Fish-Inches

3

Identifying the Constant of Proportionality in Graphs

WARM UP

Solve each equation for the variable.

1. $\frac{1}{2}a = 5$

2. $\frac{p}{\frac{1}{3}} = 2$

3. $3x = \frac{3}{2}$

4. $\frac{6}{z} = \frac{1}{6}$

LEARNING GOALS

- Determine if relationships represented in words, tables, equations, or graphs are proportional.
- Interpret the meaning of linear proportional relationships represented in words, tables, equations, and graphs.
- Identify and interpret the constant of proportionality for quantities that are proportional and represented in words, tables, equations, and graphs.
- Explain what a point on the graph of a proportional relationship means in terms of the problem situation.
- Explain what the points $(0, 0)$ and $(1, r)$ mean on the graph of a proportional relationship, where r is the unit rate.

You have determined the constant of proportionality in problem situations and from equations. How can you represent the constant of proportionality in graphs?

The Fish-Inches System of Measurement

You are thinking of purchasing an aquarium. You contact the owner of an aquarium store. You need to know how many fish to purchase for an aquarium, but first you must determine how big the aquarium will be. The owner of the aquarium store tells you his rule of thumb is to purchase "a total length of fish of 3 inches for each 2 gallons of water in the aquarium."

1. **How many gallons of water would you need if you had a 4-inch fish and a 2-inch fish? Draw a diagram to explain your reasoning.**

> Drawing a model would be really helpful here.

2. **Define variables for the quantities that are changing in this problem situation.**

3. **Write an equation for each:**

    a. **fish-inches based on the gallons of water**

    b. **gallons of water based on fish-inches**

4. Use one of your equations to solve each problem.

   a. If an aquarium holds 10 gallons of water, how many fish-inches should you purchase?

   b. If you want to purchase a 5-inch fish, two 2-inch fish, and three 3-inch fish, how many gallons of water should the aquarium hold?

5. Determine the constant of proportionality given by each equation and explain what it means in context.
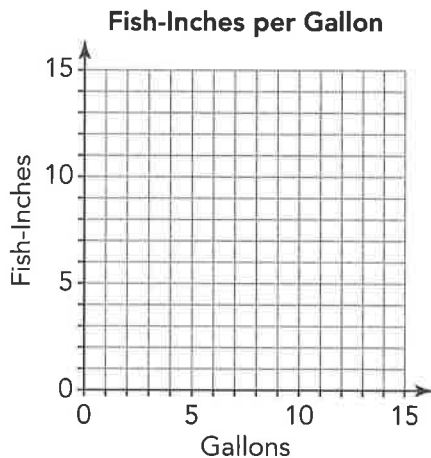
Graphs of Two Constants of Proportionality

Let's graph each equation you wrote in the previous activity.

1. **Create a table of ordered pairs. Then plot the ordered pairs to create a graph of each equation.**

Fish-Inches						
Gallons						

Fish-Inches per Gallon

Gallons per Fish-Inch
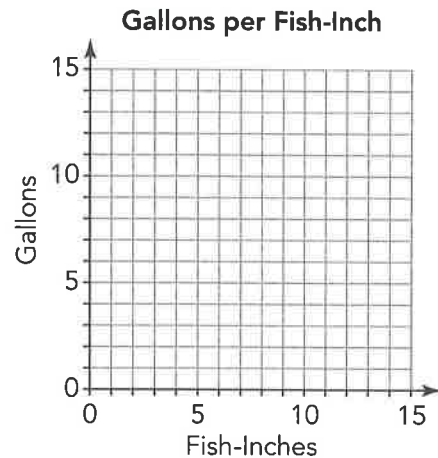
2. **What does the point (0, 0) mean on each graph?**

3. **Determine the meaning of each point.**

   a. **What does the point (6, 9) on the Fish-Inches per Gallon graph represent?**

   b. **What does the point (9, 6) on the Gallons per Fish-Inch graph represent?**

c. What does the point $(1, 1\frac{1}{2})$ on the Fish-Inches per Gallon graph represent?

d. What does the point $(1, \frac{2}{3})$ on the Gallons per Fish-Inch graph represent?

4. What is the unit rate for each graph? Explain how you can determine the unit rate using the graph.

5. Use one of your graphs to determine each answer.

   a. How many inches of fish can fit into 10 gallons of water?

   b. How many gallons are needed for $7\frac{1}{2}$ inches of fish?

   > The constant of proportionality is represented on the graph, too. Can you locate it?

6. Use one of the graphs to estimate each answer. Explain how you used the graph to determine your estimate.

   a. How many gallons would be needed for 16 inches of fish?

   b. How many inches of fish would fit into 16 gallons?
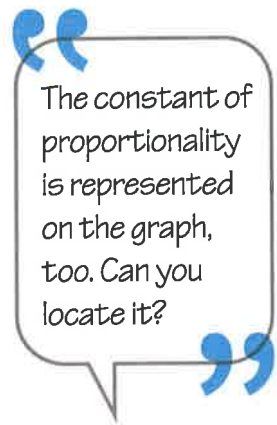
ACTIVITY 3.2

Constant of Proportionality from a Graph

The graph shown displays the relationship between the time and distance Ella runs.
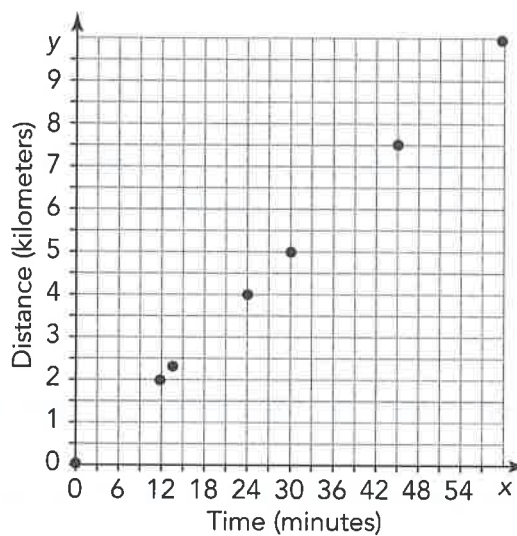
1. **Define variables and write an equation to represent the relationship between Ella's distance and time.**

2. **Use your equation to answer each question.**

   a. **How far can Ella run in 15 minutes?**

b. How long does it take Ella to run 7.5 kilometers?

c. How far can Ella run in one hour?

d. Determine the constant of proportionality in kilometers per hour. Then, write another equation representing Ella's distance (*d*) varies directly with time (*t*).

> How can you determine the constant of proportionality from a graph?

e. How is this equation the same as, and different from, the previous equation you wrote?

A graph establishes dependency. So, if the graph shows a proportional relationship, then y varies directly as x.

You have seen that proportional relationships can be represented on graphs and that the constant of proportionality can be identified from the graph.

1. Determine if each graph shows a proportional relationship between x and y. If possible, determine the constant of proportionality. Explain how you determined your answer.
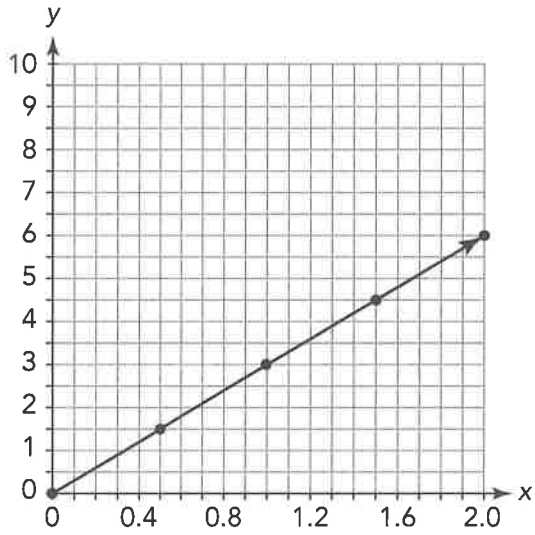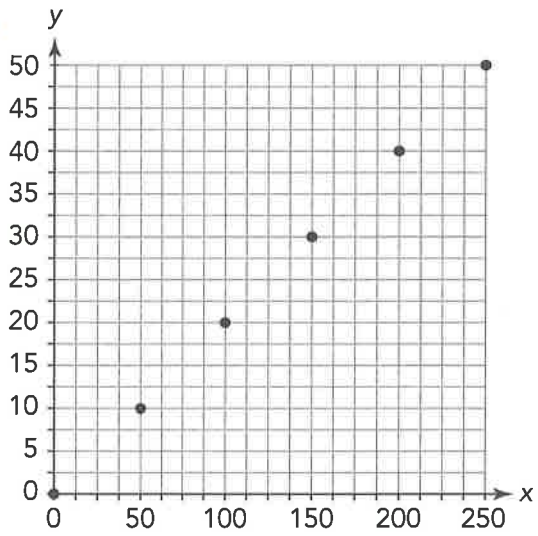
a.
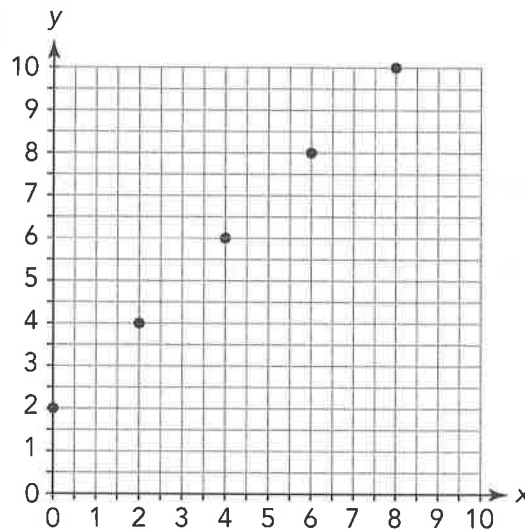
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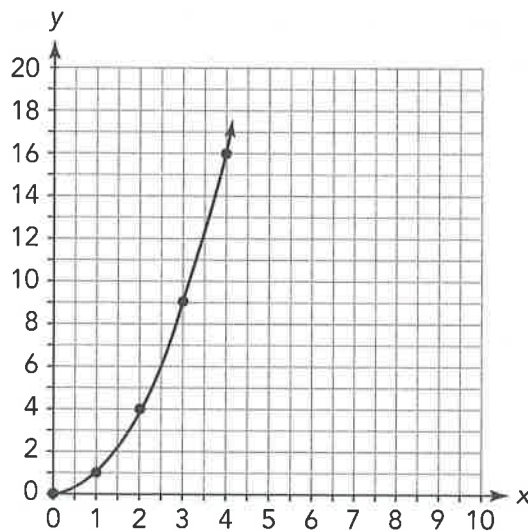
c.

d.

TALK the TALK 💬

How Do You Know?

Use examples to explain your answer to each question.

1. Given a graph of a relationship between two quantities, how do you know:

   a. if the graph shows a proportional relationship?

   b. what the constant of proportionality is?

   c. what the unit rate is?

   d. what any ordered pair on the graph represents?

Assignment

Math 7 hw
due 10/11/19

Write

Given a graph of a proportional relationship, the quotient of the *y*-value of any ordered pair divided by the *x*-value of that ordered pair is the constant of proportionality. Explain why.

Remember

When the relationship between two quantities is proportional, the graph of the relationship is a straight line that passes through the origin. The point (1, *r*) represents the unit rate and the ratio $\frac{r}{1}$ represents the constant of proportionality, *k*.

Practice

Determine the constant of proportionality *k* and interpret it in the context of each problem.
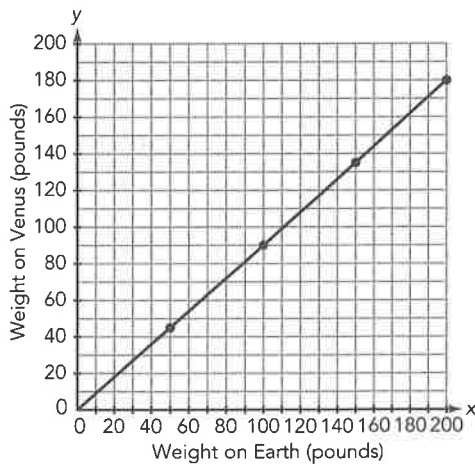
1. The graph shows the relationship between the distance in miles between you and a storm and the number of seconds between when you see lightning and when you hear thunder.
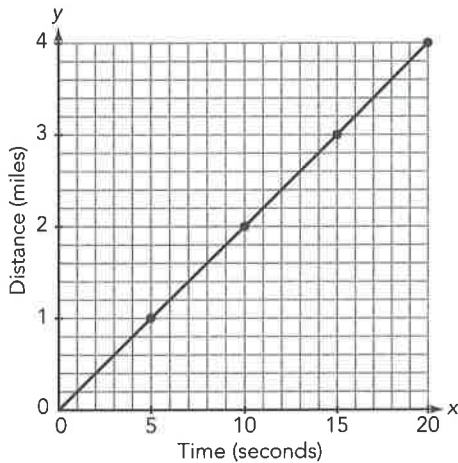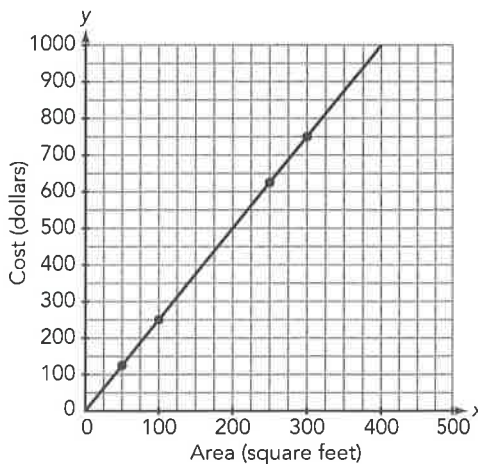

2. The graph shows the relationship between the number of euros Jason received and the number of dollars Jason exchanged during his trip to Spain.
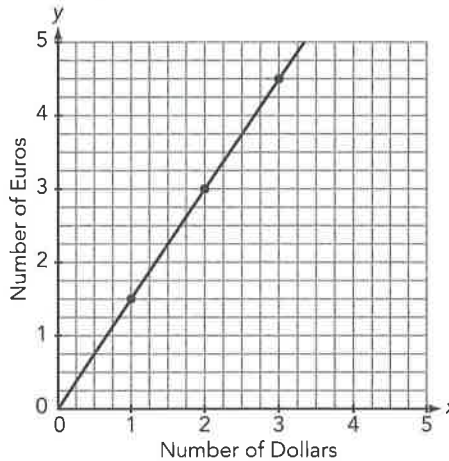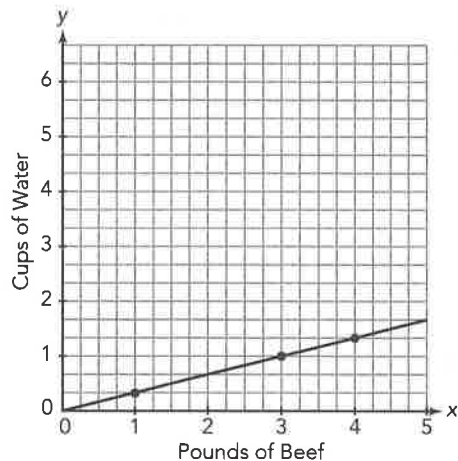

3. The graph shows the relationship between the weight of an object on Earth and the weight of the same object object on Venus.
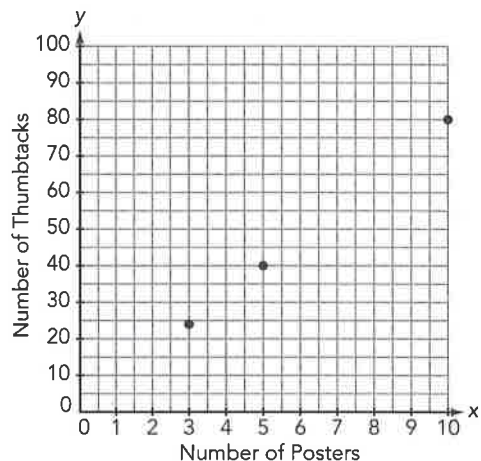

4. The graph shows the relationship between the area of a room in square feet and the cost of covering the floor with new tile.

5. The graph shows the relationship between the cups of water and pounds of beef needed for a beef casserole.

6. The graph shows the relationship between the number of posters in a classroom and the number of thumbtacks used to hold them up.

Stretch

At any given time of the day, the length of your shadow is proportional to your height. Suppose a person who is 81 inches tall casts a shadow that is 94.5 inches long. Another person in the same place casts a shadow that is 84 inches long. How tall is the second person?

Review

1. Use the equation for the constant of proportionality, $k = \frac{y}{x}$, to determine each unknown value.

   a. $k = \frac{3}{2}$ and $y = 15$

   b. $k = \frac{1}{4}$ and $y = 5$

2. Determine a unit rate for each scenario.

   a. $\frac{3}{4}$ of an inch of rain fell in $\frac{1}{2}$ hour.

   b. Heather charges a half-dollar for each eighth of a pizza.

3. Simplify each expression.

   a. $8 - 4(5) + 2^4$

   b. $10 \div (1 + 4) - 3^2$