

Make Tables of Equivalent Ratios

Student Probe

Complete the following table of equivalent ratios:

| | | | | | | | |
|--------|----|----|----|----|----|--|--|
| Horses | 6 | 9 | 12 | 15 | 18 | | |
| Acres | 30 | 45 | 60 | | | | |

Answer:

| | | | | | | | |
|--------|----|----|----|----|----|-----|-----|
| Horses | 6 | 9 | 12 | 15 | 18 | 21 | 24 |
| Acres | 30 | 45 | 60 | 75 | 90 | 105 | 120 |

Lesson Description

This lesson, based on students' understanding of equivalent fractions, uses tables of equivalent ratios relating quantities with whole-number measurement to finding missing values in the tables.

Rationale

Students who are able to view equivalent ratios as deriving from pairs of rows or columns of the multiplication table as well as make connections between their understanding of multiplication and division with ratios and rates are then able to expand their ability to solve a wide range of problems involving ratios and rates.

Understanding the relationship between the numbers of a ratio and constructing a table to organize the data reinforces student understanding of the relationship between rational numbers and gives students background knowledge for understanding functions and function tables.

Preparation

If using an interactive board, prepare several pages with two-column tables. Worksheets or student-made tables will work as well.

At a Glance

What: Make table of equivalent ratios and find missing values.

Common Core State Standards: CC.6.RP.3a.

Use ratio and rate reasoning to solve real-world and mathematical problems. (a) Make tables of equivalent ratios relating quantities with whole number measurements, find missing values in the tables, and plot pairs of values on the coordinate plane. Use tables to compare ratios.

Mathematical Practices:

Reason abstractly and quantitatively.

Look for and make use of structure.

Model with mathematics.

Who: Students unable to name equivalent ratios or complete a table of equivalent ratios.

Grade Level: 6

Prerequisite Vocabulary: ratio, equivalent, simplify, compare

Prerequisite Skills: Name equivalent fractions, simplify and compare fractions, find the missing part of a fraction that is equivalent to another

Delivery Format: Whole group, small group, individual

Lesson Length: 20-40 minutes

Materials, Resources, Technology: white/chalk board or interactive board, paper, pencil

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. Look at this list of fractions and tell me what the missing numerator would be: $\frac{2}{3}, \frac{4}{6}, \frac{6}{9}, \frac{\square}{12}$</p> <p>How do you know?</p> | <p>8</p> <p>When I look at the numerators, $2 \cdot 2 = 4, 2 \cdot 3 = 6, \text{ so } 2 \cdot 4 = 8.$</p> | <p>What is the first fraction? $\frac{2}{3}$</p> <p>Now, look at the next fraction and tell me what you notice about the numerator in it compared to $\frac{2}{3}$.</p> <p>Now look at the denominators. What do you see?</p> <p>If the student is able to see the relationship between the first two fractions, the teacher then should continue listening for the student to say that each fraction is equivalent to $\frac{2}{3}$.</p> <p>If the student is unable to see this relationship, Refer to Equivalent Fractions.</p> |
| <p>2. What is it about those four fractions that allowed you to find the missing numerator?</p> | <p>They're equivalent (or equal or simplified) to $\frac{2}{3}$.</p> | <p>Prompt the student to simplify all of the fractions and determine they are equivalent to $\frac{2}{3}$.</p> |
| <p>3. In the same way that we can find the missing part of a set of equivalent fractions, we can also find the missing parts of equivalent ratios. The best way is to use a table.</p> | | |

| The teacher says or does... | Expect students to say or do... | If students do not, then the teacher says or does... | | | | | | | | | | | | | | | | |
|---|--|--|---------|----|----|------|----|----|----|----------|--|--|----|---------|----|----|----|---|
| <p>4. Look at this table of equivalent ratios showing the number of eggs needed to make a chocolate cake using the same recipe. Can you complete it?</p> <table border="1" data-bbox="191 619 581 697"> <tr> <td>cakes</td> <td>2</td> <td>4</td> <td>6</td> <td></td> </tr> <tr> <td>eggs</td> <td>6</td> <td>12</td> <td></td> <td></td> </tr> </table> | cakes | 2 | 4 | 6 | | eggs | 6 | 12 | | | <p>For 6 cakes, it will be 18 eggs and the next ratio will be 8 cakes and 24 eggs.</p> | <p>Model the relationship of the number of cakes to each other, the number of eggs and the ratios to each other.</p> | | | | | | |
| cakes | 2 | 4 | 6 | | | | | | | | | | | | | | | |
| eggs | 6 | 12 | | | | | | | | | | | | | | | | |
| <p>5. How were you able to predict what the missing numbers in the ratios would be?</p> | <p>I knew that 4 to 12 is 2 to 6 doubled and the 6 cakes was three times the two cakes, so I multiplied the eggs (6) by 2 to get 12 eggs. Then I multiplied 2 cakes by 4 and the 6 eggs by 4 to get the last ratio. (The student may use different wording, but as long as the meaning and reasoning are similar, his/her answer is correct.)</p> | <p>See above.</p> | | | | | | | | | | | | | | | | |
| <p>6. Let's try a different situation. I'm going to tell you about it and I want you to construct a table using what I tell you.</p> <p>Briana helped her mother in the garden and picked 12 tomatoes in 15 minutes. The next day, she was able to pick 24 tomatoes in 30 minutes. On day 3, Briana picked 36 tomatoes. How many minutes did it take her, if she picked at the same rate as the first two days?</p> | <p>The student draws a ratio table, vertically or horizontally showing the following:</p> <table border="1" data-bbox="613 1325 824 1472"> <tr> <td>tomatoes</td> <td>minutes</td> </tr> <tr> <td>12</td> <td>15</td> </tr> <tr> <td>24</td> <td>30</td> </tr> <tr> <td>36</td> <td>45</td> </tr> </table> <p>OR</p> <table border="1" data-bbox="613 1514 1008 1591"> <tr> <td>tomatoes</td> <td>12</td> <td>24</td> <td>36</td> </tr> <tr> <td>minutes</td> <td>15</td> <td>30</td> <td>45</td> </tr> </table> | tomatoes | minutes | 12 | 15 | 24 | 30 | 36 | 45 | tomatoes | 12 | 24 | 36 | minutes | 15 | 30 | 45 | <p>Ask the student to draw a table and complete it with the information given. Guide the student in a discussion about the pattern of growth that is taking place in the number of minutes and the amount of tomatoes picked.</p> |
| tomatoes | minutes | | | | | | | | | | | | | | | | | |
| 12 | 15 | | | | | | | | | | | | | | | | | |
| 24 | 30 | | | | | | | | | | | | | | | | | |
| 36 | 45 | | | | | | | | | | | | | | | | | |
| tomatoes | 12 | 24 | 36 | | | | | | | | | | | | | | | |
| minutes | 15 | 30 | 45 | | | | | | | | | | | | | | | |

| The teacher says or does... | Expect students to say or do... | If students do not, then the teacher says or does... | | | | | | | | | | | | | | | | |
|---|---|--|-------|---|--------|---|--------|---|--------|---|---------|----|---------|----|---------|----|---------|---|
| <p>7. Let's try this one: Marie bought 2 goldfish and paid \$3.00 for them. Then she went back each day and bought 4 more goldfish and paid \$6.00 for them, the next day she bought 6 goldfish. On the last day, she bought 14 goldfish. Construct a ratio table showing how many goldfish she bought and how much money she paid each day for them.</p> | <p>The student constructs a ratio table, completing it, either vertically or horizontally (see above) as shown below:</p> <table border="1" data-bbox="613 428 1010 747"> <thead> <tr> <th>Goldfish</th> <th>price</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>\$3.00</td> </tr> <tr> <td>4</td> <td>\$6.00</td> </tr> <tr> <td>6</td> <td>\$9.00</td> </tr> <tr> <td>8</td> <td>\$12.00</td> </tr> <tr> <td>10</td> <td>\$15.00</td> </tr> <tr> <td>12</td> <td>\$18.00</td> </tr> <tr> <td>14</td> <td>\$21.00</td> </tr> </tbody> </table> | Goldfish | price | 2 | \$3.00 | 4 | \$6.00 | 6 | \$9.00 | 8 | \$12.00 | 10 | \$15.00 | 12 | \$18.00 | 14 | \$21.00 | <p>Teacher shows the student that the pattern is growing thusly:</p> <p>2 $2 \times 2 = 4$ $2 \times 3 = 6$ $2 \times 4 = 8$ $2 \times 5 = 10$ $2 \times 6 = 12$ $2 \times 7 = 14$</p> <p>Teacher then shows that the same pattern works for the price:</p> <p>$3.00 \times 2 = 6.00$ $3.00 \times 3 = 9.00$ $3.00 \times 4 = 12.00$ $3.00 \times 5 = 15.00$ $3.00 \times 6 = 18.00$ $3.00 \times 7 = 21.00$</p> <p>(Note: students may need to be shown that $3 \times 2 = 6$ and $3.00 \times 2 = 6.00$ represent the same problem.)</p> |
| Goldfish | price | | | | | | | | | | | | | | | | | |
| 2 | \$3.00 | | | | | | | | | | | | | | | | | |
| 4 | \$6.00 | | | | | | | | | | | | | | | | | |
| 6 | \$9.00 | | | | | | | | | | | | | | | | | |
| 8 | \$12.00 | | | | | | | | | | | | | | | | | |
| 10 | \$15.00 | | | | | | | | | | | | | | | | | |
| 12 | \$18.00 | | | | | | | | | | | | | | | | | |
| 14 | \$21.00 | | | | | | | | | | | | | | | | | |

| The teacher says or does... | Expect students to say or do... | If students do not, then the teacher says or does... | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--|--|---------|------|------|----|----|---|-------|---------|---|---|--|----|-------|---------|---|---|--|---|--|---|--|----|--|----|
| <p>8. Show me what you would do to solve this problem:</p> <p>If Tommy is able to download 5 songs in 3 minutes, how many downloads will he be able to complete in 15 minutes?</p> | <p>The student constructs a ratio table, completing it, either vertically or horizontally (see above) as shown below (student work is shown in red):</p> <table border="1" data-bbox="613 541 1008 663"> <thead> <tr> <th>Songs</th> <th>Minutes</th> </tr> </thead> <tbody> <tr> <td>5x5↓</td> <td>3x5↓</td> </tr> <tr> <td>25</td> <td>15</td> </tr> </tbody> </table> | Songs | Minutes | 5x5↓ | 3x5↓ | 25 | 15 | <p>If students do not, then the teacher has the student construct a ratio table and insert the given information as shown below:</p> <table border="1" data-bbox="1036 464 1430 585"> <thead> <tr> <th>Songs</th> <th>Minutes</th> </tr> </thead> <tbody> <tr> <td>5</td> <td>3</td> </tr> <tr> <td></td> <td>15</td> </tr> </tbody> </table> <p>The teacher then guides the student in a discussion about the following: If 5 songs are downloaded in 3 minutes, how many songs are downloaded in 6 minutes? (Answer: 10 or “twice as many which is 10”)</p> <p>The teacher then asks, how could you show all of the possible downloads every 3 minutes in a ratio table. The student would construct the following table:</p> <table border="1" data-bbox="1036 1129 1430 1371"> <thead> <tr> <th>Songs</th> <th>Minutes</th> </tr> </thead> <tbody> <tr> <td>5</td> <td>3</td> </tr> <tr> <td></td> <td>6</td> </tr> <tr> <td></td> <td>9</td> </tr> <tr> <td></td> <td>12</td> </tr> <tr> <td></td> <td>15</td> </tr> </tbody> </table> <p>The teacher would then have the student complete the number of songs, using the pattern that he/she derives from the minutes’ pattern (multiplying by 2, then 3, then 4, then 5) to yield the following number of songs: 5, 10, 15, 20, 25</p> <p>The teacher asks, “So, how many songs could he download in 15 minutes?” (Answer, 25)</p> | Songs | Minutes | 5 | 3 | | 15 | Songs | Minutes | 5 | 3 | | 6 | | 9 | | 12 | | 15 |
| Songs | Minutes | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5x5↓ | 3x5↓ | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25 | 15 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Songs | Minutes | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 3 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 15 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Songs | Minutes | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 3 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 6 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 9 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 12 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 15 | | | | | | | | | | | | | | | | | | | | | | | | | |

Teacher Notes

None

Variations

None

Formative Assessment

If a popular online music video receives 200 “like” ratings in 5 minutes and it receives a constant rate of “like” ratings, how many “like” ratings will it receive in an hour?

| | | | | | | | | | | | | | |
|----------------|-----|--|--|--|--|--|--|--|--|--|--|--|--|
| “Like” ratings | 200 | | | | | | | | | | | | |
| Minutes | 5 | | | | | | | | | | | | |

Answer: 2,400

| | | | | | | | | | | | | |
|----------------|-----|-----|-----|-----|------|------|------|------|------|------|------|------|
| “Like” ratings | 200 | 400 | 600 | 800 | 1000 | 1200 | 1400 | 1600 | 1800 | 2000 | 2200 | 2400 |
| Minutes | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 |

References

Mathematics Preparation for Algebra. (n.d.). Retrieved Dec. 10, 2010, from Doing What Works
Marjorie Montague, Ph.D. (2004, 12 7). *Math Problem Solving for Middle School Students With Disabilities*. Retrieved April 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.