

3.NBT: NUMBERS & OPERATIONS IN BASE TEN

Cluster Statement: A: Use place value understanding and properties of operations to perform multi-digit arithmetic.

Additional Cluster (Students should spend the large majority of their time (65-85%) on the major work of the grade/course. Supporting work and, where appropriate, additional work should be connected to and engage students in the major work of the grade.)

Standard Text	Standard for Mathematical Practices	Students who demonstrate understanding can:
<p>3.NBT.A.1 Use place value understanding to round whole numbers to the nearest 10 or 100.</p>	<p>SMP6 Students can attend to precision by using appropriate vocabulary including that of base ten place value and rounding to communicate their reasoning and justify their answer to rounding problems.</p>	<ul style="list-style-type: none"> • Identifying the place value of digits in the ones, tens, hundred, and thousands place. • Round up a two-digit number in the tens place by looking at the place value of the ones. • Round up a three-digit number in the hundreds place by looking at the place value of the tens place. • Explain why and how they rounded with accuracy. • Demonstrate their understanding through visuals that correlate to place value understanding to round whole numbers
		Depth of Knowledge: 1-2
		Bloom's Taxonomy: Apply
<p>3.NBT.A.2 Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.</p>	<p>SMP 2 Students can reason abstractly and quantitatively by reasoning and express their knowledge of place value and of addition and subtraction algorithms when finding the unknown number.</p> <p>SMP 4 Students can model with mathematics by using representations, including number lines, bundling into groups of tens and groups of one hundred, to</p>	<p>Students who demonstrate understanding can:</p> <ul style="list-style-type: none"> • Demonstrate their understanding by fluently using place value to add and subtract. • Add and subtract whole numbers up to and including 1,000. • Use estimation strategies to assess reasonableness of answers. • Model and explain how the relationship between addition and subtraction can be applied to solve addition and subtraction problems.

	<p>demonstrate and explain their thinking.</p> <p>SMP 6 Students can attend to precision by incorporating appropriate vocabulary including that of place value and properties of operations in their explanations.</p> <p>SMP 7 Students can look for and make use of structure by using the structure of place value (composing and decomposing tens and hundreds) and addition and subtraction algorithms to develop efficient strategies to add and subtract to within 1000.</p>	<ul style="list-style-type: none"> • Use expanded form to decompose numbers and then find sums and differences • Utilize visuals that represent their understanding of place value to round whole numbers to the nearest 10 or 100. <p>Depth of Knowledge: 1-2</p> <p>Bloom's Taxonomy: Understand, Apply</p>
<p>Standard Text</p> <p>3.NBT.A.3 Multiply one-digit whole numbers by multiples of 10 in the range 10-90 (e.g., 9×80, 5×60) using strategies based on place value and properties of operations.</p>	<p>Standard for Mathematical Practices</p> <p>SMP 2 Students can reason abstractly and quantitatively by using their knowledge of place value, properties of operations, and multiplication algorithms to find the unknown number.</p> <p>SMP 4 Students can model with mathematics by using concrete and pictorial models or manipulatives to represent base ten quantities for multiplying.</p> <p>SMP 6 Students can attend to precision by using appropriate vocabulary including that of place value and properties of operations in their explanations.</p> <p>SMP 7 Students can look for and make use of structure by utilizing the structure of numbers (i.e. place value, composing and decomposing tens and hundreds) and multiplication algorithms to develop efficient strategies to perform multiplication and explain their thought process.</p>	<p>Students who demonstrate understanding can:</p> <ul style="list-style-type: none"> • Using strategies based on place value knowledge and the utilization of the properties of operations. • Use concrete and pictorial models, based on place value and the properties of operations to find the product of a one-digit whole number by a multiple of 10 in the range 10–90 <p>Depth of Knowledge: 1-2</p> <p>Bloom's Taxonomy: Understand, Apply</p>

Previous Learning Connections	Current Learning Connections	Future Learning Connections
<ul style="list-style-type: none"> • In 2nd grade, learners used place value understanding and properties of operations to add and subtract. • Connect to understanding that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. Understand the following as special cases. (2.NBT.1) • Connect to numbers within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. (2.NBT.7) • Connect to why addition and subtraction strategies work, using place value and the properties of operations. (2.NBT.9) • Connect to mentally added 10 or 100 to a given number 100–900, and mentally subtract 10 or 100 from a given number 100–900. (2.NBT.8) 	<ul style="list-style-type: none"> • Connect to apply properties of operations as strategies to multiply and divide. (3.OA.5) • Connect to fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction. (3.NBT.2) • Connect to relate area to the operations of multiplication and addition. (3.MD.7) • Connect to multiply one-digit whole numbers by multiples of 10 in the range 10–90 (e.g., 9×80, 5×60) using strategies based on place value and properties of operations. (3.NBT.3) 	<ul style="list-style-type: none"> • Connect to use place value understanding and properties of operations to perform multi-digit arithmetic. Learners use place value understanding to round multi-digit whole numbers to any place. (4.NBT.3) • Connect to fluently add and subtract multi-digit whole numbers using the standard algorithm. (4.NBT.4) • Connect to multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. (4.NBT.5) • Connect to find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. (4.NBT.6)
<p>Clarification Statement:</p> <ul style="list-style-type: none"> • The expectation is that students have a deep understanding of place value and number sense and can explain and reason about the answers they get when they round. • Students build on work in previous grades regarding strategies based on place value, the properties of operations, and relating addition to subtraction. • Students continue adding and subtracting within 1,000, extending their understanding of place value by composing and decomposing tens and hundreds. • Students explain their thinking and show their work and verify that their answer is reasonable. Problems should include both vertical and horizontal forms, including opportunities for students to apply the commutative and associative properties. • Estimation strategies include identifying when estimation is appropriate, determining the level of accuracy needed, selecting the appropriate method of estimation, and verifying solutions or determining the reasonableness of situations. Estimation strategies include, but are not limited to: front-end estimation with 		

adjusting (using the highest place value and estimating from the front end, making adjustments to the estimate by taking into account the remaining amounts), rounding and adjusting (students round down or round up and then adjust their estimate depending on how much the rounding affected the original values), using friendly or compatible numbers such as factors

- Students extend on their work in multiplication by applying understanding of place value.
- The special role of 10 in the base-ten system is important in understanding multiplication of one-digit numbers with multiples of 10.
- Using the properties of operations (commutative, associative, and distributive) and place value, students are able to explain their reasoning.

Common Misconceptions

- Students may misunderstand “rounding down” and actually lower the value of the digit in the designated place.
- Students may misunderstand “rounding up” and change the digit in the designated place while leaving digits in smaller places as they are.
- Students who learn to add and subtract procedurally without a deep understanding of place value and regrouping will struggle to determine whether their answers are reasonable.
- Students may not understand the concept that 10 in any position (place) makes one (group) in the next position and vice versa.
- Students may not understand that multiplying 3×40 means you have 3 groups of 4 tens and that is 12 tens or 120 (rather than multiply 4×3 and “add a zero at the end”).

Multi-Layered System of Supports (MLSS)/Suggested Instructional Strategies

Pre-Teach

Pre-teach (targeted) *What pre-teaching will prepare students to productively struggle with the mathematics for this cluster within your HQIM?*

- For example, some learners may benefit from targeted pre-teaching that rehearses prior learning when studying using place value understanding and properties of operations to perform multi-digit arithmetic because understanding place value is the foundation of understanding numbers. Through understanding place value students will be able to easily manipulate numbers to help with mental math strategies. Understanding of place value also helps students to understand addition and subtraction.

Pre-teach (intensive) *What critical understandings will prepare students to access the mathematics for this cluster?*

- 2.NBT.A.1 Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. This standard provides a foundation for work with using place value understanding and properties of operations to perform multi-digit arithmetic because it helps students understand the process of regrouping and the reasoning of why we regroup when adding/subtracting. It also provides the basis of the place value system so students can expand their understanding to larger numbers. If students have unfinished learning within this standard, based on assessment data, consider ways to provide intensive pre-teaching support prior to the start of the unit to ensure students are ready to access grade level instruction and assignments.

Core Instruction

Access

Perception: *How will the learning for students provide multiple formats to reduce barriers to learning, such as providing the same information through different modalities (e.g., through vision, hearing, or touch) and providing information in a format that will allow for adjustability by the user?*

- For example, learners engaging with using place value understanding and properties of operations to perform multi-digit arithmetic benefit when learning experiences ensure information is

accessible to learners with sensory and perceptual disabilities, but also easier to access and comprehend for many others such as displaying information in a flexible format to vary perceptual features such as layout of the visual or other elements lining the numbers up with larger graph paper, putting the numbers in a table, etc.. because this will allow students to access the numbers and the concept more effectively. The ability to manipulate sensory and perceptual features provides options for increasing the clarity and importance of the information for a wide range of learners. It also allows for adjustments and preferences of others when manipulating and working with the concept.

Build

Effort and Persistence: How will the learning for students provide options for sustaining effort and persistence?

- For example, learners engaging with using place value understanding and properties of operations to perform multi-digit arithmetic benefit when learning experiences attend to students attention and affect to support sustained effort and concentration such as creating cooperative learning groups with clear goals, roles, and responsibilities because all learners must be able to collaborate and communicate effectively. Groups with defined roles allows all students to be active participants in the group and helps keep students engaged in the group. It also allows for differentiation and guided peer support.

Language and Symbols: How will the learning for students provide alternative representations to ensure accessibility, clarity and comprehensibility for all learners? (e.g., a graph illustrating the relationship between two variables may be informative to one learner and inaccessible or puzzling to another; picture or image may carry very different meanings for learners from differing cultural or familial backgrounds)

- For example, learners engaging with using place value understanding and properties of operations to perform multi-digit arithmetic benefit when learning experiences attend to the linguistic and nonlinguistic representations of mathematics to ensure clarity can comprehensibility for all learners such as pre-teaching vocabulary and symbols, especially in ways that promote connection to the learners' experience and prior knowledge because when students understand the vocabulary they are better prepared to understand the concept. The key vocabulary is the gateway into discussing, making connections, and applying the concept. Understanding key vocabulary such as ones, tens, hundreds, thousands, addition, subtraction, etc. will help students when manipulating numbers.

Expression and Communication: How will the learning provide multiple modalities for students to easily express knowledge, ideas, and concepts in the learning environment?

- For example, learners engaging with using place value understanding and properties of operations to perform multi-digit arithmetic benefit when learning experiences attend to the multiple ways students can express knowledge, ideas, and concepts such as solving problems using a variety of strategies because using a variety of tools and strategies allows students to express and show their learning in a way that is meaningful to them. It allows more points of access to the content. It also provides a more flexible and accessible toolkit in which learners can successfully take part in their learning and show or share what they understand and know.

Internalize

Comprehension: How will the learning for students support transforming accessible information into usable knowledge, knowledge that is accessible for future learning and decision-making?

- For example, learners engaging with using place value understanding and properties of operations to perform multi-digit arithmetic benefit when learning experiences attend to students by intentionally building connections to prior understandings and experiences; relating important information to the learning goals; providing a process for meaning making of new learning; and, applying learning to new contexts such as providing options for organizing and possible

approaches (tables and representations for processing mathematical operations) because place value understanding including addition and subtraction of numbers is a key concept. All learners need to be able to generalize and transfer their learning into different contexts. Students need multiple representations for this to occur. In order to understand place value, addition, and subtraction students need to understand more than just an algorithm or step. Students need multiple representations to help understand the meaning and other ways to manipulate the numbers in order to build understanding of place value.

Re-teach

Re-teach (targeted) *What formative assessment data (e.g., tasks, exit tickets, observations) will help identify content needing to be revisiting during a unit?*

- For example, students may benefit from re-engaging with content during a unit on using place value understanding and properties of operations to perform multi-digit arithmetic by clarifying mathematical ideas and/or concepts through a short mini-lesson because it will provide students the opportunity to rethink about the value of numbers and digits in numbers. Understanding the value of digits and numbers provides students the foundation to understand addition and subtraction of numbers.

Re-teach (intensive) *What assessment data will help identify content needing to be revisited for intensive interventions?*

- For example, some students may benefit from intensive extra time during and after a unit using place value understanding and properties of operations to perform multi-digit arithmetic by clarifying mathematical ideas and/or concepts by addressing conceptual understanding because students need to understand and internalize the value of numbers. The more students understand the value of numbers the more they will be able to manipulate numbers and begin to understand addition and subtraction of numbers.

Extension

What type of extension will offer additional challenges to 'broaden' your student's knowledge of the mathematics developed within your HQIM?

For example, some learners may benefit from an extension such as open-ended tasks linking multiple disciplines when studying using place value understanding and properties of operations to perform multi-digit arithmetic because when students are allowed to apply their understanding to real world tasks, they develop a deeper understanding of the concept. Through applying their understanding of place value as well as adding and subtracting numbers to a real world, multi-disciplinary tasks students must take their possibly isolated understanding of a concept and integrate and apply it to their own interests and lives.

Culturally and Linguistically Responsive Instruction:

Validate/Affirm: How can you design your mathematics classroom to intentionally and purposefully legitimize the home culture and languages of students and reverse the negative stereotypes regarding the mathematical abilities of students of marginalized cultures and languages?

Build/Bridge: How can you create connections between the cultural and linguistic behaviors of your students' home culture and language the culture and language of school mathematics to support students in creating mathematical identities as capable mathematicians that can use mathematics within school and society?

Goal Setting: Setting challenging but attainable goals with students can communicate the belief and expectation that all students can engage with interesting and rigorous mathematical content and achieve in mathematics. Unfortunately, the reverse is also true, when students encounter low expectations through their interactions with adults and the media, they may see little reason to persist in mathematics, which can create a vicious cycle of low expectations and low achievement. For example, when studying using place value understanding and

properties of operations to perform multi-digit arithmetic goal setting is critical because it allows students the opportunity to think about and evaluate where they are at in their learning. It helps students focus on where they need to go and helps them develop a plan to get where they need to be.

Standards Aligned Instructionally Embedded Formative Assessment Resources:

Source: Cognia Testlet for Grade 3 Numbers and Operations in Base Ten

STANDARD: Multiply one-digit whole numbers by multiples of 10 in the range 10–90 (e.g., 9×80 , 5×60) using strategies based on place value and properties of operations. (03.NBT.01.03)

LEARNING TARGET: I can add a three-digit and two-digit number and find the missing number in a multiplication expression that equals the sum of the addition expression. DOK: 3

1. An equation is shown.

$$316 + 44 = 6 \times ?$$

- a. What is the sum of the left side of the equation? Show your work or explain how you know.
- b. What number can be written in place of the question mark that makes the equation true? Show your work or explain how you know.

Relevance to families and communities:

During a unit focused on rounding, adding, and subtraction consider options for learning from your families and communities the cultural and linguistic ways this mathematics exists outside of school to create stronger home to school connections for students, for example, learning about how families determine how much and what type of cloth to make various textiles for their family and the community.

Cross-Curricular Connections:

Language Arts: Expository writing to describe scientific or statistical data.

Social Studies: Understanding statistical data in current events