MSTAR INTERVENTION

L2

Lesson 2: Determine Proportionality by Using Simplification

Lesson Objective

- Students will determine whether 2 ratios are proportional by using simplification.

Instructional Materials

Material	Quantity	Description
How Am I Doing? graph	1 per student	
Colored pencils	1 per student	
Index cards with various number pairs	1 per student	Use number pairs for which students can easily identify a greatest common factor.
Display Masters	1 each	• Key Idea: Determine Proportionality by Using Simplification • Chicken Soup A–G • $\frac{2}{6}$ and $\frac{6}{12}$ A–G
Handouts	1 per student	• Cumulative Review • Practice 1 • Practice 2 • Independent Practice
Answer Keys	1 each	• Cumulative Review • Practice 1 • Practice 2 • Independent Practice

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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 simplifying ratios. Simplification will be used to determine whether 2 ratios are proportional.

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

- 2 ratios are proportional if they simplify to the same ratio.

Use the Key Idea: Determine Proportionality by Using Simplification DM 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, make a deck of index cards with a pair of numbers on each. Have each student choose 1 card, find the greatest common factor of the pair of numbers, and share his or her answer with the group.
- Have students discuss each of the following questions with a partner. Choose 2–3 pairs to share with the group:
  - How do you simplify a ratio? (find the greatest common factor and then divide the top and the bottom of the ratio by the greatest common factor)
  - If 15 boys and 12 girls were in a class, what would be the simplified ratio of boys to girls? (5 boys to 4 girls)

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- How can you determine whether 2 ratios are proportional? (they simplify to the same ratio)

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

Demonstrate

1. Simplify 2 ratios.

Say: *In the previous lesson, we learned that 2 equivalent ratios are proportional, or have a proportional relationship. Today, we will determine whether 2 ratios are proportional.*

Say: *In the Ratios and Rates module, we learned that to determine whether 2 ratios are equivalent, we should simplify each ratio and compare. 2 ratios are equivalent if they simplify to the same ratio.*

Say: *Suppose I have 2 containers of soup. 1 container has 9 cups of chicken and 12 cups of tomato sauce. The other has 15 cups of chicken and 20 cups of tomato sauce. I want to know whether the 2 containers of soup will taste the same. For the containers to have the same flavor, they must have the same ratio of chicken to tomato sauce. How can I determine whether the ratios are the same? (simplify the ratios to see whether they are proportional)*

Write the ratio $\frac{9}{12}$. Use the Chicken Soup A DM display master as needed.

Say: $\frac{9}{12}$ *can be simplified. What is the greatest common*

TEACHER NOTE
Throughout this lesson, explicitly reinforce and use the pertinent vocabulary for this module: "proportion," "proportional," "proportional relationship," and "proportionality." Ensure that students use the same language when responding to questions or explaining their thinking.

WATCH FOR
Some students do not have a solid foundation with multiplication and division facts. This problem will become evident when students attempt to simplify and find common factors. Reference the Multiplication and Division Facts module if students need additional support in this area.

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factor of 9 and 12? (3) Because 3 is the greatest common factor, I will divide both the numerator and the denominator by 3. Recall that I can divide the ratio by $\frac{3}{3}$ because $\frac{3}{3}$ is equal to 1; therefore, the relationship the ratio describes will stay the same.

Demonstrate that $\frac{9}{12}$ will be divided by $\frac{3}{3}$. Use the Chicken Soup B **DM** display master as needed.

Say: *When I divide 9 by 3, what will my new numerator be? (3) When I divide 12 by 3, what will my new denominator be? (4) Therefore, the simplified ratio of $\frac{9}{12}$ is $\frac{3}{4}$. This means that the ratio 9 to 12 can be divided into equal groups of 3 cups of chicken for every 4 cups of tomato sauce.*

Demonstrate that $\frac{9}{12}$ divided by $\frac{3}{3}$ is equal to $\frac{3}{4}$. Use the Chicken Soup C **DM** display master as needed.

Say: *Now, let's simplify the ratio $\frac{15}{20}$.*

Write the ratio $\frac{15}{20}$. Use the Chicken Soup D **DM** display master as needed.

Say: *$\frac{15}{20}$ can be simplified. What is the greatest common factor of 15 and 20? (5) Because 5 is the greatest common factor, I will divide both the numerator and the denominator by 5.*

Demonstrate that $\frac{15}{20}$ will be divided by $\frac{5}{5}$. Use the Chicken Soup E **DM** display master as needed.

Say: *When I divide 15 by 5, what will my new numerator be? (3) When I divide 20 by 5, what will my new denominator be? (4) Therefore, the simplified ratio of $\frac{15}{20}$ is $\frac{3}{4}$. This means that I can divide the ratio $\frac{15}{20}$ into equal groups of 3 cups of chicken for every 4 cups of tomato sauce.*

Demonstrate that $\frac{15}{20}$ divided by $\frac{5}{5}$ is equal to $\frac{3}{4}$. Use the Chicken Soup F **DM** display master as needed.

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2. Determine whether the given ratios are proportional.

Say: *In the previous lesson, we learned that if 2 ratios are equivalent, they are proportional, or a proportional relationship exists.*

Refer to the previous example, in which $\frac{9}{12}$ and $\frac{15}{20}$ were simplified.

Say: *We just simplified the 2 ratios $\frac{9}{12}$ and $\frac{15}{20}$ to $\frac{3}{4}$. Because they simplify to the same ratio, are the 2 given ratios proportional? (yes) How do we know? (because the 2 given ratios simplified to the same ratio)*

Say: *Because both ratios simplify to 3 to 4, there are 3 cups of chicken for every 4 cups of tomato sauce in both containers of soup. Now I know the soup in both containers will taste the same, assuming the other ingredients are proportional as well!*

Use the Chicken Soup G **DM** display master as needed.

3. Determine whether 2 ratios are proportional by using simplification.

Say: *Let's take a look at another problem. Suppose I was given the 2 ratios $\frac{2}{6}$ and $\frac{6}{12}$. Let's determine whether these 2 ratios are proportional. We first need to simplify each ratio. Let's begin with $\frac{2}{6}$.*

Write the ratio $\frac{2}{6}$. Use the $\frac{2}{6}$ and $\frac{6}{12}$ A **DM** display master as needed.

Say: *Turn to your partner and discuss the following:*

- *Can the ratio $\frac{2}{6}$ be simplified? (yes)*
- *If so, what is the greatest common factor of 2 and 6? (2)*

Call on 2–3 pairs to share what they have discussed.

Say: *We will divide the numerator and the denominator by 2.*

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Demonstrate that $\frac{2}{6}$ will be divided by $\frac{2}{2}$. Use the $\frac{2}{6}$ and $\frac{6}{12}$ B **DM** display master as needed.

Say: *When I divide 2 by 2, what will my new numerator be? (1) When I divide 6 by 2, what will my new denominator be? (3) Therefore, the simplified ratio of* $\frac{2}{6}$ *is* $\frac{1}{3}$.

Demonstrate that $\frac{2}{6}$ divided by $\frac{2}{2}$ is $\frac{1}{3}$. Use the $\frac{2}{6}$ and $\frac{6}{12}$ C **DM** display master as needed.

Say: *To determine proportionality between* $\frac{2}{6}$ *and* $\frac{6}{12}$*, we must also simplify* $\frac{6}{12}$.

Write the ratio $\frac{6}{12}$. Use the $\frac{2}{6}$ and $\frac{6}{12}$ D **DM** display master as needed.

Say: *Turn to your partner and discuss the following:*

- *Can the ratio* $\frac{6}{12}$ *be simplified? (yes)*
- *If so, what is the greatest common factor of 6 and 12? (6)*

Call on 2–3 pairs to share what they have discussed.

Say: *We will divide the numerator and the denominator by 6.*

Demonstrate that $\frac{6}{12}$ will be divided by $\frac{6}{6}$. Use the $\frac{2}{6}$ and $\frac{6}{12}$ E **DM** display master as needed.

Say: *When I divide 6 by 6, what will my new numerator be? (1) When I divide 12 by 6, what will my new denominator be? (2) Therefore, the simplified ratio of* $\frac{6}{12}$ *is* $\frac{1}{2}$.

Demonstrate that $\frac{6}{12}$ divided by $\frac{6}{6}$ is $\frac{1}{2}$. Use the $\frac{2}{6}$ and $\frac{6}{12}$ F **DM** display master as needed.

Say: *Now that we know* $\frac{2}{6}$ *simplifies to* $\frac{1}{3}$ *and* $\frac{6}{12}$ *simplifies to* $\frac{1}{2}$*, we can compare the 2 ratios. Are the simplified ratios* $\frac{1}{3}$ *and* $\frac{1}{2}$ *equal? (no)*

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Therefore, the given ratios $\frac{2}{6}$ and $\frac{6}{12}$ are not equivalent. Because the 2 given ratios did not simplify to the same ratio and, therefore, are not equivalent, they are not proportional.

Use the $\frac{2}{6}$ and $\frac{6}{12}$ G **DM** display master as needed.

Practice

For each 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 1: Help students complete the Practice 1 handout. After the first 2 problems, have students check their answers with a partner and share their reasoning for choosing "proportional" or "not proportional." Select a few students to verbalize their reasoning or their partner's reasoning. Ensure that students use the correct mathematical language in their explanations. Then, follow the same checking procedure after the last 2 problems.

Students will determine whether each pair of ratios is proportional by using simplification.

Activity 2: Have students work in pairs to complete the Practice 2 handout. Have students verbalize their reasoning and each step in the process to their partners.

1. Each partner will create any 2 ratios.
2. Partners will trade papers and determine whether their partner's ratios are proportional by using simplification. If they are, the student will write the 2 ratios as a proportion.
3. Students will trade back papers, discuss their answers, and then repeat the activity.

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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 answers to the following questions:

- What does it mean for 2 ratios to be proportional?
- What is an example of 2 proportional ratios? Explain how you determined that they are proportional.
- What is an example of 2 ratios that are not proportional? Explain how you determined that they are not proportional.

Clear up any misconceptions. Students who struggle with determining proportionality by using simplification need additional instruction.

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