1.1--1.3

Solving One-Step Equations By Adding, Subtracting, Multiplying & Dividing

Solving Equations by Adding or Subtracting

A variable is a letter or a symbol used to represent a value that can change.

A constant is a value that does not change.

A numerical expression contains only constants and operations.

An algebraic expression may contain variables, constants, and operations.

1.1--1.3 Solving Equations by Adding or Subtracting

You will need to translate between algebraic expressions and words to be successful in math.

+ Plus, sum, increased by	− Minus, difference, less than
× Times, product, equal groups of	÷ Divided by, quotient

Solving Equations by Adding or Subtracting

Example 1: Translating from Algebra to Words

Give two ways to write each algebraic expression in words.

A. $9 + r$

the sum of 9 and r

9 increased by r

B. $q - 3$

the difference of q and 3

3 less than q

C. $7m$

the product of m and 7

m times 7

D. $j \div 6$

the quotient of j and 6

j divided by 6

Example 2: Translating from Words to Algebra

John types 62 words per minute. Write an expression for the number of words he types in *m* minutes.

***m* represents the number of minutes that John type**

$62 \cdot m$ or $62m$ *Think: m groups of 62 words*

Solving Equations by Adding or Subtracting

Example 3: Translating from Words to Algebra

Roberto is 4 years older than Emily, who is *y* years old. Write an expression for Roberto's age

***y* represents Emily's age.**

***y* + 4** *Think: "older than" means "greater than."*

Solving Equations by Adding or Subtracting

Example 4: Translating from Words to Algebra

Joey earns $5 for each car he washes. Write an expression for the number of cars Joey must wash to earn *d* dollars.

***d* represents the total amount that Joey will earn.**

$\frac{d}{5}$ *Think: How many groups of $5 are in d?*

Solving Equations by Adding or Subtracting

To <u>evaluate</u> an expression is to find its value.

To evaluate an algebraic expression,
substitute
numbers for the variables in the expression
and
then simplify the expression.

Solving Equations by Adding or Subtracting

Example 5

Evaluate each expression for $m = 3$, $n = 2$, and $p = 9$.

a. mn

$mn = 3 \cdot 2$ — *Substitute 3 for m and 2 for n.*

$= 6$ — *Simplify.*

b. $p - n$

$p - n = 9 - 2$ — *Substitute 9 for p and 2 for n.*

$= 7$ — *Simplify.*

c. $p \div m$

$p \div m = 9 \div 3$ — *Substitute 9 for p and 3 for m.*

$= 3$ — *Simplify.*

Example 6: Recycling Application

Approximately eighty-five 20-ounce plastic bottles must be recycled to produce the fiberfill for a sleeping bag.

Write an expression for the number of bottles needed to make *s* sleeping bags.

The expression 85*s* models the number of bottles to make *s* sleeping bags.

Solving Equations by Adding or Subtracting

Example 7

Solve the equation. Check your answer.

$$\frac{5}{16} = z - \frac{7}{16}$$

$$+\frac{7}{16} \qquad +\frac{7}{16}$$

$$\frac{3}{4} = z$$

Since $\frac{7}{16}$ is subtracted from z, add $\frac{7}{16}$ to both sides to undo the subtraction.

Check

$$\frac{5}{16} = z - \frac{7}{16}$$

$\frac{5}{16}$	$\frac{3}{4} - \frac{7}{16}$
$\frac{5}{16}$	$\frac{5}{16}$ ✓

To check your solution, substitute $\frac{3}{4}$ for z in the original equation.

Solving Equations by Adding or Subtracting

Example 8

A person's maximum heart rate is the highest rate, in beats per minute, that the person's heart should reach. One method to estimate maximum heart rate states that your age added to your maximum heart rate is 220. Using this method, write and solve an equation to find a person's age if the person's maximum heart rate is 185 beats per minute.

Solving Equations by Adding or Subtracting

Example 8 Continued

age	added to	maximum heart rate	is	220
a	+	r	=	220

$a + r = 220$

Write an equation to represent the relationship.

$a + 185 = 220$

$-185 \quad -185$

$a = 35$

Substitute 185 for r. Since 185 is added to a, subtract 185 from both sides to undo the addition.

A person whose maximum heart rate is 185 beats per minute would be 35 years old.

Solving Equations by Adding or Subtracting

Example 9

Solve the equation. Check your answer.

$$\frac{c}{8} = 7$$

$$(8)\left(\frac{c}{8}\right) = (8)(7)$$

$$c = 56$$

Since c is divided by 8, multiply both sides by 8 to undo the division.

Check

$$\frac{c}{8} = 7$$

$\frac{56}{8}$	7
7	7 ✓

To check your solution, substitute 56 for c in the original equation.

Solving Equations by Adding or Subtracting

Example 10

Solve the equation. Check your answer.

$$0.5y = -10$$

$$\frac{0.5y}{0.5} = \frac{-10}{0.5}$$

$$y = -20$$

Since y is multiplied by 0.5, divide both sides by 0.5 to undo the multiplication.

Check $0.5y = -10$

$0.5(-20)$	-10
-10	-10 ✓

To check your solution, substitute –20 for y in the original equation.

Solving Equations by Adding or Subtracting

Example 11

Solve the equation.

$$\frac{5}{6}w = -20$$

$$\left(\frac{6}{5}\right)\frac{5}{6}w = \left(\frac{6}{5}\right)(-20)$$

$$w = -24$$

The reciprocal of $\frac{5}{6}$ is $\frac{6}{5}$. Since w is multiplied by $\frac{5}{6}$, multiply both sides by $\frac{6}{5}$.

Check

$$\frac{5}{6}w = -20$$

$\left(\frac{5}{6}\right)(-24)$	-20
-20	-20 ✓

To check your solution, substitute –24 for w in the original equation.

Solving Equations by Adding or Subtracting

Example 12

Chad puts $\frac{1}{4}$ of the money he earns from mowing lawns into a college education fund. This year Chad added $285 to his college education fund. Write and solve an equation to find how much money Chad earned mowing lawns this year.

one-fourth times earnings equals college fund

$\frac{1}{4}m = c$ *Write an equation to represent the relationship.*

$\frac{m}{4} = 285$ *Substitute 285 for c. Since m is divided by 4, multiply both sides by 4 to undo the division.*

$(4)\frac{m}{4} = (4)285$

$m = \$1140$ Chad earned $1140 mowing lawns.

Solving Equations by Adding or Subtracting

Example 13

The distance in miles from the airport that a plane should begin descending, divided by 3, equals the plane's height above the ground in thousands of feet. A plane began descending 45 miles from the airport. Use the equation to find how high the plane was flying when the descent began.

Distance divided by 3 equals height in thousands of feet

$\frac{d}{3} = h$ *Write an equation to represent the relationship.*

$\frac{45}{3} = h$ *Substitute 45 for d.*

$15 = h$

The plane was flying at 15,000 ft when the descent began.

Solving Equations by Adding or Subtracting

Example 14

A person's weight on Venus is about $\frac{9}{10}$ of his or her weight on Earth. Write and solve an equation to find how much a person weighs on Earth if he or she weighs 108 pounds on Venus.

$108 = \frac{9}{10}w$; 120 lb