Changing Units

Student Probe

Jenny needs 72 inches of ribbon for a craft project. The ribbon is sold by the yard. How many yards of ribbon does Jenny need to purchase?

Answer: 2 yards

Lesson Description

In this lesson, students will use ratio tables to make conversions between units in a single measurement system. Two examples (one in customary units and one in metric units) are given.

Rationale

Conversions within the metric system are fairly straightforward. Students can use their understanding of base ten to make sense of them. Unfortunately, the customary system involves a variety of conversion factors that are not related to a decimal system. Students will need to commit most of those factors to memory. However, the emphasis should be on the most commonly used units such as inches, feet, yards, pints, quarts, gallons, etc.
Exact conversions between metric and the customary system should not be done. By using tables created with a few known conversion facts, students can develop a strategy that will solve all conversion problems.

Preparation

None

At a Glance

What: Make unit conversions within the same system of measurement
Common Core State Standard: CC.5.MD.1. Convert among different-sized standard measurement units within a given measurement system, and use these conversions in solving multi-step, real world problems.
Mathematical Practices:
Make sense of problems and persevere in solving them.
Reason abstractly and quantitatively.
Attend to precision.
Look for and express regularity in repeated reasoning.
Who: Students who have difficulty converting units within the same measurement system
Grade Level: 5
Prerequisite Vocabulary: inches, feet yards, millimeters, meters, etc.
Prerequisite Skills: common conversions, such as 3 feet=1 yard
Delivery Format: Individual, small group, whole group
Lesson Length: 15-30 minutes
Materials, Resources, Technology: calculator (optional)
Student Worksheets: none

Lesson

<table>
<tr><th>The teacher says or does…</th><th>Expect students to say or do…</th><th>If students do not, then the teacher says or does…</th></tr>
<tr><td>1. Kevin wants to build a pen for his dog. He knows that he needs 250 feet of fencing. When he went to the store to buy the fencing material, he found it was measured in yards. How many yards does he need to buy?

What do we need to do to figure out this problem?</td><td>Change 250 feet to yards.</td><td>He needs 250 feet of fencing. How many yards is that?</td></tr>
<tr><td>2. How many feet are there in one yard?</td><td>3 feet= 1 yard</td><td>Prompt students if they have forgotten, or show them a yard stick.</td></tr>
<tr><td>3. Will the number of yards be more than or less than the number of feet?
How do you know?
(Optional question: Should we multiply or divide?)</td><td>Less than, because a yard is longer than a foot.

Divide</td><td></td></tr>
<tr><td>4. We are going to create a table to figure out this problem.
(Model this for students.)
<table><tr><th>Feet</th><th>Yards</th></tr><tr><td>3</td><td>1</td></tr><tr><td>6</td><td></td></tr><tr><td>9</td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>
Complete the table for 2 and 3 feet.</td><td><table><tr><th>Feet</th><th>Yards</th></tr><tr><td>3</td><td>1</td></tr><tr><td>6</td><td>2</td></tr><tr><td>9</td><td>3</td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table></td><td>Encourage students to skip count.</td></tr>
</table>

<table>
<tr><th>The teacher says or does…</th><th>Expect students to say or do…</th><th>If students do not, then the teacher says or does…</th></tr>
<tr><td>5. It would take a long time to go all the way to 250 feet by ones. How can we make it go faster?</td><td>Answers will vary.
Encourage students to increase by larger “chunks”, such as tens and hundreds.</td><td></td></tr>
<tr><td>6. Let’s jump to 90 feet.
Now let’s jump to 240 feet.

(Optional question: What patterns do you see in the table?)</td><td><table><tr><th>Feet</th><th>Yards</th></tr><tr><td>3</td><td>1</td></tr><tr><td>6</td><td>2</td></tr><tr><td>9</td><td>3</td></tr><tr><td>90</td><td>30</td></tr><tr><td>240</td><td>80</td></tr></table></td><td>Monitor students.</td></tr>
<tr><td>7. We are almost there.
How many feet are left?
How do you know?

From the table we can see that 9 feet = 3 yards.
How many more feet to we have?</td><td>$250-240=10$ feet

$10-9=1$ foot</td><td></td></tr>
<tr><td>8. So how many yards do we need?</td><td>$80+3=83$ yards and 1 more foot.</td><td>Assist students as they count the number of yards.</td></tr>
<tr><td>9. Repeat, as necessary, with other customary units.</td><td></td><td></td></tr>
<tr><td>10. How many centimeters are there in 4.27 meters?

What do we need to know to solve this problem?</td><td>How many centimeters are in a meter.</td><td></td></tr>
<tr><td>11. How many centimeters are there in one meter?</td><td>100 cm = 1 m</td><td>How many cents (pennies) are in one dollar?
Show them a meter stick.</td></tr>
<tr><td>12. Will the number of centimeters be more than or less than the number of meters?
How do you know?
(Optional question: Should we multiply or divide?)</td><td>More, because a centimeter is shorter than a meter.

Multiply</td><td></td></tr>
</table>

<table>
<tr><th>The teacher says or does…</th><th>Expect students to say or do…</th><th>If students do not, then the teacher says or does…</th></tr>
<tr><td>13. We are going to create a table to figure this out. (Model for students.) Complete as much of the table as you can.

<table><tr><th>Meters</th><th>cm</th></tr><tr><td>1</td><td>100</td></tr><tr><td>2</td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>
(Optional question: What patterns do you see in the table?)</td><td>Answers will vary.

<table><tr><th>Meters</th><th>cm</th></tr><tr><td>1</td><td>100</td></tr><tr><td>2</td><td>200</td></tr><tr><td>3</td><td>300</td></tr><tr><td>4</td><td>400</td></tr><tr><td>4.27</td><td>427</td></tr></table></td><td>Monitor students, encouraging them to use “chunks” of 100.</td></tr>
<tr><td>14. How did you know that 0.27 m = 27 cm?</td><td>$0.27=\frac{27}{100}$. Since there are 100 cm in 1 meter, there must be 27 cm in 0.27 m.</td><td>Show students 27 cm on the meter stick.</td></tr>
<tr><td>15. Repeat, as necessary, with other customary units.</td><td></td><td></td></tr>
</table>

Teacher Notes:

1. This lesson only provides examples of a strategy for making conversions. Students will need more practice to become proficient.
2. Refrain from telling students a procedure for making conversions. They will derive their own procedure with experience.

Variations

Proportions may be used to make conversions. Consider Kevin’s fencing problem:

$$\frac{1\,yard}{3\,feet}=\frac{\_\_\_\,yards}{250\,feet}.$$

Formative Assessment

Madison bought a large container of orange juice. The label states that it contains 192 ounces. Madison knows that 8 ounces = 1 cup. How many cups of orange juice are in the container?

Answer: 24 cups

Cups	Ounces
1	8
10	80
20	160
24	192

$192 - 160 = 32$

$32 \div 8 = 4$

References

Marjorie Montague, Ph.D. (2004, 12 7). *Math Problem Solving for Middle School Students With Disabilities*. Retrieved 4 25, 2011, from The Iris Center

Russell Gersten, P. (n.d.). *RTI and Mathematics IES Practice Guide - Response to Intervention in Mathematics*. Retrieved 2 25, 2011, from rti4sucess.