Grade 3 Math Content [1]

Number and Operations: Whole Numbers

Addition and Subtraction and the Number System

In Grade 3, students build an understanding of the base-ten number system to 1,000 by studying the structure of 1,000 and using a base-ten context to represent the place value of two-digit and three-digit numbers. Students identify the hundreds digit as representing how many 100s are in the number, the tens digit as representing how many 10s, and the ones digit as representing how many 1s. They also break numbers into 100s, 10s, and 1s in different ways:

137 = 1 hundred, 3 tens, and 7 ones

137 = 1 hundred, 2 tens, and 17 ones

137 = 13 tens and 7 ones

137 = 12 tens and 17 ones

137 = 11 tens and 27 ones

. . .

In their work with number and operations in Grade 3, students focus particularly on addition and subtraction. Students solve addition and subtraction problems with two-digit and three-digit numbers, developing computation strategies that are built on adding and subtracting multiples of 10 and finding combinations that add to 100. Addition strategies include breaking the numbers apart and then either adding by place or adding on one number in parts. They also examine problems that lend themselves to changing the numbers in order to make them easier to add. Subtraction strategies include subtracting a number in parts, adding up, and subtracting back.

[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*.

Addition Strategies

Adding by Place

349 + 175 =

300 + 100 = 400

40 + 70 = 110

9 + 5 = 14

400 + 110 + 14 = 524

Adding on number on in parts

349 + 175 =

349 + 100 = 449

449 + 50 = 499

499 + 25 = 524

Changing the numbers

349 + 175 =

350 + 175 = 525

525 – 1 = 524

Subtraction Strategies

Subtracting in parts

451 – 187 =

451 – 100 = 351

351 – 80 = 271

271 – 7 = 264

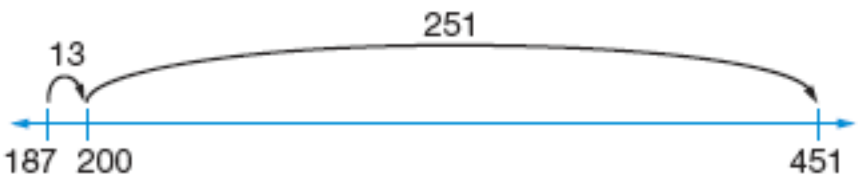
Adding up

451 – 187 =

187 + $\underline{13}$ = 200

200 + $\underline{251}$ = 451

13 + 251 = 264



Subtracting back

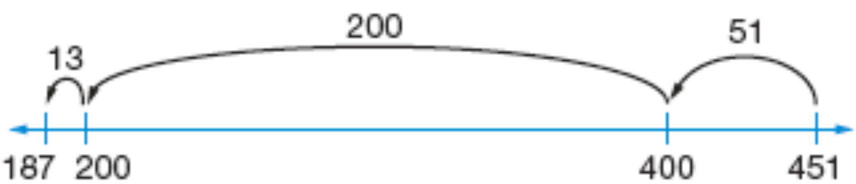
451 – 187 =

451 – 51 = 400

400 – 200 = 200

200 – 13 = 187

51 + 200 + 13 = 264



Students expand their understanding of subtraction to include other problem situations besides removal (or take away)—the type they are probably most familiar with from their work in Grade K-2. These include comparison problems and finding the missing part of a whole:

If I am collecting 1,000 baseball cards, and I have 250 so far, how many more do I need?

The ability to visualize what is happening in a subtraction situation is an important foundation for understanding the operation and how it works, and for making good decisions about strategies for computation. Students use visual representations (cubes, number lines, 300 charts, and 1,000 Charts) and story contexts. They work on developing fluency with the subtraction problems related to the addition combinations to 10 + 10 (the subtraction facts) so they are able to use these easily when solving subtraction problems with two-digit and three-digit numbers.

The Algebra Connections pages of each of the three curriculum units that focus on addition and subtraction show how students are applying the commutative and associative properties of addition as they develop strategies for solving addition problems. These pages also highlight students' application of the inverse relationship between addition and subtraction and how algebraic ideas underlie what students are doing when they create equivalent expressions in order to solve a problem (e.g., 48 + 72 = 50 + 70).

Emphases

The Base Ten Number System

- Understanding the equivalence of one group and the discrete units that comprise it
- Extending knowledge of the number system to 1,000

Whole Number Operations

- Understanding different types of subtraction problems
- Describing, analyzing, and comparing strategies for adding and subtracting whole numbers

Computational Fluency

- Adding and subtracting accurately and efficiently

Benchmarks (compiled from Units 1, 3, and 8)

- Demonstrate fluency with the addition combinations up to 10 + 10
- Add multiples of 10 (up to 100) to and subtract them from 2-digit and small 3-digit numbers
- Solve addition problems with 2-digit numbers using strategies involving breaking numbers apart by place or adding one number in parts
- Break up 3-digit numbers less than 200 into 100s, 10s, and 1s in different ways (e.g. 153 equals 1 hundred, 5 tens, and 3 ones; 15 tens and 3 ones; 14 tens and 13 ones, etc.)
- Find combinations of 2-digit numbers that add to 100 or $1.00
- Read, write, and sequence numbers to 1,000
- Identify the value of each digit in a 3-digit number (100s, 10s, and 1s)
- Identify how many groups of 10 are in a 3-digit number (e.g. 153 has 15 groups of 10, plus 3 ones)
- Solve addition problems with 3-digit numbers (to 400) using strategies that involve breaking numbers apart, either by place value or by adding one number in parts
- Solve subtraction story problems in contexts that include removing a part from a whole, comparing two quantities, or finding a missing part
- Solve subtraction problems with 2-digit and 3-digit numbers (to 300) using strategies that involve either subtracting a number in parts, adding up, or subtracting back
- Add multiples of 10 and 100 (to 1,000) to and subtract them from any 3-digit number
- Solve 3-digit addition problems using at least one strategy efficiently
- Demonstrate fluency with problems related to the addition combinations to 10 + 10 (the subtraction facts)
- Solve subtraction problems with 3-digit numbers using strategies that involve either subtracting a number in parts, adding up, or subtracting back

Multiplication and Division

In Grade 3, students investigate the properties of multiplication and division, including the inverse relationship between these two operations, and develop strategies for solving multiplication and division problems. Their work focuses on developing the idea that multiplication involves some *number of equal-sized groups*, and that division also involves equal groups.

Students are introduced to arrays—rectangular arrangements of objects in rows and columns—to help them develop visual images that support their understanding of multiplication.

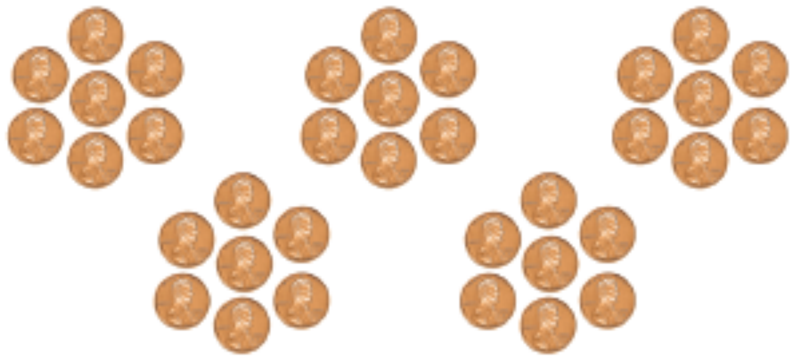
3 by 4 array

They use these rectangular arrays to represent the relationship between a product and its factors. Students determine, describe, and compare sets of multiples, noticing their characteristics and relationships, and use these to investigate important ideas about how multiplication works. They learn the multiplication combinations with products up to 50.

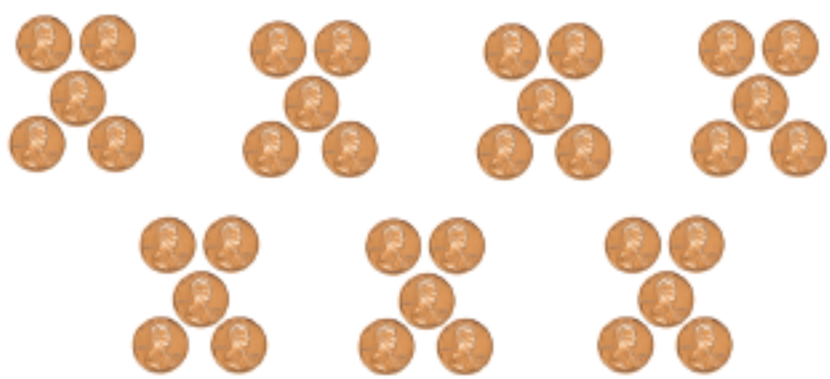
4 x 5 = 5 x 4 = Start with ______________	7 x 6 = 6 x 7 = Start with ______________

Students solve division situations that involve *sharing*, ("Divide 35 pennies among 5 people equally. How many pennies are in each share?") and those that involve *grouping* ("How many groups of 5 pennies can I make if I have 35 pennies?").

Sharing: Divide 35 pennies among 5 people equally. How many pennies are in each share?



Grouping: How many groups of 5 pennies can I make if I have 35 pennies?



Students use their knowledge of the relationship between division and multiplication by reasoning in ways like the following: "I know that five 5s is 25, and two more 5s make 35, so I have 7 groups of 5." Students are also introduced to two forms of division notation — $35 \div 5$ and $5\overline{)35}$ — and learn how to interpret these numbers and symbols in terms of the meaning and actions of division.

The Algebra Connections page in the curriculum unit that focuses on multiplication and division shows how students are applying the commutative and distributive properties of multiplication as they solve problems. It also highlights students' application of the inverse relationship between multiplication and division.

Emphases

Whole Number Operations

- Understanding the meaning of multiplication
- Reasoning about numbers and their factors and multiples
- Understanding and working with an array model of multiplication
- Developing strategies for division based on understanding the inverse relationship between multiplication and division

Computational Fluency

- Learning the multiplication combinations with products to 50 fluently

Benchmarks

- Demonstrate an understanding of multiplication and division as involving groups of equal groups
- Solve multiplication combinations and related division problems using skip counting or known multiplication combinations
- Interpret and use multiplication and division notation
- Demonstrate fluency with the multiplication combinations with products up to 50 (by the end of Grade 3)

Number and Operations:
Rational Numbers

Students use a variety of contexts to understand, represent, and combine fractions. These include rectangles representing "brownies," hexagonal pattern block "cookies," and groups of objects.

Students work with halves, fourths, eighths, thirds, and sixths as they learn how fractions represent equal parts of a whole. They learn the meanings of the numerator and denominator of a fraction, so that when comparing unit fractions (fractions with a numerator of 1), they understand that the larger the denominator the smaller the part of the whole: 1/6 is smaller than ½ of the same whole. Students also gain experience with common equivalencies, for example, that 3/6 and 2/4 are both equal to 1/2.

Using these equivalents in contexts, students find combinations of fractions that are equivalent to a whole or to another fraction. For example,

$$1/2 + 2/6 + 1/6 = 1$$
$$1/3 + 1/6 = 1/2$$

Students are introduced to decimal fractions (0.50 and 0.25), using the context of money, and gain familiarity with fraction and decimal equivalents involving halves and fourths.

Emphases

Rational Numbers

- Understanding the meaning of fractions (halves, fourths, eighths, thirds, sixths) and decimal fractions (0.50, 0.25) as equal parts of a whole (an object, an area, a set of objects)
- Using representations to combine fractions (halves, fourths, eighths, thirds, and sixths)

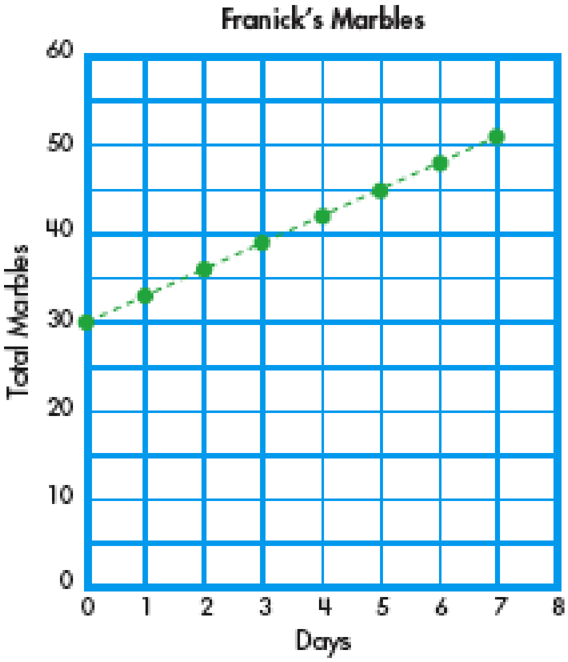
Benchmarks

- Divide a single whole or a quantity into equal parts and name those parts as fractions or mixed numbers
- Identify equivalent fractions (e.g. $\frac{3}{6} = \frac{1}{2}$ and $\frac{1}{3} = \frac{2}{6}$)
- Find combinations of fractions that are equal to 1 and to other fractions (e.g. $\frac{3}{6} + \frac{1}{2} = 1$; $\frac{1}{6} + \frac{1}{6} = \frac{1}{3}$; and $\frac{1}{3} + \frac{1}{6} = \frac{1}{2}$)

Patterns, Functions, and Change

Students study situations of change as they examine temperature change over time in different places around the world, analyze number sequences generated by repeating patterns, and consider a fantasy situation of constant change in which children receive a certain number of *Magic Marbles* each day. They make, read, and compare line graphs that show a relationship between two variables in situations of change over time. Students learn how to find the two values represented by a point on a coordinate graph by referring to the scales on the horizontal and vertical axes. Students focus on seeing a graph as a whole, thinking about the overall shape of a graph, and discussing what that overall shape shows about the change in the situation it represents. A class temperature graph is created over the course of the year and discussed regularly. Students learn to read and interpret temperatures using standard units.

Students also use tables as a representation that shows how one variable changes in relation to another variable. Emphasis is on how the numbers in the table relate to the situation they represent and to graphs of the same situation.



Day	Franick
Beginning	30
Day 1	33
Day 2	36
Day 3	39
Day 4	42
Day 5	45
Day 6	48
Day 7	51

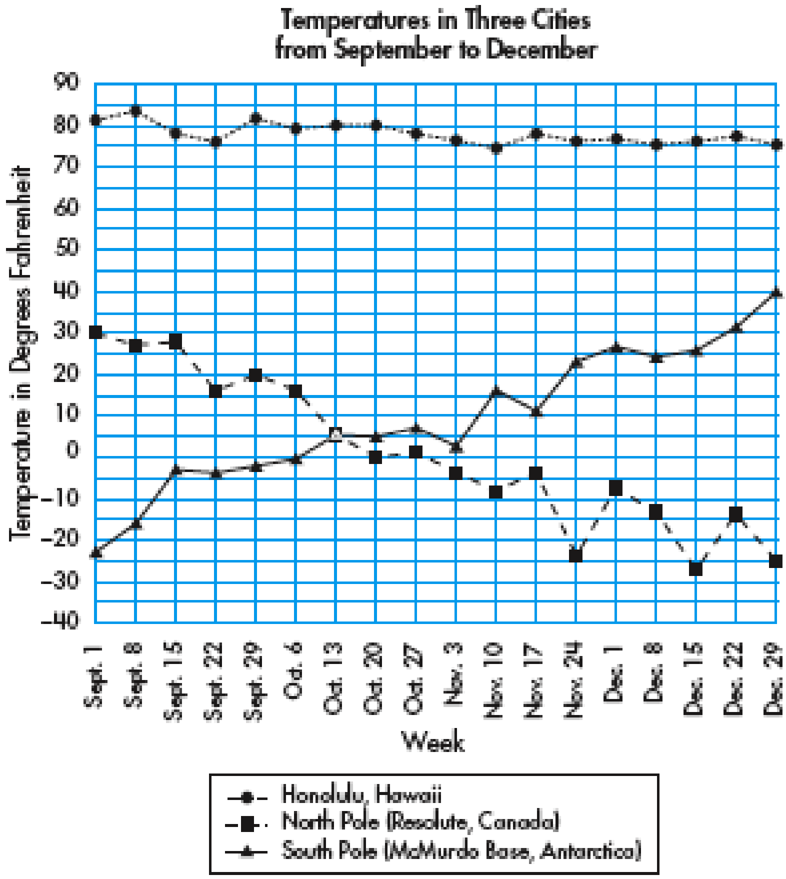


Table and graph from Grade 3 Unit 6 and *Line graph from Grade 3 Unit 6*

Students use both tables and graphs to examine and compare situations with a constant rate of change. They examine the relationship between columns of the table and consider why the points on graphs representing such situations fall in a straight line. By examining the tables and graphs, students consider any initial amount and the constant rate of change to develop general rules that express the relationship between two variables in these contexts.

Emphases

Using Tables and Graphs

- Using graphs to represent change
- Using tables to represent change

Linear Change

- Describing and representing a constant rate of change

Number Sequences

- Constructing, describing, and extending number sequences with constant increments generated by various contexts

Measuring Temperature

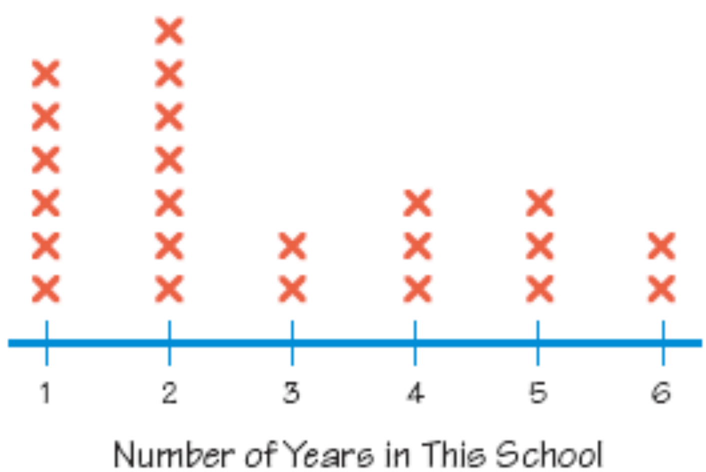
- Understanding temperature and measuring with standard units

Benchmarks

- Interpret graphs of change over time, including both the meaning of points on the graph and how the graph shows that values are increasing, decreasing, or staying the same
- Interpret temperature values (e.g., relate temperatures to seasons, to what outdoor clothing would be needed)
- Create a table of values for a situation with a constant rate of change and explain the values in the table in terms of the situation
- Compare related situations of constant change by interpreting the graphs, tables, and sequences that represent those situation

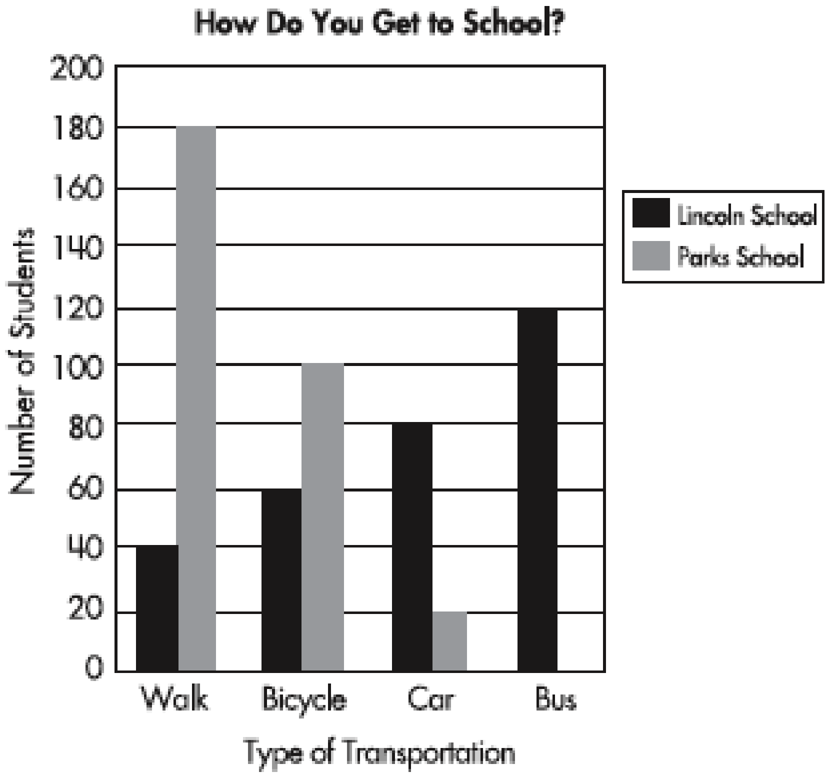
Data Analysis

Students collect, represent, describe, and interpret data. They work with both categorical and numerical data, and consider how to look at a data set as a whole and make statements about the whole group. In order to make sensible statements about a categorical data set that has many different values, students group the data into categories that help them see the data as a whole. Students order numerical data by value so that they can see the shape of the data—where the data are concentrated, where they are spread out, which intervals have many pieces of data, and which have very few. They describe what values would be typical or atypical, based on the data, and compare data sets in order to develop a sense of how data can be useful in describing and comparing some characteristic of a group.



Students work with their own data, creating representations, and then comparing and discussing these representations. Students use double bar graphs to compare groups, including some in which the scales have intervals greater than 1.

How Do You Get to School



Students interpret line plots and create their own line plots to represent numerical data. By conducting their own data investigations, students consider how the question they pose and the way they conduct their study affect the resulting data.

Emphases

Data Analysis

- Describing, summarizing, and comparing data
- Representing data
- Designing and carrying out a data investigation

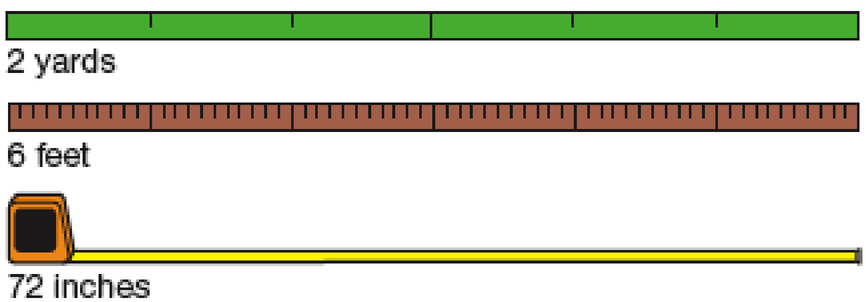
Benchmarks

- Organize, represent, and describe categorical data, choosing categories that help make sense of the data

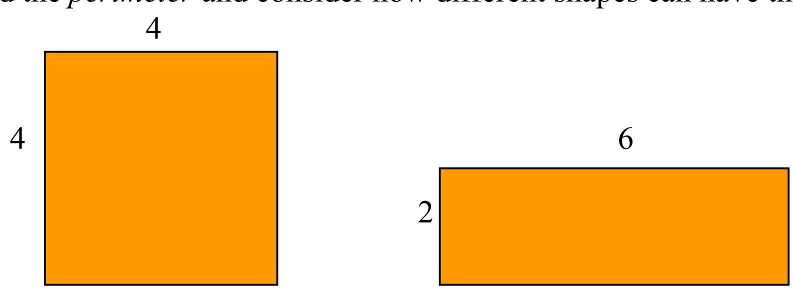
- Interpret a bar graph
- Make a line plot for a set of numerical data
- Describe the shape of the data for a numerical data set, including where data are concentrated, where there are few data, what the lowest and highest values are, what the mode is, and where there is an outlier
- Summarize a set of data, describing concentrations of data and what those concentrations mean in terms of the situation the data represent

Measurement

In Grade 3, students work on measurement in the data, 2D geometry and measurement, 3D 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.

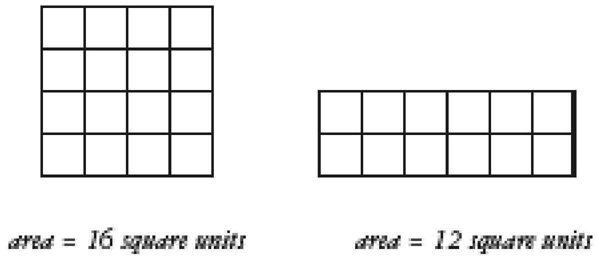


Students learn that the distance around the outside edges of a two-dimensional shape is called the *perimeter* and consider how different shapes can have the same perimeter.

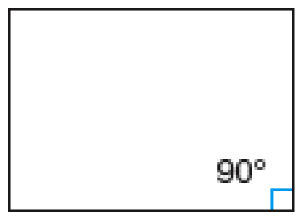


perimeter = 16 units *perimeter = 16 units*

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.

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

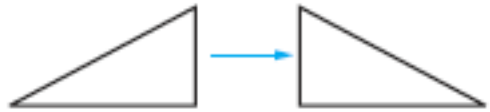
- Identify and measure the perimeter of a figure using U.S. standard and metric units
- Identify and find the area of given figures by counting whole and partial square units
- Identify right angles and recognize whether an angle is larger or smaller than a right angle
- Determine the number of cubes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

Geometry and Measurement

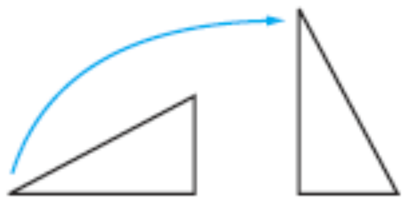
Students study the attributes of two-dimensional (2-D) and three-dimensional (3-D) shapes, and how these attributes determine their classification. For example, a polygon is classified as a triangle or a quadrilateral based on the number of its sides.

Students also investigate the idea that one shape may have more than one name as they consider the properties of squares and rectangles. They describe shapes by whether or not they are *congruent* to other shapes, and use geometric motions—*slides* (translations), *flips* (reflections), and *turns* (rotations)—to determine if shapes are congruent.

slide (translation)



flip (reflection)

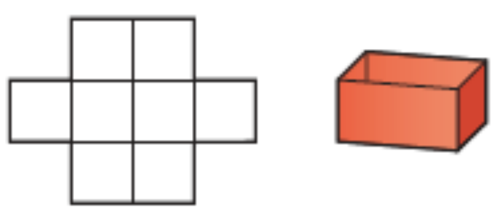


turn (rotation)

Students describe attributes of common geometric solids (3-D shapes), such as how many edges and faces a solid shape has, or how a pyramid has triangular faces coming to a point. They learn to distinguish between polyhedra (3-D shapes having only flat surfaces) and nonpolyhedra (3-D shapes that have curved surfaces) and, within the class of polyhedra, between prisms and pyramids.

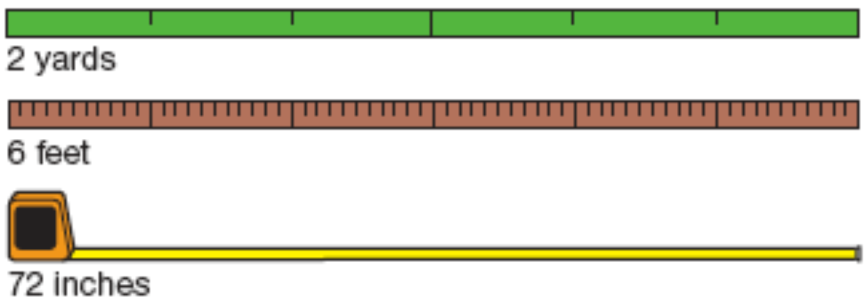
prism *pyramid*

Students learn about how 3-D objects can be represented in 2-D space. For example, they design nets for open boxes that, if constructed in 3-D, would hold a certain number of cubes. They determine the volume of the rectangular prisms that fit into a variety of open boxes.

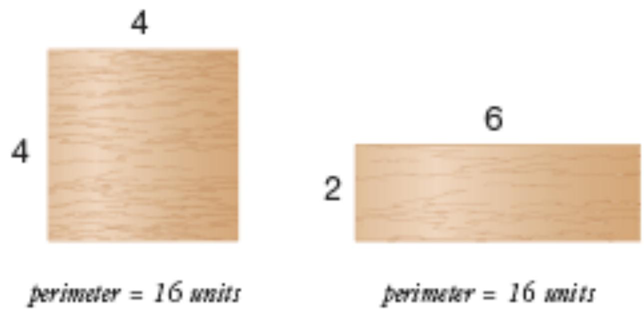


net for open box
to hold two cubes

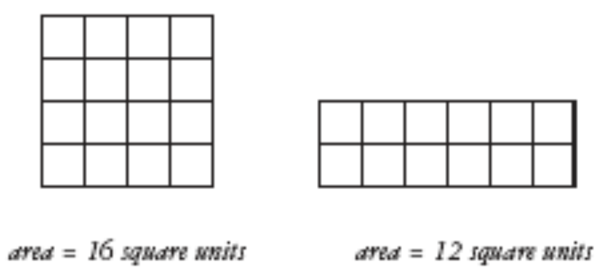
Students' measurement work in Grade 3 includes linear measurement, area, angle measurement, and volume. They measure length and perimeter with both U. S. standard units (inches, feet and yards) and metric units (centimeters and meters). Their work focuses on using measurement tools accurately, and understanding the relationship between measures when the same length is measured with different units.



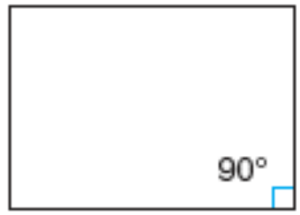
Students learn that the distance around the outside edges of a two-dimensional shape is called the *perimeter*, and consider how different shapes can have the same perimeter.



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.



Emphases

Features of Shape
- Describing and classifying 2-D figures
- Describing and measuring angles
- Describing properties of 3-D shapes
- Translating between 2-D and 3-D shapes

Linear Measurement

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

Area Measurement
- Understanding and finding area

Volume
- Structuring rectangular prisms and determining their volume

Benchmarks

- Identify and accurately measure the perimeter of a shape using U.S. standard and metric units
- Identify and find the area of given figures by counting whole and partial square units
- Identify triangles as three-sided closed shapes with three vertices and three angles
- Identify right angles, and recognize whether an angle is larger or smaller than a right angle
- Identify and compare attributes of 3-D solids
- Determine the number of cubes (volume) that will fit in the box made by a given pattern
- Design patterns for boxes that will hold a given number of cubes