

Instructional Supports and Resources

K-PREP Sampler Support
Grade 3
Mathematics
8/20/2012

This document provides teachers with instructional supports for effectively teaching the standards that are measured by the sample released K-PREP mathematics items.

Domain:	Measurement and Data
Cluster	<i>Represent and interpret data.</i>
Standards:	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.
Standards for Mathematical Practice:	MP.1. Make sense of problems and persevere in solving them. MP.4. Model with mathematics. MP.6. Attend to precision.

Instructional Strategies

A line plot is a type of display that positions the data along the appropriate scale, drawn as a number line diagram. These plots have two names in common use, “dot plot” (because each observation is represented as a dot) and “line plot” (because each observation is represented above a number line diagram).

The number line diagram in a line plot corresponds to the scale on the measurement tool used to generate the data. In a context involving measurement of liquid volumes, the scale on a line plot could correspond to the scale etched on a graduated cylinder. In a context involving measurement of temperature, one might imagine a picture in which the scale on the line plot corresponds to the scale printed on a thermometer.

Students should understand that the numbers on the scale of a line plot indicate the total number of measurement units from the zero of the scale.

Students in second grade measured length in whole units using both metric and U.S. customary systems. It’s important to review with students how to read and use a standard ruler including details about halves and quarter marks on the ruler. Students should connect their understanding of fractions to measuring to one-half and one-quarter inch. Third graders need many opportunities measuring the length of various objects in their environment.

Students are to measure lengths using rulers marked with halves and fourths of an inch and record the data on a line plot. The horizontal scale of the line plot is marked off in whole numbers, halves or fourths. Students can create rulers with appropriate markings and use the ruler to create the line plots.

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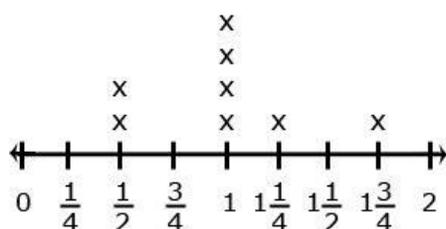
Instructional Resources/Tools

Some important ideas related to measuring with a ruler are:

- The starting point of where one places a ruler to begin measuring
- Measuring is approximate. Items that students measure will not always measure exactly $\frac{1}{4}$, $\frac{1}{2}$ or one whole inch. Students will need to decide on an appropriate estimate length.
- Making paper rulers and folding to find the half and quarter marks will help students develop a stronger understanding of measuring length.

Students generate data by measuring and create a line plot to display their findings. An example of a line plot is shown below:

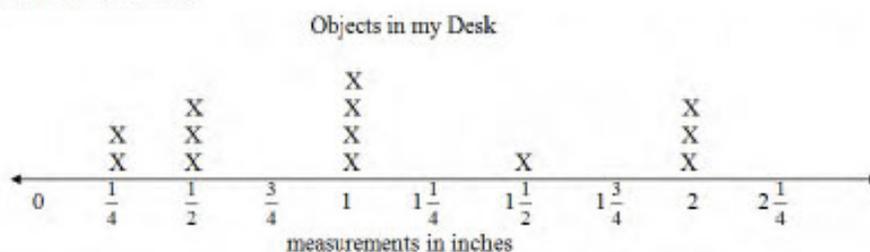
Number of Objects Measured



This standard provides a context for students to work with fractions by measuring objects to a quarter of an inch.

Example:

Measure objects in your desk to the nearest $\frac{1}{2}$ or $\frac{1}{4}$ of an inch, display data collected on a line plot. How many objects measured $\frac{1}{4}$? $\frac{1}{2}$? etc...



Brock has a collection of insects. For a science fair project, he needs to create a line plot of their lengths. He measured them using a ruler marked in inches. On the following page is a picture of his collection. Measure the insects and create a line plot of their lengths to the nearest quarter inch.

Students gather measurement data (e.g., the length of everyone's pencil to the nearest quarter inch). Have students create a line plot, marking the appropriate lengths on the horizontal line and plotting the data.

<http://www.k-5mathteachingresources.com/support-files/measuringstriplineplot.pdf>

<http://www.uen.org/core/math/downloads/3MD4.pdf>

<http://www.vcmsonline.com/uploads/1/1/5/0/11506865/greatakssamplerproof2.pdf> (Could be adapted to address 3.MD.4)

Resources:

Ohio Department of Education. Model Curriculum. March, 2011.
<http://www.education.ohio.gov>.

Arizona Department of Education. Mathematics Resources and Common Core Standards. June, 2011.
<http://www.azed.gov/standards-practices/mathematics-standards/>.

North Carolina State Board of Education. Elementary and Middle Grades Resources.
<http://www.ncpublicschools.org/curriculum/mathematics/scos/>.

Tools for the Common Core Standards. CCSSM Progressions. April, 2011.
<http://commoncoretools.me/category/progressions/>.

Domain:	Number and Operations—Fractions (NF)
Cluster	<i>Develop understanding of fractions as numbers.</i>
Standards:	3.NF.1. Understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size $1/b$.
Standards for Mathematical Practice:	MP.1. Make sense of problems and persevere in solving them. MP.4. Model with mathematics. MP.7. Look for and make use of structure.

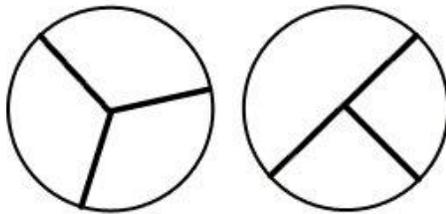
Instructional Strategies

In the standards document, there are critical areas described for each grade level. In grade 3, Critical Area #2 is “Developing understanding of fractions, especially unit fractions (fractions with numerator 1)”.

Students develop an understanding of fractions, beginning with unit fractions. Students view fractions in general as being built out of unit fractions, and they use fractions along with visual fraction models to represent parts of a whole. Students understand that the size of a fractional part is relative to the size of the whole. For example, $\frac{1}{2}$ of the paint in a small bucket could be less paint than $\frac{1}{3}$ of the paint in a larger bucket, but $\frac{1}{3}$ of a ribbon is longer than $\frac{1}{5}$ of the same ribbon because when the ribbon is divided into 3 equal parts, the parts are longer than when the ribbon is divided into 5 equal parts.

Some important concepts related to developing understanding of fractions include:

- Understand fractional parts must be equal-sized
Example Non-example



These are thirds These are NOT thirds

- The number of equal parts tell how many make a whole
- As the number of equal pieces in the whole increases, the size of the fractional pieces decreases
- The size of the fractional part is relative to the whole
 - The number of children in one-half of a classroom is different than the number of children in one-half of a school. (the whole in each set is different therefore the half in each set will be different)
- When a whole is cut into equal parts, the denominator represents the number of equal parts
- The numerator of a fraction is the count of the number of equal parts
 - $\frac{3}{4}$ means that there are 3 one-fourths
 - Students can count *one fourth, two fourths, three fourths*

This is the initial experience students will have with fractions and is best done over time. Students need many opportunities to discuss fractional parts using concrete models to develop familiarity and understanding of fractions. Expectations in this domain are limited to fractions with denominators 2, 3, 4, 6 and 8.

Grade 3 Sampler Item 7

Understanding that a fraction is a quantity formed by part of a whole is essential to number sense with fractions. Fractional parts are the building blocks for all fraction concepts. Students need to relate dividing a shape into equal parts and representing this relationship on a number line, where the equal parts are between two whole numbers. Help students plot fractions on a number line, by using the meaning of the fraction. For example, to plot $\frac{4}{5}$ on a number line, there are 5 equal parts with 4 copies of the 5 equal parts.

Students think all shapes can be divided the same way. Present shapes other than circles, squares or rectangles to prevent students from overgeneralizing that all shapes can be divided the same way. For example, have students fold a triangle into eighths. Provide oral directions for folding the triangle:

1. Fold the triangle into half by folding the left vertex (at the base of the triangle) over to meet the right vertex.
2. Fold in this manner two more times.
3. Have students label each eighth using fractional notation. Then, have students count the fractional parts in the triangle (one-eighth, two-eighths, three-eighths, and so on).

Instructional Resources/Tools

National Library of Virtual Manipulatives resources

Fractions – Naming – Write the fraction corresponding to the highlighted portion of a shape.
http://nlvm.usu.edu/en/nav/frames_asid_203_g_1_t_1.html?from=topic_t_1.html

Fractions – Visualizing – Illustrate a fraction by dividing a shape and highlighting the appropriate parts.
http://nlvm.usu.edu/en/nav/frames_asid_104_g_1_t_1.html?from=topic_t_1.html

Fractions – Parts of a Whole – Relates parts of a whole unit to written description and fraction
http://nlvm.usu.edu/en/nav/frames_asid_103_g_1_t_1.html?from=topic_t_1.html

<http://mdk12.org/instruction/sampitems/mathematics/grade3/6A2a.html>

<http://illuminations.nctm.org/LessonDetail.aspx?ID=L343> (Fun with Pattern Block Fractions)

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