LESSON 2

Objective

Use proportions to represent relationships.

Common Core State Standards

- **6.RP.1** Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. *For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."*
- **6.RP.2** Understand the concept of a unit rate *a*/*b* associated with a ratio *a*:*b* with $b \neq 0$, and use rate language in the context of a ratio relationship. *For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."*
- **6.RP.3b** Solve unit rate problems including those involving unit pricing and constant speed. *For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?*

Proportions

Students use their knowledge of ratios to represent and solve proportions. They use models to find equivalent ratios and use ratios to solve a proportion. They learn that a proportion is a statement that two ratios are equal. These activities develop proportional thinking, which students use to solve problems involving rates, unit conversions, and functions.

Try It! *Perform the Try It! activity on the next page.*

Talk About It

Discuss the Try It! activity.

- **Ask:** *What ratio is modeled with the rods?*
- **Ask:** *How many green rods would you need to create a train the same length as 15 red rods? How do you know? What operation did you use?*
- **Ask:** *Are the two ratios equal? How do you know?* **Say:** *If two ratios are equal, we call the relationship a* proportion.
- **Ask:** *How many red rods does the proportion require for each green rod?* Elicit that the answer is $1\frac{1}{2}$ (or $\frac{3}{2}$). Tell students that this ratio— $\frac{3}{2}$ red rods per green rod—is called the *unit rate* for the problem.

Solve It

Reread the problem with students. Have students write each proportion represented by the models. Emphasize that only one solution works for the problem, but that any two equal ratios define a proportion.

More Ideas

For other ways to teach proportions—

- Use Pattern Blocks. Suggest to students that a supplier sells 3 blue rhombuses for every 2 red trapezoids. Have students build a blue hexagon on top of a red hexagon to show the 3-to-2 correspondence. Have students determine how many blue rhombuses are sold for every 6 red trapezoids.
- Have students generate equal ratios in tables and use the ratio tables to form proportions. Students work in pairs using Two-Color Counters to form the equal ratios.

Formative Assessment

Have students try the following problem.

The ratio of benches to trees in a park is 2:9. If there are 18 trees, how many benches are in the park?

A. 4 benches **B.** 7 benches **C.** 14 benches **D.** 9 benches

Try It! 30 minutes | Groups of 4

Here is a problem about proportions.

A company makes charms for bracelets. For every 3 hearts, it makes 2 diamonds. If the company makes 15 hearts, how many diamonds does it make?

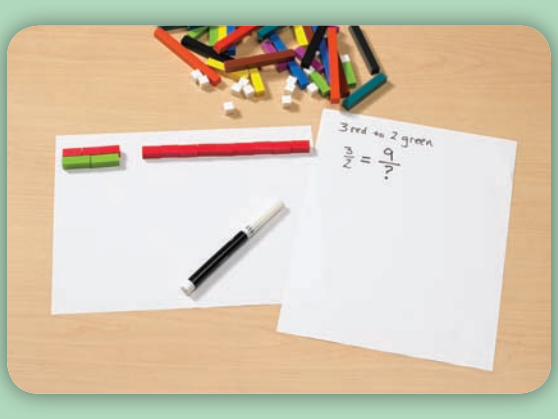
Introduce the problem. Then have students do the activity to solve the problem. Distribute Cuisenaire Rods, paper, and pencils. Explain that a proportion is formed by two equivalent ratios. Write on the board:

$$\frac{3 \text{ hearts}}{2 \text{ diamonds}} = \frac{15 \text{ hearts}}{? \text{ diamonds}}$$

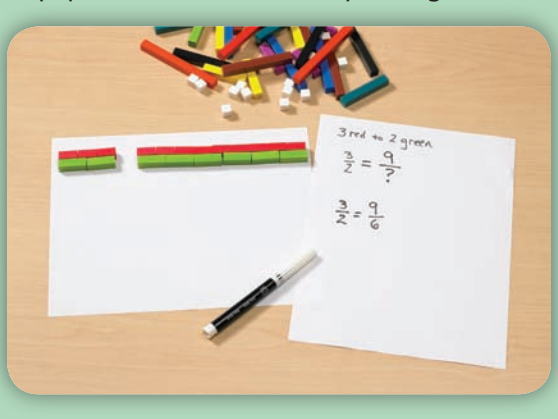
Materials

- Cuisenaire® Rods (1 set per group)
- paper (2 sheets per group)
- pencils (1 per group)

1. Have students work with the rods to find those that have a 3:2 ratio (e.g., red to green). Observe as students create a train of 3 red rods and build a one-color train using only 2 rods underneath the red train. Have students create a representation of their trains on a separate sheet of paper and write the corresponding ratio.



2. Instruct students to keep the red and green trains. Have them construct a train using 9 red rods to the right of those trains. Have students create their representation on their paper and write the corresponding proportion to be solved.



3. Have students complete the train and their representation. Tell students that a statement that says two ratios are equal is called a *proportion*. Talk with students about "solving a proportion." Equal fractions are equal ratios, so solving a proportion is the same as finding an equivalent fraction. Have students go back and solve the Try It! question.

⚠ Look Out!

Some students might have trouble writing the proportion correctly. Emphasize that the comparison is down or across. Set up a framework for students to fill in:

$$\frac{\square \text{ hearts}}{\square \text{ diamonds}} = \frac{\square \text{ hearts}}{\square \text{ diamonds}}$$

or

$$\frac{\square \text{ hearts}}{\square \text{ hearts}} = \frac{\square \text{ diamonds}}{\square \text{ diamonds}}$$

Have them fill in 3:2 down and 3:2 across to emphasize the pattern.

Answer Key

Use Cuisenaire Rods to model each proportion. Then solve the proportion using the rods.

(Check students' work.)

1. $\frac{1}{6} = \frac{2}{?}$

$\frac{1}{6} = \frac{2}{12}$

2. $\frac{2}{5} = \frac{4}{?}$

$\frac{2}{5} = \frac{4}{10}$

Using Cuisenaire Rods, model each proportion. Sketch the model.Then solve the proportion.

3. $\frac{3}{2} = \frac{?}{6}$

$\frac{3}{2} = \frac{9}{6}$

4. $\frac{?}{8} = \frac{1}{4}$

$\frac{2}{8} = \frac{1}{4}$

Solve each proportion.

5. $\frac{2}{3} = \frac{6}{9}$

6. $\frac{1}{3} = \frac{3}{9}$

7. $\frac{5}{6} = \frac{20}{24}$

8. $\frac{4}{5} = \frac{12}{15}$

9. $\frac{4}{8} = \frac{1}{2}$

10. $\frac{2}{5} = \frac{10}{25}$

Answer Key

Challenge! What question do you ask yourself to solve Question 6? What question do you ask yourself to solve Question 9? How do the problems and questions differ?

Challenge: (Sample) How do you get from 3 to 9? How do you get from 8 to 2? The problems differ in that in Question 6 the greater number is the denominator of the second fraction. This means that the answer for 6 is related to multiplication and the answer for 9 is related to division.

 Name _____

Use Cuisenaire Rods to model each proportion. Then solve the proportion using the rods.

1. $\frac{1}{6} = \frac{2}{?}$

$\frac{1}{6} = \frac{2}{\square}$

2. $\frac{2}{5} = \frac{4}{?}$

$\frac{2}{5} = \frac{4}{\square}$

Using Cuisenaire Rods, model each proportion. Sketch the model.Then solve the proportion.

3. $\frac{3}{2} = \frac{?}{6}$

$\frac{3}{2} = \frac{\square}{6}$

4. $\frac{?}{8} = \frac{1}{4}$

$\frac{\square}{8} = \frac{1}{4}$

Solve each proportion.

5. $\frac{2}{3} = \frac{6}{\square}$

6. $\frac{1}{3} = \frac{\square}{9}$

7. $\frac{5}{6} = \frac{20}{\square}$

8. $\frac{4}{5} = \frac{\square}{15}$

9. $\frac{\square}{8} = \frac{1}{2}$

10. $\frac{2}{5} = \frac{\square}{25}$

Name _____

Challenge! What question do you ask yourself to solve Question 6? What question do you ask yourself to solve Question 9? How do the problems and questions differ?