

PRACTICE

1. Brandon enters bike races. He bikes $8\frac{1}{2}$ miles every $\frac{1}{2}$ hour. Complete the table to find how far Brandon bikes for each time interval.

Distance (mi)	$8\frac{1}{2}$				
Time (h)	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$

Simplify each complex fraction.

2. $\frac{\frac{3}{4}}{\frac{2}{3}} =$ _____ 3. $\frac{\frac{1}{2}}{\frac{5}{8}} =$ _____ 4. $\frac{\frac{4}{5}}{\frac{2}{3}} =$ _____ 5. $\frac{\frac{6}{7}}{\frac{1}{7}} =$ _____

Find each unit rate.

6. Julio walks $3\frac{1}{2}$ miles in $1\frac{1}{4}$ hours. 7. Kenny reads $\frac{5}{8}$ page in $\frac{2}{3}$ minute.

8. Marcia uses $\frac{3}{4}$ cup sugar when she halves the recipe. 9. Sandra tiles $\frac{5}{4}$ square yards in $\frac{1}{3}$ hour.

The information for two cell phone companies is given.

10. What is the unit rate for On Call?

On Call 3.5 hours: \$10	Talk Time $\frac{1}{2}$ hour: \$1.25
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11. What is the unit rate for Talk Time?

12. Determine which of the companies offers the best deal. Explain your answer.

13. **What if?** Another company offers a rate of \$0.05 per minute.

a. How would you find the unit rate per hour?

b. Is this a better deal than On Call or Talk Time?

Proportional Relationships, Tables, and Equations

COMMON CORE

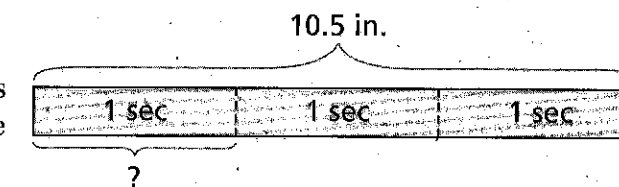
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Essential question: How can you use tables and equations to identify and describe proportional relationships?

1 EXPLORE Discovering Proportional Relationships

A giant tortoise moves at a slow but steady pace. It takes the giant tortoise 3 seconds to travel 10.5 inches.

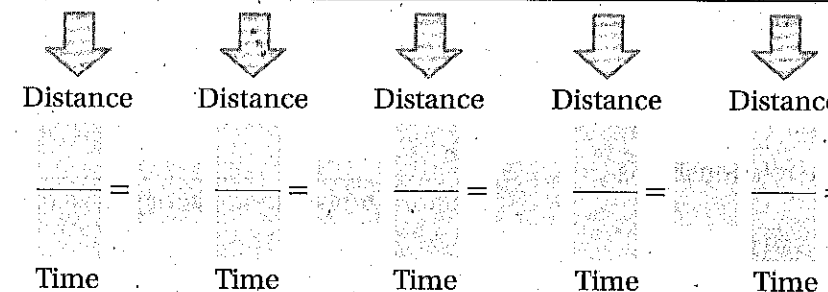
- A Use the bar diagram to help you determine how many inches a tortoise travels in 1 second. What operation did you use to find the answer?



- B Complete the table.

Time (sec)	1	2	3	4	5
Distance (in.)			10.5		

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



- D What do you notice about the ratios?
E **Conjecture** How do you think the distance a tortoise travels is related to the time?

REFLECT

- 1a. Suppose the tortoise travels for 12 seconds. Explain how you could find the distance the tortoise travels.
1b. How would you describe the rate or speed at which a tortoise travels?

Proportional Relationships, Tables, and Equations

COMMON CORE

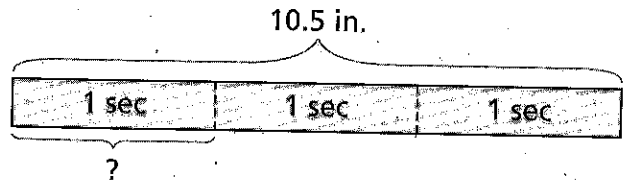
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1 EXPLORE Discovering Proportional Relationships

A giant tortoise moves at a slow but steady pace. It takes the giant tortoise 3 seconds to travel 10.5 inches.






- A** Use the bar diagram to help you determine how many inches a tortoise travels in 1 second. What operation did you use to find the answer?



- B** Complete the table.

Time (sec)	1	2	3	4	5
Distance (in.)			10.5		

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

					
	Distance	Distance	Distance	Distance	Distance
	$\frac{\quad}{\quad} =$	$\frac{\quad}{\quad} =$	$\frac{\quad}{\quad} =$	$\frac{\quad}{\quad} =$	$\frac{\quad}{\quad} =$
	Time	Time	Time	Time	Time

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

- E Conjecture** How do you think the distance a tortoise travels is related to the time?

REFLECT

- 1a.** Suppose the tortoise travels for 12 seconds. Explain how you could find the distance the tortoise travels.

- 1b.** How would you describe the rate or speed at which a tortoise travels?

A **proportional relationship** is a relationship between two quantities in which the ratio of one quantity to the other quantity is constant. A giant tortoise can live as long as 150 years. One reason these reptiles live so long is their slow heart rate. A giant tortoise's heart beats only 6 times per minute. The giant tortoise's heart rate is an example of a proportional relationship. The ratio of the number of heart beats to the number of minutes is 6.

2 EXAMPLE Identifying Proportional Relationships

Alberto types 45 words per minute. Is the relationship between the number of words and the number of minutes a proportional relationship? Why or why not?

A Complete the table.

Time (min)	1	2	3	4	5
Number of Words	45				

B Complete the ratios.

$$\frac{\text{Number of Words}}{\text{Time}} = \frac{45}{1} = \frac{\quad}{\quad} = \frac{\quad}{\quad} = \frac{\quad}{\quad} = \frac{\quad}{\quad} =$$

The ratios are _____.

The *common ratio* is _____.

So, the relationship is _____.

TRY THIS!

2a. The table shows the distance Allison drove on one day of her vacation. Is the relationship between the distance and the time a proportional relationship? Why or why not?

Time (h)	1	2	3	4	5
Distance (mi)	65	120	195	220	300

REFLECT

2b. Do you think Allison drove at a constant speed for the entire trip? Why or why not?

The equation for a proportional relationship has a special form. If the relationship between x and y is a proportional relationship, then the equation for the relationship may be written as $y = ax$, where a is a positive number. The constant a is called the **constant of proportionality**.

$$y = ax$$

↑
constant of proportionality

3 EXAMPLE Writing an Equation for a Proportional Relationship

Two pounds of cashews cost \$5, 3 pounds of cashews cost \$7.50, and 8 pounds of cashews cost \$20. Show that the relationship between the number of pounds of cashews and the cost is a proportional relationship. Then write an equation for the relationship.

Make a table to find the common ratio. Then write an equation with the common ratio as the constant of proportionality.

- A Complete the table.

Number of Pounds	2	3	8
Cost (\$)	5		

- B Complete the ratios. $\frac{\text{Cost}}{\text{Number of Pounds}} = \frac{5}{2} = \frac{\quad}{\quad} = \frac{\quad}{\quad} = \frac{\quad}{\quad}$

The common ratio is _____.

- C To write an equation, first tell what the variables represent.

Let x represent the number of pounds of cashews.

Let y represent the cost in dollars.

Use the common ratio as the constant of proportionality.

So, the equation for the relationship is _____.

REFLECT

- 3a. How can you use substitution to check your equation?

- 3b. What is the unit cost (unit rate) for the cashews? How does the unit cost appear in your equation?

- 3c. How can you use your equation to find the cost of 6 pounds of cashews?

PRACTICE

Tell whether the relationship is a proportional relationship. If so, give the constant of proportionality.

1.

Number of Minutes	3	4	5	6	7
Number of Seconds	180	240	300	360	420

2.

Time (h)	1	2	3	4	5
Biking Distance (mi)	12	26	36	44	50

3. Naomi reads 9 pages in 27 minutes, 12 pages in 36 minutes, 15 pages in 45 minutes, and 50 pages in 150 minutes.

4. A scuba diver descends at a constant rate of 8 feet per minute.

Write an equation for the relationship. Tell what the variables represent.

5. It takes Li 1 hour to drive 65 miles, 2 hours to drive 130 miles, and 3 hours to drive 195 miles.

6. There are 3.9 milligrams of calcium in each ounce of cooked chicken.

7.

Gallons of Gasoline	3	4	5	6
Total Cost (\$)	9.45	12.60	15.75	18.90

8.

Cups of Batter	2	6	8	12
Number of Muffins	5	15	20	30

Information on three car rental companies is given.

9. Write an equation that gives the cost y of renting a car for x days from Rent-All.

Rent-All				
Days	3	4	5	6
Total Cost (\$)	55.50	74.00	92.50	111.00

10. What is the cost per day of renting a car from A-1?

A-1 Rentals
The cost y of renting a car for x days is given by $y = 22.5x$.

Car Town
The cost of renting a car from us is just \$19.25 per day!

11. Which company offers the best deal? Why?