

Unit Rates

Student Probe

Tracy can ride her bike 30 miles in three hours. How far can she ride in one hour?

Answer: 10 miles

Lesson Description

In this lesson students will explore the verbal description of a proportional relationship using tables and diagrams to determine the constant of proportionality (unit rate).

Rationale

Proportional reasoning is the ability to think about and compare ratios, the multiplicative relationship between quantities. In many real world situations it is helpful to determine the unit rate of two quantities when making comparisons. Cost per item, miles per gallon, miles per hour, and pay per hour are a few of the many applications of unit rates. In mathematics, the concept of unit rate is used in the slope of a line, the constant of proportionality of similar figures, and in defining trigonometric ratios.

Preparation

Prepare ratio tables for students to use when solving the problems.

At a Glance

What: Identify the unit rate from tables, diagrams, and verbal descriptions of proportional relationships

Common Core State Standard: CC.7.RP.2b.

Recognize and represent proportional relationships between quantities. (b)

Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. Mathematical Practices:

Model with mathematics.

Who: Students who cannot determine the unit rate in a proportional relationship

Grade Level: 7

Prerequisite Vocabulary: unit, ratio, ratio table, proportional

Prerequisite Skills: equivalent fractions, ratio tables, multiplication and division of positive numbers, including fractions and decimals

Delivery Format: Individual, small group

Lesson Length: 20-30 minutes

Materials, Resources, Technology: calculator (optional)

Student Worksheets: None

Lesson

| The teacher says or does... | Expect students to say or do... | If students do not, then the teacher says or does... | | | | | | | | |
|---|--|--|----|---|---|-------|-----|-----|----|--|
| <p>1. Teresa and her family went on a trip. They drove 200 miles in four hours. Complete the ratio table.</p> | <table border="1"> <tr> <td>Hours</td> <td>4</td> <td>2</td> <td>1</td> </tr> <tr> <td>Miles</td> <td>200</td> <td>100</td> <td>50</td> </tr> </table> | Hours | 4 | 2 | 1 | Miles | 200 | 100 | 50 | <p>Prompt students. Refer to Ratios and Proportional Thinking.</p> |
| Hours | 4 | 2 | 1 | | | | | | | |
| Miles | 200 | 100 | 50 | | | | | | | |
| <p>2. Notice that they drove 50 miles in one hour. We sometimes say they drove 50 miles per hour. This is called the unit rate. It is the distance they drove in one hour.</p> | | | | | | | | | | |
| <p>3. Since their unit rate is 50 miles in one hour, how far could they drive in 6 hours? How do you know?</p> | <p>300 miles $50 \cdot 6 = 300$</p> | <p>Extend the ratio table in Step 1 to show 6 hours. Ask students if there is a way to compute this without using a ratio table.</p> | | | | | | | | |
| <p>4. Many times we can use the unit rate to make solving problems easier. Try this problem: Eliza bought 3 markers for \$2.40. First, let's find the cost of one marker. That is the unit rate for this problem. Explain how you know.</p> | <p>$\\$2.40 \div 3 \text{ markers} = \\0.80</p> | <p>Prompt students. Refer to Multiplying and Dividing Whole Numbers.</p> | | | | | | | | |
| <p>5. Now determine the cost for 10 markers at the same price. How do you know?</p> | <p>$\\$0.80 \cdot 10 \text{ markers} = \\8.00</p> | <p>Prompt students. Refer to Multiplying and Dividing Whole Numbers.</p> | | | | | | | | |
| <p>6. Now solve this problem: A box of twelve candy bars costs \$4.80. Find the cost of 5 candy bars. Explain how you got your answer.</p> | <p>$\\$4.80 \div 12 \text{ candybars} = \\0.40 $\\$0.40 \cdot 5 \text{ candybars} = \\2.00</p> | <p>What is the unit rate? Or What is the cost of one candy bar? Refer to Multiplying and Dividing Whole Numbers.</p> | | | | | | | | |
| <p>7. Repeat with additional problems as necessary.</p> | | | | | | | | | | |

Teacher Notes

Traditional textbooks show students how to set up an equation of two ratios and “cross-multiply”. This can be a very mechanical approach and may lead to confusion and error. The use of ratio tables allows students to develop a good foundation and an intuitive understanding of proportional reasoning.

Variations

None

Formative Assessment

A flock of geese eat 50 pounds of grain in one week. If they eat the same amount each day, how much do they eat in one day?

Answer: $50 \text{ pounds} \div 7 \text{ days} = 7\frac{1}{7}$ or 7.14 pounds per day

References

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Marjorie Montague, Ph.D. (2004, 12 7). *Math Problem Solving for Middle School Students With Disabilities*. Retrieved 4 25, 2011, from The Iris Center
Van de Walle, J. A., & Lovin, L. H. (2006). *Teaching Student-Centered Mathematics Grades 5-8 Volume 3*. Boston, MA: Pearson Education, Inc.