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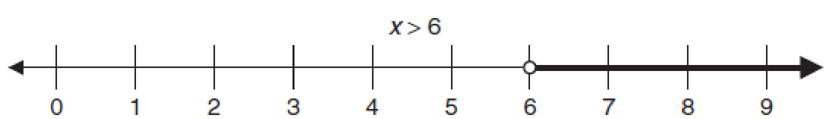
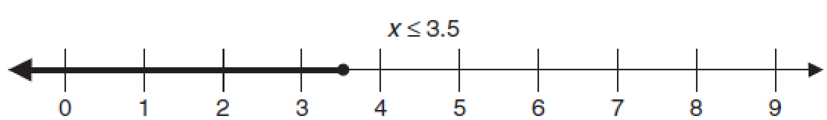
9.1 Graphing Inequalities on the Number Line

- An **inequality** is any mathematical sentence that has an inequality symbol. The solution to any inequality can be represented on a number line by a ray whose starting point is an open or closed circle.
- A **ray** begins at a starting point and goes on forever in one direction.
- A **closed circle** means that the starting point is part of the solution set of the inequality.
- An **open circle** means that the starting point is not part of the solution set of the inequality.
- The **graph of an inequality** in one variable is the set of all points on a number line that make the inequality true. This set of points is the solution set of the inequality.

Example:

Graph the solution set for each inequality.





9.2 Using Models to Represent One-Step Equations

Equations are mathematical statements that declare the two expressions are equal. Similarly, a balanced scale shows that two quantities are equivalent. Scales can be used as models to represent equations.

Information:

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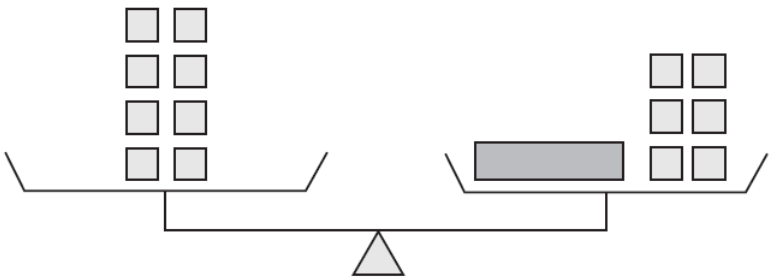
9.2 Using Models to Represent One-Step Equations (cont.)

Example:

Write an equation that represents the given pan balance. Use the variable x to represent [gray rectangle] and use numbers to represent each group of [square] units. Then, solve the equation.



$$8 = x + 6$$
$$8 - 6 = x + 6 - 6$$
$$2 = x$$

In the pan balance, one [gray rectangle] is equivalent to 2 [square] units.

9.2 Using Inverse Operations to Solve One-Step Equations

- To **solve an equation** means to determine what value or values will replace the variable to make the equation true.
- A **one-step equation** is an equation that can be solved using only one operation.
- A **solution** to an equation is any value for a variable that makes the equation true. To solve an equation, you must isolate the variable using inverse operations.
- **Inverse operations** are operations that undo each other. Addition is the inverse of subtraction, and subtraction is the inverse operation of addition.

Example:

In the given equation, state the inverse operation needed to isolate the variable. Then, solve the equation. Check to see if the value of your solution maintains balance in the original equation.

$13 = t - 9$

The inverse operation would be to add 9 to both sides.

$13 = t - 9$	Check:
$13 + 9 = t - 9 + 9$	$13 \stackrel{?}{=} 22 - 9$
$22 = t$	$13 = 13$

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9.3 Using Inverse Operations to Solve One-Step Equations

To solve an equation, you must isolate the variable using inverse operations. Inverse operations are operations that undo each other. Multiplication is the inverse operation of division, and division is the inverse operation of multiplication.

Example:

In the given equation, state the inverse operation needed to isolate the variable. Then, solve the equation. Check to see if the value of your solution maintains balance in the original equation.

$5.2x = 36.4$

The inverse operation would be to divide both sides by 5.2.

$$5.2x = 36.4$$
$$\frac{5.2x}{5.2} = \frac{36.4}{5.2}$$
$$x = 7$$

Check

$$5.2 \times 7 \stackrel{?}{=} 36.4$$
$$36.4 = 36.4$$

.

9.4 Representing Situations in Multiple Ways

It is common to use equations, tables, and graphs in order to solve and describe certain problem situations.

Example:

Xavier is preparing to fill his empty swimming pool. The water hose he uses produces 9 gallons of water per minute. Define variables to represent the number of gallons of water in the swimming pool and the number of minutes Xavier uses the water hose.

Let g represent the number of gallons of water in the swimming pool, and let m represent the number of minutes Xavier uses the water hose.

Write an equation that models the relationship between those variables.

$g = 9m$

Use the equation to determine the number of gallons of water in the swimming pool after:

- 10 minutes

  $g = 9 \cdot 10$

  $g = 90$ minutes
- 20 minutes

  $g = 9 \cdot 20$

  $g = 180$ minutes
- 1 hour

  $g = 9 \cdot 60$

  $g = 540$ minutes
- 75 minutes

  $g = 9 \cdot 75$

  $g = 675$ minutes
- 125 minutes

  $g = 9 \cdot 125$

  $g = 1125$ minutes

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9.5 Using Multiple Representations to Solve Problems

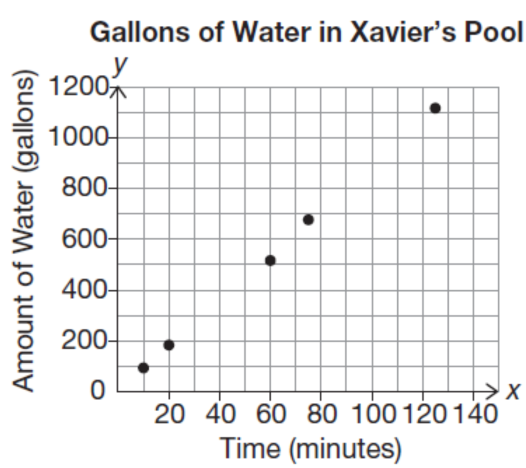
Problem situations can be represented in different ways. Tables and graphs can be created using information calculated from solving an equation.

Example:

Complete the table with your answers from Xavier's water hose situation.

Time (minutes)	Amount of Water (gallons)
10	90
20	180
60	540
75	675
125	1125

Use the table to complete the graph of the number of gallons of water in the pool versus the number of minutes.



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9.6 Examining the Many Different Uses of Variables in Mathematics

Variables are often used to represent numbers in order to describe certain properties. Variables are also used to represent unknown quantities in equations and formulas.

Example:

Variables used in the formula to calculate area of a triangle:

A = area

b = length of the triangle's base

h = height of the triangle

Calculate the area of a triangle with a base of 12 inches and a height of 15 inches.

$$A = \frac{1}{2}(12)(15)$$

$A = 90$ square inches

Example:

Variables used to represent an unknown quantity:

$$8.5y = 102$$
$$8.5y \div 8.5 = 102 \div 8.5$$
$$y = 12$$

Example:

Variables used to describe properties:

Associative Property of Addition for any numbers a, b, and c.

$a + (b + c) = (a + b) + c$

Example:

Variables used as quantities that vary in a situation.

A car is traveling at a constant speed of 40 miles per hour. How many miles would the car travel in h hours?

$40h = m$

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9.7 Identifying and Defining Independent and Dependent Variables and Quantities

When one quantity depends on another in a problem situation, it is said to be the **dependent quantity**. The quantity on which it depends is called the **independent quantity**. The variable that represents the independent quantity is called the **independent variable**. The variable that represents the dependent quantity is called the **dependent variable**.

Example:

Ramona works in a crayon factory. The machine she operates produces 200 crayons per minute.

- Name the two quantities that are changing in this problem situation.

  The two quantities that are changing are the time and the number of crayons produced.

- Describe which quantity depends on the other.

  The number of crayons is the dependent quantity, because the number of crayons produced depends on the amount of time Ramona operates the machine.

- Let c represent the number of crayons produced, and let t represent the time (in minutes) that Ramona operates the machine. Write an equation to represent the problem situation.

  $c = 200t$

- Identify the independent and dependent variables in the equation.

  The dependent variable is c and the independent variable is t.