

## Lesson 6: Unit Rates

### Lesson Objective

- Students will generate unit rates.

### Instructional Materials

| Material              | Quantity                       | Description  |
|-----------------------|--------------------------------|--|
| Colored pencils       | 2 different colors per student |  |
| Paper                 | 1 sheet per student            |  |
| How Am I Doing? graph | 1 per student                  |  |
| Display Masters       | 1 each                         | <ul style="list-style-type: none"> <li>• Preview: Key Idea: Unit Rates</li> <li>• Engage Prior/Informal Knowledge: Venn Diagram</li> <li>• Engage Prior/Informal Knowledge: Ratios and Rates Venn Diagram</li> <li>• Demonstrate: 12 Fruit Bars to 4 Children A</li> <li>• Demonstrate: 12 Fruit Bars to 4 Children B</li> <li>• Demonstrate: 12 Fruit Bars to 4 Children C</li> <li>• Demonstrate: 12 Fruit Bars to 4 Children D</li> <li>• Demonstrate: 12 Fruit Bars to 4 Children E</li> </ul> |
| Handouts              | 1 each per student             | <ul style="list-style-type: none"> <li>• Cumulative Review</li> <li>• Venn Diagram</li> <li>• Practice 1</li> <li>• Practice 2</li> <li>• Independent Practice</li> </ul>  |
| Answer Keys           | 1 each                         | <ul style="list-style-type: none"> <li>• Cumulative Review</li> <li>• Practice 1</li> <li>• Practice 2</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 make corrections, as needed, using a colored pencil. Collect student papers to determine who needs additional instruction.

## Preview

This lesson will build on students' prior conceptual knowledge of rates and simplifying rates. Unit rates will be shown to compare a quantity to 1 unit, such as miles per gallon.

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

- A unit rate describes how many units there are of the first quantity for 1 unit of the second quantity.<sup>1</sup>

Use the Key Idea: Unit Rates  display master as needed.

## Engage Prior/Informal Knowledge

To open the lesson, have students use a Venn diagram to compare ratios and rates to activate students' background knowledge and preskills.

**Say:** *Today we will make a Venn diagram of the things we know about ratios and rates.*

Display a blank Venn diagram. Use the Venn Diagram  display master as needed.


Distribute the Venn Diagram handout to students.

**Say:** *The left section of the diagram stands for the characteristics that are unique to ratios, and the right section describes the unique characteristics of rates. Write "ratios" above the left section and "rates" above the right.*

**Say:** *The section in the middle is used to list characteristics that ratios and rates*

share.

**Say:** *What are some similarities between ratios and rates? (Ratios and rates can be written using a colon, the word “to,” or a fraction bar. Ratios and rates can compare 2 quantities. Ratios and rates can compare a part to a part.)*

Write students’ ideas on the Venn diagram. Have students fill out their handout. Refer to the Ratios and Rates Venn Diagram  display master as needed for suggestions.

**Say:** *What are some characteristics of ratios that are not characteristics of rates? (Ratios can compare a part to a whole, can compare like quantities, and must have the same units, such as people or apples.)*

Continue to fill in the Venn diagram as students provide answers.

**Say:** *What are some characteristics of rates that are not shared by ratios? (Rates can compare only a part to a part, can compare unlike quantities, and must have units that are different, such as girls and basketballs.)*

Continue to fill in the Venn diagram.

Have students share and then display their completed Venn diagrams.

If students cannot complete this activity, stop and explicitly teach the material.

## Demonstrate

1. Think aloud as you calculate a unit rate.

**Say:** *A rate compares 2 unlike quantities. I may or may not be able to simplify a rate.*

**Say:** *There are 12 fruit bars and 4 children. What is the rate of fruit bars to children? ( $\frac{12 \text{ fruit bars}}{4 \text{ children}}$ )*

**Say:** *Can this rate be simplified? (yes) How? (by dividing the numerator and denominator by a common factor other than 1; the common factor is 4)*

**Say:** *What is the simplified rate? (3 fruit bars to 1 child)*

**Say:** *A rate that simplifies to describe how many units there are of the first quantity for 1 unit of the second quantity is called a unit rate.*

**Say:** *A unit rate will always have a comparison to 1; for example, 3 fruit bars to 1 child. When a unit rate is written, the words "per," "for," or "each" are sometimes used.*

**Say:** *Some examples of unit rates are an automobile that gets 21 miles per gallon (unit: 1 gallon), buying 3 pounds of bananas for \$1 (unit: \$1), and \$5 for each shirt (unit: 1 shirt).*

## 2. Model rates with drawings.

Distribute 1 sheet of paper to each student.

Demonstrate how to fold the paper horizontally into 2 equal parts. Have students do the same.

**Say:** *We will draw models for unit rates.*

**Say:** *The rate is 12 fruit bars to 4 children.*

**Say:** *Draw 2 rectangles of the same length at the top of your paper. Divide the first rectangle into 12 pieces and the second rectangle into 4 pieces.*

Demonstrate how to draw the 2 rectangles. Use the 12 Fruit Bars to 4 Children A display master as needed.



**Say:** Remember that your drawing does not have to be perfect. Do the best you can.

**Say:** What things are we comparing in this problem? (fruit bars to children)

**Say:** Use 1 of your colored pencils to write "fruit bars" above the top rectangle. Use another colored pencil to write "children" below the bottom rectangle.

Label your drawing. Use the 12 Fruit Bars to 4 Children B  display master as needed.

**Say:** Now write an "f" on each piece of the top bar and a "c" on each piece of the bottom bar.

Use the 12 Fruit Bars to 4 Children C  display master as needed.

3. Generate a rate and unit rate to represent the modeled situation.


**Say:** How many fruit bars do we have? (12) How many children do we have? (4)

**Say:** What is the rate of fruit bars to children? ( $\frac{12 \text{ fruit bars}}{4 \text{ children}}$ )

Write the rate to the right of the model. Use the 12 Fruit Bars to 4 Children D  display master as needed.

Have students write this rate to the right of the model drawing.

**Say:** Once I have drawn the model, I can draw a dark line between each unit rate.

Display the model with the bars drawn. Use the 12 Fruit Bars to 4 Children E  display master as needed.

Have students draw a dark line between each unit rate.

**Say:** *This way you can see the unit rate easily.*

**Say:** *What was the unit rate again? (3 fruit bars per child)*

**Say:** *Are there any other ways to compare these 2 quantities? (compare 4 children to 12 fruit bars, which would simplify to 1 child to 3 fruit bars)*

**Say:** *When we find a unit rate, we write the 1 unit in the denominator, so that we can say “per” or “each” for 1. So even though you might find that the rate was 1 child to 3 fruit bars, you would say “3 fruit bars per child”—not “1 child per 3 fruit bars.”*

**Say:** *Therefore, if you simplify a rate and the 1 unit is on the top, reverse the quantities to find the unit rate.*

## 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. Select a few students to verbalize their reasoning.

Students can complete the problem on the bottom half of the paper used in the Demonstrate section of this lesson.

Circulate and watch students. Encourage them to label the model as shown on the Practice 1 answer key. As you circulate, ask students the following questions:

- What is the rate? ( $\frac{2 \text{ pies}}{8 \text{ apples}}$ )
- Can this rate be simplified? (Yes, 2 is a common factor.)
- What is the new rate? ( $\frac{1 \text{ pie}}{4 \text{ apples}}$ )

- How could we write this simplified rate as a unit rate? (4 apples per pie)

**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.

## 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 is the difference between a rate and a unit rate?
- What is the difference between a rate and a ratio?

Clear up any misconceptions. Students who struggle with generating unit rates need additional instruction.

1. Beckman, Sybilla. (2011). *Mathematics for elementary teachers with activity manual, 3rd Edition*. Boston, MA: Addison-Wesley.