2023 Mathematics *Standards of Learning*
Understanding the Standards – Grade 1

The Understanding the Standards document includes the mathematics understandings and key concepts that assist teachers in planning standards-focused instruction of the first grade 2023 Mathematics *Standards of Learning*. The Understanding the Standards includes definitions, explanations, and examples regarding each mathematics standard and describes what students should know (core knowledge) as a result of the instruction specific to the course/grade level.

Number and Number Sense

1.NS.1 The student will utilize flexible counting strategies to determine and describe quantities up to 120.

Students will demonstrate the following Knowledge and Skills:

a) Count forward orally by ones from 0 to 120 starting at any number between 0 and 120.
b) Count backward orally by ones when given any number between 1 and 30.
c) Represent forward counting patterns when counting by groups of 5 and groups of 10 up to 120 using a variety of tools (e.g., objects, coins, 120 chart).
d) Represent forward counting patterns when counting by groups of 2 up to at least 30 using a variety of tools (e.g., beaded number strings, number paths [a prelude to number lines], 120 chart).
e) Group a collection of up to 120 objects into tens and ones, and count to determine the total (e.g., 5 groups of ten and 6 ones is equal to 56 total objects).
f) Identify a penny, nickel, and dime by their attributes and describe the number of pennies equivalent to a nickel and a dime.
g) Count by ones, fives, or tens to determine the value of a collection of like coins (pennies, nickels, or dimes), whose total value is 100 cents or less.

1.NS.1 The student will utilize flexible counting strategies to determine and describe quantities up to 120. *Additional Content Background and Instructional Guidance:*

• The natural numbers are 1, 2, 3, 4…. The whole numbers are 0, 1, 2, 3, 4…. Students should count the whole numbers 0, 1, 2, 3, 4….
• There are three developmental levels of counting:
    o rote sequence;
    o one-to-one correspondence; and
    o the cardinality of numbers.
• Counting involves two separate skills: verbalizing the list (rote sequence counting) of standard number words in order (“one, two, three, …”) and connecting this sequence with the objects in the set being counted, using one-to-one correspondence. The association of number words with collections of objects is achieved by moving, touching, or pointing to objects as the number words are spoken. Objects may be presented in random order or arranged for easy counting. Objects for counting may be arranged in various configurations including in a line, in a rectangular array, in a circle, or in a scattered formation.

1.NS.1 The student will utilize flexible counting strategies to determine and describe quantities up to 120.

Additional Content Background and Instructional Guidance:

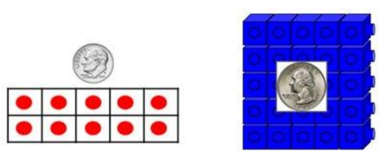
- If a set is empty, it has zero objects or elements. Zero is both a number and a digit. It is used as a placeholder in our number system.
- Cardinality is knowing how many are in a set by recognizing that the last counting word tells the total number in a set. Once a student has counted a collection of objects, the teacher may be able to assess whether the student has cardinality of number by asking the question, "How many are there?" Students who do not yet have cardinality of number are often unable to tell you how many objects there were in the collection without recounting them.
- Rote counting is a prerequisite skill for the understanding of addition (one more), subtraction (one less), and the ten-to-one concept of place value.
- Conservation of number is applied when students understand that a group of 10 objects is still 10 objects regardless of whether they are arranged in a cup, group, row, stack, etc.
- Counting forward and backward leads to the development of counting on and counting back.
- Counting forward by rote, supported by visuals such as the hundreds chart or number path, advances children's development of sequencing.
- A number path is a counting model where each number is represented within a rectangle and can be counted. This is an example of a number path:

1	2	3	4	5	6	7	8	9	10

- A number line is a length model where each number represents its length (distance) from zero. When young children use a number line as a counting tool, they often confuse what should be counted (the numbers or the spaces between the numbers). A number path is more appropriate for students at this age.
- Counting backward by rote lays the foundation for subtraction. Students should count backward beginning with 30, 29, 28… through …3, 2, 1, 0.
- The patterns developed when skip counting are precursors for recognizing numeric patterns, functional relationships, and concepts underlying money, time, and multiplication.
- Skip counting by twos supports the development of the concept of even numbers and the development of multiplication facts for two.
- Skip counting by fives lays the foundation for telling time to the nearest five minutes, counting money, and developing the multiplication facts for five.
- Skip counting by tens is a precursor for place value, addition (10 more), subtraction (10 less), counting money, and developing the multiplication facts for ten.
- Calculators can be used to display the numerical growing patterns resulting from skip counting. The constant feature of the four-function calculator can be used to display the numbers in the sequence when skip counting by that constant.
- Unitizing is the concept that a group of objects can be counted as one unit (e.g., 10 ones can be counted as 1 ten).
- The number system is based on a pattern of tens where each place has 10 times the value of the place to its right. This is known as the ten-to-one concept of place value.

1.NS.1 The student will utilize flexible counting strategies to determine and describe quantities up to 120. *Additional Content Background and Instructional Guidance:*

- Using objects and asking questions such as, "How many are in each group?" or "How many groups are there?" and" What is the total number you have?" supports students as they learn to skip count and helps to solidify their understanding of cardinality and assists in developing multiplicative reasoning.
- Manipulatives that can be physically connected and separated into groups of tens and leftover ones, such as connecting or snap cubes, beans on craft sticks, pennies in cups, bundles of sticks, or beads on pipe cleaners should be used. Ten-to-one trading activities with manipulatives on place value mats, including base 10 blocks, are more appropriate in Grade 2.
- Frequent and varied experiences with coins help students develop an understanding of money and gain an awareness of consumer skills and the use of money in everyday life:
  - counting collections of pennies (practicing one-to-one correspondence);
  - drawing pennies to show the value of a given coin (e.g., nickel, dime, or quarter);
  - physically manipulating coins and making comparisons about their sizes, colors, and values;
  - playing store and purchasing classroom objects, using play money (pennies);
  - using skip counting to count a collection of like coins;
  - representing the value of coins using a variety of organizers, such as five/ten frames or hundreds charts, pictures; and
  - trading the equivalent value of pennies for a nickel, a dime, and a quarter, using play money.
- Counting coins is an application of unitizing. Unitizing is the concept that a group of objects can be counted as one unit (e.g., 10 pennies can be counted as 1 dime).
- In order to develop the concept that a nickel has a value of five cents (which is the same as five pennies), that a dime has a value of 10 cents (which is the same as ten pennies), and a quarter has a value of 25 cents (which is the same as twenty-five pennies), even though each coin (nickel, dime, quarter) is only one object. Manipulatives such as ten frames, hundreds charts, or cube stacks can be used to show the value of each coin.



- A variety of classroom experiences in which students manipulate physical models of money and count forward to determine the value of a collection of coins are important activities to develop competence with counting money.

1.NS.2 The student will represent, compare, and order quantities up to 120.

Students will demonstrate the following Knowledge and Skills:

a) Read and write numerals 0-120 in sequence and out of sequence.
b) Estimate the number of objects (up to 120) in a given collection and justify the reasonableness of an answer.
c) Create a concrete or pictorial representation of a number using tens and ones and write the corresponding numeral up to 120 (e.g., 47 can be represented as 47 ones or it can be grouped into 4 tens with 7 ones left over).
d) Describe the number of groups of tens and ones when given a two-digit number and justify reasoning.
e) Compare two numbers between 0 and 120 represented pictorially or with concrete objects using the terms *greater than*, *less than*, or *equal to*.
f) Order three sets, each set containing up to 120 objects, from least to greatest, and greatest to least.

1.NS.2 The student will represent, compare, and order quantities up to 120. *Additional Content Background and Instructional Guidance:*
• Place value understanding is essential when representing, comparing, and ordering numbers. Hands-on experiences are essential to developing the ten-to-one place value understanding for the base 10 number system and to understanding the value of each digit in a two-digit number. • Manipulatives that clearly illustrate the relationships among tens and ones as physically proportional are most appropriate for this grade (e.g., the tens piece is 10 times larger than the ones piece). Connecting cubes that students use to build rods of 10 serve as a valuable tool in the development of base 10 (ten-to-one) understanding. Ten-to-one trading activities with manipulatives on place value mats and base 10 blocks are more appropriate for students in Grade 2. • Recording the numeral when using physical and pictorial models leads to an understanding that the position of each digit in a numeral determines the quantity it represents. • Exploring ways to estimate the number of objects in a set, based on appearance (e.g., clustering, grouping, comparing), enhances the development of number sense. • To estimate means to determine a number that is close to the exact amount without counting each individual object. When asking for a reasonable estimate of a number of objects in a set, teachers might ask, "*About* how much?" or "*About* how many?" or "Is this *about* 10, 50, or 100?" • Opportunities to estimate a quantity, given a benchmark of 10 and/or 100 objects, enhance a student's ability to estimate with greater accuracy. Examples could include Estimation Jars or Estimation Routines. • When creating concrete or pictorial representations of a number up to 120, manipulatives such as connecting cubes, ten frames, cups and beans, and bundles of straws can be used to represent tens and ones, and to name and write the number. • After naming and creating models of two-digit numbers, students can use the representation to describe a number in terms of tens and ones and justify reasoning. • Students are generally familiar with the concept of *more* and have less experience with the concept of *less/fewer*. It is important to use the terms together to build an understanding of

1.NS.2 The student will represent, compare, and order quantities up to 120.

Additional Content Background and Instructional Guidance:

their relationship. For example, when asking which group has more, follow by asking which group has fewer. Symbols for comparing (< and >) are not introduced until Grade 2.

- Opportunities to order sets (each set containing up to 120 objects) from least to greatest and greatest to least can be concrete (e.g., collections of money, connecting cubes, cups and beans) or pictorial (e.g., ten frames, math racks).

1.NS.3 The student will use mathematical reasoning and justification to solve contextual problems that involve partitioning models into two and four equal-sized parts.

Students will demonstrate the following Knowledge and Skills:

a) Represent equal shares of a whole with two or four sharers, when given a contextual problem.

b) Represent and name halves and fourths of a whole, using a region/area model (e.g., pie pieces, pattern blocks, paper folding, drawings) and a set model (e.g., eggs, marbles, counters) limited to two or four items.

c) Describe and justify how shares are equal pieces or equal parts of the whole (limited to halves, fourths) when given a contextual problem.

1.NS.3 The student will use mathematical reasoning and justification to solve contextual problems that involve partitioning models into two and four equal-sized parts.   *Additional Content Background and Instructional Guidance:*

- Practical situations with fractions should involve real-life problems in which students themselves determine how to subdivide a whole into equal parts, test those parts to be sure they are equal, and use those parts to re-create the whole.
- When working with fractions, the whole must be defined.
- Fractions can have different meanings: part-whole, division, measurement, ratio, and operator. The focus in Grade 1 is to develop the idea of equal sharing (division) and part-whole relationships. Fraction notation will be introduced in Grade 2.
- An equal sharing problem is an idea that young children understand intuitively because of their experiences sharing objects with siblings, friends, etc. Consider the following examples:
  - two children sharing four sandwiches
  - two children sharing one sandwich
  - four children sharing one piece of paper
  - four children sharing two brownies (see image below)

- In a region/area model, the whole is a continuous region and can be partitioned/divided into parts having the same area. Region/area models (e.g., circular and rectangular pie pieces, pattern blocks, geoboards, folding paper) are helpful tools for students. As they touch and move the concrete objects, students begin to understand the part-to-whole relationship and other concepts about fractions.
- In a set model, the whole is discontinuous. The set of discrete items represents the whole and each item in the set represents an equivalent part of the set. For example, in a set of four counters, one counter represents one-fourth of the set. In the set model, the set can be subdivided into subsets with the same number of items in each subset. For example, a set of four counters can be subdivided into two subsets of two counters each, with each subset representing one-half of the whole set.

1.NS.3 The student will use mathematical reasoning and justification to solve contextual problems that involve partitioning models into two and four equal-sized parts. *Additional Content Background and Instructional Guidance:*
• In the primary grades, having experiences with sets that are composed of congruent figures (e.g., eggs in a carton) before working with sets that have noncongruent parts (e.g., toy cars, models of dinosaurs) may help build understanding. • Using formal fraction notation is not expected at this level. Connecting the vocabulary for halves and fourths to concrete models and contextual problems through informal, integrated experiences with fractions will help students develop a foundation for deeper learning in later grades. • Providing opportunities to make connections and comparisons among fraction representations by connecting concrete or pictorial representations with spoken representations (e.g., “one-half,” “one part out of two equal parts,” or “one-half is more than one-fourth of the same whole”) deepens understanding of the language and meaning of fractions.

Computation and Estimation

1.CE.1 The student will recall with automaticity addition and subtraction facts within 10 and represent, solve, and justify solutions to single-step problems, including those in context, using addition and subtraction with whole numbers within 20.

Students will demonstrate the following Knowledge and Skills:

a) Recognize and describe with fluency part-part-whole relationships for numbers up to 10 in a variety of configurations.

b) Demonstrate fluency with addition and subtraction within 10 by applying reasoning strategies (e.g., count on/count back, one more/one less, doubles, make ten).

c) Recall with automaticity addition and subtraction facts within 10.

d) Investigate, recognize, and describe part-part-whole relationships for numbers up to 20 in a variety of configurations (e.g., beaded racks, double ten frames).

e) Solve addition and subtraction problems within 20 using various strategies (e.g., inverse relationships: if 9 + 3 = 12 then 12 - 3 = 9; decomposition using known sums/differences: 9 + 7 can be thought of as 9 decomposed into 2 and 7, then use doubles, 7 + 7 = 14; 14 + 2 = 16 or decompose the 7 into 1 and 6; make a ten: 1 + 9 = 10; 10 + 6 = 16).

f) Represent, solve, and justify solutions to single-step addition and subtraction problems (join, separate, and part-part-whole) within 20, including those in context, using words, objects, drawings, or numbers.

g) Determine the unknown whole number that will result in a sum or difference of 10 or 20 (e.g., 14 - __ = 10 or 15 + __ = 20).

h) Identify and use (+) as a symbol for addition and (-) as a symbol for subtraction.

i) Describe the equal symbol (=) as a balance representing an equivalent relationship between expressions on either side of the equal symbol (e.g., 6 and 1 is the same as 4 and 3; 6 + 1 is balanced with 4 + 3; 6 + 1 = 4 + 3).

j) Use concrete materials to model, identify, and justify when two expressions are not equal (e.g., 10 - 3 is not equal to 3 + 5).

k) Use concrete materials to model an equation that represents the relationship of two expressions of equal value.

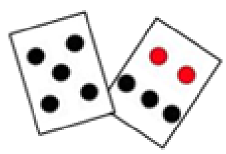
l) Write an equation that could be used to represent the solution to an oral, written, or picture problem.

1.CE.1 The student will recall with automaticity addition and subtraction facts within 10 and represent, solve, and justify solutions to single-step problems, including those in context, using addition and subtraction with whole numbers within 20. *Additional Content Background and Instructional Guidance:*
• Computational fluency is the ability to think flexibly to choose appropriate strategies to solve problems accurately and efficiently. Students should develop fluency and recall with automaticity facts to 10, and then use strategies and known facts to 10 to determine facts to 20. • Flexibility requires knowledge of more than one approach to solving a particular kind of problem. Being flexible allows students to choose an appropriate strategy for the numbers involved, particularly where they do not need to recall with automaticity.

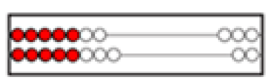
1.CE.1 The student will recall with automaticity addition and subtraction facts within 10 and represent, solve, and justify solutions to single-step problems, including those in context, using addition and subtraction with whole numbers within 20.

Additional Content Background and Instructional Guidance:

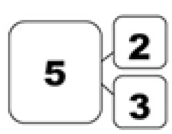
- Meaningful practice of computation strategies can be attained through hands-on activities, manipulatives, and graphic organizers.
- Accuracy is the ability to determine a correct answer using knowledge of number facts and other important number relationships.
- Efficiency is the ability to carry out a strategy effortlessly at a reasonably quick pace.
- Mathematically fluent students are not only able to provide correct answers quickly, but they are also able to use known facts and computation strategies to efficiently determine answers that they do not know.
- Automaticity of facts can be achieved through timed exercises such as flashcards and/or supplemental handouts to generate many correct responses in a short amount of time.
- Students should have the opportunity to subitize a set of objects presented in various configurations (e.g., regular and irregular dot patterns, five-frames, ten-frames, random arrangements). Subitizing is the ability to look at a small set of objects and instantly know how many there are without counting them. Generally, students at this level can subitize numbers up to 5 (and may be able to subitize larger numbers that are presented in an organized arrangement, such as a ten-frame). Subitizing is an important pre-requisite to developing computational fluency.
- Dot patterns should be presented in both regular and irregular arrangements. This will help students to understand that numbers are made up of parts and will later assist them in combining parts as well as counting on.



- Parts of numbers to 10 should be represented in different ways, such as five frames, ten frames, strings of beads, arrangements of tiles or toothpicks, dot cards, or beaded number frames.



- Missing number cards (number bonds) help students see that numbers can be "broken" into pieces to make computation easier (decomposing/composing). With missing number cards, students recognize the relationships between numbers through a written model that shows how the numbers are related. A missing number card helps students clearly visualize the part-whole relationship.



- Composing and decomposing numbers flexibly forms a basis for understanding properties of the operations and later formal algebraic concepts and procedures.
- Addition and subtraction are inverse operations and should be taught concurrently to develop an understanding of this relationship.

1.CE.1 The student will recall with automaticity addition and subtraction facts within 10 and represent, solve, and justify solutions to single-step problems, including those in context, using addition and subtraction with whole numbers within 20.

Additional Content Background and Instructional Guidance:

- Manipulatives should be used to develop an understanding of addition and subtraction facts.
- Students should have opportunities to select and use a variety of efficient strategies. Examples of strategies for developing basic addition and subtraction facts include:

Examples of Addition and Subtraction Strategies

Strategy	Example
count all	1, 2, 3, 4, 5, 6, 7 …
count on	8, 9, 10, 11 …
count back	12, 11, 10, 9 …
skip count	5, 10, 15, 20…
one more than, two more than	one more than 5 is 6; two more than 8 is 10
one less than, two less than	one less than 10 is 9; two less than 8 is 6
doubles	2 + 2 = 4; 3 + 3 = 6
near doubles	3 + 4 is the same as (3 + 3) + 1
make 10 facts	7 + 4 can be thought of as 7 + 3 + 1 (making a ten and one more)
think addition for subtraction	9 – 5 can be thought of as “5 and what number makes 9?”
use of the commutative property	4 + 3 is the same as 3 + 4
use of the inverse property (related facts)	4 + 3 = 7, 3 + 4 = 7, 7 – 4 = 3, and 7 – 3 = 4
use of the additive identity property	4 + 0 = 4, 0 + 4 = 4
use patterns to make sums	0 + 5 = 5, 1 + 4 = 5, 2 + 3 = 5

Note: Students at this level are not expected to name the properties.

- Flexibility with facts to 10 should be applied to facts to 20 (e.g., when adding 4 + 7, it is appropriate to think of 4 as 3 + 1 to combine 3 and 7 to make a 10, whereas when adding 4 + 8, it is appropriate to think of 4 as 2 + 2 to combine 8 and 2 to make a 10).
- The problem-solving process is enhanced when students:
  - visualize the action in the story problem and draw a picture to show their thinking;
  - model the problem using manipulatives, representations, and/or number sentences/equations; and
  - justify their reasoning and varied approaches through collaborative discussions.
- In problem-solving, emphasis should be placed on thinking and reasoning rather than on key words. Focusing on key words such as *in all, altogether, difference,* etc., encourages students to perform a particular operation rather than make sense of the context of the problem. A key word focus prepares students to solve a limited set of problems and often leads to incorrect solutions as well as challenges in upcoming grades and courses.
- Extensive research has been undertaken over the last several decades regarding different problem types. Many of these studies have been published in professional mathematics education publications using different labels and terminology to describe the varied problem types.

1.CE.1 The student will recall with automaticity addition and subtraction facts within 10 and represent, solve, and justify solutions to single-step problems, including those in context, using addition and subtraction with whole numbers within 20.

Additional Content Background and Instructional Guidance:

Grade 1: Common Addition and Subtraction Problem Types		
Join (Result Unknown)	Join (Change Unknown)	Join (Start Unknown)
Sue had 9 pencils. Alex gave her 5 more pencils. How many pencils does Sue have altogether?	Sue had 9 pencils. Alex gave her some more pencils. Now Sue has 14 pencils. How many pencils did Alex give her?	Sue had some pencils. Alex gave her 5 more. Now Sue has 14 pencils. How many pencils did Sue have to start with?
Separate (Result Unknown)	Separate (Change Unknown)	Separate (Start Unknown)
Brooke had 10 cookies. She gave 6 cookies to Joe. How many cookies does Brooke have now?	Brooke had 10 cookies. She gave some to Joe. She has 4 cookies left. How many cookies did Brooke give to Joe?	Brooke had some cookies. She gave 6 to Joe. Now she has 4 cookies left. How many cookies did Brooke start with?
Part-Whole (Whole Unknown)	Part-Whole (One Part Unknown)	Part-Whole (Both Parts Unknown)
Lisa has 4 red markers and 8 blue markers. How many markers does she have?	Lisa has 12 markers. Four of the markers are red, and the rest are blue. How many blue markers does Lisa have?	Lisa has a pack of red and blue markers. She has 12 markers in all. How many markers could be red? How many could be blue?

- A variety of problem types related to addition and subtraction are represented in the chart above. Compare Problems will be introduced to students in Grade 2. It is important to note that Join Problems (with start unknown), Separate Problems (with start unknown), Compare Problems (with larger unknown – using "fewer"), and Compare Problems (with smaller unknown – using "more") are the most challenging for students.
- Equations should be routinely modeled in conjunction with story problems. Manipulatives such as connecting cubes and counters can be used to model equations.
- Equality can be shown using a balance scale or a number balance. An equation, such as 3 + 5 = 6 + 2, can be represented using a balance scale, with equal amounts on each side.
- An equation (number sentence) is a mathematical statement representing two expressions that are equivalent. It consists of two expressions, one on each side of an equal symbol (e.g., 5 + 3 = 8, 8 = 5 + 3 and 4 + 3 = 9 − 2).
- An expression is a representation of a quantity. It contains numbers, variables, and/or computational operation symbols. It does not have an equal symbol (e.g., 5, 4 + 3, 8 − 2). Students at this level are not expected to use the term expression.
- At this level, equality should be represented using objects, pictures, words, and symbols through the use of the equal symbol while inequality should be communicated primarily through words such as not equal, not equivalent, etc. A common misunderstanding is that

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the equal symbol always means “the answer comes next.” The equal symbol represents a balance between expressions. The equal symbol means “is the same as” or “another name for” or “equal in value.” Exploring equations in less familiar forms can help students build understanding of the equal symbol (e.g., 8 = 10 - 2, 5 = 5, or 7 = 12 - 5). • A common misunderstanding is that the equal symbol always means “the answer comes next.” The equal symbol represents a balance between expressions. The equal symbol means “is the same as” or “another name for” or “equal in value.” Exploring equations in less familiar forms can help students build an understanding of the equal symbol (e.g., 8 = 10 - 2, 5 = 5, or 7 = 12 - 5). • Experiences looking at equations and determining whether they are true or not true (e.g., 5 = 9 – 4 is true and 6 + 5 = 15 – 2 is not true) will help develop an understanding of equality and inequality. • Inequalities such as 5 < 4 + 3 are not equations. Equations must have an equal symbol (e.g., 5 + 6 = 11). Students at this level are not expected to work with inequalities. • Solving missing addend contextual problems help with the understanding of equality and the use of the equal symbol (e.g., There are four red birds in the tree. Some black birds fly to the tree. Now there are six birds in the tree. How many black birds flew to the tree? 4 +__ = 6).

Measurement and Geometry

1.MG.1 The student will reason mathematically using nonstandard units to measure and compare objects by length, weight, and volume.

Students will demonstrate the following Knowledge and Skills:

a) Use nonstandard units to measure the:
   i) lengths of two objects (units laid end to end with no gaps or overlaps) and compare the measurements using the terms longer/shorter, taller/shorter, or the same as;
   ii) weights of two objects (using a balance scale or a pan scale) and compare the measurements using the terms lighter, heavier, or the same as; and
   iii) volumes of two containers and compare the measurements using the terms more, less, or the same as.

b) Measure the length, weight, or volume of the same object or container with two different units and describe how and why the measurements differ.

1.MG.1 The student will reason mathematically using nonstandard units to measure and compare objects by length, weight, and volume. *Additional Content Background and Instructional Guidance:*
• Measurement involves comparing an attribute of an object to the same attribute of the unit of measurement (e.g., the length of the edge of a cube measures the length of a book; the weight of the cube measures the weight of the book; the volume of the cube measures the volume of a container). Students need experiences that help develop their understanding that the length measurement of an object is the number of same-size nonstandard tools of length (e.g., connecting cubes, paper clips, erasers) with no gaps or overlaps. • The process of measurement involves selecting a unit of measure, comparing the unit to the object to be measured, counting the number of times the unit is used to measure the object, and arriving at an approximate total number of units. • Premature use of instruments or formulas leaves children without the understanding necessary for solving measurement problems. • When children's initial explorations of length, weight, and volume involve the use of nonstandard units, they develop some understanding of the need for standard measurement units for length, weight, and volume, especially when they communicate with others about these measures. • Students develop conservation of measurement when they understand that the attributes do not change when the object is manipulated (e.g., a piece of string that is coiled maintains its length as it is straightened; the volume of water does not change when poured from a pitcher into a fish tank). • Length is the distance between two points. Through hands-on experiences, students should develop an understanding that the length of an object is determined by laying same-size nonstandard units (e.g., connecting cubes, paper clips, erasers) end to end with no gaps or overlaps. • Weight is a measure of the heaviness of an object. Experiences comparing the weights of two objects (one in each hand) using the terms "lighter," "heavier," or "the same" promote an understanding of the concept of balance.

1.MG.1 The student will reason mathematically using nonstandard units to measure and compare objects by length, weight, and volume. *Additional Content Background and Instructional Guidance:*
• Physically measuring the weights of objects, using a balance scale, helps students develop an intuitive idea of what it means to say something is "lighter," "heavier," or "the same." • Balance scales are instruments used for comparing weight. A balance scale usually has a beam that is supported in the center. On each side of the beam are two identical trays. When the trays hold equal weights, the beam is level, and the scale is "balanced." If the trays do not hold equal weights, the tray containing less weight will rise and the tray containing more weight will fall. • Volume is the measure of the capacity of a container and how much it holds. • Experiences that include pouring the contents of one container into another to compare the volumes of the two containers to determine whether the volume of one is more, less, or equivalent are needed. • Varying and mixing the sizes and/or shapes of the containers (e.g., using short, wide containers as well as tall, narrow containers) provide opportunities for students to explore and develop an understanding of how volume changes. • Opportunities to measure the same item using different units provide opportunities for students to develop an understanding that using paperclips to determine the length of a desk results in a different measurement than using glue sticks to measure. This is because paper clips are smaller than glue sticks and therefore it takes fewer glue sticks to measure the length of a desk than paper clips. When measuring the volume of a bucket, using tennis balls instead of pom poms would lead to different measurements, as it would take more pom poms to fill the bucket than tennis balls.

1.MG.2 The student will describe, sort, draw, and name plane figures (circles, triangles, squares, and rectangles), and compose larger plane figures by combining simple plane figures.

Students will demonstrate the following Knowledge and Skills:

a) Describe triangles, squares, and rectangles using the terms sides, vertices, and angles. Describe a circle using terms such as *round* and *curved*.

b) Sort plane figures based on their characteristics (e.g., number of sides, vertices, angles, curved).

c) Draw and name the plane figure (circle, square, rectangle, triangle) when given information about the number of sides, vertices, and angles.

d) Identify, name, and describe representations of circles, squares, rectangles, and triangles, regardless of orientation, in different environments and explain reasoning.

e) Recognize and name the angles found in rectangles and squares as right angles.

f) Compose larger plane figures by combining two or three simple plane figures (triangles, squares, and/or rectangles).

1.MG.2 The student will describe, sort, draw, and name plane figures (circles, triangles, squares, and rectangles), and compose larger plane figures by combining simple plane figures.

Additional Content Background and Instructional Guidance:

- An important part of the geometry strand in kindergarten through Grade 2 is the naming and describing of figures. Children move from their own vocabulary and begin to incorporate conventional terminology as the teacher uses geometric terms.
  - A plane figure is any closed, two-dimensional shape.
  - A vertex is the point at which two or more lines, line segments, or rays meet to form an angle. The term *vertices* is the plural form of vertex.
  - A line is a collection of points extending indefinitely in both directions. It has no endpoints.
  - A line segment is part of a line. It has two endpoints and includes all the points between and including those endpoints.
  - A ray is part of a line. It has one endpoint and extends indefinitely in one direction.
  - An angle is formed by two rays that share a common endpoint called the vertex. Angles are found wherever lines or line segments intersect.
  - A polygon is a closed plane figure composed of at least three line segments that do not cross. Students at this level do not need to use the term *polygon*.
  - A triangle is a polygon with three sides and three vertices.
  - A quadrilateral is a polygon with four sides. Students at this level do not need to use the term *quadrilateral*.
  - A rectangle is a quadrilateral with four right angles. A right angle measures exactly 90 degrees.
  - A square is a special rectangle with four sides of equal (congruent) length and four right angles. Students at this level do not need to use the term *congruent*.
  - A circle is the set of points in a plane that are the same distance from a point called the center. A circle is not a polygon, because it does not have straight sides.
- Triangles, rectangles, and squares should be presented in a variety of spatial orientations so that students do not develop the common misconception that triangles, rectangles, and squares must have one side parallel to the bottom of the page on which they are printed.

1.MG.2 The student will describe, sort, draw, and name plane figures (circles, triangles, squares, and rectangles), and compose larger plane figures by combining simple plane figures. *Additional Content Background and Instructional Guidance:*
• Representations of circles, squares, rectangles, and triangles can be found in the students' environments at school and at home. • A common misconception that students develop is referring to a rotated square as a diamond. Ongoing clarification should be provided (i.e., a square is a square regardless of its location in space; there is no plane figure called a diamond). • Early experiences with comparing, sorting, composing, and subdividing figures or manipulatives (e.g., pattern blocks, attribute blocks) assist students in analyzing the characteristics of plane geometric figures. • Polygons can be constructed using other polygons (e.g., six equilateral triangles can be used to construct a hexagon; two right triangles can be joined to create a square; a triangle can be joined with a rectangle to create a pentagon, etc.). 

1.MG.3 The student will demonstrate an understanding of the concept of passage of time (to the nearest hour and half-hour) and the calendar.

Students will demonstrate the following Knowledge and Skills:

a) Identify different tools to measure time including clocks (analog and digital) and calendar.
b) Describe the units of time represented on a clock as minutes and hours.
c) Tell time to the hour and half-hour, using analog and digital clocks.
d) Describe the location of the hour hand relative to time to the hour and half-hour on an analog clock.
e) Describe the location of the minute hand relative to time to the hour and half-hour on an analog clock.
f) Match the time shown on a digital clock to an analog clock to the hour and half-hour.
g) Identify specific days/dates on a calendar (e.g., What date is Saturday? How many Fridays are in October?).
h) Use ordinal numbers first through tenth to describe the relative position of specific days/dates (e.g., What is the first Monday in October? What day of the week is May 6th?).
i) Determine the day/date before and after a given day/date (e.g., Today is the 8th, so yesterday was the ?), and a date that is a specific number of days/weeks in the past or future (e.g., Tim's birthday is in 10 days, what will be the date of his birthday?).

1.MG.3 The student will demonstrate an understanding of the concept of passage of time (to the nearest hour and half-hour) and the calendar. *Additional Content Background and Instructional Guidance:*

• Many experiences using clocks help students develop an understanding of the telling of time to the hour and half-hour, including:
  o identifying the parts of an analog clock (minute and hour hands);
  o demonstrating a given time to the hour and half-hour, using a model clock;
  o writing digital time to the hour and half-hour;
  o relating time on the hour and half-hour to daily routines and school schedules (e.g., bedtime, lunchtime, recess time); and
  o connecting the hour and half-hour to fraction concepts.
• The use of a one-handed demonstration clock can help students estimate the location of the missing hand and predict a possible time.
• Practical situations are appropriate to develop a sense of the interval of time between events (e.g., club meetings occur every week on Monday; there is one week between meetings).
• The calendar is a way to represent units of time (e.g., days, weeks, months, years).
• Using a calendar develops the concept of day as a 24-hour period rather than as a period of time from sunrise to sunset.
• The calendar provides an opportunity to discuss and use ordinal numbers to describe the sequence of events (e.g., today is April 4th; yesterday was April 3rd; tomorrow will be April 5th).
• An ordinal number is a number that names the place or position of an object in a sequence or set (e.g., first, second, third). *Ordered position*, *ordinal position*, and *ordinality* are terms that refer to the place or position of an object in a sequence or set.

1.MG.3 The student will demonstrate an understanding of the concept of passage of time (to the nearest hour and half-hour) and the calendar. *Additional Content Background and Instructional Guidance:*
• At this level recognizing or reading the written words for ordinal numbers (e.g., first, second, third) is not expected. • Practical applications of ordinal numbers can be experienced through calendar and patterning activities.

Probability and Statistics

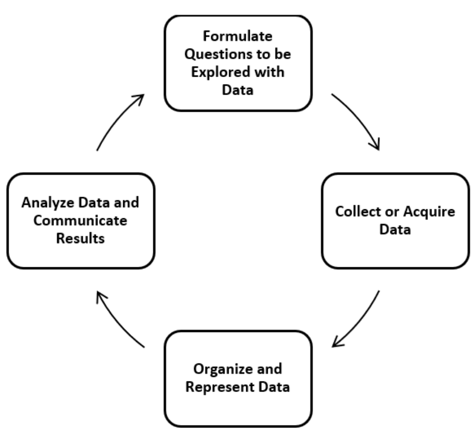
1.PS.1 The student will apply the data cycle (pose questions; collect or acquire data; organize and represent data; and analyze data and communicate results) with a focus on object graphs, picture graphs, and tables.

Students will demonstrate the following Knowledge and Skills:

a) Sort and classify concrete objects into appropriate subsets (categories) based on one or two attributes, such as size, shape, color, and/or thickness (e.g., sort a set of objects that are both red and thick).
b) Describe and label attributes of a set of objects that has been sorted.
c) Pose questions, given a predetermined context, that require the collection of data (limited to 25 or fewer data points for no more than four categories).
d) Determine the data needed to answer a posed question and collect the data using various methods (e.g., counting objects, drawing pictures, tallying).
e) Organize and represent a data set by sorting the collected data using various methods (e.g., tallying, T-charts).
f) Represent a data set (vertically or horizontally) using object graphs, picture graphs, and tables.
g) Analyze data represented in object graphs, picture graphs, and tables and communicate results:
    i) ask and answer questions about the data represented in object graphs, picture graphs, and tables (e.g., total number of data points represented, how many in each category, how many more or less are in one category than another); and
    ii) draw conclusions about the data and make predictions based on the data.

1.PS.1 The student will apply the data cycle (pose questions; collect or acquire data; organize and represent data; and analyze data and communicate results) with a focus on object graphs, picture graphs, and tables. *Additional Content Background and Instructional Guidance:*
• Students should explore the entire data cycle with a question and set of data that has been collected or acquired. Student reflection should occur throughout the data cycle. The data cycle includes the following steps: formulating questions to be explored with data, collecting or acquiring data, organizing and representing data, and analyzing and communicating results.

Data Cycle
Grade K-Algebra 2



1.PS.1 The student will apply the data cycle (pose questions; collect or acquire data; organize and represent data; and analyze data and communicate results) with a focus on object graphs, picture graphs, and tables.

Additional Content Background and Instructional Guidance:

- Sorting, classifying, and ordering real and symbolic objects (e.g., manipulatives, buttons, shoes, animals) facilitates work with patterns, geometric shapes, and data (e.g., organizing the data to represent the data in a graph to support analysis).
- To sort is to compare a set of objects in order to find similarities and differences, so that they may be arranged into organized groups.
- To classify is to arrange or organize a set of objects according to a category or attribute (a quality or characteristic).
- The same set of objects can be sorted and classified in different ways. For example, a collection of non-perishable food items can be sorted and classified by container (boxes or cans) and by type (vegetable, meat, or pasta).
- A Venn diagram can be a helpful tool when sorting by more than one attribute.
- One way to explore attributes is to investigate non-examples (e.g., a circle could be a non-example in a sort of rectangles and triangles).
- General similarities and differences among items are easily observed by primary students, who can begin to focus on more than one attribute at a time. During the primary grades, the teacher's task is to move students toward a more sophisticated understanding of classification in which two or more attributes connect or differentiate sets, such as those found in nature (e.g., leaves with different colors and different shapes).
- Data are pieces of information collected about people or things. The primary purpose of collecting data is to answer questions. The primary purpose of interpreting data is to inform decisions (e.g., which type of clothing to pack for a trip based on a weather graph or which type of lunch to serve based on class favorites).
- The teacher can provide data sets to students in addition to students engaging in their own data collection. The data cycle can be used to make connections between mathematics and other disciplines including science, social studies, or language arts.
- After generating questions, students decide what information is needed and how it can be collected. At this level, students may need scaffolded support to formulate questions that can be answered with the collection of data.
- The collection of the data often leads to new questions to be investigated.
- Data collection could involve voting, informal surveys, tallying, and charts (e.g., recording daily temperature, lunch count, attendance, favorite ice cream).
- Surveys, which are data collection tools that list choices, should provide a limited number of choices at the primary grades (e.g., When surveying classmates about their favorite pet, answer choices should be limited to four or less options).
- Tallying is a method for gathering information. Tally marks are used to show how often something happens or occurs. Each tally mark represents one occurrence. Tally marks are clustered into groups of five, with four vertical marks representing the first four occurrences and the fifth mark crossing the first four on a diagonal to represent the fifth occurrence.
- When data are presented in an organized manner, students can interpret and discuss the results and implications of their investigation (e.g., identifying parts of the data that have

1.PS.1 The student will apply the data cycle (pose questions; collect or acquire data; organize and represent data; and analyze data and communicate results) with a focus on object graphs, picture graphs, and tables. *Additional Content Background and Instructional Guidance:*
special characteristics, including categories with the greatest, the least, or the same number of responses). • Picture graphs are graphs that use pictures to represent and compare information. At this level, each picture should represent one data point. • Object graphs are graphs that use concrete materials to represent and compare the data that are collected (e.g., cubes stacked by the month, with one cube representing the birthday month of each student). • Tables are an orderly arrangement of data organized in columns and rows. Tables may be used to display some type of numerical relationship or organized lists. • At this level, data gathered and displayed by students should be limited to 25 or fewer data points for no more than four categories. • Opportunities to interpret graphs, created with the assistance of the teacher, that contain data points where the entire class is represented (e.g., tables that show who brought their lunch and who will buy their lunch for any given day, picture graph showing how students traveled to school – bus, car, walk) are needed and should continue throughout the school year. • When drawing conclusions about the data, teachers should pose questions such as, "*What might happen? What will happen? What will not happen?*"

Patterns, Functions, and Algebra

1.PFA.1 The student will identify, describe, extend, create, and transfer repeating patterns and increasing patterns using various representations.

Students will demonstrate the following Knowledge and Skills:

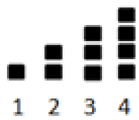
a) Identify and describe repeating and increasing patterns.
b) Analyze a repeating or increasing pattern and generalize the change to extend the pattern using objects, colors, movements, pictures, or geometric figures.
c) Create a repeating or increasing pattern using objects, pictures, movements, colors, or geometric figures.
d) Transfer a repeating or increasing pattern from one form to another.

1.PFA.1 The student will identify, describe, extend, create, and transfer repeating patterns and increasing patterns using various representations.

Additional Content Background and Instructional Guidance:

- Patterning is a fundamental cornerstone of mathematics, particularly algebra. The process of generalization leads to the foundation of algebraic reasoning.
- Opportunities to identify, describe, extend, create, and transfer patterns are essential to the primary school experience and lay the foundation for algebraic thinking.
- Patterning should include:
  - creating a given pattern using objects, sounds, movements, and pictures;
  - describing a pattern, to include identifying the core of the pattern and labeling the pattern;
  - recording a pattern with pictures or symbols;
  - transferring a pattern into a different form or different representation (e.g., blue–blue–red–green to an AABC repeating pattern); and
  - analyzing patterns in practical situations (e.g., calendar, seasons, days of the week).
- In a repeating pattern the part of the pattern that repeats is the core.
- At this level, experiences extending patterns when given a complete repetition of a core (e.g., ABACABACABAC) as well as when the final repetition of the core is incomplete (e.g., AABBAABBAA …; Red, Blue, Green, Red, Blue, Green, Red, Blue...) will deepen understanding of repeating patterns.
- Examples of repeating patterns include:
  - AABCAABC;
  - ABACABAC;
  - ABBCABBC;
  - AABCAABC; and
  - ABACDABACD.
- Transferring a pattern is creating the pattern in a different form or representation. Examples of pattern transfers include:
  - ABABAB… has the same structure as red, blue, red, blue, red, blue;
  - Snap, clap, jump, clap, snap, clap, jump, clap has the same structure as ABCBABCB…; and
  - ☺★☺★★☺★★★has the same structure as ABABBABBB....

1.PFA.1 The student will identify, describe, extend, create, and transfer repeating patterns and increasing patterns using various representations. *Additional Content Background and Instructional Guidance:*

- Growing patterns can be increasing or decreasing, and involve a progression from term to term, which make them more challenging for students than repeating patterns. Determining what comes next begins the process of generalization, which leads to the foundation of algebraic reasoning. Experiences identifying what changes and what stays the same in a growing pattern fosters algebraic thinking. Growing patterns may be represented in various ways, including numerically, or using dot patterns, staircases, pictures, etc.
- In Grade 1, growing numeric patterns will be limited to increasing values.
- Examples of growing (increasing) patterns include:
  - 

  - ☆△☆☆△☆☆☆△
  - **5, 10, 15, 20…**