

Lesson 9: Building the Cross Products Strategy From Common Denominators

Lesson Objective

- Students will identify patterns in using common denominators to find missing values in proportions as a foundation for using cross products.

Instructional Materials

Material	Quantity	Description
Whiteboard and dry-erase marker	1	
Chart paper	1 sheet	
How Am I Doing? graph	1 per student	
Colored pencils	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: Building Cross Products • Demonstrate: Table A-D
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 using common denominators to find missing values in proportions.

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

- To find missing values by using common denominators, multiply the denominator of 1 fraction representing a ratio by the numerator of the fraction representing the other ratio and vice versa. Then set these products equal to each other and solve the equation to find the missing value.

Use the Key Idea: Building Cross Products  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 problems. After solving the problem, have students discuss 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.

- Are the ratios $\frac{2}{3}$ and $\frac{6}{10}$ proportional?
- What is the missing value in the proportion $\frac{2}{6} = \frac{x}{9}$? Use a common denominator to solve.

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

Demonstrate

1. Find the missing value in a proportion. Begin building a table.

Say: *In the previous lesson, we learned how to use common denominators to find missing values in proportions. Today, we will use our knowledge of finding missing values in proportions to build a table and look for patterns.* 

Distribute the Practice handout to students. Have them complete the graphic organizer as you work through each problem. Use the Table A  display master as needed.

Say: *As we work through some familiar problems, we will fill in this graphic organizer. Let's consider the first proportion:*

$$\frac{4 \text{ boys}}{6 \text{ girls}} = \frac{x \text{ boys}}{9 \text{ girls}}$$
What are the numerators of the fractions representing the ratios in this proportion? (4 and x)

Write "4 and x" in the Numerators section on the table. Continue completing the table as you ask guiding questions.

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 denominators of the fractions representing the ratios in the proportion? (6 and 9) What is a common denominator for these 2 fractions? (54) Now, let's use our previous knowledge to solve this proportion by using a common denominator.*

Model the steps as you explain and write them in the Solve section on the table. 



TEACHER NOTE

As you work through the problems in this section, complete the graphic organizer on the noted display master. Students solved these proportions in previous lessons. The purpose of this lesson is to determine the pattern, not to solve the proportions.



TEACHER NOTE

If students have not been exposed to or have difficulty solving equations algebraically, use the language, "6x means 6 times a number, so 6 times what number will give me 30?" Eventually, transition students to the algebraic step of dividing by 6, but using the aforementioned language first will help students to develop conceptual knowledge.

Say: Recall that we must first find a common denominator. In this problem, we will use the denominator 54. We must then multiply the numerators by the same value that we multiplied their respective denominators. Then, we must write the 2 ratios as equivalent ratios with 54 as their denominators. Because the denominators are equal, we know that the numerators must be equal, so we set 36 equal to $6x$. What times 6 equals 36 ? (6) Therefore, $x = 6$ boys.

Say: Look back at our work. What did we multiply the numerators by to get equivalent ratios? (6 and 9)

Complete the last column in the graphic organizer.

Use the Table B  display master as needed.

2. Solve 2 more proportions and complete the graphic organizer.

Use the language in Step 1 to solve the proportions $\frac{2 \text{ pears}}{6 \text{ apples}} = \frac{x \text{ pears}}{15 \text{ apples}}$ and $\frac{x \text{ red beads}}{8 \text{ purple beads}} = \frac{3 \text{ red beads}}{12 \text{ purple beads}}$. Use the Table C  display master as needed.

3. Look for patterns in the table.

Say: Let's take a look at our completed graphic organizer. Turn to your partner and discuss what patterns you notice.

Choose 3–4 pairs to share different observations. Record their observations on a whiteboard or sheet of chart paper. Ensure that students use the correct mathematical language in their observations. If students do not say that the Denominators row and the Multiplied Numerators By column are the same, ask the following question.

Say: Which 2 parts of the table seem to always be the same? (Denominators and Multiplied Numerators By)

Use the Table D  display master as needed.

Say: *This observation is important. Basically, when we find a common denominator as we have in the previous 2 lessons, we multiply the denominator of 1 fraction representing a ratio by the numerator of the fraction representing the other ratio and vice versa. Then, we set these products equal to each other and solve the equation. This is called the cross products strategy. In future lessons, we will use cross products more. We will also discuss when the cross product strategy is the best method and when it is not.*

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 Practice handout, confirming that the pattern established above holds true. Then have students work with a partner to make a generalization for the cross products strategy in their own words, based on the patterns found in the graphic organizer. Choose 2–3 pairs to share their generalization. Ask the other students to give a thumbs-up or a thumbs-down to show whether they agree with each shared generalization.

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:

- What pattern was established when solving proportions by using a common denominator?
- How does this pattern relate to the idea of cross products?

Clear up any misconceptions. Students who struggle to make the connection between solving a proportion by using a common denominator and by using the cross products strategy need additional instruction.