MSTAR INTERVENTION

L6

Lesson 6: Find the Missing Value by Using Unit Rates

Lesson Objective

- Students will find the missing value in a proportion by using a unit rate.

Instructional Materials

Material	Quantity	Description
How Am I Doing? graph	1 per student	
Colored pencils	1 per student	
Display Masters	1 each	• Preview: Key Ideas: Unit Rates • Demonstrate: Potato Salad A–F • Demonstrate: Transportation A–E
Handouts	1 per student	• Cumulative Review • Practice • Independent Practice
Answer Keys	1 each	• Cumulative Review • Practice • Independent Practice

Cumulative Review

Have students answer the questions on the Cumulative Review handout. Go over the answers. Correct misconceptions. Have students use a colored pencil to make corrections as needed. Collect student papers to determine who needs additional instruction.

Preview

This lesson will build on students' conceptual knowledge of finding the missing value in a proportion by multiplying by a scale factor.

Display and introduce through a brief explanation the key ideas for this lesson:

- A unit rate describes how many units of 1 quantity for 1 unit of another quantity.
- A missing value of a proportion can be found by finding the unit rate of the complete ratio and then multiplying the fraction representing the unit rate by a scale factor.

Use the Key Ideas: Unit Rates 

display master as needed.

Engage Prior/Informal Knowledge

To open the lesson, activate students' background knowledge and preskills by leading activities such as the following:

Have students work in pairs. Assign each person in the pair 1 of the following unit rate questions. When students finish, have them discuss their solutions and reasoning with their partner. Pick 2 pairs to share their answers with the whole group. Ensure that students use the correct mathematical language in their answers and explanations.

- If a car can go 63 miles on 3 gallons of gas, what is the unit rate? (21 miles per gallon)

- If a sale at a department store is advertised as \$20 for 5 shirts, what is the unit rate? (\$4 per shirt) 1

If students cannot answer these questions, stop and explicitly teach the material.

1 TEACHER NOTE
If students struggle with the vocabulary or with finding unit rates, revisit the Ratios and Rates module.

Demonstrate

1. Find the missing value of a proportion, using a unit rate.

Say: *In the previous lesson, we found a missing value in a proportion by multiplying the fraction representing the ratio by a scale factor. Today, we will find the missing value in a proportion by finding the unit rate for the complete ratio first and then multiplying it by a scale factor.*

Say: *Consider the following scenario: The recipe for potato salad Lucy is making asks for 6 potatoes for 2 boiled eggs. Lucy has 5 boiled eggs that she wants to use in her potato salad for a party. How many potatoes does she need for 5 boiled eggs?*

Say: *This scenario is represented by the proportion* $\frac{6 \text{ potatoes}}{2 \text{ boiled eggs}} = \frac{x \text{ potatoes}}{5 \text{ boiled eggs}}$.

Use the Potato Salad A **DM** display master as needed.

Ask students what scale factor could be used to get from 2 boiled eggs to 5 boiled eggs. Ensure that students use the correct mathematical language in their answers and explanations.

Say: *Because we know the ratios are proportional, what scale factor was used to scale from 2 boiled eggs to 5 boiled eggs? (not a whole number)*

Say: *Because the scale factor is not a whole number, in this situation, we need to simplify the first ratio before finding the scale factor. Consider the ratio* $\frac{6 \text{ potatoes}}{2 \text{ boiled eggs}}$. *Because 1 of the numbers is the greatest common factor of both numbers, we can find the unit rate.*

Say: *Recall, to simplify a ratio, we need to find the greatest common factor of the numerator and denominator of the fraction representing the ratio. For the ratio* $\frac{6 \text{ potatoes}}{2 \text{ boiled eggs}}$, *what is the greatest common factor for 6 and 2? (2)*

Use the Potato Salad B **DM** display master as needed.

Say: *To find the unit rate of the ratio, we need to divide the numerator and the denominator of the fraction representing the ratio by the greatest common factor, 2. What do we get when we divide 6 by 2? (3) What do we get when we divide 2 by 2? (1) The new ratio is* $\frac{3 \text{ potatoes}}{1 \text{ boiled egg}}$. *Because this ratio represents a number of units for 1 quantity per 1 unit of the other quantity, it is a unit rate.*

Use the Potato Salad C **DM** display master as needed.

Say: *Now that we have the unit rate, we know how many potatoes are used for each boiled egg. We can use this information to find the missing value in the second ratio because now, it is possible to find a scale factor that is a whole number.*

Say: *Let's set up the proportion* $\frac{3 \text{ potatoes}}{1 \text{ boiled egg}} = \frac{x \text{ potatoes}}{5 \text{ boiled eggs}}$. *Because we know both of the denominators of the fractions representing the ratios, we can determine a scale factor to find the missing value. What would we multiply 1 by to get 5? (5) Therefore, 5 is the scale factor. We have 5 times as many boiled eggs in Ratio 2 as in the unit rate.*

Use the Potato Salad D **DM** display master as needed.

Say: *For the ratios to remain proportional, we also want 5 times as many potatoes in Ratio 2. When we multiply 3 by 5, we get how many potatoes? (15)*

Use the Potato Salad E DM display master as needed.

Say: *The missing value of the proportion is 15 potatoes. Therefore, the proportion* $\frac{3 \text{ potatoes}}{1 \text{ boiled egg}} = \frac{15 \text{ potatoes}}{5 \text{ boiled eggs}}$ *is true, as well as the proportion* $\frac{6 \text{ potatoes}}{2 \text{ boiled eggs}} = \frac{15 \text{ potatoes}}{5 \text{ boiled eggs}}$. *We know they are proportional because they both represent relationships in which there are 3 potatoes for every 1 boiled egg.*

Use the Potato Salad F DM display master as needed.

2. Find the missing value in a proportion, using a unit rate.

Say: *Consider the following scenario: Every day at Mason Elementary, 8 students ride the bus home for every 2 students who walk home. At this rate, how many students would ride the bus if 9 students walked?*

Say: *This scenario is represented by the proportion* $\frac{8 \text{ bus riders}}{2 \text{ walkers}} = \frac{x \text{ bus riders}}{9 \text{ walkers}}$.

Use the Transportation A DM display master as needed.

Say: *In this situation, we need to simplify the first ratio before finding the scale factor. Consider the ratio* $\frac{8 \text{ bus riders}}{2 \text{ walkers}}$. *We need to find the unit rate.*

Say: *Work with your partner to find the unit rate. (* $\frac{4 \text{ bus riders}}{1 \text{ walker}}$ *)*

Give students a chance to find the unit rate with their partner. Choose 2–3 pairs to share their answer with the group. Have the other students give a thumbs-up or thumbs-down to show whether they agree with each pair's unit rate.

Use the Transportation B DM display master as needed.

Say: *Now that we have the unit rate, we can use it in place of the first ratio to find the missing value in the second ratio. So, we set up the proportion* $\frac{4 \text{ bus riders}}{1 \text{ walker}} = \frac{x \text{ bus riders}}{9 \text{ walkers}}$. *Because we know both of the denominators of the fractions representing the ratios, we can determine a scale factor to find the missing value. What would we multiply 1 by to get 9? (9) There*

are 9 times as many walkers in Ratio 2 as in the unit rate.

Use the Transportation C DM display master as needed.

Say: *Now that we have found the scale factor, we can use it to find how many bus riders are in Ratio 2. If there are 9 times as many walkers, there must be 9 times as many bus riders for the ratios to be proportional. So, when we multiply 4 by 9, we get what? (36)*

Use the Transportation D DM display master as needed.

Say: *The missing value of the proportion is 36 bus riders. Therefore, the proportion* $\frac{4 \text{ bus riders}}{1 \text{ walker}} = \frac{36 \text{ bus riders}}{9 \text{ walkers}}$ *is true, as well as the proportion* $\frac{8 \text{ bus riders}}{2 \text{ walkers}} = \frac{36 \text{ bus riders}}{9 \text{ walkers}}$.

Use the Transportation E DM display master as needed.

Practice

For the practice activity, provide detailed feedback to students, highlighting what was done correctly and what needs improvement. Provide opportunities for students to correct their errors. Collect student work to review and monitor student progress.

Activity: Help students complete the activity on the Practice handout. Have students check their answers with a partner and discuss reasoning. Select a few students to verbalize their reasoning and each step in the process. Ensure that students use the correct mathematical language in their explanations.

Circulate to monitor student progress.

Independent Practice

1. Have students work independently to complete the activity on the Independent Practice handout.

2. Go over the answers (students self-check and correct, using a colored pencil).

3. Have students record the number correct in the box and complete their How Am I Doing? graph.

4. Collect the papers to review and monitor student progress. Review the key ideas. Have students provide examples from the lesson.

Closure

Have students discuss their answer to the following questions:

- When would you use a unit rate to solve a proportion? Give an example.
- What does the unit rate tell you about the relationship between the 2 units?

Clear up any misconceptions Students who struggle to identify an efficient strategy for solving a proportion need additional instruction.