**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’.