

Lesson 8: Find the Missing Value by Using a Common Denominator

Lesson Objective

- Students will find missing values in a proportion by using a common denominator.

Instructional Materials

Material	Quantity	Description
How Am I Doing? graph	1 per student	
Colored pencils	1 per student	
Index cards with 1 problem on each	2 per pair	Each index card should have a different problem, similar to the examples provided below.
Whiteboard and dry-erase marker	1 per student	
Popsicle sticks with 1 student name on each	1 per student for teacher use	
Display Masters	1 each	<ul style="list-style-type: none"> • Preview: Key Idea: Find the Missing Value • Demonstrate: Pears and Apples A-H • Demonstrate: Red and Purple Beads A-H
Handouts	1 per student	<ul style="list-style-type: none"> • Cumulative Review • Practice • Independent Practice
Answer Keys	1 each	<ul style="list-style-type: none"> • 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 determining proportionality by using a common denominator.

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

- To find the missing value in a proportion, find a common denominator of the 2 fractions representing the ratios and set the new numerators equal to each other.

Use the Key Idea: Find the Missing Value  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.

Before class, create index cards with 1 problem on each, similar to the problems listed below. Have students work in pairs and each pair choose 2 cards from the deck. On their individual whiteboards, have students solve the problems and discuss their reasoning with their partner as they work. Choose 2–3 students to share their problem and solution with the group. Ensure that students use the correct mathematical language in their answers and explanations.

- What is a common denominator for the ratios $\frac{3}{5}$ and $\frac{1}{3}$? (15)
- Are the ratios $\frac{2}{6}$ and $\frac{3}{9}$ proportional? (yes)

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

Demonstrate

1. Find a missing value in a proportion by using a common denominator.

Say: *In the previous lesson, we learned how to prove that 2 ratios are proportional by finding a common denominator for the ratios. Today, we will use a common denominator to find a missing value in a proportion.*

Say: *Previously, we learned how to find a missing value in a proportion by multiplying the fraction representing 1 ratio by a scale factor.*

Say: *Suppose I was given the scenario: When James goes grocery shopping, he buys 2 pears for every 6 apples. How many pears did he buy if he bought 15 apples?*

Say: *The proportion $\frac{2 \text{ pears}}{6 \text{ apples}} = \frac{x \text{ pears}}{15 \text{ apples}}$ represents this scenario. Using the scale factor strategy, what can I multiply 6 by to get 15?*

Use the Pears and Apples A  display master as needed.

Say: *There isn't a whole number that I can multiply 6 by to get 15; multiplying by a scale factor to find the missing value might be complicated in this problem. We need to explore another strategy for finding the missing value.*



Say: *Let's use the strategy we learned in the previous lesson of finding a common denominator and using it to find the missing value in a proportion. This graphic organizer will help guide our thinking.*

**TEACHER NOTE**

As a bridge to the next lesson, use the graphic organizer on the display masters to solve these problems. Complete the graphic organizer as you ask guiding questions.

Use the Pears and Apples B  display master as needed.

Select a popsicle stick to choose a student to answer each of the following questions. Ensure that students use the correct mathematical language in their responses.

Say: *What are the numerators of the proportion? (2 and x) What are the denominators of the proportion? (6 and 15) We must find a common multiple of 6 and 15, which are the denominators of the 2 ratios. An obvious common denominator is the product of 6 and 15, which is 90. We can use 90 as our common denominator.*

Use the Pears and Apples C  display master as needed. Complete the following steps in the Solve column of the graphic organizer.

Say: *We multiplied the denominator, 6, in the first ratio by 15 to get the common denominator 90. Because we multiplied the denominator by 15, we must also multiply the numerator, 2, by 15, so that the value of the ratio does not change.*

Say: *We multiplied the denominator, 15, in the second ratio by 6 to get the common denominator 90. Because we multiplied the denominator by 6, we must also multiply the numerator, x, by 6, so that the value of the ratio does not change.*

Use the Pears and Apples D  display master as needed.

Say: *Now, we will write each ratio as an equivalent ratio with 90 as its denominator.*

Use the Pears and Apples E  display master as needed.

Say: *Proportions are representations of equivalent ratios. Therefore, for $\frac{30}{90}$ and $\frac{6x}{90}$, because the denominators are equivalent, 30 must be equal to $6x$.*

Use the Pears and Apples F  display master as needed.

Say: *Because $30 = 6x$, I think to myself, "What number times 6 equals 30?" (5)*

Use the Pears and Apples G  display master as needed. 

Say: *$x = 5$ pears; therefore, the missing value in the proportion $\frac{2 \text{ pears}}{6 \text{ apples}} = \frac{x \text{ pears}}{15 \text{ apples}}$ is 5 pears.*

Say: *What were the numerators multiplied by to get the new numerators? (15 and 6)*

Complete the last column of the graphic organizer. Use the Pears and Apples H  display master as needed.

2. Find a missing value in a proportion.

Say: *Consider the following scenario: Leslie wants to make a necklace with all of the red and purple beads in her bag. She wants to know how many red beads she should add for every section of 8 purple beads. Her bag of beads has 3 red beads for every 12 purple beads.*

Say: *The proportion $\frac{x \text{ red beads}}{8 \text{ purple beads}} = \frac{3 \text{ red beads}}{12 \text{ purple beads}}$ represents this scenario. Let's find the missing value by using a common denominator.*

Use the Red to Purple Beads A  display master as needed.

Complete the graphic organizer as you ask guiding questions. Use the Red and Purple Beads B  display master as needed.

Say: *What are the numerators of the proportion? (x and 3)
What are the denominators of the proportion? (8 and 12) First, we must find a common multiple or common denominator of 8 and 12, which are the denominators of*

 **TEACHER NOTE**
If students have not been exposed to or have difficulty solving equations algebraically, use the following language: "6x means 6 times a number, so 6 times what number is 30." Eventually, transition students to doing the algebraic step of dividing by 6, but using the aforementioned language first will help form students' conceptual knowledge.

the 2 ratios. An obvious common multiple is the product of 8 and 12, which is 96. We can use 96 as our common denominator.

Use the Red and Purple Beads C  display master as needed. Complete the following steps in the Solve column of the graphic organizer.

Say: *We multiplied the denominator, 8, in the first ratio by 12 to get the common denominator 96. Because we multiplied the denominator by 12, we must also multiply the numerator, x , by 12, so that the value of the ratio does not change. Also, we multiplied the denominator, 12, in the second ratio by 8 to get the common denominator 96. Because we multiplied the denominator by 8, we must also multiply the numerator, 3, by 8, so that the value of the ratio does not change.*

Use the Red and Purple Beads D  display master as needed.

Say: *Now, we will write each ratio as an equivalent ratio that has 96 as its denominator.*

Use the Red and Purple Beads E  display master as needed.

Say: *A proportion is a representation of equivalent ratios. Therefore, for $\frac{12x}{96}$ and $\frac{24}{96}$ because the denominators are equivalent, $12x$ must equal 24.*

Use the Red and Purple Beads F  display master as needed.

Say: *Because $12x = 24$, I think to myself, "What number times 12 equals 24?" (2)*

Say: *$x = 2$ red beads; therefore, the missing value in the proportion $\frac{x \text{ red beads}}{8 \text{ purple beads}} = \frac{3 \text{ red beads}}{12 \text{ purple beads}}$ is 2 red beads.*

Use the Red and Purple Beads G  display master as needed.

Say: *What were the numerators multiplied by to get the new numerators? (8 and 12)*

Complete the last column of the graphic organizer. Use the Red and Purple Beads H  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: Have students complete the activity on the Practice handout. After completing each problem, 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.

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.

Closure

Review the key idea. Have students provide examples from the lesson.

Have students discuss their answer to the following questions:

- If 2 ratios are proportional and their denominators are equal, what do you know about their numerators?

- What are the different methods you have learned for solving a proportion? Under what circumstances would you use each method?

Clear up any misconceptions. Students who struggle with finding the missing value in a proportion by using common denominators need additional instruction.