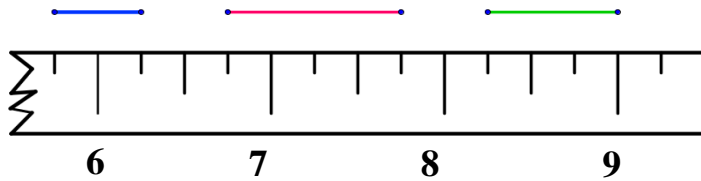


Measurement Using Standard Units

Student Probe



List the length of each colored line segment: blue, red, green. Explain how you found your answers.

Lesson Description

The lesson is intended to help students develop an understanding of measurement and the accurate use of a ruler. The lesson will give students opportunities to look at various “broken ruler” tasks and focus on the distance traveled from one end of an object to the other. The focus is on whole units, one-half units, and one-fourth units.

Rationale

Students often confuse the actual measurement taken from a ruler with a particular place on the ruler instead of the amount of distance traveled. This misconception leads to misuse or inaccurate use of a ruler and its measurements. In many problem situations students are required to look at various measurements and make comparisons between different measurements on a ruler. If students fail to understand that the length of an object as how far it is from one end to the other, then students’ ability to apply the measurements in a useful way is greatly reduced.

Preparation

Prepare copies of Ruler Tasks for each student. Provide each student with scissors and a standard 12” ruler with marks only to the nearest $\frac{1}{4}$ “. (Do not use a ruler at this point with $\frac{1}{8}$ or $\frac{1}{16}$.) Students should have some understanding of fractions and basic equivalence before starting this lesson.

At a Glance

What: Measuring to the nearest $\frac{1}{4}$ of an inch using a standard ruler.

Common Core Standards: CC.3.MD.4.

Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters.

Mathematical Practices:

Reason abstractly and quantitatively.

Use appropriate tools strategically.

Attend to precision.

Who: Students who struggle with accurate measurements using a ruler to the nearest $\frac{1}{4}$ of an inch.

Grade Level: 3

Prerequisite Vocabulary: equivalent fractions, line segment

Prerequisite Skills: naming fractions, equivalent fractions, some understanding of improper fractions and mixed numbers

Delivery Format: individual, small group

Lesson Length: 30-45 minutes

Materials, Resources, Technology: scissors, ruler with only marks as detailed as $\frac{1}{4}$ inch, real world objects to measure

Student Worksheets: Ruler Task

Lesson

The teacher says or does...	Expect students to say or do...	If students do not, then the teacher says or does...
<p>1. Take out the worksheet titled "Ruler Tasks". Let's look at the example problem given for us.</p> <p>Part A</p> <p>If we measure the arrow from end to end, we will jump 3 spaces ($\frac{1}{4}$ for each jump) and get a total of $\frac{3}{4}$ of an inch.</p> <p>How many jumps ($\frac{1}{4}$ in size) would we need to make in order to reach 1 inch in length?</p>	<p>Students would need to state that <i>four</i> – $\frac{1}{4}$ jumps are needed.</p> <p>Equivalent fraction skills are needed prior to starting this lesson.</p>	<p>If students are having trouble with basic equivalent fraction ideas, then stop working on measuring with a ruler and continue work on equivalent fractions.</p>
<p>2. Why does the measurement for the arrow not change when we move it on the ruler?</p> <p>Part B</p>	<p>Students should start to provide evidence that they understand that length on a number line or ruler is "distance traveled".</p>	
<p>3. How can the number sentence described in Part C, $\frac{1}{2} + \frac{1}{4} = \frac{3}{4}$, provide the same answer as Parts A and B?</p>	<p>Students should explain that instead of making <i>three</i> $\frac{1}{4}$ jumps they made <i>one</i> $\frac{1}{2}$ jump (which is equivalent to <i>two</i> $\frac{1}{4}$ jumps) and <i>one</i> $\frac{1}{4}$ jump.</p> <p>Students' explanations should include the idea of equivalent fractions.</p>	<p>Teacher may need to revisit the idea of equivalent fractions giving examples of how they are equivalent. ($\frac{1}{2} = \frac{2}{4}$, etc.)</p>

The teacher says or does...	Expect students to say or do...	If students do not, then the teacher says or does...
<p>4. Now that we have discussed and looked at how to measure on a ruler, let's test out our measuring skills.</p> <p>List the correct measurement for each figure pictured above Rulers A-E.</p> <p>If you have any problems finding the lengths for any of the figures for Rulers A-E, you may want to cut out the measurement strips on the attached sheet to help find an accurate measurement.</p> <p>Each strip is worth a different fractional amount of an inch. (1, $\frac{1}{2}$, and $\frac{1}{4}$)</p> <p>(See Teacher Notes.)</p>	<p>Ruler A- $2\frac{1}{4}$ inches Ruler B- $1\frac{3}{4}$ inches Ruler C- $2\frac{3}{4}$ inches Ruler D- $1\frac{1}{2}$ inches Ruler E- $2\frac{1}{4}$ inches</p>	<p>Make sure students explain verbally how they were able to determine the length for each of the figure for Rulers A-E.</p>
<p>5. How can I use the measurement strips to help find different fractional names for the same amount?</p> <p>(This provides a background for creating numbers sentences such as:</p> <p>$1 + 1 + \frac{1}{2} + \frac{1}{4} = 2\frac{3}{4}$ $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = 1\frac{1}{4}$ and other similar numbers sentences.)</p>	<p>Answers should involve the use of comparing the smaller pieces to make the larger pieces. For example:</p> <p><i>2 small</i> ($\frac{1}{4}$ inch strips) make <i>1 medium</i> ($\frac{1}{2}$ inch strip) <i>2 medium</i> ($\frac{1}{2}$ inch strips) make <i>1 large</i> (1 inch strip) <i>4 small</i> ($\frac{1}{4}$ inch strips) make <i>1 large</i> (1 inch strip)</p>	<p>Additional examples may be needed for students to fully understand the concept.</p>
<p>6. When we were working with the Ruler Problems, what size were the smallest jumps that we made?</p>	<p>Students should state that jumping from any one mark to the next was worth $\frac{1}{4}$ inch.</p> <p>(Be sure that students understand it is the smallest jump you can make, and not the jump that takes place between small marks.)</p>	<p>Students will want to say that a jump from the $\frac{1}{4}$ mark to the $\frac{3}{4}$ mark is worth $\frac{1}{4}$ because it is going from small mark to small mark. If students have this misconception, allow them to use the measurement strips to disprove their theory.</p>

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 look at more problems to see if we have fine tuned our measurement skills. These problems have rulers that are broken at the end.</p> <p>Using these rulers, measure the objects in Figure A and Figure B.</p> <p>What is the length for Figure A and how did you determine the length?</p> <p>What is the length for Figure B? How did you determine the length?</p>	<p>Figure A and B are both $2\frac{1}{2}$ inches.</p> <p>Some students may say 10 small ($\frac{1}{4}$) jumps.</p>	<p>Teacher may need to direct the conversation to revolve around how to name the small jumps as $\frac{10}{4}$ and then that if you take out two groups of <i>four</i>-$\frac{1}{4}$'s (equaling two whole inches) that leaves you with <i>two</i>-$\frac{1}{4}$'s (equaling $\frac{1}{2}$)</p>
<p>8. Find something around your area that is smaller than the length of a standard 12" ruler and measure it to the nearest $\frac{1}{4}$ inch.</p>	<p>Objects such as pencils, small notebooks, pencil boxes, sheets of paper, etc.</p>	<p>Teacher may use this as an informal assessment to see if students can apply what they have been learning about measuring using a ruler.</p>

Teacher Notes

1. Rulers A & B: *Easiest*
Students are to start at the zero mark on the ruler and measure to the nearest $\frac{1}{4}$ inch.
2. Ruler C: *More difficult*
This problem is designed to cause students to look at a measurement that doesn't start at the zero mark.
3. Ruler D & E: *Most difficult*
This problem was created in order to push students to look at a length measurement that doesn't start at zero or at a whole number amount. This forces students to look at how many spaces they must travel. Knowledge about equivalent fractions and mixed numbers/improper fractions is a necessity when creating number sentences to represent how students found the length.

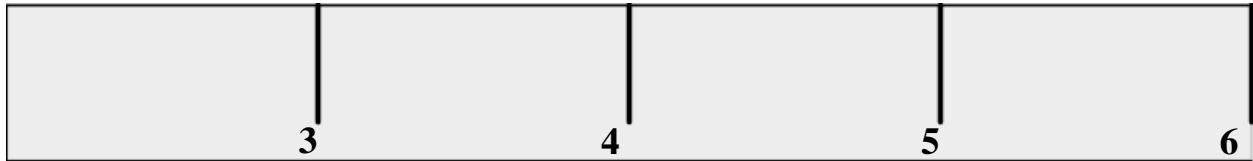
Variations

None

Formative Assessment

Finish labeling the ruler to include $\frac{1}{2}$ and $\frac{1}{4}$ inch markings.

Once you are finished labeling your new section of a ruler, draw a line segment that is $2\frac{3}{4}$ inches long.



References

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

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