PhET
RATES
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PRE-PLANNING

Students use rates to compare prices by identifying multiplicative relationships. They calculate unit rates and use the term *unit rate*. They use unit rates to solve problems involving proportional relationships in the context of fruit and vegetable prices.

LEARNING GOALS

- Reason multiplicatively about relationships between quantities
- Find missing values in a ratio table by making use of multiplicative patterns
- Calculate unit rates
- Use the term unit rate
- Generate equivalent ratios
- Solve problems by finding and using unit rates

STANDARDS ADDRESSED

- 6.RP.1.2 Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0, and use rate language in the context of a ratio relationship.
- 6.RP.1.3 Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
- 6.RP.1.3b Solve unit rate problems including those involving unit pricing and constant speed.
- SMP3
- SMP7
- SMP8

CURRICULUM ALIGNMENT

GoMath Grade 6, Lesson 6.2

PRIOR KNOWLEDGE

- Knowledge of basic multiplication facts
- Recognition of multiplicative relationships
- Familiarity with the term ratio
- Real-world experiences with prices

MATERIALS

- Technology: 2:1 or 1:1 laptop, chromebook, or iPad
- PhET sim: Unit Rates
- Activity sheet

LESSON PLAN (50 MINUTES)

WARM-UP

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MINUTES</td>
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How much do apples cost? On your warm-up sheet, write down what you know or imagine about the prices of apples.

- Survey students' responses.

In brief whole-class discussion:

- Call on a few students to share what they wrote.
- Emphasize that prices are *rates* (e.g., cost per apple or cost per pound), not just amounts of money.

Optional: Pose quick tasks or questions, based on students' suggested prices.

For example, if a student says an apple costs 25 cents, you might ask how much 4 apples, 8 apples, or 12 apples would cost.

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SIM-BASED LESSON

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MINUTES</td>
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Display the *Unit Rates* sim on your screen or interactive whiteboard. Instruct students to go to **Unit Rates: Shopping** and play for 3–5 minutes. As students play, circulate and interact. Use this time to take an interest in students' ideas and to gather information that will be helpful as the lesson progresses.

Lead a brief discussion in which a few students share their discoveries or questions.

- Illustrate students' discoveries or questions on the projected sim, or have students come up to the board to input values or to illustrate their ideas.
- Make sure that everyone knows how to use the relevant controls in the sim (e.g., how do we switch from pears to potatoes?).
- Introduce and define the term *unit rate*. Encourage students to say "unit rate" or "unit price" when discussing their strategies.
- Begin to focus the discussion on what the unit rate looks like on the double number line (by noticing the differences in prices and corresponding differences in numbers of items).

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10
MINUTES

CHALLENGE 1

As students work, notice the strategies that they are using to find the missing values. Listen especially for efficient strategies that involve reasoning about rates (e.g., using division to find the unit rate or noticing differences in prices and comparing those to differences in the number of items).

- Possible strategies:
    - Removing all but one item, so that the sim tells them the price per item.
    - Dividing the total cost (for a bag) by the number of items
    - Noticing the difference in price when one item is removed.
- Select one or more students to share their solutions.
- Many students may go down to one item, so that the sim gives them the answer. That's fine for now. The next challenge will be more challenging. Just use the opportunity to invite students to notice different ways of seeing the unit rate on the double number line.
- Move the discussion forward by focusing on relationships between the numbers on the double number line (as well as specific ideas and terms that came up in 6.1)

10
MINUTES

CHALLENGE 2

Circulate the room. Eavesdrop on students' conversations and look for written work. *How are they finding the unit rates?*

- Possible strategies:
    - Guess-and-check with repeated addition or multiplication
    - Dividing total cost by the number of items
    - Other strategies
- Identify one or more students to present their work to the class.

In whole-class discussion:

- Call on students to share how they found the unit rate. Focus on the reasoning associated with these strategies (e.g., "Why was it helpful to divide?" and "How can we tell that this answer

makes sense?").

- Discuss more than one strategy, even if they seem less advanced (e.g., repeated addition or guess-and-check type strategies). This will create the opportunity to make connections between strategies, which may be helpful to many students.

10
 MINUTES
	CHALLENGE 3
	
	 Circulate the room. Eavesdrop and students' conversations and look at their written work
	
	 • Tell students to try to solve the problem in more than one way (on paper) and then check their answer with the sim. Discuss strategies ideas with neighbors along the way.
	 • Identify one or more students to present their work to the class. Look for two specific methods:
	     ○ Find the unit rate and apply it
	     ○ Use equivalent rates
	
	 Lead a whole-class discussion:
	
	 • Call on particular students to share how they solved the problem. Focus on two methods:
	     ○ We can find the unit rate first and then use that information to solve the problem (like Student A did) or
	     ○ We can solve the problem directly creating an equivalent rate, based on a number that we want.
	 • Both methods maintain the rate, which is the ratio between the two different quantities, but they scale the numbers to the desired amount.

SUMMARY

5 MINUTES	Time permitting, Guided Practice problems from Lesson 6.2 may be used as an exit ticket.

Consider these questions as you prepare for tomorrow' lesson:
- Did the two target strategies come out in whole-class discussion?

- Did both of these seem to make sense to students? Was one friendlier than the other?
- What related problem would be useful as a warm-up for next lesson?
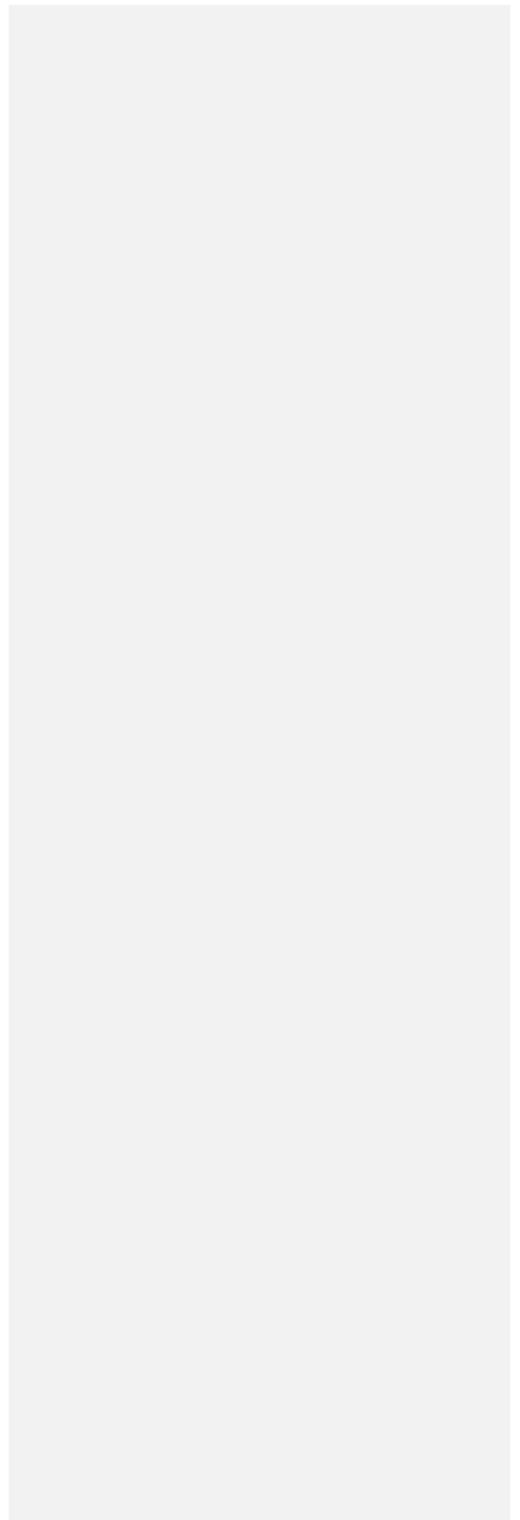
Name: _____ Date: _____ Class: _____

RATES

Go to the Shopping screen in Unit Rates (Google "phet unit rates" and click on the first result). Play with the sim for 3–5 minutes. Write down 3 discoveries that you make or questions you have.

Shopping

    a.

    b.

    c.

CHALLENGE 1

1. **Which are cheaper, apples or pears?** Use the sim to compare the prices of apples and pears. Write your findings below. (Remember that rates have "per" in the name.)

    Unit rate for apples: _____

    Unit rate for pears: _____

Be prepared to discuss the strategies that you and your classmates used. Take notes below.

2. **Which are cheaper, lemons or oranges?** Use the sim to compare the prices of lemons and oranges. Write your findings below.

    Unit rate for lemons: _____

    Unit rate for oranges: _____

Be prepared to discuss the strategies that you and your classmates used. Take notes below.

CHALLENGE 2

3. **Which are cheaper, carrots or cucumbers?** Use the sim to compare the prices of carrots and cucumbers. Record your work, and write your findings below.

   Unit rate for carrots: _____

   (Remember that rates have "per" in the name.)

   Unit rate for cucumbers: _____

Be prepared to discuss the strategies that you and your classmates used. Take notes below.

4. **Which are cheaper, potatoes or tomatoes?** Use the sim to compare the prices of potatoes and tomatoes. Record your work, and write your findings below.

   Unit rate for potatoes: _____

   (Remember that rates have "per" in the name.)

   Unit rate for tomatoes: _____

Be prepared to discuss the strategies that you and your classmates used. Take notes below.

CHALLENGE 3

5. A store offers a package of 16 mushrooms for $2. You buy *all* of the packages on the shelf, for a total of 112 mushrooms. How much will it cost?

   Record your work below. Try to solve the problem in two (or more) different ways.

   Cost for 112 mushrooms: _____

Be prepared to discuss the strategies that you and your classmates used. Take notes below.