First Grade Instructional Framework

Introduction

The purpose of this document is to connect and sequence mathematical ideas to enable teachers to plan learning opportunities for students to develop a coherent understanding of mathematics. **Clusters** and sequencing are designed to foster students' meaning making of the connections among mathematical ideas and procedures. This meaning making occurs over time. Therefore, the concepts are included in multiple clusters with increasing depth. They build across the year beginning with conceptual understanding and moving toward procedural fluency.

Each cluster includes a list of related **content standards** and a range of **suggested duration**. Standards indicate the mathematics expectations of students by the end of the school year. Standards are introduced and developed throughout the year, so the fact that a content standard is listed in a particular cluster does not indicate that it is to be mastered in the cluster. In some clusters, strikethroughs in the content standards denote the portion of the standard that will be taught later. In other clusters, the full standard appears, but suggestions about the intended focus are noted in the cluster descriptions. Because standards may be included in clusters long before mastery is expected, formative assessment is an essential tool for instructional planning and reporting student progress. This assessment naturally occurs as teachers elicit students' mathematical thinking and reasoning while doing mathematics.

Particular **Standards for Mathematical Practice** are indicated in bold for each cluster. The suggestions are a guide for teachers. While the bolded practices may lend themselves particularly well to the cluster's content, this does not imply that they are the only practices students will use. Students doing rich mathematical tasks will naturally engage in many mathematical practices as they do mathematics. During instruction teachers may observe and decide to highlight the other practices students are using beyond those bolded in the cluster.

Each cluster includes a section called **"What is the mathematics?"** that describes the significant concepts and connections within the standards necessary for students to make sense of and use the mathematics. A second section called **"Important Considerations"** provides guidance based on student learning progressions as well as ideas and models for teaching within problem-solving situations. Problem-solving and mathematical reasoning define what it means to do mathematics. Rich tasks (including word problems) provide students with concrete contexts to use as they are introduced to new mathematics. Later, work within such tasks allows students to develop understanding and eventually to demonstrate mastery. Rich tasks with multiple entry and exit points allow for natural differentiation of instruction and are accessible for all students.

The initial cluster at each grade includes a focus on **building mathematical community**. Learning mathematics involves productive struggle during problem-solving and meaningful discourse as students share strategies and explain their thinking. This requires individual students to have a mathematical mindset, a belief that they can learn and do mathematics, so they will take risks when solving non-routine tasks. Collectively, students must share ideas publicly as they critique mathematical ideas with peers and teacher. A safe community where mistakes and struggles are valued as learning opportunities is essential. Mathematical norms about how students do and talk about mathematics need to be explicitly established in the same way that other routines and expectations are introduced at the beginning of a school year.

Cluster 1: Using Numbers to Explore Our Mathematical Community
Duration: *3-4 weeks*
Content Standards: **This list includes standards addressed in this cluster, but not necessarily mastered, since all standards are benchmarks for the end of the year. Note strikethroughs and recommendations in the Important Considerations section for more information.** **NC.1.NBT.1** Count to 150, starting at any number less than 150. **NC.1.NBT.2** Understand that the two digits of a two-digit number represent amounts of tens and ones. • Unitize by making a ten from a collection of ten ones. • Model the numbers from 11 to 19 as composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones. • ~~Demonstrate that the numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens, with 0 ones.~~ **NC.1.NBT.7** Read and write numerals, and represent a number of objects with a written numeral, ~~to 100~~ to 20. **NC.1.MD.4** Organize, represent, and interpret data with up to three categories. • Ask and answer questions about the total number of data points. • Ask and answer questions about how many in each category. • Ask and answer questions about how many more or less are in one category than in another.
Mathematical Practices: **1. Make Sense of Problems and Persevere in Solving Them** **2. Reason Abstractly and Quantitatively** **3. Construct Viable Arguments and Critique the Reasoning of Others** **4. Model with Mathematics** 5. Use Appropriate Tools Strategically 6. Attend to Precision **7. Look for and make use of structure.** 8. Look for and express regularity in repeated reasoning.
What is the mathematics? ● Consider the following elements when preparing for an effective math community: 1.) Develop mathematicians with positive attitudes about **their** ability to **do** mathematics by: ● Creating opportunities to develop an appreciation for mistakes ● Seeing mistakes as opportunities to learn ● Teaching students to take responsibility for their learning 2.) Develop mathematicians who **respect others** by: ● Demonstrating acceptance, appreciation, and curiosity for different ideas and approaches ● Establishing procedures and norms for productive mathematical discourse ● Considering various solution paths 3.) Develop mathematicians with a **mindset for problem solving** by: ● Encouraging student authority and autonomy when problem solving ● Emphasizing questioning, understanding, and reasoning about math, **not** just doing math for the correct answer ● Asking follow-up questions when students are both right and wrong ● Allowing students to engage in **productive struggle**

- Students get to know each other by posing questions and collecting data about themselves and their surroundings (ex. how we get to school, lunch choice, color of shirt/pants). They analyze the data collected to describe how many in each category and how many more or less in one category than another.
- Students develop number sense by exploring how numbers are used in throughout the classroom and their world. These explorations help them make sense of why numbers are important-- to count and compare quantities, describe situations mathematically, and describe objects. These explorations also can informally introduce students to a variety of concepts that will be studied in later clusters.
- Through explorations, students reason through the need to use grouping as they start to use larger numbers (ex. During an inventory of the classroom, counting tables by ones is easy, but counting larger sets like number of blocks or books gets hard). These discussions serve as a foundation for place value in Cluster 3 as students begin to see the benefits of counting by groups for keeping track and describing higher counts. A hundreds board may be introduced as part of the discussion to help students begin to see patterns.
- Students in kindergarten have worked with numbers to 100 and can transition to counting to 150. They also count chorally by tens and look for patterns.
- Students solidify their reading and writing of numerals through 20.
- Students develop a deep conceptual understanding of the numbers 11-19 and a ten and some ones through counting, grouping, and modeling. Students should use a variety of models to show 11-19 as a ten and some ones (ex. ten frames, ten stick of cubes, rekenrek, group of ten objects banded together or in a cup). These models should be groupable and proportional so that student can easily compose and decompose one ten back into ten ones.

Important Considerations:

- Students have a natural curiosity about numbers in their world which can be used in building their number sense. Building on their interests when discussing the numbers they see around them, they explore through activities that will build a foundation for the rest of the year [ex. Inventories of classroom materials; numbers on clocks and thermometers; measuring height of class members in links or cubes, noting that Susan is taller than Bill but shorter than Kelly (NC.1.MD.1, NC.1.MD.2); folding paper into two or four sections to make a birthday card or do a writing activity (NC.1.G.3); drawing, describing and recording the number of shapes used when building various structures in the block center (NC.1.G.1, NC.1.G.2); keeping score in games; engaging in word problems incorporating the data collected (NC.1.OA.1).] While these standards are not the focus of the cluster, bringing out the mathematics in everyday experiences allows students to see that mathematics is everywhere and is useful.
- Even though students are not yet associating 10, 20, 30, 40, etc. with a number of tens, practice choral counting by tens and looking for patterns is important to build a foundation for base ten which is the focus of Cluster 3.

Cluster 2: Building a Conceptual Understanding of Addition and Subtraction
Duration: 3-4 weeks
Content Standards: ***This list includes standards addressed in this cluster, but not necessarily mastered, since all standards are benchmarks for the end of the year. Note strikethroughs and recommendations in the Important Considerations section for more information.*** **NC.1.OA.1** Represent and solve addition and subtraction word problems, within 20, with unknowns, by using objects, drawings~~, and equations with a symbol for the unknown number to represent the problem~~, when solving: ● Add to/Take from-Change Unknown ● Put together/Take Apart-Addend Unknown ● ~~Compare-Difference Unknown~~ **NC.1.OA.3** Apply the commutative and associative properties as strategies for solving addition problems. **NC.1.OA.6** Add and subtract, within 20, using strategies such as: ● Counting on ● Making ten ● Decomposing a number leading to a ten ● Using the relationship between addition and subtraction ● Using a number line ● Creating equivalent but simpler or known sums **NC.1.OA.7** Apply understanding of the equal sign to determine if equations involving addition and subtraction are true. **NC.1.OA.9** Demonstrate fluency with addition and subtraction within 10.
Mathematical Practices: **1. Make Sense of Problems and Persevere in Solving Them** **2. Reason Abstractly and Quantitatively** 3. Construct Viable Arguments and Critique the Reasoning of Others **4. Model with Mathematics** 5. Use Appropriate Tools Strategically 6. Attend to Precision **7. Look for and make use of structure.** **8. Look for and express regularity in repeated reasoning.**
What is the mathematics? ● In this cluster, students work on the concept of addition and subtraction within 20 and focus on building fluency within 10. Mastery of facts is not expected at this point in the year. ● Word problems serve as the context within which students develop an understanding of the meaning of the operations of addition and subtraction. Children best gain understanding through carefully crafted experiences where students use their own prior knowledge to solve problems rather than following a demonstrated procedure. ● In this cluster, students use concrete objects and drawings in real world contexts or to solve problems. Though these experiences students begin to understand situations in which we add and subtract. They use the language of *more, less*, and *the same as* to describe different situations including those where a quantity is increased or decreased.

- At this time students are introduced to two problem types: add to/take from and put together/take apart (part-part-whole). Compare-Difference Unknown problems are not taught at this time. This concept will be taught in Cluster 3. Students solve problems using objects and drawings.
    - Add to/take from problems involve actions that increase or decrease a quantity. In Kindergarten, students solved add to/take from problems where the result was unknown. This year students focus on change unknown problems.
        - Add to- Change unknown- There were 3 bears having a picnic. Some more bears came to join. Now there are 5 bears at the picnic. How many bears came to join the picnic?
        - Take From- Change unknown - 5 bears were having a picnic. Some bears left the picnic. Now there are 3 bears at the picnic. How many bears left the picnic?
    - Put together/ take apart problems do not involve an action. These problems can be thought of as two parts that make a whole. In Kindergarten students worked to solve put together/take apart problems where the total was known. In1st grade they also work to solve problems in which the whole and one part are known, and the other part is unknown (ex. A vase is filled with 7 flowers. Three flowers are red and the rest are yellow. How many yellow flowers are in the vase?)
- Students continue to develop number sense by focusing on relationships between numbers (ex. doubles, doubles +/- 1, benchmarks of five and ten). They solve addition and subtraction problems with multiple strategies and representations.
- The strategies below are the ways students typically solve addition and subtraction problems as they develop over time, gradually moving away from counting to using number relationships and finally towards mastery. Memorization of these specific strategies should not be the focus but rather students should be given the opportunity to choose strategies as they reason through problems. This can be supported through the use of classroom discussions in which teachers carefully sequence the sharing of student work to promote the use of different strategies and to support students in learning how to choose an efficient problem-solving method.
    - Counting on- ex. Students begin with a quantity and then count on from there to find the sum. 7+3 can thought of as 7, 8, 9, 10 (student often raise one finger as they count). After many experiences with counting on, children begin to realize it is most efficient to start at the larger addend when using this strategy.
    - Making ten-
      7 + 6 = __
      3 3
    - 10 + 3 = 13
    - Decomposing a number leading to a ten-

      12 - 4 = __
      2 2
      10 - 2 = 8
    - Using the relationship between addition and subtraction- ex. Knowing 7 + 8 = 15, a student also knows 15 - 8 = 7
    - Using a number line to make jumps by ones or by groups
    - Creating equivalent but simpler or known sums- ex. Adding 8 +9 by using the known doubles fact 8+8 = 16 and adding 1 (8+8 + 1) = 17
- Students use the associative and commutative property as strategies to add and subtract.

- The commutative property of addition states that the order of the addends does not change the sum. For example: If a child knows 4+7 =11 then they also know that 7+4=11. Knowledge of this property cuts in half the number of facts that students must master in order to be fluent with single digit addition and subtraction.
- The associative property of addition states that the grouping of 3 or more addends does not affect the sum. While students are not being given 3 addends at this time, this property is utilized when students decompose to make addition easier. For example: To solve 9 + 7 a child might decompose the 7 into 6 and 1 to make a 10. 9+7 = 9+(1+6) = (9+1)+6. These standards introduce the concept of equality *with* concrete objects and drawings but *without* using symbolic notation (=, < and >). Instead students use the language of *more, less,* and *the same value as* to describe their work.

- As students work with addition and subtraction they are moving towards becoming fluent with their math facts. In order for students to be fluent in addition and subtraction they must be able to access basic facts flexibly, accurately, efficiently and appropriately. Reasoning strategies should be at the center of basic fact instruction rather than a focus on the memorization of facts. In fact, memorization can foster inflexible thinking, ultimately working against fluency as children may continue to count by ones for sums and differences rather than internalizing number relationships that will be used throughout the grades.

Important Considerations:

- Start with number ranges within 10 and move on to within 20 as students are ready. When introducing a new problem type or problem context, consider lowering the numbers so students can engage more fully in thinking about the structure of the problem and then increase the number size.
- The consistent and accurate use of symbols to write number sentences is not expected until mid-year though students were exposed to symbols for the first time at the end of kindergarten. Students will naturally build on their knowledge of symbols for addition, subtraction, and equals to write number sentences, but the primary goal is for students to develop a deep, intuitive understanding of number relationships. It is particularly important for students to see symbols as ways to record these relationships and view the equal sign as meaning “has the same value.” As they internalize the relationships they are learning through language (ex. 4 and 3 is 7; 3 is more than 2) and seeing symbols modeled in connection with other representations they gradually take on symbol use as another way to represent those relationships.
- When students feel their strategies are valued, this can foster positive attitudes, making math more interesting and enjoyable while increasing their understanding of the concepts.
- Providing students with experiences with number relationships such as more/less, doubles, near doubles, making fives, and making tens will help them develop fact fluency.

Cluster 3: Understanding Equality and Place Value to Compare Numbers

Duration: 4-6 weeks

Content Standards:
This list includes standards addressed in this cluster, but not necessarily mastered, since all standards are benchmarks for the end of the year. Note strikethroughs and recommendations in the Important Considerations section for more information.

NC.1.NBT.1 (number sequence) and **NC.1.NBT.7** (written numbers) are continued areas of focus. These should be woven into and reinforced in instruction throughout the year.

NC.1.NBT.2
Understand that the two digits of a two-digit number represent amounts of tens and ones.

- Unitize by making a ten from a collection of ten ones.
- Model the numbers from 11 to 19 as composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.
- Demonstrate that the numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens, with 0 ones.

NC.1.NBT.7
Read and write numerals, and represent a number of objects with a written numeral to 100.

NC.1.NBT.3
Compare two two-digit numbers based on the value of the tens and ones digits, recording the results of comparisons ~~with the symbols >, =, and <.~~

NC.1.MD.4
Organize, represent, and interpret data with up to three categories.
• Ask and answer questions about the total number of data points.
• Ask and answer questions about how many in each category.
• Ask and answer questions about how many more or less are in one category than in another.

NC.1.OA.1
Represent and solve addition and subtraction word problems, within 20, with unknowns, by using objects, drawings~~, and equations with a symbol for the unknown number to represent the problem~~, when solving:

- Add to/Take from-Change Unknown
- Put together/Take Apart-Addend Unknown
- Compare-Difference Unknown

Mathematical Practices:
1. Make Sense of Problems and Persevere in Solving Them
2. Reason Abstractly and Quantitatively
3. Construct Viable Arguments and Critique the Reasoning of Others
4. Model with Mathematics
5. Use Appropriate Tools Strategically
6. Attend to Precision
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

What is the mathematics?

- Students engage in numerous grouping activities by experimenting and showing amounts of items in groups of like size collections. In Kindergarten students began to subitize numbers (instantly see how many) less than ten. In this cluster, they continue to develop thinking in collections, by grouping together items of like size collections (ex. How many towers of four can you snap together in five minutes? How many towers of five?). Eventually students should begin grouping by tens and showing the number of items as groups of ten and some more.

- Through experiences with groupable, proportional models such as a ten stick of cubes, rekenreks, groups of ten objects banded together or in a cup, or red/yellow chips on a tens frames, students begin to see 10 as ten ones and a group of ten. This concept is known is unitizing.
- Students make connections among representations including the symbolic number, the number word, and the number of tens and ones (ex. 47 is forty-seven is 4 tens and 7 ones).
- Building on Cluster 1, students should continue to pose questions and collect data about themselves, their surroundings, or about topics they are working on in other subject areas. Posing questions, collecting data, and analyzing data becomes the context in which student practice grouping by 10s and comparing quantities in two categories.
  - For example, students might divide into 3 teams and work to collect as many leaves as possible in a minute time frame. After the time is up, students work together to count the number of leaves they have collected. As students are counting the teacher might encourage students to count by groups to make counting easier, eventually counting by 10s. After counting the leaves, the quantities each team has collected can be compared (ex: How many more leaves were collected by team 2 than team 3?). Students can also use the language 'greater than', 'less than' and 'equal to' to compare the number of leaves collected by each team.
- Compare-difference unknown word problems are introduced at this point. Students should use models to directly compare the quantities represented in the problem. Examples of compare-difference unknown problems are shared below:
  - Taylor and Hayden have been collecting seashells at the beach. Hayden collected 12 shells. Taylor collected 9 shells. How many more shell did Hayden collect than Taylor? A student might work to solve this problem by creating a tower of 12 cubes and a tower of 9 cubes. By holding the towers side by side, the student would see that a tower of 12 is 3 cubes taller than a tower of 9. This means Hayden collected 3 more shells than Taylor.
  - A bowl of fruit has 13 strawberries and 15 grapes. How many less strawberries are there than grapes in the bowl? - To solve this problem a child might draw circles to represent strawberries. Then underneath those circles, the child might draw 15 circles to represent the grapes. It could then be noticed that there are 2 less strawberries than grapes. Models used for connecting place value to the operations should be proportional and groupable.
- Models used for place value should be proportional and groupable.
  - Models should be proportional (that is, ten units actually equal a group of ten). Non-proportional models (ex. One dime equals ten pennies) should be **<u>avoided</u>** at this time as students first need to make sense of place value
  - Models should also be able to be grouped and ungrouped (ex. beans in a cup; counters on a ten-frame; ten sticks made out of snap cubes) are more helpful as students explore what it really means to "build a ten." Base Ten Blocks should be **<u>avoided</u>** at this time as making a trade with non-groupable items is a more abstract concept than actually being able to pull apart the model to break apart the ten.
- Students use the language of equality and comparison such as *greater than*, *less than*, and *the same value as*, and *equal to*. At this time students are NOT expected to record the results of comparisons with the symbols < , >, and = but rather with the words "greater than" and "less than." The symbols will be a focus in Cluster 4. Student compare quantities in real life contexts through the use of models (towers of cubes, counters with ten frames, hundreds boards, number lines, number balances, etc.)

Important Considerations:

- Even though students have been working within the number 20 thus far, this is the time in which they can compare larger numbers. Be mindful that many students may still count by ones without any effort to group materials into piles. Taking the time to provide ample experiences to group items is important to build a conceptual understanding of unitizing. Ten frames will be helpful to students as they make groups of 10.
- Students should be given ample opportunities to verbalize the structure of their groups and the connection between the number of tens and ones to the two-digit number through small group and whole group discussions.
- Students who can say that a number has __ tens and ___ ones may still need support making the connection to the base-10 structure. (Ex. After a student counts a pile of beans and you can ask how many cups the child would need if they put ten beans in each cup, they may begin counting rather than making connection to the meaning of the tens place in the number.)
- At this time students should be working with proportional, groupable base ten models such as snap cubes or red/yellow counters on a tens frame so that they can compose and decompose tens themselves (ex. Snap cubes can be taken apart and put together in groups of ten by students. Base-ten blocks cannot be physically ungrouped. Similarly, a dime to represent ten is not proportional; that is, it is not ten times bigger than a penny).
- Students often have the misconception that the equal sign means “to give the answer” when it simply means “is the same value as.” Students should have the opportunity to explore with number balances in order to build the concept of equality and how finding the unknown in a problem is all about finding the balance.

Cluster 4: Understanding Measurement as a Context to Compare Numbers

Duration: 3-4 weeks

Content Standards:
This list includes standards addressed in this cluster, but not necessarily mastered, since all standards are benchmarks for the end of the year. Note strikethroughs and recommendations in the Important Considerations section for more information.

NC.1.MD.1
Order three objects by length; compare the lengths of two objects indirectly by using a third object.
NC.1.MD.2
Measure lengths with non-standard units.

- Express the length of an object as a whole number of non-standard length units.
- Measure by laying multiple copies of a shorter object (the length unit) end to end (iterating) with no gaps or overlaps.

NC.1.NBT.3
Compare two-digit numbers based on the value of the tens and ones digits, recording the results of comparison with the symbols, <, > and =.
NC.1.OA.2
Represent and solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20, by using objects, drawings, and ~~equations with a symbol for the unknown number.~~
NC.1.OA.7
Apply understanding of the equal sign ~~to determine if equations involving addition and subtraction are true.~~
NC.1.OA.8 Determine the unknown whole number in an addition or subtraction equation involving three whole numbers.

Mathematical Practices:
1. Make Sense of Problems and Persevere in Solving Them
2. Reason Abstractly and Quantitatively
3. Construct Viable Arguments and Critique the Reasoning of Others
4. Model with Mathematics
5. Use Appropriate Tools Strategically
6. Attend to Precision
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

What is the mathematics?

- Students use linear measurement in non-standard units as a context for further exploring comparison situations (ex. Measuring the length of a desk in number of pencil lengths or height with links). Experience with non-standard units support students important measurement concepts such as using the same-size units, lining up units correctly (beginning measuring at zero/edge), and no gaps between units or overlapping units. Standard units like inches and centimeters are not introduced until second grade.
- Students begin by comparing the length of objects using a 3rd object as reference. Students then describe the comparison using 'greater than', 'less than' and 'equal to'. Ex: A child might compare the length of two playground slides using a string and share they found the length of the red slide greater than the length of the blue slide.
- To make measurement more precise, students begin to explore measurement using non-standard units such as paperclips, drinking straws, toothpicks, blocks, etc.

• Students should be provided with ample experiences to measure length in nonstandard units in their own ways to establish a rationale for more precise measurement. For example, students might work in groups to measure the length of the classroom with pieces of construction paper. As groups work to measure the room, it is likely that students will leave gaps between the papers, have overlaps of paper and even turn the paper in different directions as they measure. As students share with the class their findings, student conversation should be drawn to the different lengths that were found and what might be causing the difference in measurement. This creates the context to discuss ways in which measuring can be made more accurate by laying objects of the same size end to end with no gaps or overlaps. • As students are measuring and comparing the length of objects, the symbols for comparisons should be introduced. (<, >, and =) • Measurement is used as a real-world context for introducing the addition of 3 whole numbers. Children should solve problems using objects and drawings and equations (Ex: After measuring the length of 3 pencils, students can add to find the total length of the three pencils). Choose non-standard units carefully so that the total measurement will be within the target number range for the students. For example, three brand new pencils are just over 20 inches, so you would choose a non-standard unit bigger than an inch to keep the total measure of three pencils within 20 (ex. Paper clips, links, crayons, rigatoni noodles, etc.). Offering students different non-standard units to measure naturally differentiates measurement activities by increasing or decreasing the number range needed and provides opportunity for rich discussion at the end of the task about why people got different numbers when they measured the same length. • The associative property can be used to help make addition of three numbers easier. Addition at this time should still center around using concrete objects and drawings to find sums. • As students collect measurements, they can record and analyze their data as a way to continue the work on NC.1.MD.4 from Cluster 1.
Important Considerations: • In Cluster 3, students began comparing two-digit numbers. In this cluster, they continue this work in the context of measurement, providing additional time and opportunities for students to develop mastery of NC.1.NBT.3. Symbols for comparison are included at this time. • Students should be exposed to a variety of non-standard tools of linear measurements such as pencils, noodles, paperclips, etc. • While students use symbols for operations and comparisons in this cluster, introduction to symbols for the unknown number occurs in Cluster 8.

Cluster 5: Operating with Place Value
Duration: 4-6 weeks

Content Standards:
This list includes standards addressed in this cluster, but not necessarily mastered, since all standards are benchmarks for the end of the year. Note strikethroughs and recommendations in the Important Considerations section for more information.

NC.1.NBT.1
Count to 150, starting at any number less than 150.
NC.1.NBT.2
Understand that the two digits of a two-digit number represent amounts of tens and ones.
- Unitize by making a ten from a collection of ten ones.
- Model the numbers from 11 to 19 as composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.
- Demonstrate that the numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens, with 0 ones.

NC.1.NBT.4
Using concrete models or drawings, strategies based on place value, properties of operations, and explaining the reasoning used, add, within 100, in the following situations:
- A two-digit number and a one-digit number
- A two-digit number and a multiple of 10

NC.1.NBT.5
Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used.
NC.1.NBT.6
Subtract multiples of 10 in the range 10-90 from multiples of 10 in the range 10-90, explaining the reasoning, using:
- Concrete models and drawings
- Number lines
- Strategies based on place value
- Properties of operations
- The relationship between addition and subtraction

NC.1.OA.1
Represent and solve addition and subtraction word problems, within 20, with unknowns, by using objects, drawings, and equations with a symbol for the unknown number to represent the problem, when solving:
- Add to/Take from-Change Unknown
- Put together/Take Apart-Addend Unknown
- Compare-Difference Unknown

NC.1.OA.3
Apply the commutative and associative properties as strategies for solving addition problems.
NC.1.OA.7
Apply understanding of the equal sign to determine if equations involving addition and subtraction are true.

Mathematical Practices:
1. Make Sense of Problems and Persevere in Solving Them
2. Reason Abstractly and Quantitatively
3. Construct Viable Arguments and Critique the Reasoning of Others
4. Model with Mathematics
5. Use Appropriate Tools Strategically
6. Attend to Precision
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

What is the mathematics?

The mathematics in this strand is clustered around operating with place value, which builds on students understanding of place value with numbers 11-19, and it extends their understanding to addition and subtraction within 100. In Kindergarten students began by looking at teen numbers as a group of 10 with some additional ones. In Cluster 2 (of first grade) students looked at the numbers 11-19 as a group of 10 and leftovers. In Clusters 3 and 4 they began to see the decade numbers, specifically, as indicating a number of groups of ten and two-digit numbers as a number of tens and some ones and used that knowledge to compare numbers. In this cluster, students will build on this place value understanding to add and subtract. In addition, they will continue to build their understanding of equality and equations by introducing symbols and solving for unknowns in word problems.

- Students connect their understandings of place value with the operations through the context of real-life situations and word problems, real-life situations, and within data and measurement activities.
- At this time students should be exposed to 3 problem types and represent their thinking using equations with a symbol to represent the unknown.
    - Add to/Take from-Change Unknown
    - Put together/Take Apart-Addend Unknown
    - Compare-Difference Unknown
- Students continue to develop the notion of equality (and now the equals sign) as "having the same value as." To develop a more robust understanding of the equal sign, students should be exposed to a variety of ways in which equivalent relationships can be shown. (ex. 7=4+3, 4+3=1+6, 4+3=7).
- Students are formally introduced to the symbols (+, =, and -) by making connections to the language of more, less, and the same that they have used all year. The purpose of the symbols is to record ideas in an efficient manner. The same ideas written as 3 + 4 = 7 could be communicated by saying or writing "three things and four things when put together make a group of seven things" or "three birds joining four birds on a branch make seven birds on the branch." The value of learning to use symbols is that we can communicate equivalence without knowing an exact content -ex: discussing number of apples, snow days, or coins in one's pocket. What is critical in first grade operations is that students have an internalized understanding of the many number relationships (numbers can be modeled, compared, combined, and broken apart). Mathematical symbols are simply efficient ways of communicating these relationships.
- Students use proportional and groupable place value models (see discussion in Cluster 3) to explore adding a two-digit number and a one-digit number (ex. Students race to 100 rolling dice and adding the number of cubes rolled). They explain that the next group of ten needs to be made when they have ten ones.
- Through repeated experiences with modeling addition, students notice that that they can change the order in which they add numbers with the same result (commutative property) They test this conjecture and use models to reason about why it is true.

- In addition to models, students use their understanding of number relationships to add a two-digit number and a one-digit number. (ex. Using their knowledge of making a ten to:
    - Make the next ten "57 + 8, I knew that 57 + 3 was 60 and 5 more was 65";
    - Decompose 57 into 50 and 7, adding 8 + 7 to get 15 and then 50 to get 65;
    - Hop on an open number line adding 57 + 10 and then subtracting or "hopping" back 2; moving on a hundreds board).
- Students show and explain with models that if they add a multiple of ten they can make larger jumps in the counting sequence. They look for patterns in the tens place as these jumps are made. Patterns might be more easily seen on a hundreds chart or number line.
- Students subtract a multiple of 10 from multiples of 10 using proportional, groupable models. Differences of multiples of ten (ex. 80 - 40) can be viewed as 8 tens minus 4 tens and modeled with ten sticks of snap cubes or filled ten frames.
- Students will mentally find 10 more or 10 less than a given two-digit number without counting but rather by explaining their reasoning in terms of place value understanding (ex. Chorally counting as ten sticks are removed or added from a starting number of cubes; "There were 3 tens in 34 so 10 more would be one more group of ten to make 44"). The language of 10 more than and 10 less than lends itself to comparison problems and provides opportunities to practice the symbols < and > in addition to the equals sign.
- At this time students work to apply their understanding of the equal sign to determine if addition and subtraction statements are true or false. It should be emphasized that the equal sign shows a relationship between the values on each side of the sign rather than indicating a need to 'compute'.

Important Considerations:

- Concrete materials, models, drawings, and place value strategies will be used to help students become flexible with numbers as they solve problems.
- This unit is not about subtracting in terms of the standard algorithms (borrowing and carrying) which are not expected to be mastered until fourth grade.
- Students are only expected to subtract two-digit numbers that are multiples of 10, rather any two-digit numbers (For example: Students are expected to be about to find the difference of 60 and 40 but not 62 and 40)
- Some students may still be counting up by ones to add a single digit number to a two-digit number. If necessary, continue to provide experiences through centers, number talks, and other mathematics routines to encourage students to decompose numbers to 10 in groups rather than counting by ones.
- Just as with previous clusters, addition and subtraction problems in this cluster can be presented in the context of word problems, real-life situations, and within data and measurement activities.

Cluster 6: Distinguishing and Composing Shapes

Duration: 3 weeks

Content Standards:

This list includes standards addressed in this cluster, but not necessarily mastered, since all standards are benchmarks for the end of the year. Note strikethroughs and recommendations in the Important Considerations section for more information.

NC.1.G.1
Distinguish between defining and non-defining attributes and create shapes with defining attributes by:
• Building and drawing triangles, rectangles, squares, trapezoids, hexagons, circles.
• Building cubes, rectangular prisms, cones, spheres, and cylinders.

NC.1.G.2
Create composite shapes by:
• Making a two-dimensional composite shape using rectangles, squares, trapezoids, triangles, and half-circles naming the components of the new shape.
• Making a three-dimensional composite shape using cubes, rectangular prisms, cones, and cylinders naming the components of the new shape.

Mathematical Practices:

1. Make Sense of Problems and Persevere in Solving Them
2. Reason Abstractly and Quantitatively
3. Construct Viable Arguments and Critique the Reasoning of Others
4. Model with Mathematics
5. Use Appropriate Tools Strategically
6. Attend to Precision
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

What is the mathematics?

- Early geometry is much more than vocabulary and naming shapes. It involves the development of spatial sense which is fostered through ongoing and significant experiences. Students should be encouraged to notice shapes in their everyday world as well as engage in experiences with models such as tangrams, attribute blocks, and pattern blocks.
- Students should be exposed to a wide variety of examples of a single type of shape (ex. triangle) and asked to look for what the shapes have in common in order to bring to light defining attributes of the shape. Providing examples and non-examples of shapes can also be helpful in highlighting defining attributes.
  - Defining Attributes- number of sides, number of angles, closed figures
  - Non-Defining Attributes- color, size, orientation
- In first grade, students use their understanding of defining attributes to identify, name, build, and draw triangles, rectangles, squares, trapezoids, hexagons and circles.
- Students combine rectangles, squares, trapezoids, triangles, and half-circles to create new composite shapes and describe the shapes within the new composite shapes they've created. (ex: Two triangles can be combined to make a square.)
- Students combine cubes, rectangular prisms, cones, spheres, and cylinders to create new composite shapes and describe the shapes within the new composite shapes they've created as cubes, rectangular prisms, cones, spheres, and cylinders

Important Considerations:

- Students should be exposed to shapes in a variety of sizes and contexts to avoid misconceptions about the attributes for shapes. It is common for children to incorrectly identify shapes based on non-defining attributes such as color, size and orientation (ex: A child might recognize a square as having both vertical and horizontal lines). When the square is tilted (change in orientation), the child may no longer recognize the shape as a square but believe it has now become a diamond (not a mathematical term).

- Students should identify and describe 2D and 3D shapes in a variety of contexts (hallway walk, playground, etc.) Experiences should not be limited to the standard set of pattern and attribute blocks found in math kits. Special attention should be paid to instructional materials such as posters and literature used in the classroom as some may display inaccurate or imprecise examples of shapes.
- It is common for students to identify 3D shapes by one of its faces (ex: A child might incorrectly identify a cube as a square). Students should be encouraged to identify all the faces of 3D shapes that can be described using the names of 2D shapes that students already know. Children can benefit from constructing 3D shapes from 2D shapes and then naming the new 3D shape that has been created.

Cluster 7: Partitioning and Telling Time to the Hour and Half Hour

Duration: 3 weeks

Content Standards:

This list includes standards addressed in this cluster, but not necessarily mastered, since all standards are benchmarks for the end of the year. Note strikethroughs and recommendations in the Important Considerations section for more information.

NC.1.MD.3
Tell and write time in hours and half-hours using analog and digital clocks.
NC.1.G.3
Partition circles and rectangles into two and four equal shares.
• Describe the shares as halves and fourths, as half of and fourth of.
• Describe the whole as two of, or four of the shares.
• Explain that decomposing into more equal shares creates smaller shares.

Mathematical Practices:

1. Make Sense of Problems and Persevere in Solving Them
2. Reason Abstractly and Quantitatively
3. Construct Viable Arguments and Critique the Reasoning of Others
4. Model with Mathematics
5. Use Appropriate Tools Strategically
6. Attend to Precision
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

What is the mathematics?

- This unit begins with experiences in partitioning circles and rectangles into halves and fourths. Then the understanding of partitioning is applied to learn to tell time to the hour and half hour.
- Students have an intuitive understanding of fair shares. Building on their experiences through discussions of fair-sharing lead to an understanding of equal partitioning through experiences with paper folding and geoboards. As students' partition rectangles and circles into two and four shares, they should describe the shares they've created using the language of 'halves', 'half of', 'fourth' and 'fourth of'. It is not the expectation that fractions should be written formally at this time (Ex: ¼)
- Students recognize that a whole is two of the halves put together or four of the fourths put together (ex. If I cut my sandwich in half, when I put the two halves together I have the whole sandwich. When I cut it into fourths, I put the four pieces together to make the whole sandwich.).
- Students understand that sharing equally into more pieces means each piece will be smaller (ex. If I share my sandwich with one friend, my piece will be bigger than if I share with three friends).
- Use the concept of partitioning to help students learn to tell time to the hour and half hour. Students often struggle with placement of the hour hand when drawing time to the half-hour. The work done in partitioning helps to support student understanding of hand placement as "half-past" the hour number.

Important Considerations:

- Students need to be involved in problems involving sharing and breaking down things so that it is "fair." Initial attempts to share often result in partitions that are not "equal" and provide opportunities to discuss "equal" and "fair." Take the time to discuss the meaning of fair-sharing in mathematics versus "fair" in real life situations. For example, four children sharing a pizza might each get a one-fourth piece as a "fair share." But if Dad and three children are sharing the same pizza, what is "fair" may be to give Dad a larger portion.

- Folded paper and geoboards provide opportunities to discuss multiple ways to partition and various representations (ex. "Fold your paper in half" will always result in different outcomes. Is the fold line vertical or horizontal? Is one way right? Are they both halves?).
- Use concepts of partitioning to relate to telling time to the half hour.
- Students often struggle with placement of the hour hand when drawing time to the half-hour. The work done in partitioning helps to support student understanding of hand placement as "half-past" the hour number.
- Spend time discussing what happens to the big hand on the clock as the little hand goes from one hour to the next. When the big hand is at 12, the little hand is pointing exactly at a number. When the big hand is at 6, the little hand is halfway between numbers.
- Students may benefit from work with one handed clocks. Remove the minute hand from a clock and ask students to predict where the minute hand might be based on the location of the hour hand.
- Digital clocks permit students to read times easily, but they don't easily relate to the benchmarks of time. For example, it's difficult for children to realize that 10:58 is nearly 11 o'clock.
- Students may need help in understanding the placement of the colon on the digital display.

Cluster 8: Developing Flexibility with Number

Duration: 3 weeks

Content Standards:
This list includes standards addressed in this cluster, but not necessarily mastered, since all standards are benchmarks for the end of the year. Note strikethroughs and recommendations in the Important Considerations section for more information.

NC.1.OA.1
Represent and solve addition and subtraction word problems, within 20, with unknowns, by using objects, drawings, and equations with a symbol for the unknown number to represent the problem, when solving:
• Add to/Take from-Change Unknown
• Put together/Take Apart-Addend Unknown
• Compare-Difference Unknown
NC.1.OA.2
Represent and solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20, by using objects, drawings, and equations with a symbol for the unknown number.
NC.1.OA.3
Apply the commutative and associative properties as strategies for solving addition problems.
NC.1.OA.4
Solve an unknown-addend problem, within 20, by using addition strategies and/or changing it to a subtraction problem.
NC.1.OA.6
Add and subtract, within 20, using strategies such as:
• Counting on
• Making ten
• Decomposing a number leading to a ten
• Using the relationship between addition and subtraction
• Using a number line
• Creating equivalent but simpler or known sums
NC.1.OA.9
Demonstrate fluency with addition and subtraction within 10.
NC.1.MD.5
Identify quarters, dimes, and nickels and relate their values to pennies.

Mathematical Practices:
1. Make Sense of Problems and Persevere in Solving Them
2. Reason Abstractly and Quantitatively
3. Construct Viable Arguments and Critique the Reasoning of Others
4. Model with Mathematics
5. Use Appropriate Tools Strategically
6. Attend to Precision
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

What is the mathematics?
- This cluster culminates the mathematical work of the grade as students build on their prior understanding of the relationship between numbers, addition and subtraction situations, strategies for addition and subtraction and properties of addition to develop flexibility with

number.

- By the end of this cluster students should be fluent with their facts within 10. Students who are fluent can solve for unknowns in addition and subtraction situations accurately, efficiently, and flexibly. To develop fluency, students should also be able to appropriately choose strategies that best fit with solving a particular problem.
- Students develop fluency through reasoning strategies rather than memorization as memorizing facts in isolation is inefficient and creates inflexibility.
- Students continue to use reasoning strategies to add and subtract within 20. Some common reasoning strategies used by students are included in NC.1.OA.6 (See examples in Cluster 2).
- Students continue to use objects and drawings to solve word problems within 20. In this cluster, they label their representations with equations, using a symbol for the unknown.
- Counting coins came be used as a means through which students demonstrate flexibility in their understanding of number. Initial coin exploration should be connected with skip counting and grouping.

Important Considerations:

- Timed tests can create math anxiety. Students learn their facts best when work is rooted in reasoning strategies that help them internalize number relationships. Students should be exposed to a variety of strategies such as one more/less, doubles, near doubles, making 5s, and making tens. These same number relationships are used for addition and subtraction throughout the grades (ex. In first grade students who solves 8 + 7 with 'a make a ten strategy', can apply that same strategy in a later grade to mentally compute 68 + 7). When students spend adequate time practicing these strategies their fluency naturally increases. Teachers can assess their fluency through observations and checklists.
- In order to count coins, children must be able to think about groups of 5, 10, and 25 without seeing countable objects. A child who is only able to count objects by ones will be challenged to understand the value of coins. Coins have intentionally been saved until the end of the year because of the need for students to unitize before being able to fully access the concept. As students learn the value of coins, lessons should focus on the purchasing power of each coin and the concept of equality. (Ex: a quarter can buy the same thing as 25 pennies).
- In the past, teachers may have used coins to model early place value concepts. Since coins are non-proportional, using these models too early can hinder student's development of place value understanding. (Ex: Though it takes 10 pennies to make a dime, a dime is not 10 times larger than a penny.)