

# Lesson 11: Find the Missing Value by Using Cross Products

## Lesson Objective

- Students will find missing values in proportions by using cross products.

## Instructional Materials

Material	Quantity	Description
How Am I Doing? graph	1 per student	
Colored pencils	1 per student	
Display Masters	1 each	<ul style="list-style-type: none"> <li>Preview: Key Idea: Find the Missing Value by Using Cross Products</li> <li>Demonstrate: Bags of Candy A-F</li> <li>Demonstrate: Gallons of Gas A-F</li> </ul>
Handouts	1 per student	<ul style="list-style-type: none"> <li>Cumulative Review</li> <li>Practice</li> <li>Independent Practice</li> </ul>
Answer Keys	1 each	<ul style="list-style-type: none"> <li>Cumulative Review</li> <li>Practice</li> <li>Independent Practice</li> </ul>

## 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 cross products to determine proportionality.

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

- Cross products can be used to find a missing value in a proportion by setting the numerators equal to each other and solving the equation.

Use the Key Idea: Find the Missing Value by Using 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 discuss the following questions with a partner. Ask 2–3 pairs to share their answers and reasoning with the whole group. Have the other students give a thumbs-up or a thumbs-down to show whether they agree with each shared answer. Ensure that students use the correct mathematical language in their answers and explanations.

- What are the steps for using cross products to determine whether 2 ratios are proportional?
- Are the ratios  $\frac{2}{3}$  and  $\frac{5}{8}$  proportional? Use cross products to solve.


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

## Demonstrate

1. Find the missing value of a proportion by using cross products.

**Say:** *In the previous lesson, we learned how to use cross products to determine whether 2 ratios are proportional. Today, we will use cross products to find the missing value in a proportion.*

**Say:** *Listen to this problem. At the grocery store, Lisa can buy 2 bags of candy for \$8. How many bags of candy can Lisa buy with \$20?*


**Say:** *From this scenario, I set up the proportion  $\frac{2 \text{ bags of candy}}{\$8} = \frac{x \text{ bags of candy}}{\$20}$ . I need to find the missing value in this proportion to determine how many bags of candy Lisa can buy with \$20. A strategy I could use is to multiply the fraction representing the first ratio by a scale factor. 8 times what number gives me 20? *



### TEACHER NOTE

Let students think about this question with a partner and offer suggestions.

Use the Bags of Candy A  display master as needed.

**Say:** *There is no whole number that I can multiply 8 by to get 20. I could still find the scale factor, but it could be difficult. Using another strategy might be easier. I can use cross products. *

**Say:** *We will begin with the denominator 8. We multiply the denominator 8 by the numerator  $x$  of the other ratio to get  $8x$ .*

Use the Bags of Candy B  display master as needed.

**Say:** *Now, we multiply the denominator 20 by the numerator 2 of the other ratio to get 40.*



### TEACHER NOTE

The idea of choosing the simplest strategy will be explored further in Lesson 12. While referring to the display masters, model using cross products.



### TEACHER NOTE

If students have not learned how to solve 1-step equations, provide an explanation before teaching this step.

Use the Bags of Candy C  display master as needed.

**Say:** *If I were to use the common denominator 160, I would get the numerators  $8x$  and 40. Recall that to determine proportionality, I need to see whether the numerators are equal. In this case, I know the ratios are proportional. I am trying to find the missing value, so I need to ensure that the numerators are equal. Therefore, I need to set the numerators  $8x$  and 40 equal to each other and solve for  $x$ .*

Use the Bags of Candy D  display master as needed. 

**Say:** *I need to isolate and solve for  $x$ . To solve for  $x$ , use the opposite operation, division, to isolate the  $x$  in  $8x$ . I divide both sides of the equation by 8. When I divide  $8x$  by 8, I get  $x$ . When I divide 40 by 8, I get 5. Therefore,  $x = 5$ .*

Use the Bags of Candy E  display master as needed.

**Say:** *The missing value to complete this proportion is 5. Therefore, if Lisa can buy 2 bags of candy for \$8, she can buy 5 bags of candy for \$20.*

Use the Bags of Candy F  display master as needed.

2. Find the missing value.

**Say:** *Charlie can buy 3 gallons of gas for \$6. Charlie has \$11. How many gallons of gas can he put in his car?*

**Say:** *From this scenario, I set up the proportion  $\frac{3 \text{ gallons of gas}}{\$6} = \frac{3 \text{ gallons of gas}}{\$11}$ . I need to find the missing value in this proportion to know how many gallons of gas Charlie can buy for \$11.*

Use the Gallons of Gas A  display master. 

**Say:** We will begin with the denominator 6. We multiply the denominator 6 by the numerator  $x$  of the other ratio to get  $6x$ .

Use the Gallons of Gas B  display master as needed.

**Say:** Now, we multiply the denominator 11 by the numerator 3 of the other ratio to get 33.

Use the Gallons of Gas C  display master as needed.

**Say:** If I were to use the common denominator 66, I would get the numerators  $6x$  and 33. Then, I would set the numerators  $6x$  and 33 equal to each other and solve for  $x$ .

Use the Gallons of Gas D  display master as needed. 

**Say:** To solve for  $x$ , use the opposite operation, division. In this case, I can divide both sides of the equation by 6. When I divide  $6x$  by 6, I get  $x$ . When I divide 33 by 6, I do not get a whole number. I get 5.5. Therefore,  $x = 5.5$ .

Use the Gallons of Gas E  display master as needed.

**Say:** The missing value to complete this proportion is 5.5. Therefore, if Charlie can buy 3 gallons of gas for \$6, he can buy 5.5 gallons for \$11.

**Say:** Sometimes when I solve proportions, I do not get a whole number. Using cross products instead of another method we have learned can make the process of finding the missing value in these cases easier.



**TEACHER NOTE**

While referring to the display masters, model using cross products.



**TEACHER NOTE**

To complete the next step, provide students with a calculator if necessary. It is more important for students to understand the process than to do the computation without a calculator.

Use the Gallons of Gas F  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 work in small groups to complete the activity on the Practice handout. Select a few students to verbalize their reasoning. Ensure that students use the correct mathematical language in their answers and explanations. Allow students to use calculators as needed.

## 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 steps would you use to solve a proportion by using cross products?
- What is an example of a proportion you could solve by using cross products? What is an example of a proportion that you would not want to use cross products to solve?

Clear up any misconceptions. Students who struggle with solving proportions by using cross products need additional instruction.