Lesson 4

Solve Problems with Unit Rate

Name: _____

Prerequisite: Equivalent Ratios

Study the example problem showing how to find equivalent ratios. Then solve problems 1–6.

Example

Ramon needs 12 oranges to make 3 glasses of juice. How many oranges does he need to make 5 glasses? How many oranges does he need to make 8 glasses?

You can make a table to show ratios of the number of oranges to the number of glasses of juice.

Number of Oranges	4	8	12	16	20	24	28	32
Number of Glasses	1	2	3	4	5	6	7	8

Ramon needs 20 oranges to make 5 glasses of juice.

Ramon needs 32 oranges to make 8 glasses of juice.

B **1** What ratio is given in the problem for the number of oranges to the number of glasses of juice?

12 to 3

B **2** What is the unit rate? Explain what it means in this situation.

4; Possible explanation: 4 oranges are needed

for 1 glass of juice.

M **3** Explain how you can write equivalent ratios.

Possible explanation: I can identify the

relationship between the quantities in a given

ratio. Then I can multiply or divide the quantities

in a given ratio by the same number to find other

quantities with the same relationship.

Vocabulary

equivalent ratios two or more ratios that are equal to one another.

24 : 2, 36 : 3, 48 : 4

Solve.

M **4** Nathan does push-ups for the same amount of time every day. He does 9 minutes of push-ups in 3 days. How many minutes of push-ups does Nathan do in 7 days? Make a table to show the relationship between the number of minutes and the number of days.

Show your work.

Possible work:

Number of Minutes	3	6	9	12	15	18	21
Number of Days	1	2	3	4	5	6	7

Solution: **Nathan does 21 minutes of push-ups in 7 days.**

C **5** Students are knitting scarves for a fund-raiser. Elaine can knit 4 scarves in 20 days. Mario can knit 2 more scarves than Elaine can in 40 days. What is the difference in the time it takes each of them to knit a scarf? Explain your answers.

Show your work.

Possible work:

Elaine

Number of Days	5	20	40
Number of Scarves	1	4	8

Mario

Number of Days		40	4
Number of Scarves		8 + 2 = 10	1

Elaine's unit rate is 20 ÷ 4 = 5. It takes her 5 days to knit 1 scarf. Mario will knit 8 + 2 = 10 scarfs in 40 days. So his unit rate is 40 ÷ 10 = 4. It takes Mario 4 days to knit 1 scarf. 5 − 4 = 1, so it takes Elaine 1 more day than Mario to knit a scarf.

Solution: **It takes Elaine 1 more day than Mario to knit a scarf.**

M **6** There are 24 total customers seated at 4 tables in a restaurant. Each table has the same number of customers. Tell whether each statement is *True* or *False*.

a. Multiply 24 by 4 to find the number of customers per table. ☐ True ☒ False

b. The unit rate for the number of customers per table is 6. ☒ True ☐ False

c. The ratio of customers to tables is 24 : 4. ☒ True ☐ False

d. If all the tables are the same size, a maximum of 30 customers can sit at 6 tables. ☐ True ☒ False

Key

B Basic   **M** Medium   **C** Challenge

Practice Lesson 4 Solve Problems with Unit Rate

Unit 1

Lesson 4

Name: _____

Unit Price

Study the example problem showing how to solve a problem about unit price. Then solve problems 1–7.

> **Example**
>
> All the comic books in a store are the same price. Vera buys 3 comic books for $7.50. How much do 5 comic books cost? How much do 8 comic books cost?
>
> Divide 7.50 by 3 to find the unit price.
>
> $7.50 \div 3 = 2.50$
>
> The price per book is $2.50. You can use the unit price to make a table of equivalent ratios.
>
> | Cost ($) | 2.50 | 5.00 | 7.50 | 10.00 | 12.50 | 15.00 | 17.50 | 20.00 |
> |---|---|---|---|---|---|---|---|---|
> | Comic Books | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
>
> The cost of 5 comic books is $12.50.
>
> The cost of 8 comic books is $20.00.

B **1** How can you use multiplication to find the cost of 5 comic books?

Multiply the unit price by 5: $2.50 · 5 = $12.50.

B **2** How can you use addition to find the cost of 8 comic books?

Possible answer: Add the unit price to the cost of 7 comic books: $17.50 + 2.50 = $20.00.

M **3** Explain how to find the number of comic books you could buy with $25.00.

Possible explanation: Add $2.50 to the cost of 8 comic books and continue to add

$2.50 to the cost until you reach $25.00. $20.00 + $2.50 + $2.50 = $25.00. Then add the

corresponding numbers of books. 8 comic books + 2 comic books = 10 comic books.

You can buy 10 comic books with $25.00.

Solve.

Use the following situation to solve problems 4–7.

All of the used hardcover books at a yard sale are the same price. Hugo paid $4.50 for 6 books.

M **4** Explain how to find the unit price of the books.

Divide $4.50 by 6. The unit price is $0.75.

M **5** Hugo's friends bought used books at the yard sale. Sonia paid $2.25, John paid $6.00, and Keisha paid $3.75. How many books did each friend buy?

Show your work.

Cost ($)	0.75	1.50	2.25	3.00	3.75	4.50	5.25	6.00
Number of Books	1	2	3	4	5	6	7	8

Solution: **Sonia bought 3 books. John bought 8 books. Keisha bought 5 books.**

M **6** Kim bought 10 used books at the yard sale. How much did she pay? Did you use addition or multiplication to solve this problem? Why?

$7.50; Possible explanation: I used multiplication. It was faster than extending the table.

C **7** The price for the used paperback books at the yard sale was $0.25 less than for the hardcover books. How many more paperback books than hardcover books could someone buy with $3.00?

Show your work.

Possible work:

$0.75 − $0.25 = $0.50.

The paperback price is $0.50.

Cost ($)	0.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00
Number of Books	1	2	3	4	5	6	7	8

With $3.00, someone could buy 6 paperback books but only 4 hardcover books: 6 − 4 = 2.

Solution: **Someone could buy 2 more paperback books than hardcover books with $3.00.**

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Constant Speed

Study the example problem showing how to solve a problem about constant speed. Then solve problems 1–7.

Example

Kenja traveled 120 miles in 3 hours on a train. At this speed, how long will it take her to travel 200 miles?

The unit rate for miles per hour is 120 ÷ 3, or 40. Use the unit rate to make a double number line.

Miles 0 40 80 120 160 200 240 280

Hours 0 1 2 3 4 5 6 7

Divide 200 by 40.
200 ÷ 40 = 5

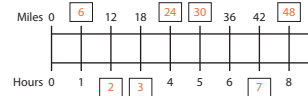It will take Kenja 5 hours to travel 200 miles.

B **1** How many miles could Kenja travel in 1 hour. Is this the same number of hours it takes Kenja to travel 1 mile? Explain your answer.

40; no; Possible explanation: The unit rate for miles per hour is 40. To find out how

many hours it takes to travel 1 mile you want the unit rate for hours per mile, which

is $\frac{1}{40}$.

B **2** Explain how to use the unit rate for miles per hour to find how many miles Kenja can travel in 8 hours.

Possible explanation: Multiply 8 by 40. Kenja can drive 320 miles in 8 hours.

M **3** Explain how to use the double number line to find how many hours it will take Kenja to travel 220 miles.

Possible explanation: 220 miles is halfway between 200 and 240 miles. So the number

of hours is halfway between 5 and 6, which is 5.5 hours. It will take Kenja 5.5 hours to

travel 220 miles.

Solve.

Use the following situation to solve problems 4–6.

Zachary exercises by jogging at a constant speed. During one week, he jogged 36 miles in 6 hours.

M **4** Complete the double number line to show the relationship between the number of miles and the hours that Zachary jogs.

Miles 0 6 12 18 24 30 36 42 48

Hours 0 1 2 3 4 5 6 7 8

M **5** Explain how you found the number of hours it takes Zachary to jog 18 miles.

Possible explanation: First I found that Zachary jogs at a speed of 6 miles per hour.

Then I divided 18 by that unit rate to find that it takes 3 hours for him to jog 18 miles.

M **6** How many miles does Zachary jog in 4.5 hours? Explain how to use the double number line to find the answer.

27 miles; Possible explanation: 4.5 hours is halfway between 4 and 5 hours. So the

number of miles is halfway between 24 and 30, which is 27.

C **7** Alyssa and Caleb both drove 210 miles to the beach in separate cars. They left at the same time. They both drove at a constant speed. Alyssa drove 105 miles in 3.5 hours. Caleb drove 168 miles in 4 hours. Who arrived earlier? How much earlier?

Show your work.

Possible work:

Alyssa's unit rate is 105 ÷ 3.5, or 30. Caleb's unit rate is 168 ÷ 4, or 42.

Alyssa: 210 ÷ 30 = 7 hours
Caleb: 210 ÷ 42 = 5 hours
7 − 5 = 2 hours

Solution: **Caleb arrived 2 hours before Alyssa.**
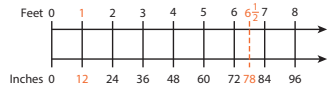
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Converting Measurement Units

Study the example problem showing how to solve a problem involving conversion of measurement units. Then solve problems 1–6.

Example

Hannah needs 78 inches of ribbon to make a picture frame. She knows that there are 60 inches in 5 feet. How many feet of ribbon are in 78 inches?

You can find the unit rate and make a double number line. There are 60 inches in 5 feet, so there are 60 ÷ 5 = 12 inches in 1 foot. The unit rate is 12.

Feet 0 1 2 3 4 5 6 $6\frac{1}{2}$ 7 8

Inches 0 12 24 36 48 60 72 78 84 96

Because the number of inches, 78, is halfway between 72 and 84, the number of feet must be halfway between 6 and 7 feet. There are $6\frac{1}{2}$ feet of ribbon in 78 inches.

B 1 Explain how to use the unit rate without the number lines to find how many feet of ribbon are in 48 inches.

Possible explanation: Divide 48 inches by 12 inches per foot.

B 2 How many inches of ribbon are in 3 feet? Explain how to find the answer without using the number lines.

36 inches; Possible explanation: Multiply 3 feet by 12 inches per foot.

M 3 What is the difference between using the unit rate to find how many feet are in a given number of inches and using the unit rate to find how many inches are in a given number of feet?

Possible answer: To find how many feet are in a given number of inches, you divide by 12. To find how many inches are in a given number of feet, you multiply by 12.

Solve.
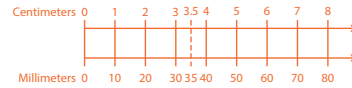**Use the following situation to solve problems 4–5.**

Antonio measures items in his pocket. He knows there are 50 millimeters in 5 centimeters. His key chain is 3.5 centimeters long. His library card is 80 millimeters long.

M 4 How many centimeters long is his library card? Explain how to use the unit rate to find the answer.

8 centimeters; Possible explanation: There are 10 millimeters in each centimeter, so the unit rate is 10. Divide 80 by the unit rate, 10, to get 8 centimeters.

M 5 How many millimeters long is his key chain? Draw a double number line to find the answer.

Show your work.

Possible work:

Centimeters 0 1 2 3 3.5 4 5 6 7 8

Millimeters 0 10 20 30 35 40 50 60 70 80

Solution: **Antonio's key chain is 35 millimeters long.**

C 6 Claire is measuring ingredients for recipes. She knows that there are 12 cups in 6 pints. She also knows that 4 quarts equals 16 cups. Which has more cups, 5 pints or 3 quarts? How many more cups?

Show your work.

Possible work:

The unit rate of cups to pints is 2. The unit rate of cups to quarts is 4.

5 pints · 2 cups per pint = 10 cups

3 quarts · 4 cups per quart = 12 cups

12 − 10 = 2

Solution: **There are 2 more cups in 3 quarts than in 5 pints.**

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Solve Problems with Unit Rate

Solve the problems.

M

1 The double number line shows the relationship between the number of minutes and the number of pages that a printer prints. How many pages does the printer print in $4\frac{1}{2}$ minutes?

Where is $4\frac{1}{2}$ minutes located on the number line?

Pages 0   20   40   60   80   100

Minutes 0   1   2   3   4   5

A 80 pages   **B** 85 pages   **C** 90 pages   **D** 100 pages

M

2 A carpenter uses 65 shelves to make 13 bookcases. She uses the same number of shelves for each bookcase. Are 32 shelves enough to build 6 more bookcases?

What is the unit rate?

Show your work.

Possible work:
65 ÷ 13 = 5 shelves per bookcase
The unit rate of shelves per bookcase is 5;
Six bookcases would require 6 · 5 = 30 shelves.

The carpenter has 32 shelves. Because she needs 30 shelves, she will have 32 − 30 = 2 shelves left over after she builds the 6 bookcases.

Solution: **Yes. The carpenter has enough shelves to build 6 more bookcases.**

M

3 The price of 6 pretzels is $5.10. Simon and Sofia bought 8 pretzels and shared the cost equally. How much did each person pay?

One calculation is not enough to solve this problem.

A $0.85   **C** $6.80

B $3.40   **D** $20.40

Jacob chose **C** as the correct answer. How did he get that answer?

Possible answer: He correctly found the cost of 8 pretzels, but he did not divide the cost by 2 to find what each person paid.

Lesson 4 Solve Problems with Unit Rate

Solve.

Lesson 4 Solve Problems with Unit Rate

B

4 Michael drove 350 miles in 7 hours at a constant speed. Tell whether each statement is *True* or *False*.

How can you find a unit rate?

a. The unit rate for miles to hours is 50.   ☒ True   ☐ False

b. Michael drove 250 miles in 4 hours.   ☐ True   ☒ False

c. To find the number of miles Michael drove in 3 hours, multiply 3 by 50.   ☒ True   ☐ False

d. To find the number of hours it took Michael to drive 300 miles, divide 300 by 50.   ☒ True   ☐ False

C

5 Jorge says there are 198 inches in 5.5 yards. Is he correct? Explain your answer.

Do you know the unit rate for inches per foot? Do you know the unit rate for feet per yard?

Show your work.
Possible student work: I know that there are:

3 feet per 1 yard   12 inches per 1 foot

I used that information to find the number of inches in 5.5 yards:

5.5 · 3 = 16.5 feet   16.5 · 12 = 198 inches

Solution: **Jorge is correct. There are 198 inches in 5.5 yards.**

M

6 At Teen Tops, a package of 5 T-shirts costs $38. At Bargain City, a package of 4 T-shirts costs $34. Which statement is the most accurate?

Finding unit prices will help you choose the correct answer.

A Bargain City is the better buy because it sells T-shirts at $8.50 per T-shirt.

B Teen Tops is the better buy because the package has more T-shirts.

C Bargain City is the better buy because $34 is less than $38.

D Teen Tops is the better buy because it sells T-shirts at $7.60 per T-shirt.