

Getting Ready to Teach Unit 3

Learning Path in the Common Core Standards

In this unit, children learn to measure and estimate lengths, relate addition and subtraction to length, represent lengths on line plots, and reason with shapes and their attributes.

Visual models and real world situations are used throughout the unit to help children understand shapes and length measurements.

Help Children Avoid Common Errors

Math Expressions gives children opportunities to analyze and correct errors, explaining why the reasoning was flawed.

In this unit we use Puzzled Penguin to show typical errors that children make. Children enjoy teaching Puzzled Penguin the correct way, why this way is correct, and why Puzzled Penguin made the error. Common errors are presented in the Puzzled Penguin feature in the following lessons:

- ▶ **Lesson 1:** Counting the marks rather than the spaces between the marks on a centimeter ruler
- ▶ **Lesson 8:** Incorrectly relating the size of the unit and the number of units

In addition to Puzzled Penguin, there are other suggestions listed in the Teacher Edition to help you watch for situations that may lead to common errors. As a part of the Unit Test Teacher Edition pages, you will find a common error and prescription listed for each test item.

Math Expressions VOCABULARY

As you teach this unit, emphasize understanding of this term.

- partner lengths

See the *Teacher Glossary*.



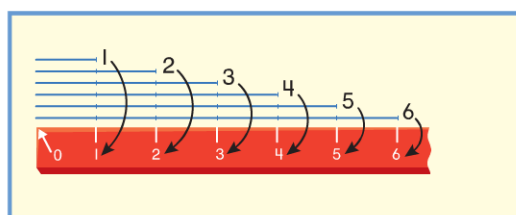
Concepts of Length Measurement

Lesson

1

Iterative Process As children begin their work with measurement, one goal is to help children see that measurement is an iterative process. When a child finds that a pencil is 8 centimeters long, it is important that he or she understands that the length is 8 centimeters not because the end of the pencil lines up with the 8 mark on a centimeter ruler, but because the length is 8 iterations (or repetitions) of a 1-centimeter length.

The exploration of the meaning of the marks on a ruler is intended to support this concept. Children can think of a ruler as a succession of very thin consecutive lengths layered on top of each other.



This important measurement concept is not limited to measurement of length but applies to all units of measure.

Measuring Tools It is important for children to realize that the units on measuring tools must always be the same; that is, they must be standard units. Without standardization, there would be no way to compare measurements, as one person's "meter" might be longer than another person's. Even when using nonstandard units in earlier grades, everyone used the same unit: for example, Inch Cubes or paper clips.

In the first part of this unit, children use 25-centimeter rulers and measure in centimeters. Later in the unit, children make and use meter sticks, yardsticks, and inch rulers. When appropriate, point out that because all the measuring tools are the same, the measurements can be compared to each other.

from THE PROGRESSIONS FOR THE COMMON CORE STATE STANDARDS ON MEASUREMENT AND DATA

Grade 2 Students in Grade 2 measure lengths to generate a set of measurement data. For example, each student might measure the length of his or her arm in centimeters, or every student might measure the height of a statue in inches. (Students might also generate their own ideas about what to measure.)

Attributes of 2-Dimensional Shapes

Lessons

2

3

4

Ever since Kindergarten, children have been exploring shapes. At this grade level, they will use attributes to identify and draw shapes.

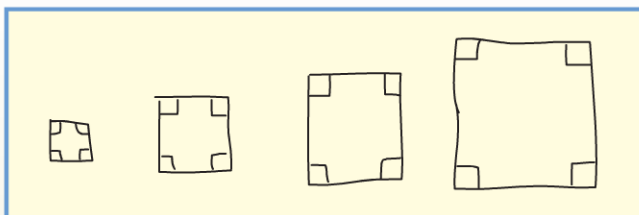
Angles Children learn that the “corners” or “vertices” of shapes are called *angles*. In geometry, *angle* has three meanings: the shape formed by the intersection of two line segments, the measure of that shape, and the rotation required to form that shape. At this grade level, children learn only about angles as shapes that together with sides make up two-dimensional closed figures.

Attributes Children extend the work they did with shapes in Grade 1 to now use attributes to identify and draw shapes with 3, 4, 5, and 6 sides and angles. They learn that the number of sides and the number of angles a shape has tells what that shape is.

triangle	3 sides	3 angles
quadrilateral	4 sides	4 angles
pentagon	5 sides	5 angles
hexagon	6 sides	6 angles

Children also measure the difference in side lengths of squares and rectangles to explore how squares and rectangles are different.

As children work with these shapes, they will draw them. Not all shapes need to be drawn with rulers. Model sketching shapes quickly so that the attributes are apparent and can be discussed. Point out that it is more important to have time to discuss the shapes than to spend a great deal of time to draw the shapes perfectly.



Estimate and Measure Side Lengths in 2-Dimensional Shapes

Lessons

3

4

Measuring side lengths of geometric figures brings together concepts from measurement and from geometry. Children continue to use centimeter rulers in these two lessons.

Estimation Since children have measured lengths in centimeters in the previous lessons, they now extend their measuring skills to include estimating the side lengths of figures before measuring. This is a practical skill that is useful in many real world situations. Practice is the best way to help children improve their ability to estimate lengths. Encourage discussion of ways that children use to estimate lengths. Some children may know that the width of one of their fingers is 1 centimeter or that the width of their palm is about 5 centimeters. Some may have a visual sense of 1 centimeter and can imagine moving along a line and counting off centimeters.

Measure Lengths Children measure the side lengths of a figure to find the distance around the figure. This gives children practice in measuring and prepares them for next year's work with perimeter. For some of the exercises, children measure by marking off each centimeter length. This helps reinforce the idea that measurement is iterative. Children also measure lengths when they are asked to draw figures with given side lengths.



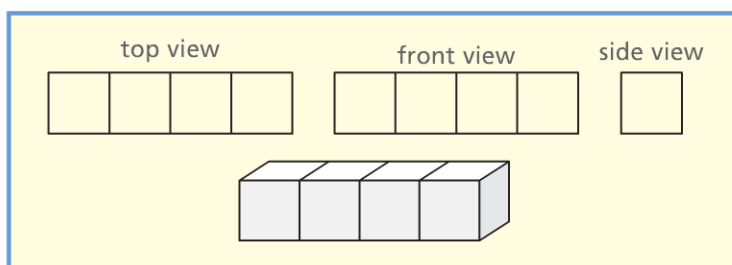
Attributes of 3-Dimensional Shapes

Lesson

5

Rectangular Prisms Each child constructs a rectangular prism and two cubes using nets for these shapes. Children discuss and determine the attributes of these shapes. They learn that the plane figures that make up the outside of these shapes are called *faces*.

Shapes with Cubes After children build their cubes, they work together to explore 3-dimensional shapes constructed with cubes. They construct shapes from front, top, and side view drawings of a shape, and they make front, top, and side view drawings for a given shape. Both aspects of the activity—visualizing the shape and drawing the views—support children in developing spatial sense.



Attributes Children use attributes to distinguish between 2-dimensional shapes and 3-dimensional shapes. Identifying these differences help children to construct hierarchical ideas based on properties. As children use differences in shapes to recognize, draw, and investigate shapes, they build a foundation for future work with perimeter, area, and similarity.

Tools for Measuring Length

Lessons

6

7

8

Either the metric system or the customary system is used for measuring length in almost all countries. Although most countries use the metric system, the United States is the only major country still using the customary system.

Meter Stick As children construct meter sticks, they explore the relationship between centimeters and meters and compare this relationship to that between cents and dollars in our monetary system. Although decimeters are in common use in many countries, the children will not work with them at this time. That the relationship of decimeters to meters is like that of dimes to dollars may be noted as a way to help children relate smaller metric units to a meter. After making meter sticks, children will measure heights in centimeters to collect data for creating line plots. (See the next page for more information on line plots.)

Inch Ruler and Yardstick Children build and use inch rulers and yardsticks. As they measure with both, they may notice that the length of an object contains more inches than feet and more feet than yards. They use these tools to gather height data in inches.

Compensatory Principle When children compare the data they collect for their heights in centimeters and in inches, they see that more centimeters than inches are needed to record the same height. This informal exposure to the Compensatory Principle, which states that when a smaller unit is used to measure a length, more units will be needed to measure the length, helps children build an intuitive understanding of the principle.

Children do not need to know the name of the principle but rather to understand the concept that more smaller units than larger units are needed to measure the same length.

from THE PROGRESSIONS FOR THE COMMON CORE STATE STANDARDS ON MEASUREMENT AND DATA

Grade 2 In Grade 2 the only requirement of the Standards dealing with measurement data is that students generate measurement data and build line plots to display the resulting data sets. (Students do not have to generate the data every time they work on making line plots. That would be too time-consuming. After some experiences in generating the data, most work in producing line plots can be done by providing students with data sets.)

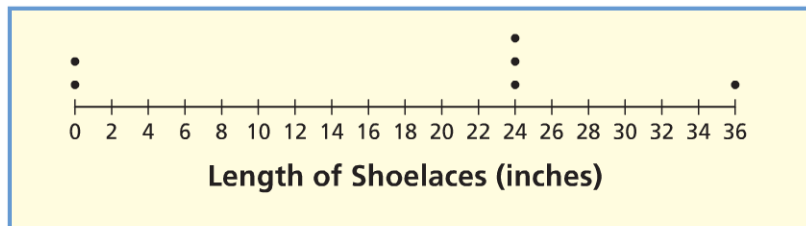
Line Plots

The definition of a line plot given in the Glossary of the Common Core State Standards for Mathematics is “a method of visually displaying a distribution of data values where each data value is shown as a dot or mark above a number line. Also known as a dot plot.”

Generate Data Measurement is a way to generate data—most measurements are made for a reason. That reason may be to explore relationships, to test ideas, or to see whether an experiment can be duplicated. In this unit, children learn to use measurement to generate data and then to display and analyze those data.

Make Line Plots Making a line plot is a simple process. A number line of appropriate length is drawn and labeled to match the scale of the measuring tool used to gather the data. Then a dot (or an X) is placed above the tick mark for a given measurement.

For example, suppose that 6 children recorded the lengths of their shoelaces in inches to generate this data set: 24, 0, 24, 0, 36, 24. The line plot representing these data looks like this:



Analyze Line Plots The data points in a line plot show the shape of the data. The spread of the data, clusters of points, outliers—all are easy to see and interpret, though children will not use these terms. For example, the line plot above shows that three children had 24-inch shoelaces, that two children had no shoelaces, and that one child had much longer shoelaces. Discussion of what these results mean might lead to comments such as “some shoes do not have shoelaces” or “it seems as if most shoes have 24-inch shoelaces.”

from THE PROGRESSIONS FOR THE COMMON CORE STATE STANDARDS ON MEASUREMENT AND DATA

Grade 2 A display of measurement data must present the measured values with their appropriate magnitudes and spacing on the measurement scale in question (length, temperature, liquid capacity, etc.). One method for doing this is to make a *line plot*.