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, and 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.**

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?**

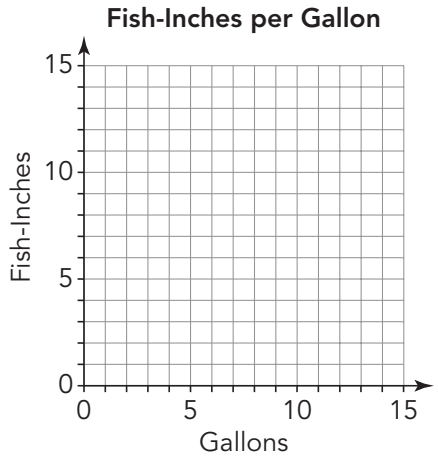
5. **Determine the constant of proportionality given by each equation and explain what it means in context.**

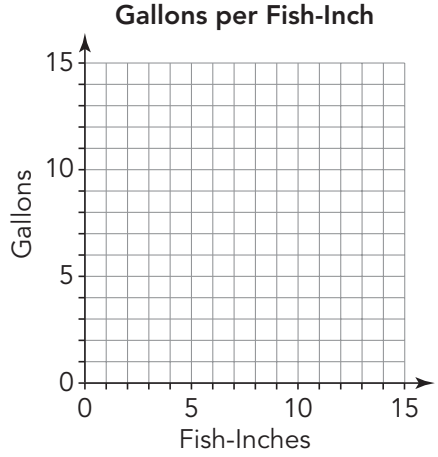
ACTIVITY
3.1 Graphs of Two Constants of Proportionality

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							





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 fish-inches can fit into 10 gallons of water?

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

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 fish-inches?

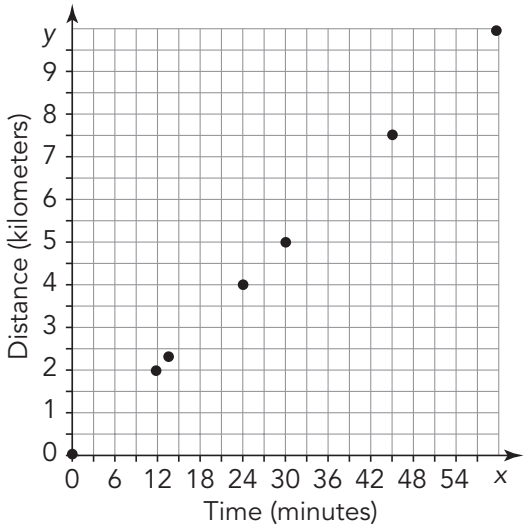
   b. How many fish-inches would fit into 16 gallons?

NOTES

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.

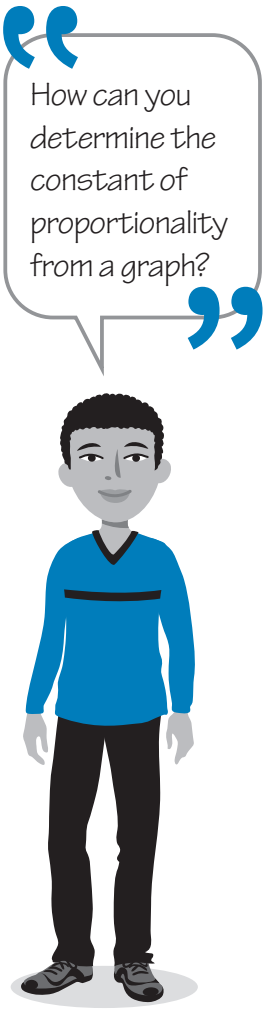
2. Use your equation to answer each question.

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 that represents how Ella's distance (d) varies directly with time (t).



e. How is this equation similar to, and different from, the previous equation you wrote?

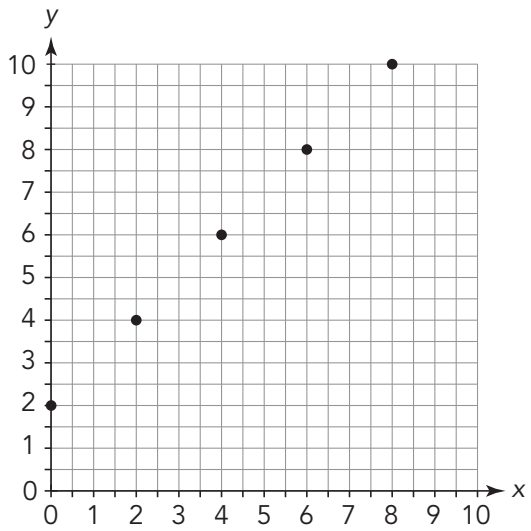
ACTIVITY
3.3 Determining Proportional Relationships from Graphs

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

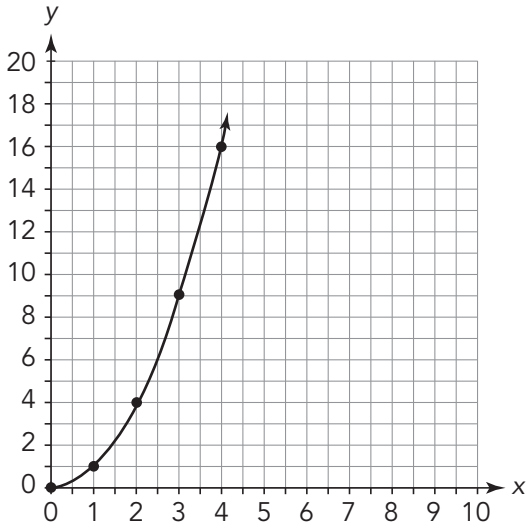
You have seen that proportional relationships can be represented on graphs and that the constant of proportionality can be identified from the graph.

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.



b.



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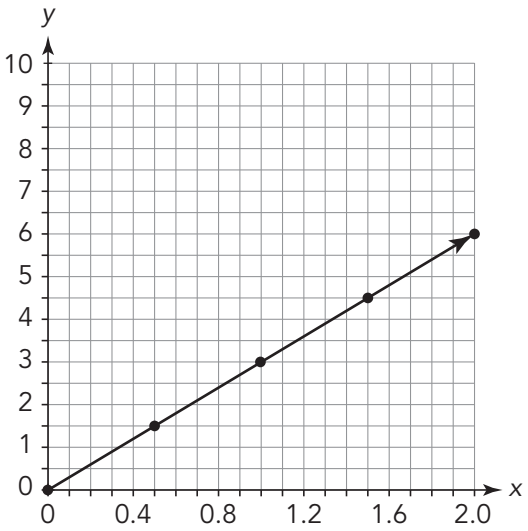
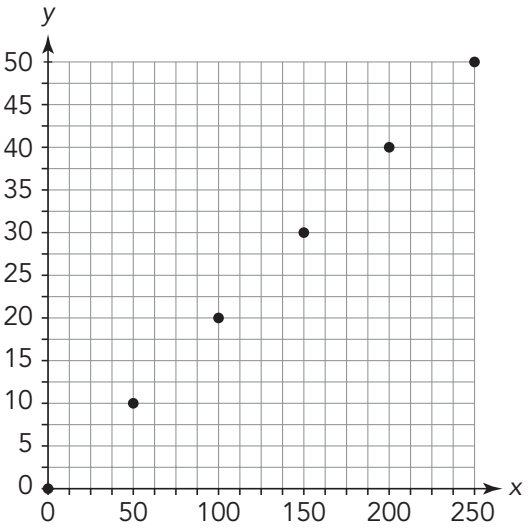

y
10
9
8
7
6
5
4
3
2
1
0
0
0.4
0.8
1.2
1.6
2.0
x

d.


y
50
45
40
35
30
25
20
15
10
5
0
0
50
100
150
200
250
x

NOTES

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?**