

LESSON 3.1 Representing Proportional Relationships

 **FL CC** 8.EE.2.6

... derive the equation $y = mx$ for a line through the origin... Also 8.F.2.4



ESSENTIAL QUESTION

How can you use tables, graphs, and equations to represent proportional situations?

EXPLORE ACTIVITY



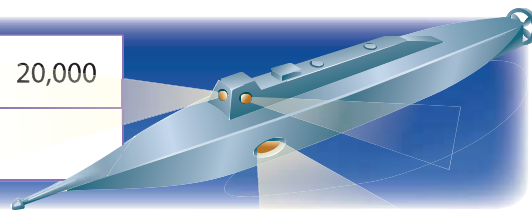
FL CC Prep for 8.EE.2.6

Representing Proportional Relationships with Tables

In 1870, the French writer Jules Verne published *20,000 Leagues Under the Sea*, one of the most popular science fiction novels ever written. One definition of a *league* is a unit of measure equaling 3 miles.

- A** Complete the table.

Distance (leagues)	1	2	6		20,000
Distance (miles)	3			36	



- B** What relationships do you see among the numbers in the table?

- C** For each column of the table, find the ratio of the distance in miles to the distance in leagues. Write each ratio in simplest form.

$$\frac{3}{1} = \frac{\square}{\square} \quad \frac{\square}{2} = \frac{\square}{\square} \quad \frac{\square}{6} = \frac{\square}{\square} \quad \frac{36}{\square} = \frac{\square}{\square} \quad \frac{\square}{20,000} = \frac{\square}{\square}$$

- D** What do you notice about the ratios? _____

Reflect

- If you know the distance between two points in leagues, how can you find the distance in miles? _____
- If you know the distance between two points in miles, how can you find the distance in leagues? _____



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Representing Proportional Relationships with Equations

The ratio of the distance in miles to the distance in leagues is constant. This relationship is said to be *proportional*. A **proportional relationship** is a relationship between two quantities in which the ratio of one quantity to the other quantity is constant.

A proportional relationship can be described by an equation of the form $y = kx$, where k is a number called the **constant of proportionality**.

Sometimes it is useful to use another form of the equation, $k = \frac{y}{x}$.

EXAMPLE 1



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Meghan earns \$12 an hour at her part-time job. Show that the relationship between the amount she earned and the number of hours she worked is a proportional relationship. Then write an equation for the relationship.

STEP 1

Make a table relating amount earned to number of hours.

For every hour Meghan works, she earns \$12. So, for 8 hours of work, she earns $8 \times \$12 = \96 .

Number of hours	1	2	4	8
Amount earned (\$)	12	24	48	96

STEP 2

For each number of hours, write the relationship of the amount earned and the number of hours as a ratio in simplest form.

$$\frac{\text{amount earned}}{\text{number of hours}} \quad \frac{12}{1} = 12 \quad \frac{24}{2} = 12 \quad \frac{48}{4} = 12 \quad \frac{96}{8} = 12$$

Since the ratios between the two quantities are all equal to 12, the relationship is proportional.

STEP 3

Write an equation.

First tell what the variables represent.

Let x represent the number of hours.
Let y represent the amount earned.

Use the ratio as the constant of proportionality in the equation $y = kx$.

- The equation is $y = 12x$.

Math Talk

Mathematical Practices

Describe two real-world quantities with a proportional relationship that can be described by the equation $y = 25x$.



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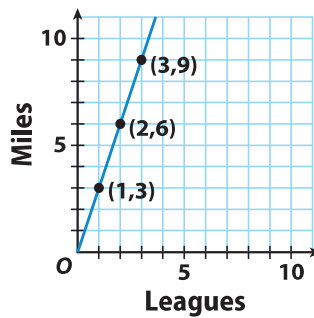
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YOUR TURN

- Fifteen bicycles are produced each hour at the Speedy Bike Works. Show that the relationship between the number of bikes produced and the number of hours is a proportional relationship. Then write an equation for the relationship. _____

Representing Proportional Relationships with Graphs

You can represent a proportional relationship with a graph. The graph will be a line that passes through the origin (0, 0). The graph shows the relationship between distance measured in miles to distance measured in leagues.



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EXAMPLE 2

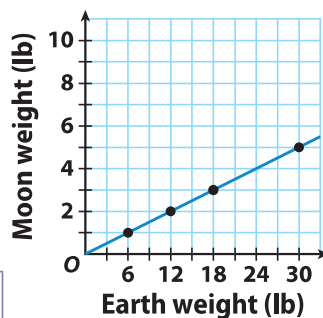


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The graph shows the relationship between the weight of an object on the Moon and its weight on Earth. Write an equation for this relationship.

STEP 1 Use the points on the graph to make a table.

Earth weight (lb)	6	12	18	30
Moon weight (lb)	1	2	3	5



STEP 2 Find the constant of proportionality.

$$\frac{\text{Moon weight}}{\text{Earth weight}} \quad \frac{1}{6} = \frac{1}{6} \quad \frac{2}{12} = \frac{1}{6} \quad \frac{3}{18} = \frac{1}{6} \quad \frac{5}{30} = \frac{1}{6}$$

The constant of proportionality is $\frac{1}{6}$.

STEP 3 Write an equation.

Let x represent weight on Earth.

Let y represent weight on the Moon.

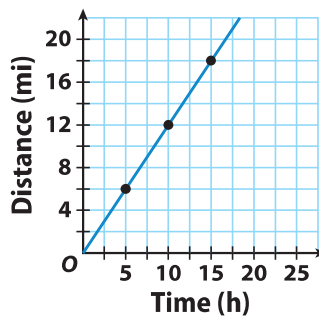
- The equation is $y = \frac{1}{6}x$. Replace k with $\frac{1}{6}$ in $y = kx$.

YOUR TURN

The graph shows the relationship between the amount of time that a backpacker hikes and the distance traveled.

- What does the point (5, 6) represent?

- What is the equation of the relationship?



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