

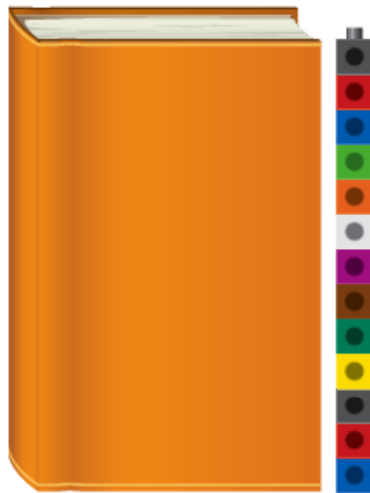


Math Content by Strand¹

Measurement

Kindergarten

In Kindergarten, students are introduced to length and linear measurement through measuring by direct comparison. As they compare objects to determine the longest object, they discuss and make sense of important aspects of accurate measurement such as choosing which dimension to measure.



Students begin to think about the different dimensions of objects.

Students begin to think about the different dimensions of objects.

They also become comfortable with, and use language to describe length—long, short, wide, tall, high (and the comparative forms—longer, wider, etc). Later in the year students use multiple nonstandard units (e.g., craft sticks or cubes) to quantify length: "How many craft sticks long is this desk? the path

¹ This document applies to the 2nd edition of *Investigations* (2008, 2012). See <http://investigations.terc.edu/CCSS/> for changes when implementing *Investigations and the Common Core Standards*.

from the window to the door?" "How many cubes long is my shoe? this pencil?" As they measure lengths around their classroom, students think about what happens if the units are (or are not) laid straight or if there are (or are not) gaps or overlaps between them.



Students begin to think about measuring accurately.

Emphases

Linear Measurement

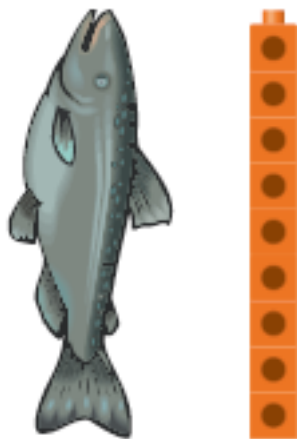
- Understanding length and using linear units

Benchmarks

- Decide which of two objects is longer
- Measure the length of an object by lining up multiple units

Grade 1

It is important for students to develop a sense of how measurement is used--and when it is helpful--in the real world. Unit 5, *Fish Lengths and Animal Jumps*, involves students in a real context in which measuring is used, that of measuring fish to determine if they are “keepers.” They measure relatively small lengths (up to 18 inches) and larger distances (up to 5-6 feet), and see that measurement is applied to both objects and distances.



The focus of the unit is on developing a foundation of skills for accurate linear measurement, such as knowing where to start and stop measuring, understanding how measuring tools must be lined up so that

there are no gaps or overlaps, knowing which dimension to measure, measuring the shortest line from point to point, and understanding that many measurements are not reported in whole numbers.

Regardless of what is measured, students learn that when one measures an object twice--or when two different people measure it--the same results should be obtained, assuming the same measuring unit is used. Students also explore what happens when something is measured with small units versus larger units. Students begin to see that measuring an object in cubes will result in a different count than will measuring the same object in inch tiles or paper clips, but may not yet see the inverse relationship between size of unit and number of units needed to cover a distance.



Emphases

Linear Measurement:

- Understanding length
- Using linear units
- Measuring with standard units

Benchmarks

- Demonstrate measuring techniques when measuring a distance with nonstandard or standard units. These techniques include starting at the beginning, ending at the end, leaving no gaps or overlaps, measuring in a straight line, and keeping track of the number of units
- Know at least one way of describing a measurement that falls between two whole numbers
- Understand that the same results should be obtained when the same object is measured twice, or when two different people measure the same object (using the same unit)
- Understand that measuring with different-sized units will result in different numbers

Grade 2

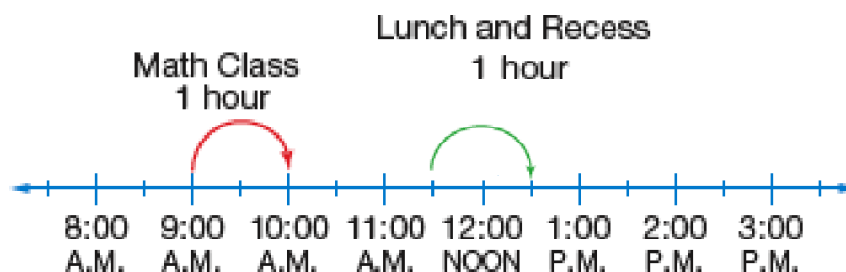
In Grade 2, students continue to develop their understanding of length and how it is measured. They first compare lengths of objects by indirect and direct comparison and then use linear units to measure objects and compare measurements. Students learn about iterating a unit and about the relationship between sizes of units and the results of measuring: the smaller the unit, the greater the count for the same length.



By discussing their methods for measuring, students learn that agreeing on a common unit is critical for communicating measurement information to others and comparing results. This leads to work with standard measures: inches, feet, and centimeters.

As students move from using non-standard units (e.g., cubes) to measure objects to using standard tools of measurement such as rulers and yardsticks, the emphasis is on making sure that their use of a measuring tool is connected to making sense of length as an attribute of objects. Students begin their work with standard measurement tools by constructing their own inch rulers, which helps foster not only an understanding of the conventional units, but also the process of measuring with a tool and the principles that underlie the design and use of the tool. Students become accustomed to both systems of measurement: metric and U.S. Standard.

Students practice naming, notating, and telling time on digital and analog clocks. They also work with the idea that time can be represented as a horizontal sequence. Students work with timelines, associating events with a particular time. Students determine intervals of time with an emphasis on starting and ending times on the hour or half hour.



Emphases

Linear Measurement

- Understanding length
- Using linear units
- Measuring with standard units

Time

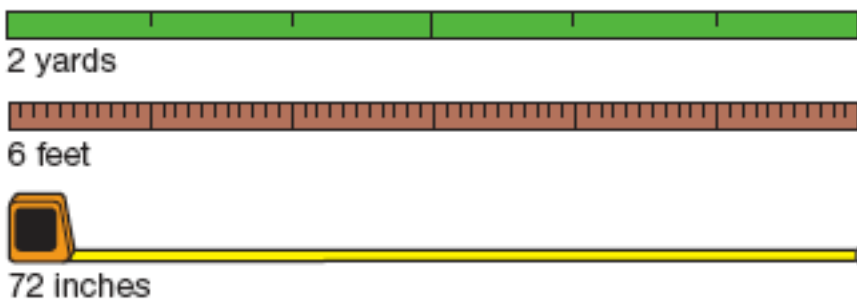
- Representing time and calculating duration

Benchmarks

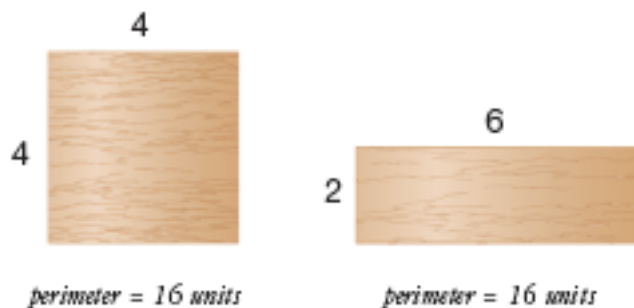
- Identify sources of measurement error
- Recognize that the same count of different-sized units yields different lengths
- Recognize that, when measuring the same length, larger units yield smaller counts
- Measure objects using inches and centimeters
- Use a ruler to measure lengths longer than one foot
- Solve problems involving the beginning time of an event, ending time of an event, and duration of the event; given two of these, find the third for events beginning and ending on the hour or half-hour
- Use a timeline to record and determine duration to the hour or half-hour

Grade 3

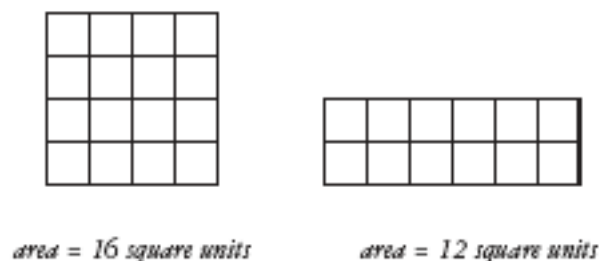
In Grade 3, students work on measurement in the data, 2-D geometry and measurement, 3-D geometry and measurement, and patterns and functions units. Measurement work in Grade 3 includes linear measurement, area, angle measurement, volume, and temperature. Students measure length and calculate perimeter with both U.S. standard units (inches, feet and yards) and metric units (centimeters and meters). Their work focuses on using measurement tools accurately, and understanding the relationship between measures when the same length is measured with different units.



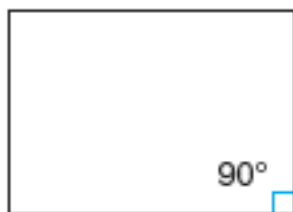
Students learn that the distance around the outside edges of a two-dimensional shape is called the *perimeter* and consider how different shapes can have the same perimeter.



They identify the amount of 2-D space a given shape covers as its *area*, and learn that area is measured in square units.



They identify the internal angle of a rectangle or square as 90 *degrees*. They use right angles as a benchmark as they consider the sizes of angles of other polygons.



Students also learn how the term *degrees* is used differently when talking about measuring temperature. A class temperature graph is created over the course of the school year. Students learn to read and interpret temperature using standard units.

Students practice naming, notating, and telling time on digital and analog clocks. They begin at the start of the year with telling time at five-minute intervals and then move to telling time at any minute. Students also work on intervals of time. For example, they begin with a time and determine what time it will be after a given number of minutes have passed or they determine how many minutes have passed when given a starting and ending time.

LogoPaths is designed to help students investigate movement along paths, length, perimeter, angle and the characteristics of a variety of shapes. In the *LogoPaths* environment, students determine the angle measurements and lengths to move a turtle through a maze or across an empty plane.

Emphases

Linear Measurement

- Measuring length
- Measuring with standard units
- Understanding and finding perimeter

Area Measurement:

- Understanding and finding area

Features of Shape

- Describing and measuring angles

Volume:

- Structuring rectangular prisms and determining their volume

Measuring Temperature

- Understanding temperature and measuring with standard units

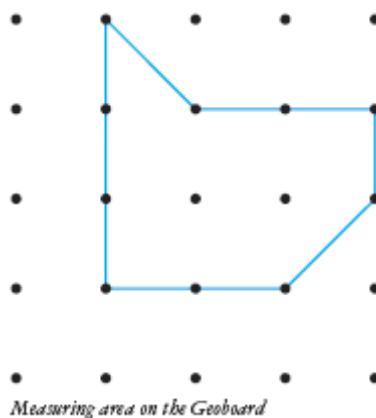
Benchmarks

- Identify and measure the perimeter of a figure using U.S. standard and metric units
- Identify and find the area of given figures by counting whole and partial square units
- Identify right angles and recognize whether an angle is larger or smaller than a right angle
- Determine the number of cubes (volume) that will fit in the box made by a given pattern

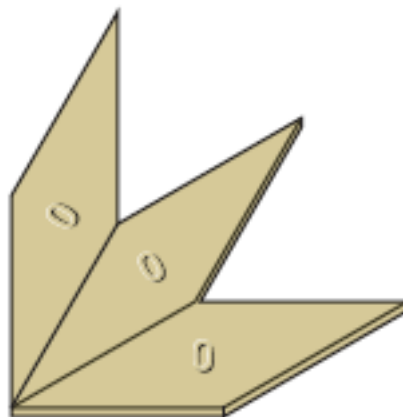
Grade 4

In Grade 4, students work on measurement in the 2-D geometry and measurement and 3-D geometry and measurement units. Students continue to build on measurement work from earlier grades, which includes linear measurement, area, angle measurement, and volume. They use both U.S. standard units (inches, feet and yards) and metric units (centimeters and meters) to measure lengths up to 100 feet, and they determine the perimeter of various shapes.

They measure the area of both regular and nonregular polygons in square units by using the understanding that area can be decomposed—that is, broken into smaller parts.

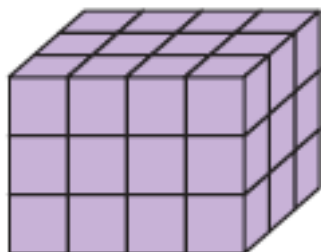


Students work on determining the size of angles relative to a right angle, or 90 degrees. For instance, if three equal angles form a right angle, then each of the smaller angles must be $\frac{1}{3}$ of 90 degrees or 30 degrees.



A right angle formed with Power Polygons

Finally, students work on understanding volume by structuring and determining the volume of one kind of geometric solid, a rectangular prism, in cubic units. They develop strategies for determining the number of cubes in 3-D arrays of cubes by mentally organizing the cubes--for example as a stack of three rectangular layers, each composed of three rows of four cubes.



LogoPaths is designed to help students investigate movement along paths, length, perimeter, angle and the characteristics of a variety of shapes. In the *LogoPaths* environment, students determine the angle measurements and lengths to move a turtle through a maze or across an empty plane.

Emphases

Linear Measurement

- Measuring with standard units

Features of Shape

- Describing and measuring angles

Area Measurement

- Finding and understanding area

Volume

- Structuring rectangular prisms and determining their volume

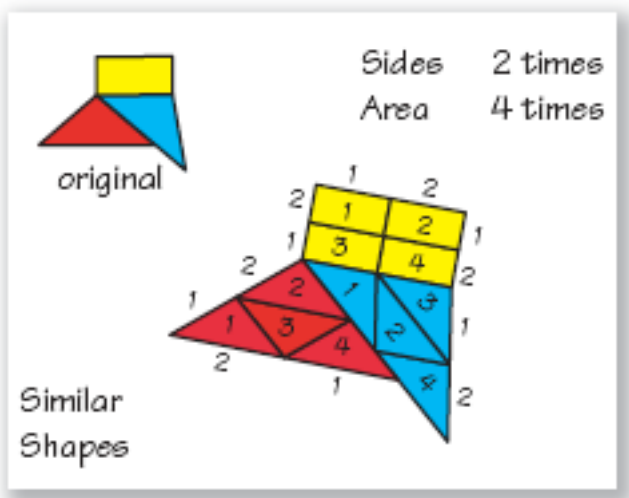
Benchmarks

- Use appropriate measurement tools to measure distance
- Know that a right angle measures 90 degrees, and use this as a landmark to find angles of 30, 45, and 60 degrees
- Find the area of polygons using a square unit of measure
- Find the volume of cube buildings and rectangular prisms

Grade 5

In Grade 5, students work on measurement in the 2-D geometry and measurement and 3-D geometry and measurement units. They continue to build on measurement work from previous grades as they find the measure of angles of polygons, determine the volume of three-dimensional (3-D) shapes, and work with area and perimeter.

Students investigate angle size in a set of polygons and measure angles of 30, 45, 60, 90, 120, and 150 degrees by comparing the angles of these shapes. Students also investigate perimeter and area. They consider how changes to the shape of a rectangle can affect one of the measures and not the other (e.g., two shapes that have the same area don't necessarily have the same perimeter), and examine the relationship between area and perimeter in similar figures.



Students determine the volume of boxes (rectangular prisms) made from 2-D patterns and create patterns for boxes to hold a certain number of cubes. They develop strategies for determining the number of cubes in 3-D arrays by mentally organizing the cubes—for example as a stack of three rectangular layers, each three by four cubes. Students deepen their understanding of the relationship between volume and the linear dimensions of length, width, and height. Once students have developed viable strategies for finding the volume of rectangular prisms, they extend their understanding of volume to other solids such as pyramids, cylinders, and cones, measured in cubic units.



LogoPaths is designed to help students investigate movement along paths, length, perimeter, angle and the characteristics of a variety of shapes. In the *LogoPaths* environment, students determine the angle measurements and lengths to move a turtle through a maze or across an empty plane.

Emphases

Features of Shape

- Describing and measuring angles

Linear and Area Measurement

- Finding the perimeter and area of rectangles

Volume

- Structuring rectangular prisms and determining their volume
- Structuring prisms, pyramids, cylinders, and cones and determining their volume

Benchmarks

- Use known angle sizes to determine the sizes of other angles (30, 45, 60, 90, 120, and 150 degrees)
- Determine the perimeter and area of rectangles
- Find the volume of rectangular prisms
- Use standard units to measure volume