This is the March 2015 version of the Grade 1 Model Curriculum for Mathematics. The current focus of this document is to provide instructional strategies and resources, and to identify connections and misconceptions related to the clusters and standards. The Ohio Department of Education is working in collaboration with assessment consortia, national professional organizations and other multi-state initiatives to develop common content elaborations and learning expectations.

Grade 1	
Domain	**Cluster**
Operations and Algebraic Thinking	• 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	• Extend the counting sequence. • Understand place value. • Use place value understanding and properties of operations to add and subtract.
Measurement and Data	• Measure lengths indirectly and by iterating length units. • Tell and write time. • Represent and interpret data.
Geometry	• Reason with shapes and their attributes.

Grade 1

Domain	**Operations and Algebraic Thinking**
Cluster	***Represent and solve problems involving addition and subtraction.***
Standards	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. 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.

Content Elaborations

Ohio has chosen to support shared interpretation of the standards by linking the work of multistate partnerships as the Mathematics Content Elaborations. Further clarification of the standards can be found through these reliable organizations and their links:

- Achieve the Core Modules, Resources
- Hunt Institute Video examples
- Institute for Mathematics and Education Learning Progressions Narratives
- Illustrative Mathematics Sample tasks
- National Council of Supervisors of Mathematics (NCSM) Resources, Lessons, Items
- National Council of Teacher of Mathematics (NCTM) Resources, Lessons, Items
- Partnership for Assessment of Readiness for College and Careers (PARCC) Resources, Items

Expectations for Learning

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- Calculator Usage
- Accommodations
- Reference Sheets

Instructional Strategies and Resources

Instructional Strategies

Provide opportunities for students to participate in shared problem-solving activities to solve word problems.

Collaborate in small groups to develop problem-solving strategies using a variety of models such as drawings, words, and equations with symbols for the unknown numbers to find the solutions. Additionally students need the opportunity to explain, write and reflect on their problem-solving strategies. The situations for the addition and subtraction story problems should involve sums and differences less than or equal to 20 using the numbers 0 to 20. They need to align with the 12 situations found in Table 1 of the *Common Core State Standards (CCSS) for Mathematics*.

Students need the opportunity of writing and solving story problems involving three addends with a sum that is less than or equal to 20. For example, each student writes or draws a problem in which three whole things are being combined. The students exchange their problems with other students, solving them individually and then discussing their models and solution strategies. Now both students work together to solve each problem using a different strategy.

Literature is a wonderful way to incorporate problem-solving in a context that young students can understand. Many literature books that include mathematical ideas and concepts have been written in recent years. For Grade 1, the incorporation of books that contain a problem situation involving addition and subtraction with numbers 0 to 20 should be included in the curriculum. Use the situations found in Table 1 of the CCSS for guidance in selecting appropriate books. As the teacher reads the story, students use a variety of manipulatives, drawings, or equations to model and find the solution to problems from the story.

Instructional Resources/Tools

ORC # 2807 From the International Reading Association, National Council of Teachers of English and Verizon Thinkfinity: Giant story problems: Reading comprehension through math problem-solving
Using drawings, equations, and written responses, students work cooperatively in two class sessions to solve Giant Story Problems while they gain practice in reading for information.

Common Core State Standards for Mathematics: Common addition and subtraction situations
Table 1 on page 88 in the *Common Core State Standards (CCSS) for School for Mathematics* illustrates 12 addition and subtraction problem situations.

Common Misconceptions

Many children misunderstand the meaning of the equal sign. The equal sign means "is the same as" but most primary students believe the equal sign tells you that the "answer is coming up" to the right of the equal sign. This misconception is over-generalized by only seeing examples of number sentences with an operation to the left of the equal sign and the answer on the right. First graders need to see equations written multiple ways, for example
5 + 7 = 12 and 12 = 5 + 7.

A second misconception that many students have is that it is valid to assume that a key word or phrase in a problem suggests the same operation will be used every time. For example, they might assume that the word *left* always means that subtraction must be used to find a solution. Providing problems in which key words like this are used to represent different operations is essential. For example, the use of the word *left* in this problem does not indicate subtraction as a solution method: Seth took the 8 stickers he no longer wanted and gave them to Anna. Now Seth has 11 stickers *left*. How many stickers did Seth have to begin with? Students need to analyze word problems and avoid using key words to solve them.

Diverse Learners

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Connections:

This cluster is connected to the First Grade Critical Area of Focus #1, **Developing understanding of addition, subtraction, and strategies for addition and subtraction within 20**. More information about this critical area of focus can be found by clicking here.

This cluster is connected to *Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from* in Kindergarten, to *Work with addition and subtraction equations* in Grade 1, and to *Represent and solve problems involving addition and subtraction* and *Add and subtract within 20* in Grade 2.

Grade 1

Domain	Operations and Algebraic Thinking
Cluster	***Understand and apply properties of operations and the relationship between addition and subtraction.***
Standards	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).* 4. Understand subtraction as an unknown-addend problem. *For example, subtract 10 – 8 by finding the number that makes 10 when added to 8.*

Content Elaborations

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Instructional Strategies and Resources

Instructional Strategies

One focus in this cluster is for students to discover and apply the commutative and associative properties as strategies for solving addition problems. Students do not need to learn the names for these properties. It is important for students to share, discuss and compare their strategies as a class. The second focus is using the relationship between addition and subtraction as a strategy to solve unknown-addend problems. Students naturally connect counting on to solving subtraction problems. For the problem "15 – 7 =?" they think about the number they have to add to 7 to get to 15. First graders should be working with sums and differences less than or equal to 20 using the numbers 0 to 20.

Provide investigations that require students to identify and then apply a pattern or structure in mathematics. For example, pose a string of addition and subtraction problems involving the same three numbers chosen from the numbers 0 to 20, like 4 + 13 = 17 and 13 + 4 = 17. Students analyze number patterns and create conjectures or guesses. Have students choose other combinations of three numbers and explore to see if the patterns work for all numbers 0 to 20. Students then share and discuss their reasoning. Be sure to highlight students' uses of the commutative and associative properties and the relationship between addition and subtraction.

Expand the student work to three or more addends to provide the opportunities to change the order and/or groupings to make tens. This will allow the connections between place-value models and the properties of operations for addition to be seen. Understanding the commutative and associative properties builds flexibility for computation and estimation, a key element of number sense.

Provide multiple opportunities for students to study the relationship between addition and subtraction in a variety of ways, including games, modeling and real-world situations. Students need to understand that addition and subtraction

are related, and that subtraction can be used to solve problems where the addend is unknown.

Career Connection

Students will use manipulatives present among various workplaces (e.g., pencils, paper clips, rulers) to show the relationship between addition and subtraction. Host a career speaker in the classroom to discuss how addition and subtraction are essential to their work (e.g., logistics, accounting, health science).

Instructional Resources/Tools

A variety of objects for modeling and solving addition and subtraction problems

Dot Card and Ten Frame Activities (pp. 9-11, 21-24, 26-30, 32-37) Numeracy Project, Winnipeg School Division, 2005-2006

ORC # 3992 From the National Council of Teachers of Mathematics: Balancing equations
In this lesson, students imitate the action of a pan balance and record the modeled subtraction facts in equation form.

ORC # 3978 From the National Council of Teachers of Mathematics: How many left?
This lesson encourages the students to explore unknown-addend problems using the set model and the game *Guess How Many?*

Common Misconceptions

A common misconception is that the commutative property applies to subtraction. After students have discovered and applied the commutative property for addition, ask them to investigate whether this property works for subtraction. Have students share and discuss their reasoning and guide them to conclude that the commutative property does not apply to subtraction.

First graders might have informally encountered negative numbers in their lives, so they think they can take away more than the number of items in a given set, resulting in a negative number below zero. Provide many problems situations where students take away all objects from a set, e.g. 19 - 19 = 0 and focus on the meaning of 0 objects and 0 as a number. Ask students to discuss whether they can take away more objects than what they have.

Diverse Learners

Strategies for meeting the needs of all learners including gifted students, English Language Learners (ELL) and students with disabilities can be found at this site. Additional strategies and resources based on the Universal Design for Learning principles can be found at www.cast.org.

Connections:

This cluster is connected to the First Grade Critical Area of Focus #1**, Developing understanding of addition, subtraction, and strategies for addition and subtraction within 20**. More information about this critical area of focus can be found by clicking here.

This cluster is connected to *Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from* in Kindergarten, to *Add and subtract within 20* and *Use place value understanding and properties of operations to add and subtract* in Grade 1 and to *Use place value understanding and properties of operations to add and subtract* in Grade 2.

Grade 1

Domain	Operations and Algebraic Thinking
Cluster	***Add and subtract within 20.***
Standards	5. Relate counting to addition and subtraction (e.g., by counting on 2 to add 2). 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).

Content Elaborations

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Instructional Strategies and Resources

Instructional Strategies

Provide many experiences for students to construct strategies to solve the different problem types illustrated in Table 1 in the Common Core State Standards on page 88. These experiences should help students combine their procedural and conceptual understandings. Have students invent and refine their strategies for solving problems involving sums and differences less than or equal to 20 using the numbers 0 to 20. Ask them to explain and compare their strategies as a class.

Provide multiple and varied experiences that will help students develop a strong sense of numbers based on comprehension – not rules and procedures. Number sense is a blend of comprehension of numbers and operations and fluency with numbers and operations. Students gain computational fluency (using efficient and accurate methods for computing) as they come to understand the role and meaning of arithmetic operations in number systems.

Primary students come to understand addition and subtraction as they connect counting and number sequence to these operations. Addition and subtraction also involve part to whole relationships. Students' understanding that the whole is made up of parts is connected to decomposing and composing numbers.

Provide numerous opportunities for students to use the *counting on* strategy for solving addition and subtraction problems. For example, provide a ten frame showing 5 colored dots in one row. Students add 3 dots of a different color to the next row and write 5 + 3. Ask students to count on from 5 to find the total number of dots. Then have them add an equal sign and the number eight to 5 + 3 to form the equation 5 + 3 = 8. Ask students to verbally explain how counting

on helps to add one part to another part to find a sum. Discourage students from inventing a counting back strategy for subtraction because it is difficult and leads to errors.

Instructional Resources/Tools

Five-frame and Ten-frame

A variety of objects for counting

A variety of objects for modeling and solving addition and subtraction problems

ORC #4269 From the National Council of Teachers of Mathematics: More and more buttons
Students use buttons to create, model, and record addition sentences in this lesson. A *Sums to Ten* chart is provided for students to use.

ORC # 4312 From the National Council of Teachers of Mathematics: Balancing discoveries
This lesson encourages students to explore another model of addition, the balance model. The exploration also involves recording the modeled addition facts in equation form. Students begin to memorize the addition facts by playing the *Seven-Up* game.

ORC # 4313 From the National Council of Teachers of Mathematics: Seeing doubles
In this lesson, the students focus on dominoes with the same number of spots on each side and on the related addition facts. They make triangle-shaped flash cards for the doubles facts.

Common Misconceptions

Students ignore the need for regrouping when subtracting with numbers 0 to 20 and think that they should always subtract a smaller number from a larger number. For example, students solve 15 – 7 by subtracting 5 from 7 and 0 (0 tens) from 1 to get 12 as the incorrect answer. Students need to relate their understanding of place-value concepts and grouping in tens and ones to their steps for subtraction. They need to show these relationships for each step using mathematical drawings, ten-frames or base-ten blocks so they can understand an efficient strategy for multi-digit subtraction.

Diverse Learners

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Connections:

This cluster is connected to the First Grade Critical Area of Focus #1, **Developing understanding of addition, subtraction, and strategies for addition and subtraction within 20**. More information about this critical area of focus can be found by clicking here.

This cluster is connected to all clusters in the Counting and Cardinality Domain, *Understand addition as putting together and adding to, and understanding subtraction as taking apart and taking from* and *Work with numbers 11-19 to gain foundations for place value* in Kindergarten, to *Understand and apply properties of operations and the relationship between addition and subtraction* in Grade 1, and to *Add and subtract within 20* and *Use place value understanding and properties of operations to add and subtract* in Grade 2.

Grade 1

Domain	**Operations and Algebraic Thinking**
Cluster	***Work with addition and subtraction equations.***
Standards	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.* 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 = ☐.*

Content Elaborations

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Instructional Strategies and Resources

Instructional Strategies

Provide opportunities for students use objects of equal weight and a number balance to model equations for sums and differences less than or equal to 20 using the numbers 0 to 20. Give students equations in a variety of forms that are true and false. Include equations that show the identity property, commutative property of addition, and associative property of addition. Students need not use formal terms for these properties.

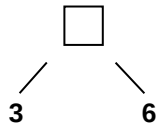
13 = 13	Identity Property
8 + 5 = 5 + 8	Commutative Property for Addition
3 + 7 + 4 = 10 + 4	Associative Property for Addition

Ask students to determine whether the equations are true or false and to record their work with drawings. Students then compare their answers as a class and discuss their reasoning.

Present equations recorded in a nontraditional way, like 13 = 16 – 3 and 9 + 4 = 18 – 5, then ask, “Is this true?”. Have students decide if the equation is true or false. Then as a class, students discuss their thinking that supports their answers.

Provide situations relevant to first graders for these problem types illustrated in Table 1 of the *Common Core State Standards (CCSS)*: Add to / Result Unknown, Take from / Start Unknown, and Add to / Result Unknown. Demonstrate how students can use graphic organizers such as the Math Mountain to help them think about problems.

The Math Mountain shows a sum with diagonal lines going down to connect with the two addends, forming a triangular shape. It shows two known quantities and one unknown quantity. Use various symbols, such as a square, to represent an unknown sum or addend in a horizontal equation. For example, here is a Take from / Start Unknown problem situation such as: Some markers were in a box. Matt took 3 markers to use. There are now 6 markers in the box. How many markers were in the box before? The teacher draws a square to represent the unknown sum and diagonal lines to the numbers 3 and 6.



Have students practice using the Math Mountain to organize their solutions to problems involving sums and differences less than or equal to 20 with the numbers 0 to 20. Then ask them to share their reactions to using the Math Mountain.

Provide numerous experiences for students to compose and decompose numbers less than or equal to 20 using a variety of manipulatives. Have them represent their work with drawings, words, and numbers. Ask students to share their work and thinking with their classmates. Then ask the class to identify similarities and differences in the students' representations.

Instructional Resources/Tools

A variety of objects that can be used for modeling and solving addition and subtraction problems
Number balances
Five-frames and ten-frames
Double ten-frames

ORC # 4321 From the National Council of Teachers of Mathematics: Finding the Balance
This lesson encourages students to explore another model of subtraction, the balance. Students will use real and virtual balances. Students also explore recording the modeled subtraction facts in equation form. Click on *Pan Balance – Shapes* to get to the online tool *Pan Balance – Numbers.* This virtual tool can be used to strengthen students' understanding and computation of numerical expressions and equality.

Common Misconceptions

Many students think that the equals sign means that an operation must be performed on the numbers on the left and the result of this operation is written on the right. They think that the equal sign is like an arrow that means *becomes* and one number cannot be alone on the left. Students often ignore the equal sign in equations that are written in a nontraditional way. For instance, students find the incorrect value for the unknown in the equation $9 = \Delta - 5$ by thinking $9 - 5 = 4$. It is important to provide equations with a single number on the left as in $18 = 10 + 8$. Showing pairs of equations such as $11 = 7 + 4$ and $7 + 4 = 11$ gives students experiences with the meaning of the equal sign as *is the same as* and equations with one number to the left.

Diverse Learners

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Connections:

This cluster is connected to the First Grade Critical Area of Focus #1**, Developing understanding of addition, subtraction, and strategies for addition and subtraction within 20**. More information about this critical area of focus can be found by clicking here.

This cluster is connected to *Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from* in Kindergarten, to *Represent and solve problems involving addition and subtraction* in Grade 1, and to *Represent and solve problems involving addition and subtraction* and *Add and subtract within 20* in Grade 2.

Grade 1

Domain	Number and Operations in Base Ten
Cluster	***Extend the counting sequence.***
Standards	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.

Content Elaborations

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Instructional Strategies and Resources

Instructional Strategies

In this grade, students build on their counting to 100 by ones and tens beginning with numbers other than 1 as they learned in Kindergarten. Students can start counting at any number less than 120 and continue to 120. It is important for students to connect different representations for the same quantity or number. Students use materials to count by ones and tens to a build models that represent a number, then they connect this model to the number word and its representation as a written numeral.

Students learn to use numerals to represent numbers by relating their place-value notation to their models. They build on their experiences with numbers 0 to 20 in Kindergarten to create models for 21 to 120 with groupable and pregroupable materials (see Resources/Tools). Students represent the quantities shown in the models by placing numerals in labeled hundreds, tens and ones columns. They eventually move to representing the numbers in standard form, where the group of hundreds, tens, then singles shown in the model matches the left-to-right order of digits in numbers.

Listen as students orally count to 120 and focus on their transitions between decades and the century number. These transitions will be signaled by a 9 and require new rules to be used to generate the next set of numbers. Students need to listen to their rhythm and pattern as they orally count so they can develop a strong number word list.

Extend hundreds charts by attaching a blank hundreds charts and writing the numbers 101 to 120 in the spaces following the same pattern as in the hundreds chart. Students can use these charts to connect the number symbols with their count words for numbers 1 to 120.

Post the number words in the classroom to help students read and write them.

Instructional Resources/Tools

Groupable models

- Dried beans and a small cup for 10 beans
- Linking cubes
- Plastic chain links

Pregrouped materials

- Base-ten blocks
- Dried beans and beans sticks (10 beans glued on a craft stick)
- Strips (ten connected squares) and squares (singles)
- Ten-frame
- Place-value mat with ten-frames
- Hundreds chart and Blank hundreds chart

Diverse Learners

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Connections:

This cluster is connected to the First Grade Critical Area of Focus #2**, Developing understanding of whole number relationships and place value, including grouping in tens and ones**. More information about this critical area of focus can be found by clicking here.

This cluster is connected to *Know number names and the count sequence* and *Compare numbers* in Kindergarten, and to *Understand place value* in Grade 2.

Grade 1

Domain	Number and Operations in Base Ten
Cluster	***Understand place value.***
Standards	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). 3. Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and <.

Content Elaborations

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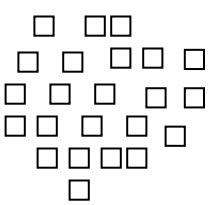
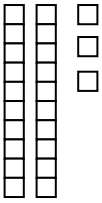
Instructional Strategies and Resources

Instructional Strategies

Essential skills for students to develop include making tens (composing) and breaking a number into tens and ones (decomposing). Composing numbers by tens is foundational for representing numbers with numerals by writing the number of tens and the number of leftover ones. Decomposing numbers by tens builds number sense and the awareness that the order of the digits is important. Composing and decomposing numbers involves number relationships and promotes flexibility with mental computation.

The beginning concepts of place value are developed in Grade 1 with the understanding of ones and tens. The major concept is that putting ten ones together makes a ten and that there is a way to write that down so the same number is always understood. Students move from counting by ones, to creating groups and ones, to tens and ones. It is essential at this grade for students to see and use multiple representations of making tens using base-ten blocks, bundles of tens and ones, and ten-frames. Making the connections among the representations, the numerals and the words are very important. Students need to connect these different representations for the numbers 0 to 99.





Tens	Ones
2	3

23

Twenty-three

Group of ones

Group of 2 tens and 3 ones

Place value table

Write the number

Read and say the number

Students need to move through a progression of representations to learn a concept. They start with a concrete model, move to a pictorial or representational model, then an abstract model. For example, ask students to place a handful of small objects in one region and a handful in another region. Next have them draw a picture of the objects in each region. They can draw a likeness of the objects or use a symbol for the objects in their drawing. Now they count the physical objects or the objects in their drawings in each region and use numerals to represent the two counts. They also say and write the number word. Now students can compare the two numbers using an inequality symbol or an equal sign.

Instructional Resources/Tools

Groupable models

- Dried beans and a small cup for 10 dried beans
- Linking cubes
- Plastic chain links

Pregrouped materials

- Base-ten blocks
- Dried beans and bean sticks (10 dried beans glued on a craft stick)
- Five-frame and Ten-frame
- Place-value mat with ten-frames
- Strips (ten connected squares) and squares (singles)

National Library of Virtual Manipulatives Base Block (Adjust the application to only deal with ones and tens)

Common Misconceptions

Often when students learn to use an aid (Pac Man, bird, alligator, etc.) for knowing which comparison sign (<, >, =) to use, the students don't associate the real meaning and name with the sign. The use of the learning aids must be accompanied by the connection to the names: < Less Than, > Greater Than, and = Equal To. More importantly, students need to begin to develop the understanding of what it means for one number to be greater than another. In Grade 1, it means that this number has more tens, or the same number of tens, but with more ones, making it greater.

Additionally, the symbols are shortcuts for writing down this relationship. Finally, students need to begin to understand that both inequality symbols (<, >) can create true statements about any two numbers where one is greater/smaller than the other, (15 < 28 and 28 >15).

Diverse Learners

Strategies for meeting the needs of all learners including gifted students, English Language Learners (ELL) and students with disabilities can be found at this site. Additional strategies and resources based on the Universal Design for Learning principles can be found at www.cast.org.

Connections:

This cluster is connected to the First Grade Critical Area of Focus #2, **Developing understanding of whole number relationships and place value, including grouping in tens and ones**. More information about this critical area of focus can be found by clicking here.

This cluster is connected to *Work with numbers 11-19 to gain foundations for place value* in Kindergarten, and to *Understand place value* in Grade 2.

Grade 1

Domain	Number and Operations in Base Ten
Cluster	***Use place value understanding and properties of operations to add and subtract.***
Standards	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. 5. Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used. 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.

Content Elaborations

Ohio has chosen to support shared interpretation of the standards by linking the work of multistate partnerships as the Mathematics Content Elaborations. Further clarification of the standards can be found through these reliable organizations and their links:

- Achieve the Core Modules, Resources
- Hunt Institute Video examples
- Institute for Mathematics and Education Learning Progressions Narratives
- Illustrative Mathematics Sample tasks
- National Council of Supervisors of Mathematics (NCSM) Resources, Lessons, Items
- National Council of Teacher of Mathematics (NCTM) Resources, Lessons, Items
- Partnership for Assessment of Readiness for College and Careers (PARCC) Resources, Items

Expectations for Learning

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- Sample Items
- Calculator Usage
- Accommodations
- Reference Sheets

Instructional Strategies and Resources

Instructional Strategies

Provide multiple and varied experiences that will help students develop a strong sense of numbers based on comprehension – not rules and procedures. Number sense is a blend of comprehension of numbers and operations and fluency with numbers and operations. Students gain computational fluency (using efficient and accurate methods for computing) as they come to understand the role and meaning of arithmetic operations in number systems.

Students should solve problems using concrete models and drawings to support and record their solutions. It is important for them to share the reasoning that supports their solution strategies with their classmates.

Students will usually move to using base-ten concepts, properties of operations, and the relationship between addition and subtraction to invent mental and written strategies for addition and subtraction. Help students share, explore, and record their invented strategies. Recording the expressions and equations in the strategies horizontally encourages students to think about the numbers and the quantities they represent. Encourage students to try the mental and written strategies created by their classmates. Students eventually need to choose efficient strategies to use to find accurate solutions.

Students should use and connect different representations when they solve a problem. They should start by building a

concrete model to represent a problem. This will help them form a mental picture of the model. Now students move to using pictures and drawings to represent and solve the problem. If students skip the first step, building the concrete model, they might use finger counting to solve the problem. Finger counting is an inefficient strategy for adding within 100 and subtracting within multiples of 10 between10 and 90.

Have students connect a 0-99 chart or a 1-100 chart to their invented strategy for finding 10 more and 10 less than a given number. Ask them to record their strategy and explain their reasoning.

Instructional Resources/Tools

Groupable models

- Dried beans and a small cup for 10 dried beans
- Linking cubes
- Plastic chain links

Pregrouped materials

- Base-ten blocks
- Dried beans and bean sticks (10 dried beans glued on a craft stick)
- Strips (ten connected squares) and squares (singles)
- Five-frame and Ten-frame
- Place-value mat with ten-frames
- Hundreds chart and Blank hundreds chart

National Library of Virtual Manipulatives Base Ten Block (Adjust the application to deal only with ones and tens)

Diverse Learners

Strategies for meeting the needs of all learners including gifted students, English Language Learners (ELL) and students with disabilities can be found at this site. Additional strategies and resources based on the Universal Design for Learning principles can be found at www.cast.org.

Connections:

This cluster is connected to the First Grade Critical Area of Focus #1, **Developing understanding of addition, subtraction, and strategies for addition and subtraction within 20**. More information about this critical area of focus can be found by clicking here.

This cluster connects to *Understand and apply properties of operations and the relationship between addition and subtraction* and *Understand place value* in Grade 1, and to *Add and subtract within 20*, *Use place value understanding and properties of operations to add and subtract* and *Relate addition and subtraction to length* in Grade 2.

Grade 1

Domain	Measurement and Data
Cluster	***Measure lengths indirectly and by iterating length units.***
Standards	1. Order three objects by length; compare the lengths of two objects indirectly by using a third object. 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.*

Content Elaborations

Ohio has chosen to support shared interpretation of the standards by linking the work of multistate partnerships as the Mathematics Content Elaborations. Further clarification of the standards can be found through these reliable organizations and their links:

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- Illustrative Mathematics Sample tasks
- National Council of Supervisors of Mathematics (NCSM) Resources, Lessons, Items
- National Council of Teacher of Mathematics (NCTM) Resources, Lessons, Items
- Partnership for Assessment of Readiness for College and Careers (PARCC) Resources, Items

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Instructional Strategies and Resources

Instructional Strategies

The measure of an attribute is a count of how many units are needed to fill, cover or match the attribute of the object being measured. Students need to understand what a unit of measure is and how it is used to find a measurement. They need to predict the measurement, find the measurement and then discuss the estimates, errors and the measuring process. It is important for students to measure the same attribute of an object with differently sized units.

It is beneficial to use informal units for beginning measurement activities at all grade levels because they allow students to focus on the attributes being measured. The numbers for the measurements can be kept manageable by simply adjusting the size of the units. Experiences with informal or nonstandard units promote the need for measuring with standard units.

Measurement units share the attribute being measured. Students need to use as many copies of the length unit as necessary to match the length being measured. For instance, use large footprints with the same size as length units. Place the footprints end to end, without gaps or overlaps, to measure the length of a room to the nearest whole footprint. Use language that reflects the approximate nature of measurement, such as the length of the room is about 19 footprints. Students need to also measure the lengths of curves and other distances that are not straight lines.

Students need to make their own measuring tools. For instance, they can place paper clips end to end along a piece of cardboard, make marks at the endpoints of the clips and color in the spaces. Students can now see that the spaces represent the unit of measure, not the marks or numbers on a ruler. Eventually they write numbers in the center of the spaces. Encourage students not to use the end of the ruler as a starting point. Compare and discuss two measurements of the same distance, one found by using a ruler and one found by aligning the actual units end to end,

as in a chain of paper clips. Students should also measure lengths that are longer than a ruler.

Have students use reasoning to compare measurements indirectly, for example to order the lengths of Objects A, B and C, examine then compare the lengths of Object A and Object B and the lengths of Object B and Object C. The results of these two comparisons allow students to use reasoning to determine how the length of Object A compares to the length of Object C. For example, to order three objects by their lengths, reason that if Object A is smaller than Object B and Object B is smaller than Object C, then Object A has to be smaller than Object C. The order of objects by their length from smallest to largest would be Object A - Object B - Object C.

Instructional Resources/Tools

Clothesline rope
Yarn
Toothpicks
Straws
Paper clips
Connecting cubes
Cuisenaire rods
A variety of common two- and three-dimensional objects
Strips of tagboard or cardboard

ORC # 4329 From the National Council of Teachers of Mathematics, Illuminations:
The Length of My Feet This lesson focuses students' attention on the attributes of length and develops their knowledge of and skill in using nonstandard units of measurement.

ORC # 1485 From the American Association for the Advancement of Science: Estimation and Measurement
In this lesson students will use nonstandard units to estimate and measure distances.

Common Misconceptions

Some students may view the measurement process as a procedural counting task. They might count the markings on a ruler rather than the spaces between (the unit of measure). Students need numerous experiences measuring lengths with student-made tapes or rulers with numbers in the center of the spaces.

Diverse Learners

Strategies for meeting the needs of all learners including gifted students, English Language Learners (ELL) and students with disabilities can be found at this site. Additional strategies and resources based on the Universal Design for Learning principles can be found at www.cast.org.

Connections:

This cluster is connected to the First Grade Critical Area of Focus #3**, Developing understanding of linear measurement and measuring lengths as iterating length units**. More information about this critical area of focus can be found by clicking here.

This cluster connects to *Describe and compare measurable attributes* in Kindergarten, and to *Measure and estimate lengths in standard units* and *Represent and interpret data* in Grade 2.

Grade 1

Domain	Measurement and Data
Cluster	***Tell and write time.***
Standards	3. Tell and write time in hours and half hours using analog and digital clocks.

Content Elaborations

Ohio has chosen to support shared interpretation of the standards by linking the work of multistate partnerships as the Mathematics Content Elaborations. Further clarification of the standards can be found through these reliable organizations and their links:

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- Illustrative Mathematics Sample tasks
- National Council of Supervisors of Mathematics (NCSM) Resources, Lessons, Items
- National Council of Teacher of Mathematics (NCTM) Resources, Lessons, Items
- Partnership for Assessment of Readiness for College and Careers (PARCC) Resources, Items

Expectations for Learning

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Instructional Strategies and Resources

Instructional Strategies

Students are likely to experience some difficulties learning about time. On an analog clock, the little hand indicates approximate time to the nearest hour and the focus is on where it is pointing. The big hand shows minutes before and after an hour and the focus is on distance that it has gone around the clock or the distance yet to go for the hand to get back to the top. It is easier for students to read times on digital clocks, but these do not relate times very well.

Students need to experience a progression of activities for learning how to tell time. Begin by using a one-handed clock to tell times in hour and half-hour intervals, then discuss what is happening to the unseen big hand. Next use two real clocks, one with the minute hand removed, and compare the hands on the clocks. Students can predict the position of the missing big hand to the nearest hour or half-hour and check their prediction using the two-handed clock. They can also predict the display on a digital clock given a time on a one- or two-handed analog clock and vice-versa.

Have students tell the time for events in their everyday lives to the nearest hour or half hour.

Make a variety of models for analog clocks. One model uses a strip of paper marked in half hours. Connect the ends with tape to form the strip into a circle.

Instructional Resources/Tools

ORC # 4328 From the National Council of Teachers of Mathematics, Illuminations: Grouchy Lessons of Time This lesson provides an introduction to and practice with the concept of time and hours.

Diverse Learners

Strategies for meeting the needs of all learners including gifted students, English Language Learners (ELL) and students with disabilities can be found at this site. Additional strategies and resources based on the Universal Design for Learning principles can be found at www.cast.org.

Connections:

This cluster is connected to the First Grade Critical Area of Focus #3, **Developing understanding of linear measurement and measuring lengths as iterating length units**. More information about this critical area of focus can be found by clicking here.

This Cluster connects to *Work with time and money* in Grade 2.

Grade 1

Domain	Measurement and Data
Cluster	***Represent and interpret data.***
Standards	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.

Content Elaborations

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- Hunt Institute Video examples
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- Illustrative Mathematics Sample tasks
- National Council of Supervisors of Mathematics (NCSM) Resources, Lessons, Items
- National Council of Teacher of Mathematics (NCTM) Resources, Lessons, Items
- Partnership for Assessment of Readiness for College and Careers (PARCC) Resources, Items

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Instructional Strategies and Resources

Instructional Strategies

Ask students to sort a collection of items in up to three categories. Then ask questions about the number of items in each category and the total number of items. Also ask students to compare the number of items in each category. The total number of items to be sorted should be less than or equal to 100 to allow for sums and differences less than or equal to 100 using the numbers 0 to 100.

Connect to the geometry content studied in Grade 1. Provide categories and have students sort identical collections of different geometric shapes. After the shapes have been sorted, ask these questions: How many triangles are in the collection? How many rectangles are there? How many triangles and rectangles are there? Which category has the most items? How many more? Which category has the least? How many less?

Students can create real or cluster graphs after they have had multiple experiences with sorting objects according to given categories. The teacher should model a cluster graph several times before students make their own. A cluster graph in Grade 1 has two or three labeled loops or regions (categories). Students place items inside the regions that represent a category that they chose. Items that do not fit in a category are placed outside of the loops or regions. Students can place items in a region that overlaps the categories if they see a connection between categories. Ask questions that compare the number of items in each category and the total number of items inside and outside of the regions.

Instructional Resources/Tools

Yarn or large paper for loops

A variety of objects to sort

Geometric shapes

ORC # 5777 From the Charles A. Dana Center, University of Texas at Austin: Buttons, Buttons, Everywhere!
In this lesson students use attributes such as shape, color, size, etc. to describe, compare, and sort buttons.

Diverse Learners

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Connections:

This cluster is connected to the First Grade Critical Area of Focus #3, **Developing understanding of linear measurement and measuring lengths as iterating length units**. More information about this critical area of focus can be found by clicking here.

This cluster connects to *Classify objects and count the number of objects in each category* in Kindergarten, and to *Represent and interpret data* in Grade 2.

Grade 1

Domain	Geometry
Cluster	***Reason with shapes and their attributes***
Standards	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. 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. 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.

Content Elaborations

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- Hunt Institute Video examples
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- Illustrative Mathematics Sample tasks
- National Council of Supervisors of Mathematics (NCSM) Resources, Lessons, Items
- National Council of Teacher of Mathematics (NCTM) Resources, Lessons, Items
- Partnership for Assessment of Readiness for College and Careers (PARCC) Resources, Items

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Instructional Strategies and Resources

Instructional Strategies

Students can easily form shapes on geoboards using colored rubber bands to represent the sides of a shape. Ask students to create a shape with four sides on their geoboard and then copy the shape on dot paper. Students can share and describe their shapes as a class while the teacher records the different defining attributes mentioned by the students.

Pattern block pieces can be used to model defining attributes for shapes. Ask students to create their own rule for sorting pattern blocks. Students take turns sharing their sorting rules with their classmates and showing examples that support their rule. The classmates then draw a new shape that fits this same rule after it is shared.

Students can use a variety of manipulatives and real-world objects to build larger shapes. The manipulatives can include paper shapes, pattern blocks, color tiles, triangles cut from squares (isosceles right triangles), tangrams, canned food (right circular cylinders) and gift boxes (cubes or right rectangular prisms).

Folding shapes made from paper enables students to physically feel the shape and form the equal shares. Ask students to fold circles and rectangles first into halves and then into fourths. They should observe and then discuss the change in the size of the parts.

Instructional Resources/Tools

Paper shapes

Pattern blocks

Color tiles

Isosceles right triangles cut from squares

Tangrams

Canned food (right circular cylinders)

Gift boxes (cubes and right rectangular prisms)

ORC # 1481 From the Math Forum: Introduction to fractions for primary students
http://mathforum.org/varnelle/knum1.html
http://mathforum.org/varnelle/knum2.html
http://mathforum.org/varnelle/knum5.html

This four-lesson unit introduces young children to fractions. Students learn to recognize equal parts of a whole as halves, thirds and fourths.
van Hiele Puzzle

Common Misconceptions

Students may think that a square that has been rotated so that the sides form 45-degree angles with the vertical diagonal is no longer a square but a diamond. They need to have experiences with shapes in different orientations. For example, in the building-shapes strategy above, ask students to orient the smaller shapes in different ways.

Some students may think that the size of the equal shares is directly related to the number of equal shares. For example, they think that fourths are larger than halves because there are four fourths in one whole and only two halves in one whole. Students need to focus on the change in the size of the fractional parts as recommended in the folding shapes strategy. The first activity in the unit *Introduction to Fractions for Primary Students* (referenced above) includes a link, *Parts of a Whole*, to an interactive manipulative. It allows students to divide a circle into the number of equal parts that they choose. Students can easily see the change in the size of the equal shares as they increase or decrease the number of parts.

Diverse Learners

Strategies for meeting the needs of all learners including gifted students, English Language Learners (ELL) and students with disabilities can be found at this site. Additional strategies and resources based on the Universal Design for Learning principles can be found at www.cast.org.

Connections

This cluster is connected to the First Grade Critical Area of Focus #4**, Reasoning about attributes of, and composing and decomposing geometric shapes**. More information about this critical area of focus can be found by clicking here.

This cluster is connected to both clusters in the Geometry Domain in Kindergarten and *to Reason with shapes and their attributes* in Grade 2.