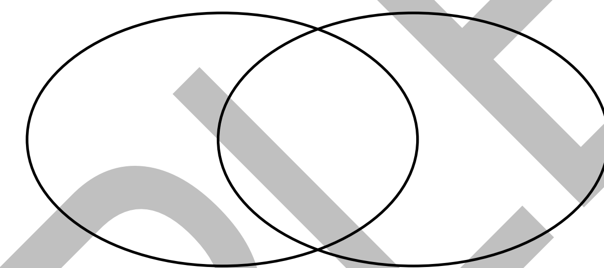
Standard 8.1D; 8.1E; 8.2A (L–M)

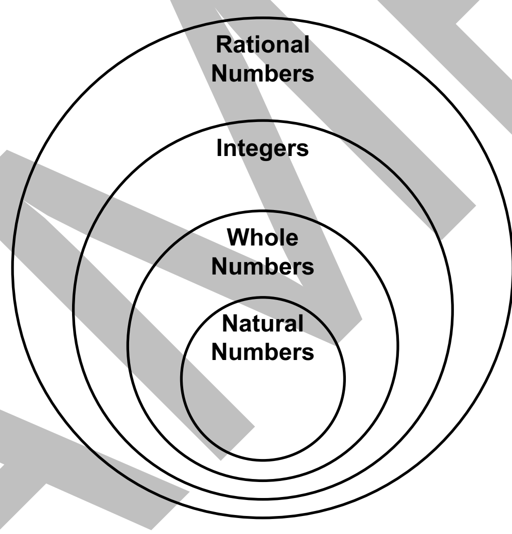
Classifying Rational Numbers

Let's review what you already know about numbers. **Natural numbers** are the numbers you use to count (1, 2, 3, …). **Whole numbers** are all of the natural numbers and zero (0, 1, 2, 3, …). Whole numbers are never negative and do not have a decimal point or a fraction. **Integers** are all whole numbers and their opposites (…, -3, -2, -1, 0, 1, 2, 3, …). A **rational number** is any number that can be written as a fraction. Rational numbers can be represented as a point on a number line. Rational numbers include fractions, integers, and decimals that terminate (end) or repeat a pattern of numbers.

You can use a Venn diagram to classify different types of numbers. A **Venn diagram** is a drawing that shows relationships among different items. You may have seen Venn diagrams that look like the one to the right. Each oval represents a set. The overlapping part of the two ovals contains the items that are common to both sets.



The Venn diagram for classifying types of numbers looks different because each set of numbers is part of another set of numbers. A Venn diagram for rational numbers is shown below.



On Your Own: Write each number below in the correct section of the Venn diagram above.

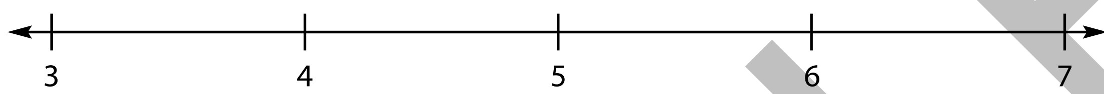
1. 14
2. 7.25
3. $-\frac{3}{4}$
4. -3
5. 10.125
6. 0
7. -105
8. -0.4
9. $\frac{3}{11}$
10. 9
11. $-\frac{11}{5}$
12. 300

Standard 8.1D; 8.1E; 8.1F; 8.2D (M)

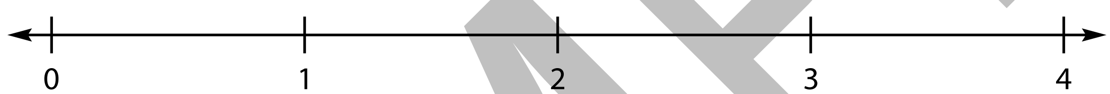
Line 'em up!

Directions: Approximate the values of the irrational numbers below. Then, label each number on the number line.

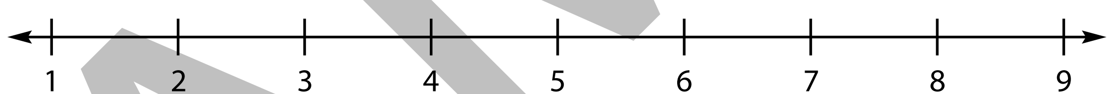
1. $\sqrt{18}$ 5.34281… $2\sqrt{3}$ 2π



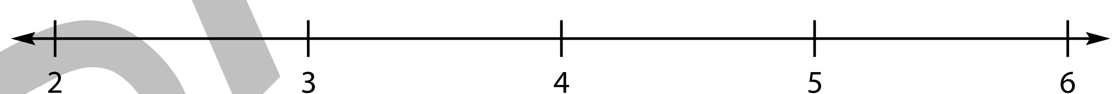
2. $\frac{\pi}{2}$ 3.27091… $\sqrt{7}$ $\frac{\sqrt{12}}{2}$



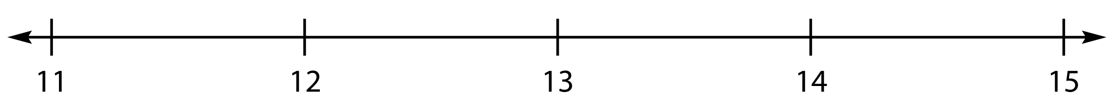
3. 5.98263… $\sqrt{29}$ $3\sqrt{8}$ $\frac{\pi}{3}$



4. $\frac{3\pi}{2}$ $\sqrt{26}$ $2\sqrt{5}$ 5.69732…



5. 4π $\sqrt{150}$ 13.58925… $2\pi\sqrt{5}$



Standard 8.1D; 8.1E; 8.4A (L–M)

Rise, Run, & Slope

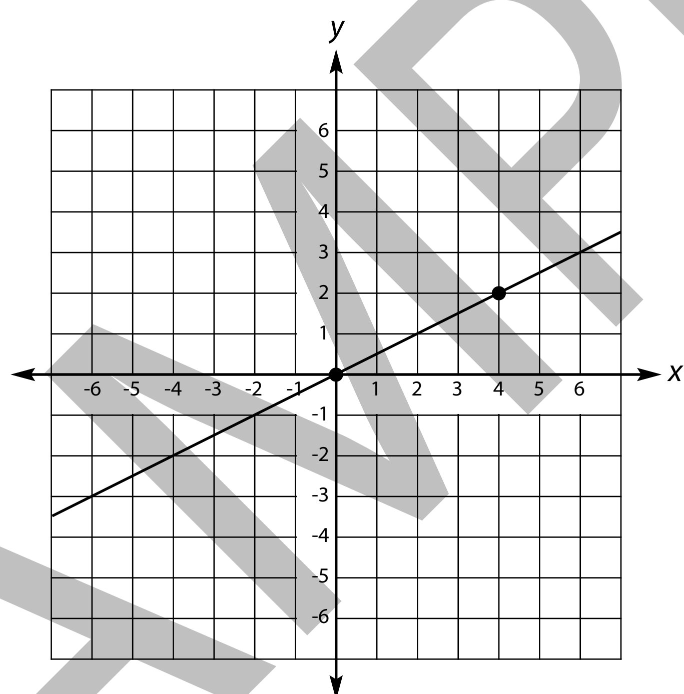
In geometry, **rise** refers to the change in the *y*-values between two points graphed on a line. **Run** refers to the change in the *x*-values between two points graphed on a line. To find the slope of a line, you divide the rise by the run, as shown in the equation below.

$$\text{slope of a line} = \frac{\text{rise}}{\text{run}}$$

We can also represent rise as $y_2 - y_1$ (the difference in *y*-values) and run as $x_2 - x_1$ (the difference in *x*-values). Then the equation for finding slope would look like the one shown below.

$$\text{slope of a line} = \frac{y_2 - y_1}{x_2 - x_1}$$

We can understand this better if we look at the graph below.



Point (4, 2) and point (0, 0) are two points on the graphed line.

Talk About It

- What is the change in the *x*-values between the two points?
- What is the change in the *y*-values between the two points?

The change in the *x*-values is 4, so the run is 4. The change in the *y*-values is 2, so the rise is 2.

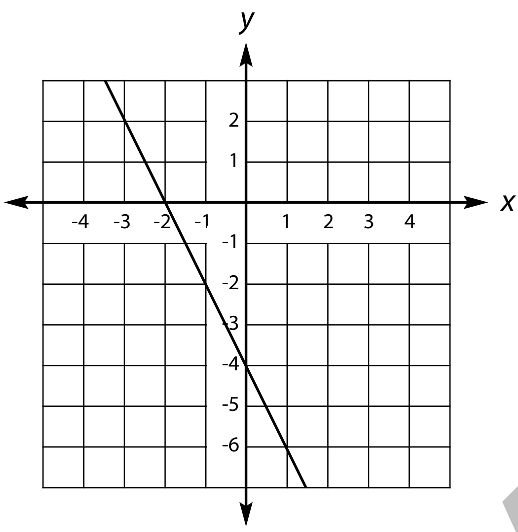
continue to next page

Standard 8.1D; 8.1F; 8.4C (M)

Using Graphs to Find Slope & *y*-intercept

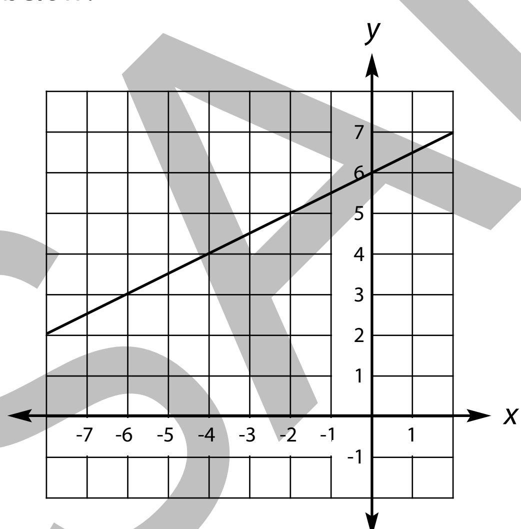
Directions: Answer the questions for each graph below.

1. What is the slope of the line shown on the graph below?



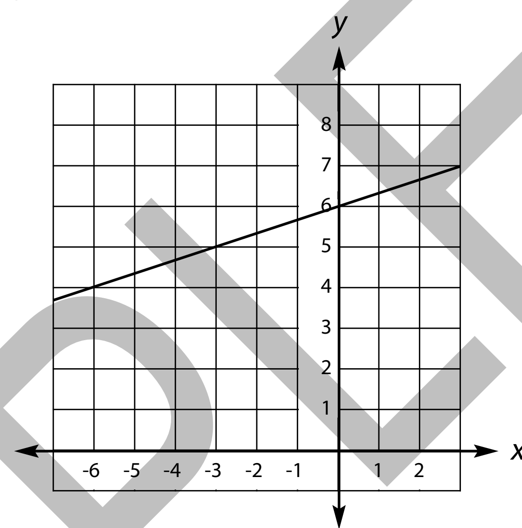
Answer: ____________________

2. What is the *y*-intercept of the line shown below?



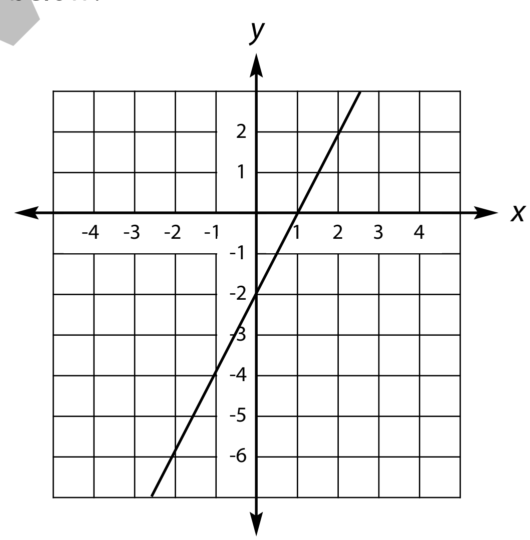
Answer: ____________________

3. What is the slope of the line shown on the graph below?



Answer: ____________________

4. What is the *y*-intercept of the line shown below?



Answer: ____________________

Standard 8.1A; 8.1B; 8.1D; 8.1F; 8.9A (L–M)

Systems of Linear Equations

To make sure that two kittens are growing well, a veterinarian weighs each one every two weeks and records their weights in tables like the ones shown below.

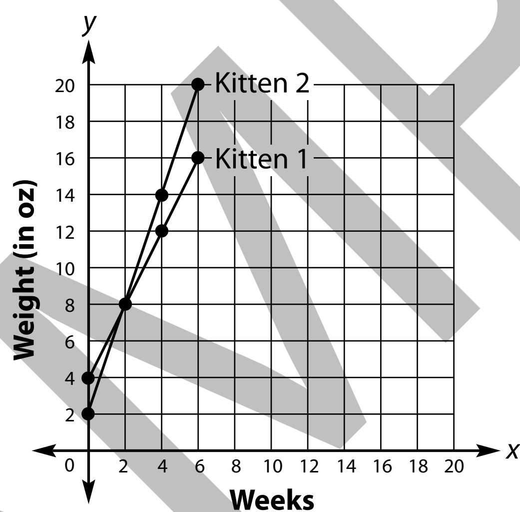
Kitten 1

x	*y*
0	4 oz
2	8 oz
4	12 oz
6	16 oz

Kitten 2

x	*y*
0	2 oz
2	8 oz
4	14 oz
6	20 oz

In each table, *x* represents the number of weeks and *y* represents each kitten's weight. The veterinarian uses the *x*- and *y*-values from the tables to create a graph like the one shown below. The graph shows the kittens' weight over time.



Talk About It–1

- What do you notice about the two lines on the graph?
- Which point appears on both graphed lines?
- During which week did both kittens have the same weight?

We can use each line's slope and *y*-intercept to create equations that represent the kittens' weight over time.

Kitten 1 $y = 2x + 4$

Kitten 2 $y = 3x + 2$

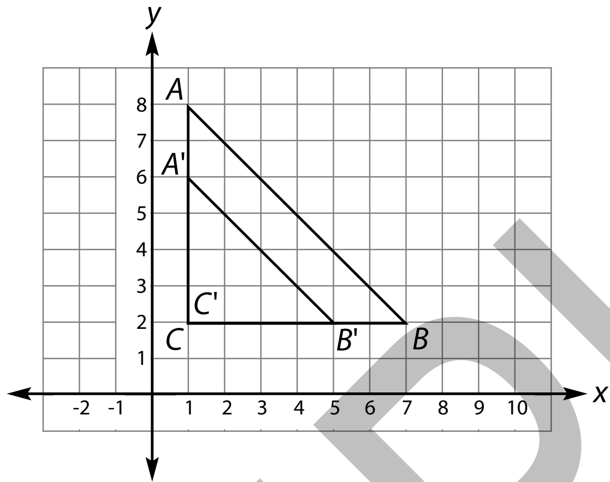
continue to next page

Standard 8.1D; 8.1F; 8.3B (M–H)

Similar Shapes on a Coordinate Plane

Directions: Study the diagram on each of the following coordinate planes. Complete the items that accompany each diagram.

1.



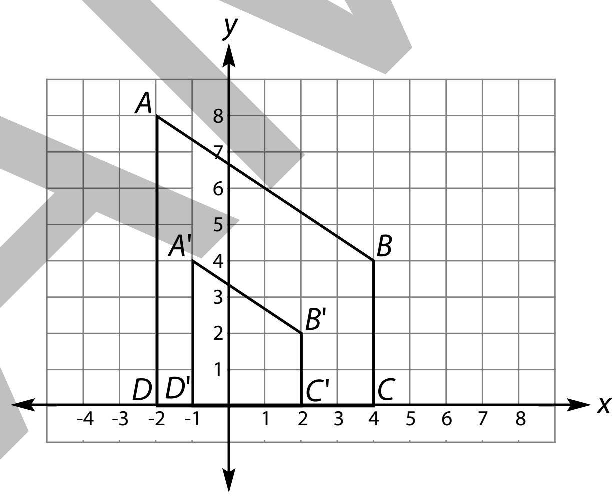
a. What is the length of $\overline{BC}$? ____________

b. What scale factor was used to create $\triangle A'B'C'$? ____________

c. What is the length of $\overline{B'C'}$? ____________

d. If $m\angle ABC = 45°$, then $m\angle A'B'C'$ = ____________.

2.



a. What is the length of $\overline{C'D'}$? ____________

b. What scale factor was used to create Trapezoid $A'B'C'D'$? ____________

c. If the length of $\overline{AB}$ is 7, what is the length of $\overline{A'B'}$? ____________

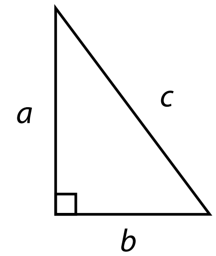
d. If $m\angle ABC = 124°$, then $m\angle A'B'C'$ = ____________.

continue to next page

Standard 8.1D; 8.1E; 8.1F; 8.6C (L–M)

The Pythagorean Theorem

The diagram below shows a right triangle. In a **right triangle**, the sides that meet to form the right angle are the **legs** of the triangle. The side opposite the right angle is the **hypotenuse**.



Talk About It–1

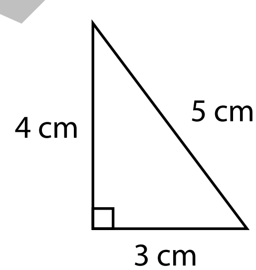
- In the diagram above, what letters were used to label the right triangle's legs?
- What letter was used to label the right triangle's hypotenuse?

The three sides of every right triangle have a special relationship. The Greek mathematician Pythagoras first proved this relationship, so we refer to it as the Pythagorean Theorem (rule). According to the **Pythagorean Theorem**, the square of a right triangle's hypotenuse equals the sum of the squares of the triangle's legs. We can express this relationship with the following equation.

$$a^2 + b^2 = c^2$$

Mathematicians have used several methods to prove the Pythagorean Theorem, including the following method.

Let's begin with the right triangle shown below. The triangle has legs that measure 3 centimeters and 4 centimeters and a hypotenuse that measures 5 centimeters.



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Standard 8.1D; 8.1F; 8.1G; 8.7B (L–M)

Total Surface Area: Cylinders

The three-dimensional figure below (Figure A) is a cylinder. A **cylinder** has two congruent circular faces and one rectangular face. The diagram below to the right (Figure B) shows the net for this cylinder.

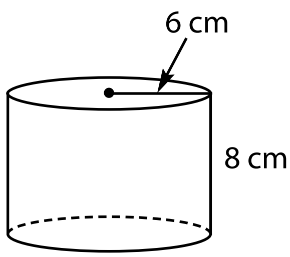


Figure A

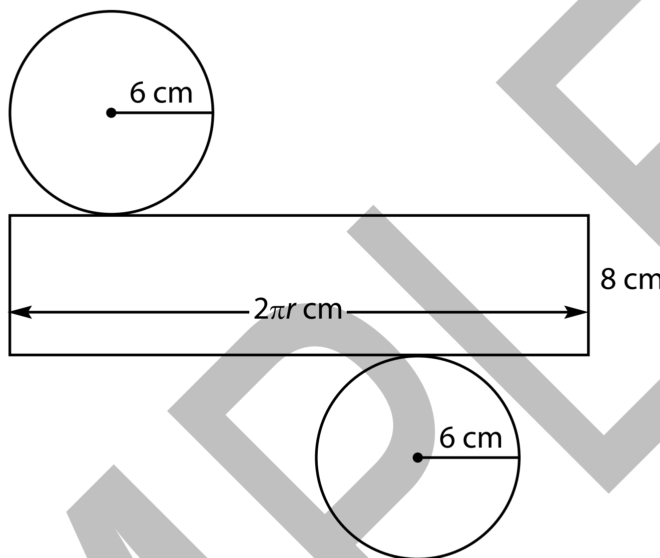


Figure B

Talk About It: How can you find the total surface area of a cylinder?

Try It: Use the net above to complete the following items. Show all of your work on a separate sheet of paper.

1. What is the area of each of the cylinder's circular bases? ______________________
2. What is the area of the cylinder's rectangular face? ______________________
3. Write your calculations from the previous two questions to find the total surface area of the cylinder.

   2 x ______________________ + ______________________ = __________________________

   (area of circular base) (area of rectangular face) (total surface area of cylinder)

4. What formula could you use to find the total surface area of a cylinder? ______________________

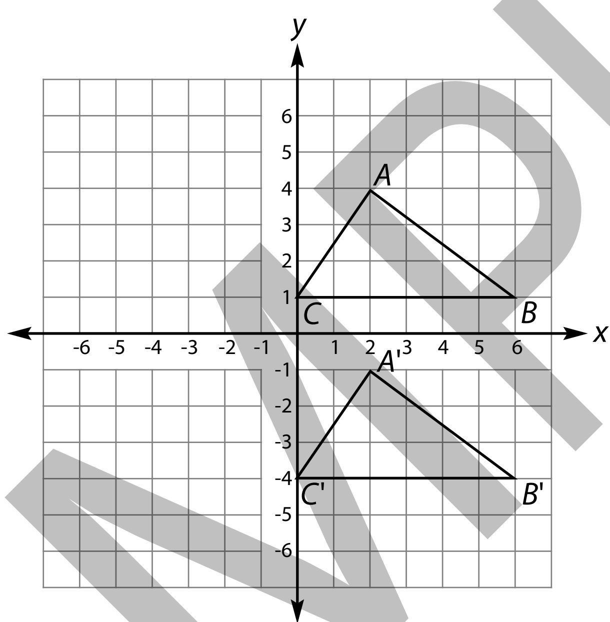
Standard 8.1D; 8.1E; 8.1F; 8.1G; 8.10C (M–H)

Using Algebraic Representations of Transformations

In previous lessons, you learned how to represent dilations using algebraic form. You can also represent rigid transformations (translations, rotations, and reflections) using algebraic form.

Translations

In a translation, a figure can slide horizontally, vertically, or a combination of both. A positive change results when a figure moves up or to the right. A positive change indicates addition. A negative change results when a figure moves down or to the left. A negative change indicates subtraction. Look at the triangles on the coordinate plane below.



In the diagram, △*ABC* has been translated down, a negative change. We can represent the coordinates of the vertices for △*A'B'C'* algebraically, as shown below.

$$(x, y) \dashrightarrow (x, y - 5)$$

Try It–1: Based on the algebraic representation above, determine the coordinates for each vertex of △*A'B'C'* to complete the table below.

△*ABC* (*x*, *y*)	△*A'B'C'* (*x*, *y*)
(2, 4)	(2, 4) - - - - - - - - - - -► (2, -1)
(6, 1)	
(0, 1)	

continue to next page

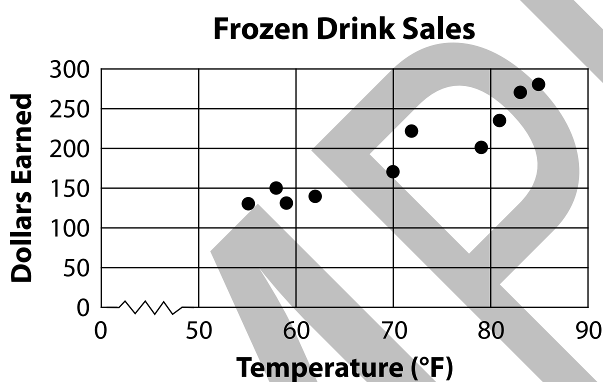
Standard 8.1A; 8.1C; 8.1D; 8.1F; 8.1G; 8.5D (L–M)

Strategies for Drawing Trend Lines

Before you can draw a trend line on a scatterplot, you must determine whether the scatterplot suggests a linear association between the two data sets. Remember, a linear association occurs when the data points resemble a straight line and seem to increase or decrease at a constant rate. If the scatterplot does not suggest a linear association, you cannot draw a trend line. Trend lines can only represent linear associations.

After you have determined that a scatterplot suggests a linear association between the two data sets, you can consider how to draw a trend line.

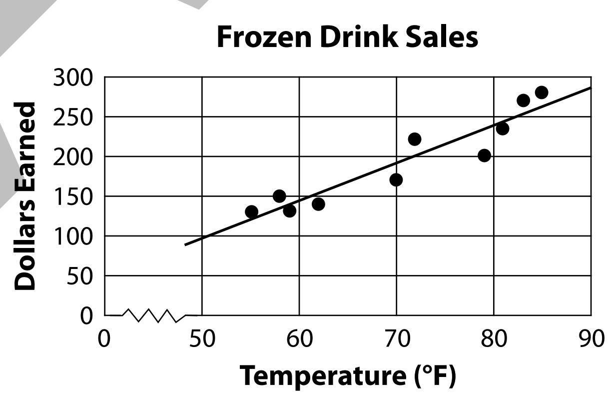
Look at the scatterplot below, and think about the association between the two data sets.



The scatterplot suggests a linear association between the data sets, so we can draw a trend line.

A trend line should be drawn so that about half of the data points are above the trend line and about half of the data points are below the trend line. Most of the data points should be *relatively close* to the line. (Outliers may be quite far away from the trend line.) The trend line may pass through all, most, some, or none of the data points on the scatterplot.

The scatterplot below includes a trend line that meets the requirements described above.



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Standard 8.1A; 8.1B; 8.1C; 8.1G; 8.12D (L–M)

Something of Interest

From previous lessons, you know that a bank pays interest on money you deposit into a savings account. **Interest rate** is the percentage a bank pays on the **principal**, the amount of money that earns interest. For a savings account, the principal is the account balance. The interest rate earned on a savings account depends on many factors, including the bank holding the account and the length of time your money remains in the account.

Talk About It–1: Why do banks pay interest on the money you deposit into a savings account?

You also know that **simple interest** is an amount earned only on the principal of an account, and **compound interest** is an amount earned on both the principal and any interest an account has accrued. Let's look at the following examples to review and compare these two kinds of interest.

Example #1

> Lori opened a savings account with a one-time deposit of $1,200. The savings account earned 1.5% simple interest each year. If Lori made no deposits or withdrawals, calculate the amount of interest her initial deposit had earned at the end of 3 years.

To find the answer, we use the formula for calculating simple interest that appears below.

$$\text{Interest } (I) = \text{principal } (p) \times \text{rate } (r) \times \text{time } (t)$$

$$I = prt$$

$$I = 1{,}200 \times 0.015 \times 3$$

$$I = 54$$

After 3 years, Lori's initial deposit will have earned $54. The balance in her account would be $1,254 at the end of 3 years.

Example #2

> Lori opened another savings account at a different bank with a one-time deposit of $1,200. The savings account earned 1.5% compound interest each year. If Lori made no deposits or withdrawals, calculate the amount of interest her initial deposit had earned at the end of 3 years.

Talk About It–2: Can we use the formula we used in Example #1 to answer this question? Why or why not?

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