



Lesson 18: Finding a Rate by Dividing Two Quantities

Student Outcomes

- While there is no physical way to divide two different quantities like (5 miles)/(2 hours), students make use of the structure of division and ratios to model (5 miles)/(2 hours) as a quantity 2.5 mph. Interpreting a rate as a division of two quantities, or better yet a fraction, is the first step towards converting measurement units using rates later in the module and dimensional analysis in high school. Students use this interpretation of a rate in word problems when multiplying a rate by a quantity, as in $\left(5 \frac{\text{gal}}{\text{min}}\right) \cdot (10 \text{ min}) = \frac{5 \text{ gal}}{1 \cancel{\text{min}}} \cdot 10 \cancel{\text{min}} = 50 \text{ gal}$.

Materials

- Stations—Set up six workstations around the classroom, identifying each with a number from 1 to 6.
- Countdown timer

Classwork

Mathematical Modeling Exercises (12 minutes)

Mathematical Modeling Exercises

- At Fun Burger, the Burger Master can make hamburgers at a rate of 4 burgers/minute. In order to address the heavy volume of customers, he needs to continue at this rate for 30 minutes. If he continues to make hamburgers at this pace, how many hamburgers will the Burger Master make in 30 minutes?

$$4 \frac{\text{burgers}}{\text{minute}} \times 30 \cancel{\text{minutes}} = 120 \text{ burgers}$$

If the Burger Master can make four burgers in one minute, he can make 120 burgers in 30 minutes.

Model how to solve the exercise as students take notes. Students can be part of the discussion on how to solve each problem, but the teacher should be modeling the process.

- At what rate does the Burger Master make hamburgers?
- How long does the Burger Master make hamburgers?
- Multiply the rate by the amount of time the Burger Master works.
- Answer the question asked in the problem.

- Chandra is an editor at the New York Gazette. Her job is to read each article before it is printed in the newspaper. If Chandra can read 10 words/second, how many words can she read in 60 seconds?

$$10 \frac{\text{words}}{1 \text{ second}} \times 60 \cancel{\text{seconds}} = 600 \text{ words}$$

If Chandra can read 10 words in 1 second, then she can read 600 words in 60 seconds.

Model how to solve the exercise as students take notes. Ask for student volunteers to explain each step.

- At what rate does Chandra read?
- How long does Chandra have to read?
- Multiply the unit rate by the amount of time Chandra reads.
- Answer the question asked in the problem.

Exercises (18 minutes—3 minutes per station)

Students work in groups to complete station work.

Station One: Helena works for a publishing firm. She is considered an average typist and can type 52 words/minute. If she continues at this rate, how many minutes would it take Helen to type 104 words?

Station Two: Jaxon test drives cars for a car company. Part of his job is to test the cruise control on a testing course. On his last test drive, Jaxon set the cruise control at 48 miles/hour and drove for 2 hours. How many miles did Jaxon drive?

Station Three: To train for an upcoming marathon, Alvin runs 9 miles a day. If Alvin runs 9 miles every day for 30 days, how many total miles will he run?

Station Four: A library just hired Brittany to write reviews on different books. The job requires Brittany to read 3 books/week. If Brittany reads a total of 36 books, how many weeks will she work?

Station Five: Notebooks are on sale for 4 notebooks/dollar. Mrs. Day wants to buy notebooks for her students but only has \$12 to spend. How many notebooks can Mrs. Day buy?

Station Six: Kevin hopes to earn a college basketball scholarship. To improve his shooting skills, Kevin shoots 50 baskets/day. If Kevin shoots 50 baskets every day for 60 days, how many shots would Kevin take?

Exercises

Use the table below to write down your work and answers for the stations.

- | | |
|----|---|
| 1. | <i>If Helena types at a constant rate of 52 words/minute, she can type 104 words in 2 minutes.</i> |
| 2. | <i>If Jaxon drives at a constant rate of 48 miles/hour, he can drive 96 miles in 2 hours.</i> |
| 3. | <i>If Alvin runs 9 miles every day for 30 days, he would run a total of 270 miles.</i> |
| 4. | <i>If Brittany is required to read 3 books/week, she would have to work 12 weeks in order to read 36 books.</i> |
| 5. | <i>If notebooks are on sale for 4 notebooks/dollar, then Mrs. Day can buy 48 notebooks for \$12.</i> |
| 6. | <i>If Kevin continues to shoot 50 baskets/day for 60 days, he would shoot a total of 3,000 baskets.</i> |

Closing (10 minutes)

Discuss solutions for each station. Students show how they solved each problem. Allow time for questions.

Lesson Summary

We can convert measurement units using rates. The information can be used to further interpret the problem.

Here is an example:

$$\begin{aligned}\left(5 \frac{\text{gal}}{\text{min}}\right) \cdot (10 \text{ min}) &= \frac{5 \text{ gal}}{1 \cancel{\text{min}}} \cdot 10 \cancel{\text{min}} \\ &= 50 \text{ gal.}\end{aligned}$$

Exit Ticket (5 minutes)

Name _____

Date _____

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Exit Ticket

Alejandra drove from Michigan to Colorado to visit her friend. The speed limit on the highway is 70 miles/hour. If Alejandra's combined driving time for the trip was 14 hours, how many miles did Alejandra drive?

Exit Ticket Sample Solutions

Alejandra drove from Michigan to Colorado to visit her friend. The speed limit on the highway is 70 miles/hour. If Alejandra's combined driving time for the trip was 14 hours, how many miles did Alejandra drive?

980 miles

Problem Set Sample Solutions

1. Enguun earns \$17 per hour tutoring student-athletes at Brooklyn University.

- a. If Enguun tutored for 12 hours this month, how much money did she earn this month?

\$204

- b. If Enguun tutored for 19.5 hours last month, how much money did she earn last month?

\$331.50

2. The Piney Creek Swim Club is preparing for the opening day of the summer season. The pool holds 22,410 gallons of water, and water is being pumped in at 540 gallons per hour. The swim club has its first practice in 42 hours. Will the pool be full in time? Explain your answer.

Yes, the pool will be full of water in time for the first practice because 22,680 gallons of water can be pumped in 42 hours at a rate of 540 gallons per hour. Since 22,680 gallons is more water than the pool needs, we know that the swim club will have enough water.