# Lesson 4 Part 1: Introduction Solve Problems with Unit Rate

CCLS 6.RP.A.3b 6.RP.A.3d

In Lesson 3 you learned to use tables to work with equivalent ratios. Take a look at this problem.

Karalee paints magnets that she sells at craft fairs. She can paint 12 magnets in 4 hours. At this rate, how many magnets can she paint in 2 hours? In 10 hours?

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Use the math you already know to solve the problem.

Magnets		6	12		30
Hours	1		4	8	

- What is the ratio of magnets to hours? \_\_\_\_\_\_
- What ratio do you get if you double the number of magnets and hours?

\_\_\_\_\_ Write your answer in the table.

How long would it take to paint 6 magnets? How do you know? \_\_\_\_\_\_

\_\_\_\_\_ Fill in the table with this ratio.

You know how long it takes to paint 24 magnets and 6 magnets. How can you use that information to calculate how long it takes her to paint 30 magnets?

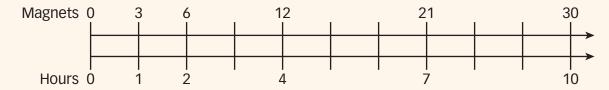
\_\_\_\_\_ Fill in the table with this ratio.

- Explain how you can use the information in the table to find out how many magnets shecan paint in 1 hour.
- Fill in the table with this ratio.



### **Section** Find Out More

A table is one way to show the relationship between the number of magnets and the time it takes to paint them. A double number line also shows the relationship.



Notice that the mark for 6 magnets is halfway between 0 and 12 and the line for 2 hours is halfway between 0 and 4 hours. You can use halves again to find the rate of 3 magnets in 1 hour.

Once you find that the unit rate is 3, you can multiply or divide to find other equivalent ratios.

Divide the number of magnets by 3 to find how long Karalee will take to complete them.

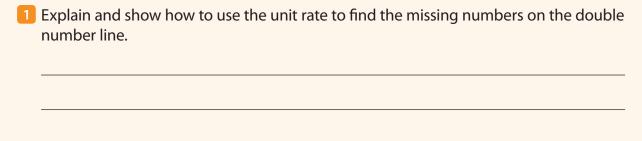
number of magnets 
$$\div$$
 unit rate = hours  
30  $\div$  3 = 10

Karalee will take 10 hours to paint 30 magnets.

Multiply the number of hours by 3 to find how many magnets Karalee can paint in that time.

Karalee can paint 21 magnets in 7 hours.

### **Reflect**





### Read the problem below. Then explore different ways to solve a problem involving unit price.

Isabella buys 4 pounds of tomatoes for \$6.00. How much do 7 pounds of tomatoes cost? How much do 10 pounds of tomatoes cost?

### ् Model It

#### You can use a table to help you find equivalent ratios.

You know that 4 pounds of tomatoes cost \$6.00.

If you divide both quantities in this ratio by 2, you find that 2 pounds cost \$3.00.

If you divide both quantities in the ratio 3 to 2 by 2, you find that 1 pound costs \$1.50. This is the **unit price**, or the price for 1 unit. Here the unit happens to be pounds.

Cost (\$)	1.50	3		6						
Pounds	1	2	3	4	5	6	7	8	9	10

### Q Model It

## You can add or multiply with the numbers in the table to complete the rest of it. Here is one way to find the missing values. Use this information to fill in the table.

3 pounds = 2 pounds + 1 pound. Add the corresponding costs: \$3.00 + \$1.50 = \$4.50.

5 pounds = 2 pounds + 3 pounds. Add the corresponding costs: \$3.00 + \$4.50 = \$7.50.

6 pounds = 2 pounds • 3. Multiply the cost of 2 pounds by 3:  $\$3.00 \cdot 3 = \$9.00$ .

7 pounds = 5 pounds + 2 pounds. Add the corresponding costs: \$7.50 + \$3.00 = \$10.50.

8 pounds = 4 pounds • 2. Multiply the cost of 4 pounds by 2:  $$6.00 \cdot 2 = $12.00$ .

9 pounds = 4 pounds + 5 pounds. Add the corresponding costs: \$6.00 + \$7.50 = \$13.50.

10 pounds = 1 pound  $\cdot$  10. Multiply the cost of 1 pound by 10: \$1.50  $\cdot$  10 = \$15.00.



	Connect	lt
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Now you will use the unit price to solve the problem from the previous page.  2 What ratio is given in the problem?
3 Explain how to use this ratio to find the unit price
How can you use the unit price to find the cost of 7 pounds of tomatoes and 10 pounds of tomatoes? Find the costs.
When might you make a table of equivalent ratios to solve a problem? When might you find the unit rate and multiplication to solve a problem?
6 Explain how can you find the amount of tomatoes that you can buy with \$18.00.
Try It
Use what you've just learned about unit price to solve these problems. Show your work on a separate sheet of paper.
7 Mrs. Sisneros bought 3 yards of ribbon for \$1.50. How much would 5 yards of the same ribbon cost?
8 Jack bought 4 bagels for \$3.00. How many bagels can he buy for \$4.50?

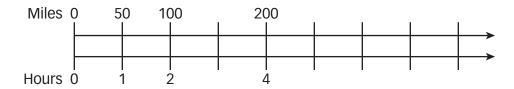


### Read the problem below. Then explore different ways to solve a problem involving constant speed.

Bill drove 200 miles in 4 hours. At this speed, how long will it take him to drive 300 miles? How long will it take him to drive 400 miles?

### ् Model It

You can show the relationship between miles and hours using a double number line.



You know that in 4 hours, Bill travels 200 miles. The same vertical line is labeled with 200 miles and 4 hours. If you divide both quantities in this ratio by 2, you find that in 2 hours he travels 100 miles. Divide both quantities in the ratio 100 to 2 by 2, and you find that in 1 hour he travels 50 miles.

### Q Model It

Here is one way you can use the quantities labeled on the double number line to complete the rest of it. Fill in the blanks below, and then finish labeling the number line.

3 hours = 2 hours + 1 hour and  $\underline{\phantom{a}}$  miles = 100 miles + 50 miles.

5 hours = 2 hours + 3 hours and miles = 100 miles + 150 miles.

6 hours = 2 hours  $\cdot$  3 and \_\_\_\_\_ miles = 100 miles  $\cdot$  3.

The rate is 50 miles for each 1 hour. Bill can drive 50 • 7, or \_\_\_\_\_ miles in 7 hours and

50 • 8, or \_\_\_\_\_ miles in 8 hours.



Conr	nect It
9 W	/hat does the double number line show as the unit rate?
10 Sł	how how to use the ratio given in the problem to find the unit rate.
11 H	ow can you use the unit rate to solve the problem?
_	
	uppose you want to know how long it will take Bill to drive 325 miles. How can you se the double number line to do this?
	escribe how you can use the unit rate to find how long it will take Bill to drive 25 miles.
	ow is solving a problem about constant speed similar to solving a problem about nit price? How are these types of problems different?
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Try It	1

Use what you just learned about constant speed to solve these problems. Show your work on a separate sheet of paper.

- 15 A jet plane flew 1,200 miles in 3 hours. At that rate, how far will it travel in 2 hours?
- 16 A small plane flew 240 miles in 2 hours. At that rate, how long will it take to travel 600 miles?



### Read the problem below. Then explore different ways to solve problems involving converting measurement units.

Toni is pouring milk for students' lunches. She knows that 3 quarts of milk contain 12 cups. How many cups can she pour with 7 quarts of milk? How many quarts does she need to pour 10 cups of milk?

### Q Model It

You can use the unit rate to make a table.

The rate is 4 cups to 1 quart. The unit rate is 4.

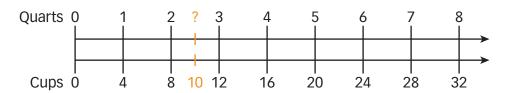
Multiply each number of quarts by 4 to find the corresponding number of cups.

Quarts	1	2	3	4	5	6	7	8
Cups	4	8	12	16	20	24	28	32

The table shows that 7 quarts is the same as 28 cups of milk.

### Q Model It

You can also use the unit rate to make a double number line. It's easy to see and use halfway points with a double number line.



Locate 10 on the bottom number line. It is halfway between 8 and 12. This means that the number of quarts is halfway between 2 and 3 on the top number line, or  $2\frac{1}{2}$  quarts.



### Connect It

Now you will use the unit rate to solve the problem from the previous page.

- 17 Show how can you find the unit rate without using the models.
- 18 Explain how you can use the unit rate to find the number of cups in 7 quarts.
- 19 Explain how you can use the unit rate to find the number of quarts that is equal to 10 cups.
- 20 Compare the answers you computed in problems 17–19 to the models on the previous page. Describe the results.
- 21 Now try a different problem. Given that there are 32 ounces in 2 pounds, explain how you would find the number of ounces in  $4\frac{1}{2}$  pounds.

### **N** Try It

Use what you just learned about measurement units to solve these problems. Show your work on a separate sheet of paper.

- Gary sees on a measuring cup that 200 centiliters are the same as 2 liters. How many liters are there in 300 centiliters? \_\_\_\_\_\_
- When Gianna asks for 4 feet of ribbon, the clerk measures a 48-inch piece. How many inches long is a 9-foot piece of ribbon?



The student used the information in the problem to find the unit rate. The unit rate can be used to find the time for any number of gallons.



### Pair/Share

How long would it take to fill a 90-gallon tub?

How much does one ear of sweet corn cost?



### Pair/Share

Suppose you have \$1.35 to spend. Why can't you spend that exact amount on corn?

Study the model below. Then solve problems 24-26.

Student Model

A hose fills an 18-gallon tub in 3 minutes. How long will it take to fill a 45-gallon tub?

Look at how you can solve the problem using the unit rate.

Ratio: 18 gallons to 3 minutes

Rate: 6 gallons for every 1 minute

**Unit Rate: 6** 

 $45 \text{ gallons} \div 6 = 7\frac{1}{2}$ 

Solution: 7 1/2 minutes

A store sells 4 ears of sweet corn for \$1.00. How much will 9 ears cost?

Show your work.

Solution:



25 The male elephant at the city zoo weighs 8,000 pounds, which is the same as 4 tons. The female elephant weighs 7,000 pounds. How many tons does she weigh?

Show your work.

Does the number of tons have to be a whole number?



Solution:

- Victor needs 30 feet of rope. The rope he wants to buy is sold by the yard. He knows that there are 3 feet in 1 yard. How many yards should he buy?
  - **A** 10
  - **B** 20
  - **C** 60
  - **D** 90

Natalia chose **D** as the correct answer. How did she get that answer?

### Pair/Share

Why do you know that the answer must be slightly less than 4?

Should the number of yards be less than or greater than the equivalent number of feet?



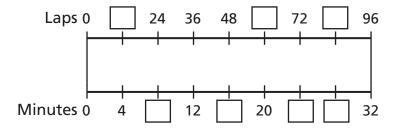
### Pair/Share

Why would the problem be more difficult if he needed to find the number of yards in 35 feet?



#### Solve the problems.

- Cory knows that 16 tablespoons are the same as 1 cup. He needs to measure  $\frac{3}{4}$  cup, but all he has is a tablespoon. How many tablespoons should Cory use?
  - **A** 4
  - **B** 8
  - **C** 12
  - **D**  $21\frac{1}{3}$
- Mrs. Rosso has to travel 390 miles on a highway. She drives 130 miles in 2 hours. If she has 7 hours to travel at that rate, will she arrive at her destination on time?
  - **A** Yes, she will arrive 1 hour early.
  - **B** Yes, she will arrive 4 hours early.
  - **C** No, she will arrive 1 hour late.
  - **D** No, she will arrive 4 hours late.
- At Mark's Hardware, a package of 8 hinges costs \$28. At Steve's Supplies, a package of 11 hinges costs \$38. Which statement is the most accurate?
  - A Mark's Hardware is the better buy because it sells hinges at \$3.50 per hinge.
  - **B** Mark's Hardware is the better buy because \$28 is less than \$38.
  - **C** Steve's Supplies is the better buy because it sells hinges at \$3.45 per hinge.
  - **D** Steve's Supplies is the better buy because you get more hinges.
- Elana can swim 12 laps in 4 minutes. Fill in the blanks in the double number line to show this relationship between laps and minutes.





There are 4 cups in a quart and 4 quarts in a gallon. How many cups are in a 5-gallon jug of water?

Show your work.

**Answer** There are \_\_\_\_\_ cups in a 5-gallon jug of water.

lvan and Jeff buy a package of 8 pens for \$4.00. Ivan wants 5 of the pens, and Jeff wants 3. How much should each student pay?

Show your work.

Answer Ivan should pay \_\_\_\_\_ and Jeff should pay \_\_\_\_\_.



**Self Check** Go back and see what you can check off on the Self Check on page 1.