Cluster 3: Use place value strategies to add and subtract whole numbers

Duration: 3-4 weeks

Content Standards

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

Generalize place value understanding for multi-digit whole numbers.

NC.4.NBT.1
Explain that in a multi-digit whole number, a digit in one place represents 10 times as much as it represents in the place to its right, up to 100,000.

NC.4.NBT.2
Read and write multi-digit whole numbers up to and including 100,000 using numerals, number names, and expanded form.

NC.4.NBT.7
Compare two multi-digit numbers up to and including 100,000 based on the values of the digits in each place, using >, =, and < symbols to record the results of the comparisons.

Use place value understanding and properties of operations to perform multi-digit arithmetic.
NC4.NBT.4
Add and subtract multi-digit whole numbers up to and including 100,000 using the standard algorithm with place value understanding.

Use the four operations with whole numbers to solve problems.
NC.4.OA.3
Solve two-step word problems involving the four operations with whole numbers.

- Use estimation strategies to assess reasonableness of answers
- Interpret remainders in word problems
- Represent problems using equations with a letter standing for the unknown quantity.

Supporting Standards:
NC.4.OA.1
Interpret a multiplication equation as comparison. Multiply or divide to solve word problems involving multiplicative comparisons using models and equations with a symbol for the unknown number. Distinguish multiplicative comparison from additive comparison.

NC.4.MD.8
Solve word problems involving addition and subtraction of time intervals that cross the hour.

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 extend their place value understanding from previous grades to include numbers up to the hundred thousands place by building on the work they have already done this year with multiplicative comparison. They then use this place value knowledge to add and subtract numbers within 100,000 using the standard algorithm in the context of one and two step word problems.

- Students increase their number sense about larger numbers with experiences estimating (ex. How many tennis balls fit in this shoe box? How many tennis balls would you estimate fit in our classroom? How much space would you need for 10,000 tennis balls? How many pages would it take to draw 100,000 stars?).
- Students build on their knowledge of multiplicative comparison from Cluster 2 to explore numbers that are 10 times greater or ten times less than other numbers. They use various tools (ex. calculator, zoomable number lines, place value blocks) to notice patterns when a number is continually multiplied or divided by ten to discover that a digit in one place is ten times as much as the digit to the right.
- Students name larger numbers within 100,000 with numerals, number names, and expanded form, connecting the expanded form to their explorations about each place being ten times more than the place to the right.
- Students use their knowledge of place value to compare two multi-digit numbers up to 100,000. They write those comparisons in number sentences with the greater than, less than, or equals sign.
- Students continue to solidify estimation, decomposition, and whole number strategies for addition and subtraction and use the relationship between addition and subtraction. As they add and subtract numbers within 100,000, they use their place value knowledge to understand the addition and subtraction algorithms as an efficient strategy to compute with larger numbers.
- Students work in multiple contexts with one and two-step word problems throughout the cluster. They use variables to represent unknown quantities in number sentences. They use estimation to anticipate and assess the reasonableness of their solutions.

Important Considerations:

- This cluster is the first point in Grade 4 where students work with larger numbers, since all Cluster 1 and 2 involve working with smaller numbers. Conceptual understanding of place value requires a foundation of multiplicative comparison and is the foundation of addition and subtraction with algorithms, so it should be thoroughly unpacked. Teaching place value at the beginning of the year before multiplicative comparison makes it difficult for students to gain more than a superficial understanding of just how to name large numbers.
- Place value and estimation strategies should be comprehensively incorporated into all work involving addition and subtraction.

- Students should understand that addition and subtraction operations still have the same meaning even with larger numbers. As they solve word problems in all the different problem types, note that the situations in which we add and subtract to solve have not changed.
- As students use variables and symbols to describe their work, be attentive to how the equal sign is being used. Avoid long strings of equations on the same line (ex. 2 + 2 = 4 + 5 = 9), which promote the idea that the equals sign means "the answer is coming." It is particularly important for students to see equals meaning "has the same value" to avoid misconceptions about the equal sign that often persist into formal high school algebra.
- Work with students to discuss when it is efficient to use different strategies to add and subtract. The addition and subtraction algorithms are efficient in some problems (particularly with large numbers), but in other problems, estimation, decomposition, compensation, or constant difference strategies might be more efficient (ex. 10,000 - 8,924 = 9,999 - 8,923). Fluency in mathematics is accuracy, efficiency, and flexibility.
- As students are making conjectures when looking for patterns as they multiply by ten, be sure to help them refine their mathematical language so that their statements are accurate. Students often notice that when they multiply a number by ten a zero is added to the end. This pattern is only true for whole numbers, however. This can create a misconception later as students begin working with decimals. Helping introduce counterexamples (ex. Does your "zero at the end" idea work with fractions?) can help students refine their statements. With experience they will begin to refine their own and each other's statements, gaining experience in Mathematical Practice 6, attending to precision.