

Lesson 1: Define Proportionality

Lesson Objective

- Students will connect equivalent ratios to proportionality.

Instructional Materials

Material	Quantity	Description
How Am I Doing? graph	1 per student	
Colored pencils	1 per student	
Whiteboard and dry-erase marker	1 for teacher use and 1 per student	
Popsicle sticks with 1 student name on each	1 per student for teacher use	
Index cards	1 per pair of students	
Display Masters	1 each	<ul style="list-style-type: none">• Key Ideas: Define Proportionality• Hot Dogs to Hot Dog Buns A-E• DVDs to CDs A-D
Handouts	1 per student	<ul style="list-style-type: none">• Practice• Independent Practice
Answer Keys	1 each	<ul style="list-style-type: none">• Practice• Independent Practice

Preview

This lesson will build on students' conceptual knowledge of equivalent ratios. Proportionality will be introduced and defined by using equivalent ratios.

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

- A proportion is an equation made up of 2 equivalent ratios.
- A proportional relationship exists when 2 ratios are equivalent.

Use the Key Ideas: Define Proportionality  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:

- Give each pair of students an index card. Have each pair work together to write a definition of "ratio." Choose 2–3 pairs to share.
- Have students complete the following activities on a whiteboard, 1 at a time. Check student responses.
 - ◇ Have students write the ratio for the number of girls in the class to the total number of students in the class.
 - ◇ Have students draw a model to create 2 equivalent ratios.

If students cannot complete these activities, stop and explicitly teach the material. Reference the Ratios and Rates module as needed.


Demonstrate


1. Find an equivalent ratio, using multiplication.

Say: *In the Ratios and Rates module, we learned how to find an equivalent ratio by using multiplication. Today, we will begin by generating an equivalent ratio.*

Use the Hot Dogs to Hot Dog Buns A  display master as needed.

Say: Suppose I was purchasing hot dogs and hot dog buns at the grocery store. Hot dogs are sold in packages of 8. Hot dog buns are sold in packages of 6.

Write an 8 under the image of the hot dogs on the  display master and a 6 under the image of hot dog buns.


Use the Hot Dogs to Hot Dog Buns B  display master as needed.

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

Say: If I bought 1 package of each, what would be the ratio of hot dogs to hot dog buns? ($\frac{8}{6}$)

Write the ratio $\frac{8}{6}$ on a whiteboard.

Say: Suppose I wanted to buy 3 packages of hot dogs and 3 packages of hot dog buns. What would the new ratio be? ($\frac{24}{18}$)

Say: I know $\frac{8}{6}$ and $\frac{24}{18}$ are equivalent ratios because I have 3 times as many hot dogs and 3 times as many hot dog buns. Because we have 3 times as many, the scale factor is 3. 

Write the steps on the whiteboard to create the equivalent ratio $\frac{24}{18}$ from $\frac{8}{6}$ (multiplying by $\frac{3}{3}$).

Use the Hot Dogs to Hot Dog Buns C  display master as needed.

2. Define “proportional relationship” by using equivalent ratios.

Say: When 2 ratios are equivalent, we say that they are



TEACHER NOTE


The concept of multiplying by a scale factor may be new for some students. If there is any confusion, reinforce the idea that multiplying by $\frac{3}{3}$ (a fraction equivalent to 1) is the same as multiplying by a scale factor of 3. Use illustrations if necessary.

proportional. Remember that 2 ratios are equivalent if they can be simplified to the same ratio. Try to simplify these 2 ratios.

Wait for students to simplify the ratios. Then review the steps as a class. Refer to the whiteboard from the previous exercise generating the equivalent ratios.

Say: *These 2 ratios are equivalent; therefore, they are proportional. When I simplify the ratio $\frac{8}{6}$, I get $\frac{4}{3}$.*

Say: *When I simplify the ratio $\frac{24}{18}$, I also get $\frac{4}{3}$.*

Demonstrate the steps for simplification. Use the Hot Dogs to Hot Dog Buns D  display master as needed.

Say: *Because $\frac{8}{6}$ and $\frac{24}{18}$ are equivalent ratios, I know that a proportional relationship exists between them. We know they are equivalent ratios because they can both be simplified to the ratio $\frac{4}{3}$.*

3. Define “proportion” and “proportionality.”

Say: *When I write the equation $\frac{8}{6} = \frac{24}{18}$, this is called a proportion. Because we know that the 2 ratios are equivalent, we can write them in a proportion. Proportionality refers to the relationship between 2 ratios that are equivalent.*

Demonstrate writing the proportion on a whiteboard for reference. Use the Hot Dogs to Hot Dog Buns E  display master as needed.

 4. Work through an additional example involving equivalent ratios.

Say: *Let’s work through another example involving*




TEACHER NOTE

Throughout this example, explicitly reinforce and use the pertinent vocabulary for this module: “proportion,” “proportional,” “proportional relationship,” and “proportionality.” Expect students to use this vocabulary in both discussions and activities.

proportional relationships. We will begin by creating an equivalent ratio from an existing ratio.


Say: *Suppose you went to an electronics store and bought 2 DVDs and 6 CDs. What would be the ratio for the number of DVDs you bought to the number of CDs you bought? ($\frac{2}{6}$)*

Write the ratio $\frac{2 \text{ DVDs}}{6 \text{ CDs}}$ on a whiteboard. Use the DVDs to CDs A  display master as needed.

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

Say: *Now, suppose you went to the same electronics store 4 days in a row and bought 2 DVDs and 6 CDs each day. How many DVDs would you have purchased after the fourth day? (8) How many CDs would you have purchased after the fourth day? (24) What is the new ratio of DVDs to CDs after the fourth day? ($\frac{8}{24}$)*

Say: *Because I bought the same ratio of DVDs to CDs each day, I know that the total I bought in 4 days, 8 DVDs and 24 CDs, is proportional to the number I bought in 1 day, 2 DVDs and 6 CDs. In 4 days, I bought 4 times as many as I bought in 1 day.*

Demonstrate the calculations for creating the equivalent ratio on the whiteboard. Use the DVDs to CDs B  display master as needed.

Say: *Equivalent ratios can be simplified to the same ratio. Let's confirm that the relationship is proportional by simplifying the 2 ratios.*

Give students a chance to simplify the ratios on their own.

Say: $\frac{2}{6}$ can be simplified to the ratio $\frac{1}{3}$.

Say: $\frac{8}{24}$ can also be simplified to the ratio $\frac{1}{3}$.

Demonstrate the process for simplification on the whiteboard. Use the DVDs to CDs C  display master as needed.

Say: *Because $\frac{2}{6}$ and $\frac{8}{24}$ are proportional, I can write them as a proportion.*

Display the proportion $\frac{2}{6} = \frac{8}{24}$ on the whiteboard. Use the DVDs to CDs D  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 Practice handout. Have students explain to a partner the steps they used to determine that their ratios were equivalent. Ensure that students use the correct mathematical terms when explaining their steps. Select a few students to verbalize their reasoning.

Assist students with creating equivalent ratios 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 ideas. Have students provide examples from the lesson.

Have students discuss their answer to the following questions:

- How do we know when 2 ratios are proportional?
- What are the steps for determining whether the ratios $\frac{3}{4}$ and $\frac{9}{12}$ are proportional?

Clear up any misconceptions. Students who struggle with determining proportionality between 2 ratios need additional instruction.