Tariq's minutes

$$\boxed{t = 98 \text{ min}}$$

$$147.5 + t = 245.5$$
$$-147.5 \quad -147.5$$
$$t = 98.0$$

$$147.5 + 98 = 245.5$$
$$147.5 \quad 245.5 = 245.5 ✓$$
$$+ \; 98.0$$
$$\overline{245.5}$$

Because addition and subtraction are inverse operations, you can solve a subtraction equation by adding.

Example

Tutor

1. Solve $x - 2 = 3$. Check your solution.

Method 1 Use models.

Model the equation.

x

|-----------x-----------|

3	2
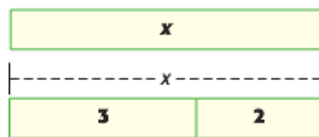
Work backward to solve the equation.
Rewrite the equation as an addition sentence and solve.
$3 + 2 = 5$

Addition Property of Equality

Words If you add the same number to each side of an equation, the two sides remain equal.

Examples

Numbers
$$5 = 5$$
$$+3 = +3$$
$$8 = 8$$

Algebra
$$x - 2 = 3$$
$$+2 = +2$$
$$x = 5$$

Method 2 Use symbols.

$$x - 2 = 3 \quad \text{Write the equation.}$$
$$+2 = +2 \quad \text{Add 2 to each side.}$$
$$x = 5 \quad \text{Simplify.}$$

Check

$$x - 2 = 3 \quad \text{Write the equation.}$$
$$5 - 2 \overset{?}{=} 3 \quad \text{Replace x with 5.}$$
$$3 = 3 ✓ \quad \text{This sentence is true.}$$

When you solve an equation by adding the same number to each side of the equation, you are using the **Addition Property of Equality**.

Using either method, the solution is 5.

Got It? Do these problems to find out.

Solve each equation. Check your solution.

a. $x - 7 = 4$

$$+7 \quad +7$$
$$x = 11$$
$$11 - 7 = 4$$
$$4 = 4 ✓$$

b. $y - 6 = 8$

$$+6 \quad +6$$
$$y = 14$$
$$14 - 6 = 8$$
$$8 = 8 ✓$$

c. $9 = a - 5$

d. Georgia's height is 4 inches less than Sienna's height. Georgia is 58 inches tall. Write and solve a subtraction equation to find Sienna's height.

$x =$ Sienna's height

$x - 4 = 58$

$x - 4 = 58$
$+4 \quad +4$
$x = 62$ in

$62 - 4 = 58$
$58 = 58$ ✓

Guided Practice

Solve each equation. Check your solution. (Example 1)

1. $y + 7 = 10$

2. $10 = 6 + e$

1. $a - 5 = 9$

2. $b - 3 = 7$

3. $4 = y - 8$

Show your work.

3. A board that measures 19.5 meters in length is cut into two pieces. One piece measures 7.2 meters. Write and solve an equation to find the length of the other piece. (Example 2)

$x =$ length of 2nd piece

$7.2 + x = 19.5$
$-7.2 \quad\quad -7.2$
$x = 12.3$ m

$7.2 + 12.3 = 19.5$
$19.5 = 19.5$ ✓

4. It takes 43 facial muscles to frown. This is 26 more muscles than it takes to smile. Write and solve an equation to find the number of muscles it takes to smile. (Example 3)

$s =$ smile muscles

$s = 17$ muscles

$s + 26 = 43$
$-26 \quad -26$

$17 + 26 = 43$
$43 = 43$ ✓

4. Catherine studied 1.25 hours for her science test. This was 0.5 hour less than she studied for her algebra test. Write and solve a subtraction equation to find how long she studied for her algebra test. (Examples 2 and 3)

$x =$ how long she studied

$x - 0.5 = 1.25$
$+0.5 \quad +.50$
$x = 1.75$ h

$1.75 - 0.5 = 1.25$
$1.25 = 1.25$ ✓