Arizona's Common Core Standards
Mathematics

Standards - Mathematical Practices - Explanations and Examples

First Grade

ARIZONA DEPARTMENT OF EDUCATION
HIGH ACADEMIC STANDARDS FOR STUDENTS
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First Grade Overview

Operations and Algebraic Thinking (OA)

- Represent and solve problems involving addition and subtraction.
- Understand and apply properties of operations and the relationship between addition and subtraction.
- Add and subtract within 20.
- Work with addition and subtraction equations.

Number and Operations in Base Ten (NBT)

- Extend the counting sequence.
- Understand place value.
- Use place value understanding and properties of operations to add and subtract.

Measurement and Data (MD)

- Measure lengths indirectly and by iterating length units.
- Tell and write time.
- Represent and interpret data.

Geometry (G)

- Reason with shapes and their attributes.

Mathematical Practices (MP)

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.

First Grade: Mathematics Standards – Mathematical Practices – Explanations and Examples

In Grade 1, instructional time should focus on four critical areas: (1) developing understanding of addition, subtraction, and strategies for addition and subtraction within 20; (2) developing understanding of whole number relationships and place value, including grouping in tens and ones; (3) developing understanding of linear measurement and measuring lengths as iterating length units; and (4) reasoning about attributes of, and composing and decomposing geometric shapes.

(1) Students develop strategies for adding and subtracting whole numbers based on their prior work with small numbers. They use a variety of models, including discrete objects and length-based models (e.g., cubes connected to form lengths), to model add-to, take-from, put-together, take-apart, and compare situations to develop meaning for the operations of addition and subtraction, and to develop strategies to solve arithmetic problems with these operations. Students understand connections between counting and addition and subtraction (e.g., adding two is the same as counting on two). They use properties of addition to add whole numbers and to create and use increasingly sophisticated strategies based on these properties (e.g., "making tens") to solve addition and subtraction problems within 20. By comparing a variety of solution strategies, children build their understanding of the relationship between addition and subtraction.

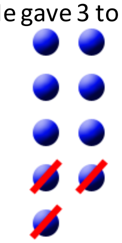
(2) Students develop, discuss, and use efficient, accurate, and generalizable methods to add within 100 and subtract multiples of 10. They compare whole numbers (at least to 100) to develop understanding of and solve problems involving their relative sizes. They think of whole numbers between 10 and 100 in terms of tens and ones (especially recognizing the numbers 11 to 19 as composed of a ten and some ones). Through activities that build number sense, they understand the order of the counting numbers and their relative magnitudes.

(3) Students develop an understanding of the meaning and processes of measurement, including underlying concepts such as iterating (the mental activity of building up the length of an object with equal-sized units) and the transitivity principle for indirect measurement. (Students should apply the principle of transitivity of measurement to make indirect comparisons, but they need not use this technical term.)

(4) Students compose and decompose plane or solid figures (e.g., put two triangles together to make a quadrilateral) and build understanding of part-whole relationships as well as the properties of the original and composite shapes. As they combine shapes, they recognize them from different perspectives and orientations, describe their geometric attributes, and determine how they are alike and different, to develop the background for measurement and for initial understandings of properties such as congruence and symmetry.

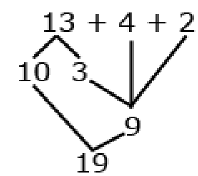
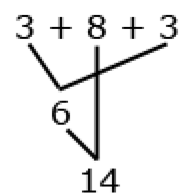
Operations and Algebraic Thinking (OA)

Represent and solve problems involving addition and subtraction.

<u>*Standards*</u> *Students are expected to:*	<u>*Mathematical Practices*</u>	<u>*Explanations and Examples*</u>
1.OA.A.1. Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem. (See Table 1.) Connections: *1.OA.2; 1.OA.3; 1.OA.6; 1.RI.3; ET01-S1C4-01; ET01-S2C1-01*	*1.MP.1.* Make sense of problems and persevere in solving them. *1.MP.2.* Reason abstractly and quantitatively. *1.MP.3.* Construct viable arguments and critique the reasoning of others. *1.MP.4.* Model with mathematics. *1.MP.5.* Use appropriate tools strategically. *1.MP.8.* Look for and express regularity in repeated reasoning.	Contextual problems that are closely connected to students' lives should be used to develop fluency with addition and subtraction. Table 1 describes the four different addition and subtraction situations and their relationship to the position of the unknown. Students use objects or drawings to represent the different situations. • Take for example: Abel has 9 balls. He gave 3 to Susan. How many balls does Abel have now?  • Compare example: Abel has 9 balls. Susan has 3 balls. How many more balls does Abel have than Susan? A student will use 9 objects to represent Abel's 9 balls and 3 objects to represent Susan's 3 balls. Then they will compare the 2 sets of objects. Note that even though the modeling of the two problems above is different, the equation, 9 - 3 = ?, can represent both situations yet the compare example can also be represented by 3 + ? = 9 (How many more do I need to make 9?). It is important to attend to the difficulty level of the problem situations in relation to the position of the unknown. • Result Unknown, Total Unknown, and Both Addends Unknown problems are the least complex for students. • The next level of difficulty includes Change Unknown, Addend Unknown, and Difference Unknown. • The most difficult are Start Unknown and versions of Bigger and Smaller Unknown (compare problems). Students may use document cameras to display their combining or separating strategies. This gives them the opportunity to communicate and justify their thinking.

Operations and Algebraic Thinking (OA)

Represent and solve problems involving addition and subtraction.

<u>*Standards*</u> *Students are expected to:*	<u>*Mathematical Practices*</u>	<u>*Explanations and Examples*</u>
1.OA.A.2. Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem. Connections: *1.OA.1; 1.OA.3; 1.OA.6; 1.RI.3; ET01-S1C4-01; ET01-S2C1-01*	*1.MP.1.* Make sense of problems and persevere in solving them. *1.MP.2.* Reason abstractly and quantitatively. *1.MP.3.* Construct viable arguments and critique the reasoning of others. *1.MP.4.* Model with mathematics. *1.MP.5.* Use appropriate tools strategically. *1.MP.8.* Look for and express regularity in repeated reasoning.	To further students' understanding of the concept of addition, students create word problems with three addends. They can also increase their estimation skills by creating problems in which the sum is less than 5, 10 or 20. They use properties of operations and different strategies to find the sum of three whole numbers such as: • Counting on and counting on again (e.g., to add 3 + 2 + 4 a student writes 3 + 2 + 4 = ? and thinks, "3, 4, 5, that's 2 more, 6, 7, 8, 9 that's 4 more so 3 + 2 + 4 = 9." • Making tens (e.g., 4 + 8 + 6 = 4 + 6 + 8 = 10 + 8 = 18) • Using "plus 10, minus 1" to add 9 (e.g., 3 + 9 + 6 A student thinks, "9 is close to 10 so I am going to add 10 plus 3 plus 6 which gives me 19. Since I added 1 too many, I need to take 1 away so the answer is 18.) • Decomposing numbers between 10 and 20 into 1 ten plus some ones to facilitate adding the ones  • Using doubles  Students will use different strategies to add the 6 and 8. • Using near doubles (e.g.,5 + 6 + 3 = 5 + 5 + 1 + 3 = 10 + 4 =14) Students may use document cameras to display their combining strategies. This gives them the opportunity to communicate and justify their thinking.

Operations and Algebraic Thinking (OA)

Understand and apply properties of operations and the relationship between addition and subtraction.

Standards *Students are expected to:*	*Mathematical Practices*	*Explanations and Examples*
1.OA.B.3. Apply properties of operations as strategies to add and subtract. *Examples: If 8 + 3 = 11 is known, then 3 + 8 = 11 is also known. (Commutative property of addition.) To add 2 + 6 + 4, the second two numbers can be added to make a ten, so 2 + 6 + 4 = 2 + 10 = 12. (Associative property of addition.)* (Students need not use formal terms for these properties.) Connections: *1.OA.1; 1.OA.2; 1.OA.7; 1.RI.3; ET01-S2C1-01*	*1.MP.2.* Reason abstractly and quantitatively. *1.MP.7.* Look for and make use of structure. *1.MP.8.* Look for and express regularity in repeated reasoning.	Students should understand the important ideas of the following properties: • Identity property of addition (e.g., 6 = 6 + 0) • Identity property of subtraction (e.g., 9 – 0 = 9) • Commutative property of addition (e.g., 4 + 5 = 5 + 4) • Associative property of addition (e.g., 3 + 9 + 1 = 3 + 10 = 13) Students need several experiences investigating whether the commutative property works with subtraction. The intent is not for students to experiment with negative numbers but only to recognize that taking 5 from 8 is not the same as taking 8 from 5. Students should recognize that they will be working with numbers later on that will allow them to subtract larger numbers from smaller numbers. However, in first grade we do not work with negative numbers.
1.OA.B.4. Understand subtraction as an unknown-addend problem. *For example, subtract 10 – 8 by finding the number that makes 10 when added to 8.* Connections: *1.OA.5; 1.NBT.4; 1.RI.3*	*1.MP.2.* Reason abstractly and quantitatively. *1.MP.7.* Look for and make use of structure. *1.MP.8.* Look for and express regularity in repeated reasoning.	When determining the answer to a subtraction problem, 12 - 5, students think, "If I have 5, how many more do I need to make 12?" Encouraging students to record this symbolically, 5 + ? = 12, will develop their understanding of the relationship between addition and subtraction. Some strategies they may use are counting objects, creating drawings, counting up, using number lines or 10 frames to determine an answer. Refer to Table 1 to consider the level of difficulty of this standard.

Operations and Algebraic Thinking (OA)

Add and subtract within 20.

Standards *Students are expected to:*	*Mathematical Practices*	*Explanations and Examples*
1.OA.C.5. Relate counting to addition and subtraction (e.g., by counting on 2 to add 2). Connections: *1.RI.3*	*1.MP.7.* Look for and make use of structure. *1.MP.8*. Look for and express regularity in repeated reasoning	Students' multiple experiences with counting may hinder their understanding of counting on and counting back as connected to addition and subtraction. To help them make these connections when students count on 3 from 4, they should write this as 4 + 3 = 7. When students count back (3) from 7, they should connect this to 7 – 3 = 4. Students often have difficulty knowing where to begin their count when counting backward.
1.OA.C.6. Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on; making ten (e.g., 8 + 6 = 8 + 2 + 4 = 10 + 4 = 14); decomposing a number leading to a ten (e.g., 13 – 4 = 13 – 3 – 1 = 10 – 1 = 9); using the relationship between addition and subtraction (e.g., knowing that 8 + 4 = 12, one knows 12 – 8 = 4); and creating equivalent but easier or known sums (e.g., adding 6 + 7 by creating the known equivalent 6 + 6 + 1 = 12 + 1 = 13). Connections: *1.OA.1; 1.OA.2; 1.OA.3; 1.OA.4; 1.OA.5; ET01-S1C2-02*	*1.MP.2.* Reason abstractly and quantitatively. *1.MP.7.* Look for and make use of structure. *1.MP.8*. Look for and express regularity in repeated reasoning.	This standard is strongly connected to all the standards in this domain. It focuses on students being able to fluently add and subtract numbers to 10 and having experiences adding and subtracting within 20. By studying patterns and relationships in addition facts and relating addition and subtraction, students build a foundation for fluency with addition and subtraction facts. Adding and subtracting fluently refers to knowledge of procedures, knowledge of when and how to use them appropriately, and skill in performing them flexibly, accurately, and efficiently. The use of objects, diagrams, or interactive whiteboards and various strategies will help students develop fluency.

<table>
<tr><td colspan="3">Operations and Algebraic Thinking (OA)
Work with addition and subtraction equations.</td></tr>
<tr><td>Standards
Students are expected to:</td><td>Mathematical Practices</td><td>Explanations and Examples</td></tr>
<tr><td>1.OA.D.7. Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false. For example, which of the following equations are true and which are false? 6 = 6, 7 = 8 – 1, 5 + 2 = 2 + 5, 4 + 1 = 5 + 2.

Connections: 1.NBT.3; 1.RI.3; 1.SL.1; ET01-S1C2-02; ET01-S2C1-01</td><td>1.MP.2. Reason abstractly and quantitatively.

1.MP.3. Construct viable arguments and critique the reasoning of others.

1.MP.6. Attend to precision.

1.MP.7. Look for and make use of structure.</td><td>Interchanging the language of "equal to" and "the same as" as well as "not equal to" and "not the same as" will help students grasp the meaning of the equal sign. Students should understand that "equality" means "the same quantity as". In order for students to avoid the common pitfall that the equal sign means "to do something" or that the equal sign means "the answer is," they need to be able to:
• Express their understanding of the meaning of the equal sign
• Accept sentences other than a + b = c as true (a = a, c = a + b, a = a + 0, a + b = b + a)
• Know that the equal sign represents a relationship between two equal quantities
• Compare expressions without calculating

These key skills are hierarchical in nature and need to be developed over time. Experiences determining if equations are true or false help student develop these skills. Initially, students develop an understanding of the meaning of equality using models. However, the goal is for students to reason at a more abstract level. At all times students should justify their answers, make conjectures (e.g., if you add a number and then subtract that same number, you always get zero), and make estimations. Once students have a solid foundation of the key skills listed above, they can begin to rewrite true/false statements using the symbols, < and >. Examples of true and false statements:
• 7 = 8 – 1
• 8 = 8
• 1 + 1 + 3 =7
• 4 + 3 = 3 + 4
• 6 – 1 = 1 – 6
• 12 + 2 – 2 = 12
• 9 + 3 = 10
• 5 + 3 = 10 – 2
• 3 + 4 + 5 = 3 + 5 + 4
• 3 + 4 + 5 = 7 + 5
• 13 = 10 + 4
• 10 + 9 + 1 = 19

Students can use a clicker (electronic response system) or interactive whiteboard to display their responses to the equations. This gives them the opportunity to communicate and justify their thinking.</td></tr>
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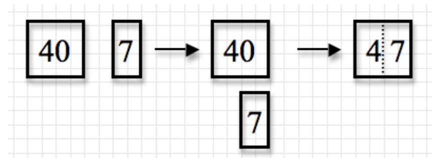
Operations and Algebraic Thinking (OA) **Work with addition and subtraction equations.**		
Standards *Students are expected to:*	*Mathematical Practices*	*Explanations and Examples*
1.OA.D.8. Determine the unknown whole number in an addition or subtraction equation relating three whole numbers. *For example, determine the unknown number that makes the equation true in each of the equations: 8 + ? = 11, 5 = □ – 3, 6 + 6 = □.* Connections: *1.OA.1; 1.OA.3; 1.OA.5; 1.OA.6; 1.NBT.4; 1.RI.3; ET01-S1C2-02; ET01-S2C1-01*	*1.MP.2.* Reason abstractly and quantitatively. *1.MP.6.* Attend to precision. *1.MP.7.* Look for and make use of structure.	Students need to understand the meaning of the equal sign and know that the quantity on one side of the equal sign must be the same quantity on the other side of the equal sign. They should be exposed to problems with the unknown in different positions. Having students create word problems for given equations will help them make sense of the equation and develop strategic thinking. Examples of possible student "think-throughs": • *8 + ? = 11*: "8 and some number is the same as 11. 8 and 2 is 10 and 1 more makes 11. So the answer is 3." • *5 = □ – 3*: "This equation means I had some cookies and I ate 3 of them. Now I have 5. How many cookies did I have to start with? Since I have 5 left and I ate 3, I know I started with 8 because I count on from 5. . . 6, 7, 8." Students may use a document camera or interactive whiteboard to display their combining or separating strategies for solving the equations. This gives them the opportunity to communicate and justify their thinking.

Number and Operations in Base Ten (NBT)

Extend the counting sequence.

<u>*Standards*</u> *Students are expected to:*	<u>*Mathematical Practices*</u>	<u>*Explanations and Examples*</u>
1.NBT.A.1. Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral. Connections: *1.NBT.2; 1.RT.3; 1.SL.1; 1.W.2*	*1.MP.2*. Reason abstractly and quantitatively. *1.MP.7*. Look for and make use of structure. *1.MP.8*. Look for and express regularity in repeated reasoning.	Students use objects, words, and/or symbols to express their understanding of numbers. They extend their counting beyond 100 to count up to 120 by counting by 1s. Some students may begin to count in groups of 10 (while other students may use groups of 2s or 5s to count). Counting in groups of 10 as well as grouping objects into 10 groups of 10 will develop students' understanding of place value concepts. Students extend reading and writing numerals beyond 20 to 120. After counting objects, students write the numeral or use numeral cards to represent the number. Given a numeral, students read the numeral, identify the quantity that each digit represents using numeral cards, and count out the given number of objects.  Students should experience counting from different starting points (e.g., start at 83; count to 120). To extend students' understanding of counting, they should be given opportunities to count backwards by ones and tens. They should also investigate patterns in the base 10 system.

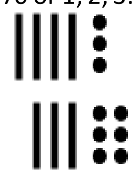
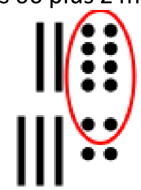
Number and Operations in Base Ten (NBT)

Understand place value.

<u>*Standards*</u> *Students are expected to:*	<u>*Mathematical Practices*</u>	<u>*Explanations and Examples*</u>
1.NBT.B.2 Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases: a. 10 can be thought of as a bundle of ten ones — called a "ten." b. The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones. c. The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones). Connections: *ET01-S1C2-02; ET01-S2C1-01*	*1.MP.2*. Reason abstractly and quantitatively. *1.MP.7.* Look for and make use of structure. *1.MP.8*. Look for and express regularity in repeated reasoning.	Understanding the concept of 10 is fundamental to children's mathematical development. Students need multiple opportunities counting 10 objects and "bundling" them into one group of ten. They count between 10 and 20 objects and make a bundle of 10 with or without some left over (this will help students who find it difficult to write teen numbers). Finally, students count any number of objects up to 99, making bundles of 10s with or without leftovers. As students are representing the various amounts, it is important that an emphasis is placed on the language associated with the quantity. For example, 53 should be expressed in multiple ways such as 53 ones or 5 groups of ten with 3 ones leftover. When students read numbers, they read them in standard form as well as using place value concepts. For example, 53 should be read as "fifty-three" as well as five tens, 3 ones. Reading 10, 20, 30, 40, 50 as "one ten, 2 tens, 3 tens, etc." helps students see the patterns in the number system. Students may use the document camera or interactive whiteboard to demonstrate their "bundling" of objects. This gives them the opportunity to communicate their thinking.
1.NBT.B.3. Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and <. Connections: *1.RI.3; 1.SL.1; 1.W.2*	*1.MP.2.* Reason abstractly and quantitatively. *1.MP.6.* Attend to precision. *1.MP.7.* Look for and make use of structure. *1.MP.8.* Look for and express regularity in repeated reasoning.	Students use models that represent two sets of numbers. To compare, students first attend to the number of tens, then, if necessary, to the number of ones. Students may also use pictures, number lines, and spoken or written words to compare two numbers. Comparative language includes but is not limited to more than, less than, greater than, most, greatest, least, same as, equal to and not equal to.

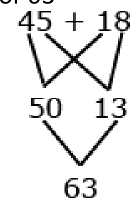
Number and Operations in Base Ten (NBT)

Use place value understanding and properties of operations to add and subtract.

Standards *Students are expected to:*	*Mathematical Practices*	*Explanations and Examples*
1.NBT.C.4. Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10, 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 and explain the reasoning used. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten. Connections: *1.OA.1; 1.OA.2; 1.OA.3; 1.OA.5; 1.OA.6; 1.NBT.2; 1.NBT.5; 1.SL.1; 1.W.2*	*1.MP.2.* Reason abstractly and quantitatively. *1.MP.3.* Construct viable arguments and critique the reasoning of others. *1.MP.4.* Model with mathematics. *1.MP.7.* Look for and make use of structure. *1.MP.8.* Look for and express regularity in repeated reasoning.	Students extend their number fact and place value strategies to add within 100. They represent a problem situation using any combination of words, numbers, pictures, physical objects, or symbols. It is important for students to understand if they are adding a number that has 10s to a number with 10s, they will have more tens than they started with; the same applies to the ones. Also, students should be able to apply their place value skills to decompose numbers. For example, 17 + 12 can be thought of 1 ten and 7 ones plus 1 ten and 2 ones. Numeral cards may help students decompose the numbers into 10s and 1s. Students should be exposed to problems both in and out of context and presented in horizontal and vertical forms. As students are solving problems, it is important that they use language associated with proper place value (see example). They should always explain and justify their mathematical thinking both verbally and in a written format. Estimating the solution prior to finding the answer focuses students on the meaning of the operation and helps them attend to the actual quantities. This standard focuses on developing addition - the intent is not to introduce traditional algorithms or rules. **Examples**: • 43 + 36 Student counts the 10s (10, 20, 30…70 or 1, 2, 3…7 tens) and then the 1s.  • 28 +34 Student thinks: 2 tens plus 3 tens is 5 tens or 50. S/he counts the ones and notices there is another 10 plus 2 more. 50 and 10 is 60 plus 2 more or 62.  *Continued on next page*

Number and Operations in Base Ten (NBT)

Use place value understanding and properties of operations to add and subtract. *continued*

Standards *Students are expected to:*	*Mathematical Practices*	*Explanations and Examples*
1.NBT.C.4. *continued*		• 45 + 18 Student thinks: Four 10s and one 10 are 5 tens or 50. Then 5 and 8 is 5 + 5 + 3 (or 8 + 2 + 3) or 13. 50 and 13 is 6 tens plus 3 more or 63  • 29 +14 Student thinks: "29 is almost 30. I added one to 29 to get to 30. 30 and 14 is 44. Since I added one to 29, I have to subtract one so the answer is 43.
1.NBT.C.5. Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used. Connections: *1.NBT.2; ET01-S1C2-02*	*1.MP.2.* Reason abstractly and quantitatively. *1.MP.3.* Construct viable arguments and critique the reasoning of others. *1.MP.7.* Look for and make use of structure. *1.MP.8.* Look for and express regularity in repeated reasoning.	This standard requires students to understand and apply the concept of 10 which leads to future place value concepts. It is critical for students to do this without counting. Prior use of models such as base ten blocks, number lines, and 100s charts helps facilitate this understanding. It also helps students see the pattern involved when adding or subtracting 10. **Examples**: • 10 more than 43 is 53 because 53 is one more 10 than 43 • 10 less than 43 is 33 because 33 is one 10 less than 43 Students may use interactive versions of models (base ten blocks, 100s charts, number lines, etc.) to develop prior understanding.

Number and Operations in Base Ten (NBT)

Use place value understanding and properties of operations to add and subtract.

Standards *Students are expected to:*	*Mathematical Practices*	*Explanations and Examples*
1.NBT.C.6. Subtract multiples of 10 in the range 10–90 from multiples of 10 in the range 10–90 (positive or zero differences), 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 and explain the reasoning used. Connections: *1.NBT.2; 1.NBT.5; 1.RI.3; 1.W.2; ET01-S1C2-02*	*1.MP.2.* Reason abstractly and quantitatively. *1.MP.3.* Construct viable arguments and critique the reasoning of others. *1.MP.4.* Model with mathematics. *1.MP.5*. Use appropriate tools strategically. *1.MP.7.* Look for and make use of structure. 1.*MP.8.* Look for and express regularity in repeated reasoning.	This standard is foundational for future work in subtraction with more complex numbers. Students should have multiple experiences representing numbers that are multiples of 10 (e.g. 90) with models or drawings. Then they subtract multiples of 10 (e.g. 20) using these representations or strategies based on place value. These opportunities develop fluency of addition and subtraction facts and reinforce counting up and back by 10s. **Examples**: • 70 - 30: Seven 10s take away three 10s is four 10s • 80 - 50: 80, 70 (one 10), 60 (two 10s), 50 (three 10s), 40 (four 10s), 30 (five 10s) • 60 - 40: I know that 4 + 2 is 6 so four 10s + two 10s is six 10s so 60 - 40 is 20 Students may use interactive versions of models (base ten blocks, 100s charts, number lines, etc.) to demonstrate and justify their thinking.

Measurement and Data (MD)

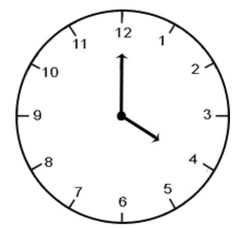
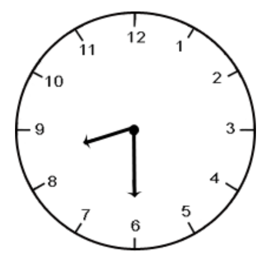
Measure lengths indirectly and by iterating length units.

Standards *Students are expected to:*	Mathematical Practices	Explanations and Examples
1.MD.A.1. Order three objects by length; compare the lengths of two objects indirectly by using a third object. Connections: *1.RI.3; SC01-S1C2-01; SC01-S1C3-01; SC01-S5C1-01; SC01-S1C2-03; ET01-S2C1-01; ET01-S1C2-02*	*1.MP.6*. Attend to precision. *1.MP.7*. Look for and make use of structure.	In order for students to be able to compare objects, students need to understand that length is measured from one end point to another end point. They determine which of two objects is longer by physically aligning the objects. Typical language of length includes taller, shorter, longer, and higher. When students use bigger or smaller as a comparison, they should explain what they mean by the word. Some objects may have more than one measurement of length, so students identify the length they are measuring. Both the length and the width of an object are measurements of length. **Examples for ordering**: • Order three students by their height • Order pencils, crayons, and/or markers by length • Build three towers (with cubes) and order them from shortest to tallest • Three students each draw one line, then order the lines from longest to shortest **Example for comparing indirectly**: • Two students each make a dough "snake." Given a tower of cubes, each student compares his/her snake to the tower. Then students make statements such as, "My snake is longer than the cube tower and your snake is shorter than the cube tower. So, my snake is longer than your snake." Students may use an interactive whiteboard or document camera to demonstrate and justify comparisons.

Measurement and Data (MD) **Measure lengths indirectly and by iterating length units.**		
Standards *Students are expected to:*	*Mathematical Practices*	*Explanations and Examples*
1.MD.A.2. Express the length of an object as a whole number of length units by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. *Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps.* Connections: *1.SL.1; 1.RI.3; ET01-S1C2-02*	*1.MP.5.* Use appropriate tools strategically. *1.MP.6.* Attend to precision. *1.MP.7.* Look for and make use of structure.	Students use their counting skills while measuring with non-standard units. While this standard limits measurement to whole numbers of length, in a natural environment, not all objects will measure to an exact whole unit. When students determine that the length of a pencil is six to seven paperclips long, they can state that it is about six paperclips long. **Example**: • Ask students to use multiple units of the same object to measure the length of a pencil. (How many paper clips will it take to measure how long the pencil is?)  Students may use the document camera or interactive whiteboard to demonstrate their counting and measuring skills.

Measurement and Data (MD)

Tell and write time.

<u>*Standards*</u> *Students are expected to:*	<u>*Mathematical Practices*</u>	<u>*Explanations and Examples*</u>
1.MD.B.3. Tell and write time in hours and half-hours using analog and digital clocks. Connections: *1.SL.1; 1.LRI.3; ET01-S1C2-02; ET01-S2C1-01*	*1.MP.5.* Use appropriate tools strategically. *1.MP.6.* Attend to precision. *1.MP.7.* Look for and make use of structure.	Ideas to support telling time: • within a day, the hour hand goes around a clock twice (the hand moves only in one direction) • when the hour hand points exactly to a number, the time is exactly on the hour • time on the hour is written in the same manner as it appears on a digital clock • the hour hand moves as time passes, so when it is half way between two numbers it is at the half hour • there are 60 minutes in one hour; so halfway between an hour, 30 minutes have passed • half hour is written with "30" after the colon "It is 4 o'clock"  "It is halfway between 8 o'clock and 9 o'clock. It is 8:30."  The idea of 30 being "halfway" is difficult for students to grasp. Students can write the numbers from 0 - 60 counting by tens on a sentence strip. Fold the paper in half and determine that halfway between 0 and 60 is 30. A number line on an interactive whiteboard may also be used to demonstrate this.

Measurement and Data (MD)

Represent and interpret data.

Standards *Students are expected to:*	*Mathematical Practices*	*Explanations and Examples*
1.MD.C.4. Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another. Connections: *1.RI.4; 1.SL.2; 1.SL.3; 1.W.2; ET01-S4C2-02; ET01-S2C1-01; SC01-S1C3-03; SC01-S1C3-04*	*1.MP.2.* Reason abstractly and quantitatively. *1.MP.3.* Construct viable arguments and critique the reasoning of others. *1.MP.4.* Model with mathematics. *1.MP.5*. Use appropriate tools strategically. *1.MP.6.* Attend to precision.	Students create object graphs and tally charts using data relevant to their lives (e.g., favorite ice cream, eye color, pets, etc.). Graphs may be constructed by groups of students as well as by individual students. Counting objects should be reinforced when collecting, representing, and interpreting data. Students describe the object graphs and tally charts they create. They should also ask and answer questions based on these charts or graphs that reinforce other mathematics concepts such as sorting and comparing. The data chosen or questions asked give students opportunities to reinforce their understanding of place value, identifying ten more and ten less, relating counting to addition and subtraction, and using comparative language and symbols. Students may use an interactive whiteboard to place objects onto a graph. This gives them the opportunity to communicate and justify their thinking.

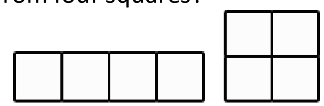
Geometry (G)

Reason with shapes and their attributes.

Standards *Students are expected to:*	*Mathematical Practices*	*Explanations and Examples*
1.G.A.1. Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, overall size); build and draw shapes to possess defining attributes. Connections: *1.RI.3; 1.SL.1; 1.SL.2; ET01-S2C1-01; SC01-S5C1-01*	*1.MP.1.* Make sense of problems and persevere in solving them. *1.MP.3.* Construct viable arguments and critique the reasoning of others. *1.MP.4*. Model with mathematics. *1.MP.7*. Look for and make use of structure.	Attributes refer to any characteristic of a shape. Students use attribute language to describe a given two-dimensional shape: number of sides, number of vertices/points, straight sides, closed. A child might describe a triangle as "right side up" or "red." These attributes are not defining because they are not relevant to whether a shape is a triangle or not. Students should articulate ideas such as, "A triangle is a triangle because it has three straight sides and is closed." It is important that students are exposed to both regular and irregular shapes so that they can communicate defining attributes. Students should use attribute language to describe why these shapes are not triangles.  Students should also use appropriate language to describe a given three-dimensional shape: number of faces, number of vertices/points, number of edges. **Example**: • A cylinder may be described as a solid that has two circular faces connected by a curved surface (which is not considered a face). Students may say, "It looks like a can." Students should compare and contrast two-and three-dimensional figures using defining attributes. **Examples**: • List two things that are the same and two things that are different between a triangle and a cube. • Given a circle and a sphere, students identify the sphere as being three-dimensional but both are round. • Given a trapezoid, find another two-dimensional shape that has two things that are the same. Students may use interactive whiteboards or computer environments to move shapes into different orientations and to enlarge or decrease the size of a shape still keeping the same shape. They can also move a point/vertex of a triangle and identify that the new shape is still a triangle. When they move one point/vertex of a rectangle they should recognize that the resulting shape is no longer a rectangle.

Geometry (G)

Reason with shapes and their attributes.

Standards *Students are expected to:*	*Mathematical Practices*	*Explanations and Examples*
1.G.A.2. Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes (cubes, right rectangular prisms, right circular cones, and right circular cylinders) to create a composite shape, and compose new shapes from the composite shape. (Students do not need to learn formal names such as "right rectangular prism.") Connections: *1.RI.3; 1.SL.1; ET01-S2C1-01*	*1.MP.1.* Make sense of problems and persevere in solving them. *1.MP.4.* Model with mathematics. *1.MP.7*. Look for and make use of structure.	The ability to describe, use and visualize the effect of composing and decomposing shapes is an important mathematical skill. It is not only relevant to geometry, but is related to children's ability to compose and decompose numbers. Students may use pattern blocks, plastic shapes, tangrams, or computer environments to make new shapes. The teacher can provide students with cutouts of shapes and ask them to combine them to make a particular shape. **Example**: • What shapes can be made from four squares?  Students can make three-dimensional shapes with clay or dough, slice into two pieces (not necessarily congruent) and describe the two resulting shapes. For example, slicing a cylinder will result in two smaller cylinders.

Geometry (G)

Reason with shapes and their attributes.

Standards *Students are expected to:*	*Mathematical Practices*	*Explanations and Examples*
1.G.A.3. Partition circles and rectangles into two and four equal shares, describe the shares using the words *halves*, *fourths*, and *quarters*, and use the phrases *half of*, *fourth of*, and *quarter of*. Describe the whole as two of, or four of the shares. Understand for these examples that decomposing into more equal shares creates smaller shares. Connections: *1.RI.3; 1.RI.4; 1.SL.1; 1.SL.2; ET01-S2C1-01*	*1.MP.2.* Reason abstractly and quantitatively. *1.MP.3.* Construct viable arguments and critique the reasoning of others. *1.MP.6.* Attend to precision. *1.MP.7.* Look for and make use of structure.	Students need experiences with different sized circles and rectangles to recognize that when they cut something into two equal pieces, each piece will equal one half of its original whole. Children should recognize that halves of two different wholes are not necessarily the same size. Also they should reason that decomposing equal shares into more equal shares results in smaller equal shares. **Examples**: • Student partitions a rectangular candy bar to share equally with one friend and thinks "I cut the rectangle into two equal parts. When I put the two parts back together, they equal the whole candy bar. One half of the candy bar is smaller than the whole candy bar."  • Student partitions an identical rectangular candy bar to share equally with 3 friends and thinks "I cut the rectangle into four equal parts. Each piece is one fourth of or one quarter of the whole candy bar. When I put the four parts back together, they equal the whole candy bar. I can compare the pieces (one half and one fourth) by placing them side-by-side. One fourth of the candy bar is smaller than one half of the candy bar.  • Students partition a pizza to share equally with three friends. They recognize that they now have four equal pieces and each will receive a fourth or quarter of the whole pizza. 

Standards for Mathematical Practice (MP)		
Standards *Students are expected to:*	***Mathematical Practices*** *are listed throughout the grade level document in the 2nd column to reflect the need to connect the mathematical practices to mathematical content in instruction.*	***Explanations and Examples***
1.MP.1. Make sense of problems and persevere in solving them.		In first grade, students realize that doing mathematics involves solving problems and discussing how they solved them. Students explain to themselves the meaning of a problem and look for ways to solve it. Younger students may use concrete objects or pictures to help them conceptualize and solve problems. They may check their thinking by asking themselves, "Does this make sense?" They are willing to try other approaches.
1.MP.2. Reason abstractly and quantitatively.		Younger students recognize that a number represents a specific quantity. They connect the quantity to written symbols. Quantitative reasoning entails creating a representation of a problem while attending to the meanings of the quantities.
1.MP.3. Construct viable arguments and critique the reasoning of others.		First graders construct arguments using concrete referents, such as objects, pictures, drawings, and actions. They also practice their mathematical communication skills as they participate in mathematical discussions involving questions like "How did you get that?" "Explain your thinking," and "Why is that true?" They not only explain their own thinking, but listen to others' explanations. They decide if the explanations make sense and ask questions.
1.MP.4. Model with mathematics.		In early grades, students experiment with representing problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, acting out, making a chart or list, creating equations, etc. Students need opportunities to connect the different representations and explain the connections. They should be able to use all of these representations as needed.
1.MP.5. Use appropriate tools strategically.		In first grade, students begin to consider the available tools (including estimation) when solving a mathematical problem and decide when certain tools might be helpful. For instance, first graders decide it might be best to use colored chips to model an addition problem.
1.MP.6. Attend to precision.		As young children begin to develop their mathematical communication skills, they try to use clear and precise language in their discussions with others and when they explain their own reasoning.

Standards for Mathematical Practice (MP)		
<u>*Standards*</u> ***Students are expected to:***	<u>*Mathematical Practices*</u> ***are listed throughout the grade level document in the 2nd column to reflect the need to connect the mathematical practices to mathematical content in instruction.***	<u>*Explanations and Examples*</u>
1.MP.7. Look for and make use of structure.		First graders begin to discern a pattern or structure. For instance, if students recognize *12 + 3 = 15,* then they also know *3 + 12 = 15. (Commutative property of addition.)* To add *4 + 6 + 4, the first two numbers can be added to make a ten, so 4 + 6 + 4 = 10 + 4 = 14.*
1.MP.8. Look for and express regularity in repeated reasoning.		In the early grades, students notice repetitive actions in counting and computation, etc. When children have multiple opportunities to add and subtract "ten" and multiples of "ten" they notice the pattern and gain a better understanding of place value. Students continually check their work by asking themselves, "Does this make sense?"

Table 1. Common addition and subtraction situations.[6]

	Result Unknown	Change Unknown	Start Unknown
Add to	Two bunnies sat on the grass. Three more bunnies hopped there. How many bunnies are on the grass now? 2 + 3 = ?	Two bunnies were sitting on the grass. Some more bunnies hopped there. Then there were five bunnies. How many bunnies hopped over to the first two? 2 + ? = 5	Some bunnies were sitting on the grass. Three more bunnies hopped there. Then there were five bunnies. How many bunnies were on the grass before? ? + 3 = 5
Take from	Five apples were on the table. I ate two apples. How many apples are on the table now? 5 – 2 = ?	Five apples were on the table. I ate some apples. Then there were three apples. How many apples did I eat? 5 – ? = 3	Some apples were on the table. I ate two apples. Then there were three apples. How many apples were on the table before? ? – 2 = 3
	Total Unknown	**Addend Unknown**	**Both Addends Unknown[1]**
Put Together / Take Apart[2]	Three red apples and two green apples are on the table. How many apples are on the table? 3 + 2 = ?	Five apples are on the table. Three are red and the rest are green. How many apples are green? 3 + ? = 5, 5 – 3 = ?	Grandma has five flowers. How many can she put in her red vase and how many in her blue vase? 5 = 0 + 5, 5 = 5 + 0 5 = 1 + 4, 5 = 4 + 1 5 = 2 + 3, 5 = 3 + 2
	Difference Unknown	**Bigger Unknown**	**Smaller Unknown**
Compare[3]	("How many more?" version): Lucy has two apples. Julie has five apples. How many more apples does Julie have than Lucy? ("How many fewer?" version): Lucy has two apples. Julie has five apples. How many fewer apples does Lucy have than Julie? 2 + ? = 5, 5 – 2 = ?	(Version with "more"): Julie has three more apples than Lucy. Lucy has two apples. How many apples does Julie have? (Version with "fewer"): Lucy has 3 fewer apples than Julie. Lucy has two apples. How many apples does Julie have? 2 + 3 = ?, 3 + 2 = ?	(Version with "more"): Julie has three more apples than Lucy. Julie has five apples. How many apples does Lucy have? (Version with "fewer"): Lucy has 3 fewer apples than Julie. Julie has five apples. How many apples does Lucy have? 5 – 3 = ?, ? + 3 = 5

[6]Adapted from Box 2-4 of Mathematics Learning in Early Childhood, National Research Council (2009, pp. 32, 33).

[1]These take apart situations can be used to show all the decompositions of a given number. The associated equations, which have the total on the left of the equal sign, help children understand that the = sign does not always mean makes or results in but always does mean is the same number as.

[2]Either addend can be unknown, so there are three variations of these problem situations. Both Addends Unknown is a productive extension of this basic situation, especially for small numbers less than or equal to 10.

[3]For the Bigger Unknown or Smaller Unknown situations, one version directs the correct operation (the version using more for the bigger unknown and using less for the smaller unknown). The other versions are more difficult.