This is the March 2015 version of the Grade 2 Model Curriculum for Mathematics. The current focus of this document is to provide instructional strategies and resources, and identify misconceptions and connections related to the clusters and standards. The Ohio Department of Education is working in collaboration with assessment consortia, national professional organizations and other multistate initiatives to develop common content elaborations and learning expectations.

Grade 2	
Domain	***Cluster***
Operations and Algebraic Thinking	• Represent and solve problems involving addition and subtraction. • Add and subtract within 20. • Work with equal groups of objects to gain foundations for multiplication.
Number and Operations in Base Ten	• Understand place value. • Use place value understanding and properties of operations to add and subtract.
Measurement and Data	• Measure and estimate lengths in standard units. • Relate addition and subtraction to length. • Work with time and money. • Represent and interpret data.
Geometry	• Reason with shapes and their attributes.

Ohio Department of Education

Grade 2

Domain	**Operations and Algebraic Thinking**
Cluster	***Represent and solve problems involving addition and subtraction.***
Standards	1. Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using 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

Ohio has selected PARCC as the contractor for the development of the Next Generation Assessments for Mathematics. PARCC is responsible for the development of the framework, blueprints, items, rubrics, and scoring for the assessments. Further information can be found at Partnership for Assessment of Readiness for College and Careers (PARCC). Specific information is located at these links:

- Model Content Framework
- Item Specifications/Evidence Tables
- Sample Items
- Calculator Usage
- Accommodations
- Reference Sheets

Instructional Strategies and Resources

Instructional Strategies

Students now build on their work with one-step problems to solve two-step problems. Second graders need to model and solve problems for all the situations shown in Table 1 on page 88 in the *Common Core State Standards* and represent their solutions with equations. The problems should involve sums and differences less than or equal to 100 using the numbers 0 to 100. It is vital that students develop the habit of checking their answer to a problem to determine if it makes sense for the situation and the questions being asked.

Ask students to write word problems for their classmates to solve. Start by giving students the answer to a problem. Then tell students whether it is an addition or subtraction problem situation. Also let them know that the sums and differences can be less than or equal to 100 using the numbers 0 to 100. For example, ask students to write an addition word problem for their classmates to solve which requires adding four two-digit numbers with 100 as the answer. Students then share, discuss and compare their solution strategies after they solve the problems.

Instructional Resources/Tools

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 twelve addition and subtraction problem situations.

ORC # 4243 From the National Council of Teachers of Mathematics: Get the Picture—Get the Story
In this lesson, students act as reporters at the Super Bowl. Students study four pictures of things that they would typically find at a football game then create problem situations that correspond to their interpretation of each of the pictures.

Common Misconceptions

Some students end their solution to a two-step problem after they complete the first step. They may have misunderstood the question or only focused on finding an answer to a problem. Students need to check their work to see if their answer makes sense in terms of the problem situation. They need ample opportunities to solve a variety of two-step problems and develop the habit of reviewing their solution after they think they have finished.

Many children have misconceptions about the equal sign. Students can misunderstand the use of the equal sign even if they have proficient computational skills. The equal sign means "is the same as" but most primary students think that the equal sign tells you that the "answer is coming up." Students might only see examples of number sentences with an operation to the left of the equal sign and the answer on the right, so they overgeneralize from those limited examples. They might also be predisposed to think of equality in terms of calculating answers rather than as a relation because it is easier for young children to carry out steps to find an answer than to identify relationships among quantities.

Students might rely on a key word or phrase in a problem to suggest an operation that will lead to an incorrect solution. For example, they might think that the word *left* always means that subtraction must be used to find a solution. Students need to solve problems where key words are contrary to such thinking. 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? It is important that students avoid using key words to solve problems.

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 Second Grade Critical Area of Focus #2, **Building fluency with addition and subtraction**. More information about this critical area of focus can be found by clicking here.

This cluster is connected to *Represent and solve problems involving addition and subtraction* and *Work with addition and subtraction equations* in Grade 1, to *Relate addition and subtraction to length* and *Work with time and money* in Grade 2, and to *Solve problems involving the four operations, and identify and explain patterns in arithmetic* in Grade 3.

Ohio Department of Education

Grade 2

Domain	**Operations and Algebraic Thinking**
Cluster	***Add and subtract within 20***
Standards	2. Fluently add and subtract within 20 using mental strategies. By end of Grade 2, know from memory all sums of two one-digit numbers.

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

Ohio has selected PARCC as the contractor for the development of the Next Generation Assessments for Mathematics. PARCC is responsible for the development of the framework, blueprints, items, rubrics, and scoring for the assessments. Further information can be found at Partnership for Assessment of Readiness for College and Careers (PARCC). Specific information is located at these links:

- Model Content Framework
- Item Specifications/Evidence Tables
- Sample Items
- Calculator Usage
- Accommodations
- Reference Sheets

Instructional Strategies and Resources

Instructional Strategies

Provide many activities that will help students develop a strong understanding of number relationships, addition and subtraction so they can develop, share and use efficient strategies for mental computation. An efficient strategy is one that can be done mentally and quickly. 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. Efficient mental processes become automatic with use.

Provide activities in which students apply the commutative and associative properties to their mental strategies for sums less or equal to 20 using the numbers 0 to 20.

Have students study how numbers are related to 5 and 10 so they can apply these relationships to their strategies for knowing 5 + 4 or 8 + 3. Students might picture 5 + 4 on a ten-frame to mentally see 9 as the answer. For remembering 8 + 7, students might think “since 8 is 2 away from 10, take 2 away from 7 to make 10 + 5 = 15.”

Provide simple word problems designed for students to invent and try a particular strategy as they solve it. Have students explain their strategies so that their classmates can understand it. Guide the discussion so that the focus is on the methods that are most useful. Encourage students to try the strategies that were shared so they can eventually adopt efficient strategies that work for them.

Make posters for student-developed mental strategies for addition and subtraction within 20. Use names for the strategies that make sense to the students and include examples of the strategies.

Present a particular strategy along with the specific addition and subtraction facts relevant to the strategy. Have students use objects and drawings to explore how these facts are alike.

Instructional Resources/Tools

Five-frames and ten-frames

ORC # 4308 From the National Council of Teachers of Mathematics: Looking back and moving forward

In the game Race to Zero at the bottom of the page, students take turns rolling a number cube and subtracting the number they rolled each time from 20. The first person to reach 0 wins the round.

ORC # 4314 From the National Council of Teachers of Mathematics: Finding fact families
In this lesson, the relationship of subtraction to addition is introduced with a book and with dominoes.

Common Misconceptions

Students may overgeneralize the idea that answers to addition problems must be bigger. Adding 0 to any number results in a sum that is equal to that number. Provide word problems involving 0 and have students model them using drawings with an empty space for 0.

Students are usually proficient when they focus on a strategy relevant to particular facts. When these facts are mixed with others, students may revert to counting as a strategy and ignore the efficient strategies they learned. Provide a list of facts from two or more strategies and ask students to name a strategy that would work for that fact. Students explain why they chose that strategy then show how to use it.

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 Second Grade Critical Area of Focus #2, **Building fluency with addition and subtraction**. More information about this critical area of focus can be found by clicking here.

This cluster is connected to *Represent and solve problems involving addition and subtraction* and *Add and subtract within 20* in Grade 1, and to *Use place value understanding and properties of operations to add and subtract* in Grade 2.

Grade 2

Domain	Operations and Algebraic Thinking
Cluster	***Work with equal groups of objects to gain foundations for multiplication.***
Standards	3. Determine whether a group of objects (up to 20) has an odd or even number of members, e.g., by pairing objects or counting them by 2s; write an equation to express an even number as a sum of two equal addends. 4. Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal addends.

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

Ohio has selected PARCC as the contractor for the development of the Next Generation Assessments for Mathematics. PARCC is responsible for the development of the framework, blueprints, items, rubrics, and scoring for the assessments. Further information can be found at Partnership for Assessment of Readiness for College and Careers (PARCC). Specific information is located at these links:

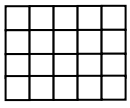
- Model Content Framework
- Item Specifications/Evidence Tables
- Sample Items
- Calculator Usage
- Accommodations
- Reference Sheets

Instructional Strategies and Resources

Instructional Strategies

Students need to understand that a collection of objects can be one thing (a group) and that a group contains a given number of objects. Investigate separating no more than 20 objects into two equal groups. Find the numbers (the total number of objects in collections up to 20 members) that will have some objects and no objects remaining after separating the collections into two equal groups. Odd numbers will have some objects remaining while even numbers will not. For an even number of objects in a collection, show the total as the sum of equal addends (repeated addition).

A rectangular array is an arrangement of objects in horizontal rows and vertical columns. Arrays can be made out of any number of objects that can be put into rows and columns. All rows contain the same number of items and all columns contain an equal number of items. Have students use objects to build all the arrays possible with no more than 25 objects. Their arrays should have up to 5 rows and up to 5 columns. Ask students to draw the arrays on grid paper and write two different equations under the arrays: one showing the total as a sum by rows and the other showing the total as a sum by columns. Both equations will show the total as a sum of equal addends.



The equation by rows: $20 = 5 + 5 + 5 + 5$

The equation by columns: $20 = 4 + 4 + 4 + 4 + 4$

Build on knowledge of composing and decomposing numbers to investigate arrays with up to 5 rows and up to 5 columns in different orientations. For example, form an array with 3 rows and 4 objects in each row. Represent the total number of objects with equations showing a sum of equal addends two different ways: by rows, $12 = 4 + 4 + 4$; by columns, $12 = 3 + 3 + 3 + 3$. Rotate the array 90° to form 4 rows with 3 objects in each row. Write two different

equations to represent 12 as a sum of equal addends: by rows, 12 = 3 + 3 + 3 + 3; by columns, 12 = 4 + 4 + 4. Have students discuss this statement and explain their reasoning: The two arrays are different and yet the same.

Ask students to think of a full ten-frame showing 10 circles as an array. One view of the ten-frame is 5 rows with 2 circles in each row. Students count by rows to 10 and write the equation 10 = 2 + 2 + 2 + 2 + 2. Then students put two full ten-frames together end-to-end so they form 10 rows of 2 circles or 10 columns of 2 circles. They use this larger array to count by 2s up to 20 and write an equation that shows 20 equal to the sum of ten 2s.

Instructional Resources/Tools

Grid paper

Five-frames and ten-frames

Tiles

Linking cubes

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 Second Grade Critical Area of Focus #2, **Building fluency with addition and subtraction** and #4, **Describing and analyzing shapes**. More information about this critical area of focus can be found by clicking here.

This cluster is connected to *Work with addition and subtraction equations* 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.

Ohio Department of Education

Grade 2

Domain	Number and Operations in Base Ten
Cluster	*Understand place value*
Standards	1. Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. Understand the following as special cases: a. 100 can be thought of as a bundle of ten tens — called a "hundred." b. The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones). 2. Count within 1000; skip-count by 5s, 10s, and 100s. 3. Read and write numbers to 1000 using base-ten numerals, number names, and expanded form. 4. Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using >, =, and < symbols to record the results of comparisons.

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

Ohio has selected PARCC as the contractor for the development of the Next Generation Assessments for Mathematics. PARCC is responsible for the development of the framework, blueprints, items, rubrics, and scoring for the assessments. Further information can be found at Partnership for Assessment of Readiness for College and Careers (PARCC). Specific information is located at these links:

- Model Content Framework
- Item Specifications/Evidence Tables
- Sample Items
- Calculator Usage
- Accommodations
- Reference Sheets

Instructional Strategies and Resources

Instructional Strategies

The understanding that 100 is 10 tens or 100 ones is critical to the understanding of place value. Using proportional models like base-ten blocks and bundles of tens along with numerals on place-value mats provides connections between physical and symbolic representations of a number. These models can be used to compare two numbers and identify the value of their digits.

Model three-digit numbers using base-ten blocks in multiple ways. For example, 236 can be 236 ones, or 23 tens and 6 ones, or 2 hundreds, 3 tens and 6 ones, or 20 tens and 36 ones. Use activities and games that have students match different representations of the same number.

Provide games and other situations that allow students to practice skip-counting. Students can use nickels, dimes and dollar bills to skip count by 5, 10 and 100. Pictures of the coins and bills can be attached to models familiar to students: a nickel on a five-frame with 5 dots or pennies and a dime on a ten-frame with 10 dots or pennies.

On a number line, have students use a clothespin or marker to identify the number that is ten more than a given number or five more than a given number.

Have students create and compare all the three-digit numbers that can be made using numbers from 0 to 9. For instance, using the numbers 1, 3, and 9, students will write the numbers 139, 193, 319, 391, 913 and 931. When students compare the numerals in the hundreds place, they should conclude that the two numbers with 9 hundreds

would be greater than the numbers showing 1 hundred or 3 hundreds. When two numbers have the same digit in the hundreds place, students need to compare their digits in the tens place to determine which number is larger.

Instructional Resources/Tools

Base-ten blocks
Pictures of nickels and dimes
Base-ten grid paper
Five-frames and Ten-frames
Online resource for base-ten blocks
Online resource for hundreds chart, use for counting by 5s and 10s
Online place value number line

Common Misconceptions

Some students may not move beyond thinking of the number 358 as 300 ones plus 50 ones plus 8 ones to the concept of 8 singles, 5 bundles of 10 singles or tens, and 3 bundles of 10 tens or hundreds. Use base-ten blocks to model the collecting of 10 ones (singles) to make a ten (a rod) or 10 tens to make a hundred (a flat). It is important that students connect a group of 10 ones with the word *ten* and a group of 10 tens with the word *hundred.*

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 Second Grade Critical Area of Focus #1, **Extending understanding of base-ten notation**. More information about this critical area of focus can be found by clicking here.

This cluster is connected to *Extend the counting sequence* and *Understand place value* in Grade 1, to *Work with equal groups of objects to gain foundations for multiplication* in Grade 2, and to *Use place value understanding and properties of operations to perform multi-digit arithmetic* in Grade 3.

Ohio Department of Education

Grade 2

Domain	Number and Operations in Base Ten
Cluster	***Use place value understanding and properties of operations to add and subtract.***
Standards	5. Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction. 6. Add up to four two-digit numbers using strategies based on place value and properties of operations. 7. Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds. 8. Mentally add 10 or 100 to a given number 100–900, and mentally subtract 10 or 100 from a given number 100–900. 9. Explain why addition and subtraction strategies work, using place value and the properties of operations.

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

Ohio has selected PARCC as the contractor for the development of the Next Generation Assessments for Mathematics. PARCC is responsible for the development of the framework, blueprints, items, rubrics, and scoring for the assessments. Further information can be found at Partnership for Assessment of Readiness for College and Careers (PARCC). Specific information is located at these links:

- Model Content Framework
- Item Specifications/Evidence Tables
- Sample Items
- Calculator Usage
- Accommodations
- Reference Sheets

Instructional Strategies and Resources

Instructional Strategies

Provide many activities that will help students develop a strong understanding of number relationships, addition and subtraction so they can develop, share and use efficient strategies for mental computation. An efficient strategy is one that can be done mentally and quickly. 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. Efficient mental processes become automatic with use.

Students need to build on their flexible strategies for adding within 100 in Grade 1 to fluently add and subtract within 100, add up to four two-digit numbers, and find sums and differences less than or equal to 1000 using numbers 0 to 1000.

Initially, students apply base-ten concepts and use direct modeling with physical objects or drawings to find different ways to solve problems. They move to inventing strategies that do not involve physical materials or counting by ones to solve problems. Student-invented strategies likely will be based on place-value concepts, the commutative and associative properties, and the relationship between addition and subtraction. These strategies should be done mentally or with a written record for support.

It is vital that student-invented strategies be shared, explored, recorded and tried by others. Recording the expressions and equations in the strategies horizontally encourages students to think about the numbers and the quantities they represent instead of the digits. Not every student will invent strategies, but all students can and will try strategies they have seen that make sense to them. Different students will prefer different strategies.

Students will decompose and compose tens and hundreds when they develop their own strategies for solving problems where regrouping is necessary. They might use the make-ten strategy (37 + 8 = 40 + 5 = 45, add 3 to 37 then 5) or (62 - 9 = 60 – 7 = 53, take off 2 to get 60, then 7 more) because no ones are exchanged for a ten or a ten for ones.

Have students analyze problems before they solve them. Present a variety of subtraction problems within 1000. Ask students to identify the problems requiring them to decompose the tens or hundreds to find a solution and explain their reasoning.

Instructional Resources/Tools

Groupable materials

- Dried beans and small cups for groups of 10 beans
- Linking cubes
- Plastic chain links

Pregrouped materials

- Base-ten blocks
- Dried beans and beans sticks (10 dried beans glued on a craft stick – 10 sticks can be bundled for 100)
- Strips (ten connected squares) and squares (singles)
- Ten-frame
- Place-value mat with ten-frames
- Hundreds chart (numbers 1-100) and blank hundreds chart (add numbers 101-120 and attach to hundreds chart)

Common Misconceptions

Students may think that the 4 in 46 represents 4, not 40. Students need many experiences representing two-and three-digit numbers with groupable then pregrouped materials.

When adding two-digit numbers, some students might start with the digits in the ones place and record the entire sum. Then they add the digits in the tens place and record this sum. Assess students' understanding of *a ten* and provide more experiences modeling addition with grouped and pregrouped base-ten materials.

When subtracting two-digit numbers, students might start with the digits in the ones place and subtract the smaller digit from the larger digit. Then they move to the tens and the hundreds places and subtract the smaller digits from the larger digits. Assess students' understanding of *a ten* and provide more experiences modeling subtraction with grouped and pregrouped base-ten materials.

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 Second Grade Critical Area of Focus #2, **Building fluency with addition and subtraction**. More information about this critical area of focus can be found by clicking here.

This cluster is connected to *Understand and apply properties of operations and the relationship between addition and subtraction* and *Add and subtract within 20 and Use place value understanding and properties of operations to add and subtract* in Grade 1, to *Add and subtract within 20* in Grade 2, and to *Use place value understanding and properties of operations to perform multi-digit arithmetic* in Grade 3.

Ohio Department of Education

Grade 2

Domain	Measurement and Data
Cluster	***Measure and estimate lengths in standard units.***
Standards	1. Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes. 2. Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen. 3. Estimate lengths using units of inches, feet, centimeters, and meters. 4. Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.

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

Ohio has selected PARCC as the contractor for the development of the Next Generation Assessments for Mathematics. PARCC is responsible for the development of the framework, blueprints, items, rubrics, and scoring for the assessments. Further information can be found at Partnership for Assessment of Readiness for College and Careers (PARCC). Specific information is located at these links:

- Model Content Framework
- Item Specifications/Evidence Tables
- Sample Items
- Calculator Usage
- Accommodations
- Reference Sheets

Instructional Strategies and Resources

Instructional Strategies

Second graders are transitioning from measuring lengths with informal or nonstandard units to measuring with these standard units: inches, feet, centimeters, and meters. The measure of length is a count of how many units are needed to match the length of the object or distance being measured. Students have to understand what a length unit is and how it is used to find a measurement. They need many experiences measuring lengths with appropriate tools so they can become very familiar with the standard units and estimate lengths. Use language that reflects the approximate nature of measurement, such as the length of the room is about 26 feet.

Have students measure the same length with different-sized units then discuss what they noticed. Ask questions to guide the discussion so students will see the relationship between the size of the units and measurement, i.e. the measurement made with the smaller unit is more than the measurement made with the larger unit and vice versa.

Insist that students always estimate lengths before they measure. Estimation helps them focus on the attribute to be measured, the length units, and the process. After they find measurements, have students discuss the estimates, their procedures for finding the measurements and the differences between their estimates and the measurements.

Instructional Resources/Tools

Centimeter rulers and tapes
Inch rulers and tapes
Yardsticks
Meter sticks

Common Misconceptions

When some students see standard rulers with numbers on the markings, they believe that the numbers are counting the marks instead of the units or spaces between the marks. Have students use informal or standard length units to make their own rulers by marking each whole unit with a number in the middle. They will see that the ruler is a representation of a row of units and focus on the spaces.

Some students might think that they can only measure lengths with a ruler starting at the left edge. Provide situations where the ruler does not start at zero. For example, a ruler is broken and the first inch number that can be seen is 2. If a pencil is measured and it is 9 inches on this ruler, the students must subtract 2 inches from the 9 inches to adjust for where the measurement started.

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 Second Grade Critical Area of Focus #3, **Using standard units of measure**. More information about this critical area of focus can be found by clicking here.

This cluster connects to *Measure lengths indirectly and by iterating length unit*s in Grade 1, and to *Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures* in Grade 3.

Ohio Department of Education

Grade 2

Domain	Measurement and Data
Cluster	***Relate addition and subtraction to length.***
Standards	5. Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem. 6. Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2, ..., and represent whole-number sums and differences within 100 on a number line diagram.

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

Ohio has selected PARCC as the contractor for the development of the Next Generation Assessments for Mathematics. PARCC is responsible for the development of the framework, blueprints, items, rubrics, and scoring for the assessments. Further information can be found at Partnership for Assessment of Readiness for College and Careers (PARCC). Specific information is located at these links:

- Model Content Framework
- Item Specifications/Evidence Tables
- Sample Items
- Calculator Usage
- Accommodations
- Reference Sheets

Instructional Strategies and Resources

Instructional Strategies

Connect the whole-number units on rulers, yardsticks, meter sticks and measuring tapes to number lines showing whole-number units starting at 0. Use these measuring tools to model different representations for whole-number sums and differences less than or equal to 100 using the numbers 0 to 100.

Use the meter stick to view units of ten (10 cm) and hundred (100 cm), and to skip count by 5s and 10s.

Provide one- and two-step word problems that include different lengths measurement made with the same unit (inches, feet, centimeters, and meters). Students add and subtract within 100 to solve problems for these situations: adding to, taking from, putting together, taking apart, and comparing, and with unknowns in all positions. Students use drawings and write equations with a symbol for the unknown to solve the problems.

Have students represent their addition and subtraction within 100 on a number line. They can use notebook or grid paper to make their own number lines. First they mark and label a line on paper with whole-number units that are equally spaced and relevant to the addition or subtraction problem. Then they show the addition or subtraction using curved lines segments above the number line and between the numbers marked on the number line. For 49 + 5, they start at 49 on the line and draw a curve to 50, then continue drawing curves to 54. Drawing the curves or making the “hops” between the numbers will help students focus on a space as the length of a unit and the sum or difference as a length.

Instructional Resources/Tools
Rulers
Yardsticks
Meter sticks
Measuring tapes
Cash register tapes or paper strips

ORC # 3991 From the National Council of Teachers of Mathematics: Hopping Backward to Solve Problems
In this lesson, students determine differences using the number line to compare lengths.

ORC # 3979 From the National Council of Teachers of Mathematics: Where Will I Land?
In this lesson, the students find differences using the number line, a continuous model for subtraction.

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 Second Grade Critical Area of Focus #2, **Building fluency with addition and subtraction**. More information about this critical area of focus can be found by clicking here.

This cluster connects *to Use place value understanding and properties of operations to add and subtract* in Grade 1, to *Represent and solve problems involving addition and subtraction* in Grade 2, and to *Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures* in Grade 3.

Ohio Department of Education

Grade 2

Domain	Measurement and Data
Cluster	***Work with time and money.***
Standards	7. Tell and write time from analog and digital clocks to the nearest five minutes, using a.m. and p.m. 8. Solve word problems involving dollar bills, quarters, dimes, nickels, and pennies, using $ and ¢ symbols appropriately. *Example: If you have 2 dimes and 3 pennies, how many cents do you have?*

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

Ohio has selected PARCC as the contractor for the development of the Next Generation Assessments for Mathematics. PARCC is responsible for the development of the framework, blueprints, items, rubrics, and scoring for the assessments. Further information can be found at Partnership for Assessment of Readiness for College and Careers (PARCC). Specific information is located at these links:

- Model Content Framework
- Item Specifications/Evidence Tables
- Sample Items
- Calculator Usage
- Accommodations
- Reference Sheets

Instructional Strategies and Resources

Instructional Strategies

Second graders expand their work with telling time from analog and digital clocks to the nearest hour or half-hour in Grade 1 to telling time to the nearest five minutes using a.m. and p.m.

The topic of money begins at Grade 2 and builds on the work in other clusters in this and previous grades. Help students learn money concepts and solidify their understanding of other topics by providing activities where students make connections between them. For instance, link the value of a dollar bill as 100 cents to the concept of 100 and counting within 1000. Use play money - nickels, dimes, and dollar bills to skip count by 5s, 10s, and 100s. Reinforce place value concepts with the values of dollar bills, dimes, and pennies.

Students use the context of money to find sums and differences less than or equal to 100 using the numbers 0 to 100. They add and subtract to solve one- and two-step word problems involving money situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions. Students use drawings and equations with a symbol for the unknown number to represent the problem. The dollar sign, $, is used for labeling whole-dollar amounts without decimals, such as $29.

Students need to learn the relationships between the values of a penny, nickel, dime, quarter and dollar bill.

Career Connection

Students will use play money to solve real-work, word problems. Arrange a field trip to your local bank or credit union where students can interview professionals who count money and interact with math in their work (e.g., bank teller, loan officer, investment banker).

Instructional Resources/Tools

Play money

Coin Box

This game will help students learn how to count, collect, exchange and make change for coins.

From the National Library of Virtual Manipulatives, Utah State University: Time – Match Clocks

Students manipulate a digital clock to show the time given on an analog clock. They can also manipulate the hands on a face clock to show the time given on a digital clock. Times are given to the nearest five minutes.

ORC # 1133 From the National Council of Teachers of Mathematics: Number Cents

In this unit, students explore the relationship between pennies, nickels, dimes, and quarters. They count sets of mixed coins, write story problems that involve money, and use coins to make patterns.

Common Misconceptions

Some students might confuse the hour and minutes hands. For the time of 3:45, they say the time is 9:15. Also, some students name the numeral closest to the hands, regardless of whether this is appropriate. For instance, for the time of 3:45 they say the time is 3:09 or 9:03. Assess students' understanding of the roles of the minute and hour hands and the relationship between them. Provide opportunities for students to experience and measure times to the nearest five minutes and the nearest hour. Have them focus on the movement and features of the hands.

Students might overgeneralize the value of coins when they count them. They might count them as individual objects. Also some students think that the value of a coin is directly related to its size, so the bigger the coin, the more it is worth. Place pictures of a nickel on the top of five-frames that are filled with pictures of pennies. In like manner, attach pictures of dimes and pennies to ten-frames and pictures of quarters to 5 x 5 grids filled with pennies. Have students use these materials to determine the value of a set of coins in cents.

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 Second Grade Critical Area of Focus #2, **Building fluency with addition and subtraction, and beyond the critical area of focus in addressing, telling time and writing time**. More information about these critical area of focus can be found by clicking here.

This cluster connects to *Tell and write time in* Grade 1, to *Represent and solve problems involving addition and subtraction* in Grade 2, and to *Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses* of objects in Grade 3.

Grade 2

Domain	**Measurement and Data**
Cluster	***Represent and interpret data.***
Standards	9. Generate measurement data by measuring lengths of several objects to the nearest whole unit, or by making repeated measurements of the same object. Show the measurements by making a line plot, where the horizontal scale is marked off in whole-number units. 10. Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put together, take-apart, and compare problems using information presented in a bar graph.

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

Ohio has selected PARCC as the contractor for the development of the Next Generation Assessments for Mathematics. PARCC is responsible for the development of the framework, blueprints, items, rubrics, and scoring for the assessments. Further information can be found at Partnership for Assessment of Readiness for College and Careers (PARCC). Specific information is located at these links:

- Model Content Framework
- Item Specifications/Evidence Tables
- Sample Items
- Calculator Usage
- Accommodations
- Reference Sheets

Instructional Strategies and Resources

Instructional Strategies

Line plots are useful tools for collecting data because they show the number of things along a numeric scale. They are made by simply drawing a number line then placing an X above the corresponding value on the line that represents each piece of data. Line plots are essentially bar graphs with a potential bar for each value on the number line.

Pose a question related to the lengths of several objects. Measure the objects to the nearest whole inch, foot, centimeter or meter. Create a line plot with whole-number units (0, 1, 2, ...) on the number line to represent the measurements.

At first students should create real object and picture graphs so each row or bar consists of countable parts. These graphs show items in a category and do not have a numerical scale. For example, a real object graph could show the students' shoes (one shoe per student) lined end to end in horizontal or vertical rows by their color. Students would simply count to find how many shoes are in each row or bar. The graphs should be limited to 2 to 4 rows or bars.

Students would then move to making horizontal or vertical bar graphs with two to four categories and a single-unit scale. Use the information in the graphs to pose and solve simple put together, take-apart, and compare problems illustrated in Table 1 of the *Common Core State Standards*.

Instructional Resources/Tools

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.

National Library of Virtual Manipulatives, Utah State University: Bar Chart
This manipulative can be used to make a bar chart with 1 to 20 for the vertical axis and 1 to 12 bars on the horizontal axis. The colors for the bars are predetermined however users can type in their own title for the graph and labels for the bars.

Common Misconceptions

The attributes for the same kind of object can vary. This will cause equal values in an object graph to appear unequal. For example, when making an object graph using shoes for boys and girls, five adjacent boy shoes would likely appear longer than five adjacent girl shoes. To standardize the objects, place the objects on the same-sized construction paper, then make the object graph.

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 goes beyond the Second Grade Critical Area of Focus to address, Using data representations. More information about this critical area of focus can be found by clicking here.

This cluster connects to *Measure lengths indirectly and by iterating length units* and *Represent and interpret data* in Grade 1, and to *Represent and interpret data* in Grade 3.

Ohio Department of Education

Grade 2

Domain	Geometry
Cluster	***Reason with shapes and their attributes***
Standards	1. Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces. Identify triangles, quadrilaterals, pentagons, hexagons, and cubes. 2. Partition a rectangle into rows of same-size squares and count to find the total number of them. 3. Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words halves, thirds, half of, a third of, etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape.

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

Ohio has selected PARCC as the contractor for the development of the Next Generation Assessments for Mathematics. PARCC is responsible for the development of the framework, blueprints, items, rubrics, and scoring for the assessments. Further information can be found at Partnership for Assessment of Readiness for College and Careers (PARCC). Specific information is located at these links:

- Model Content Framework
- Item Specifications/Evidence Tables
- Sample Items
- Calculator Usage
- Accommodations
- Reference Sheets

Instructional Strategies and Resources

Instructional Strategies

Modeling multiplication with partitioned rectangles promotes students' understanding of multiplication. Tell students that they will be drawing a square on grid paper. The length of each side is equal to 2 units. Ask them to guess how many 1 unit by 1 unit squares will be inside this 2 unit by 2 unit square. Students now draw this square and count the 1 by 1 unit squares inside it. They compare this number to their guess. Next, students draw a 2 unit by 3 unit rectangle and count how many 1 unit by 1 unit squares are inside. Now they choose the two dimensions for a rectangle, predict the number of 1 unit by 1 unit squares inside, draw the rectangle, count the number of 1 unit by 1 unit squares inside and compare this number to their guess. Students repeat this process for different-size rectangles. Finally, ask them to what they observed as they worked on the task.

It is vital that students understand different representations of fair shares. Provide a collection of different-size circles and rectangles cut from paper. Ask students to fold some shapes into halves, some into thirds, and some into fourths. They compare the locations of the folds in their shapes as a class and discuss the different representations for the fractional parts. To fold rectangles into thirds, ask students if they have ever seen how letters are folded to be placed in envelopes. Have them fold the paper very carefully to make sure the three parts are the same size. Ask them to discuss why the same process does not work to fold a circle into thirds.

Instructional Resources/Tools

Grid paper

ORC # 1481 From the Math Forum: Introduction to fractions for primary students

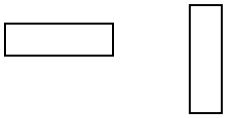
http://mathforum.org/varnelle/knum1.html

http://mathforum.org/varnelle/knum2.html
http://mathforum.org/varnelle/knum5.html

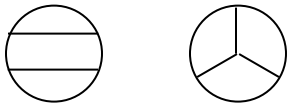
This four-lesson unit introduces young children to fractions. Students learn to recognize equal parts of a whole as halves, thirds and fourths.

Common Misconceptions

Some students may think that a shape is changed by its orientation. They may see a rectangle with the longer side as the base, but claim that the same rectangle with the shorter side as the base is a different shape. This is why is it so important to have young students handle shapes and physically feel that the shape does not change regardless of the orientation, as illustrated below.



Students also may believe that a region model represents one out of two, three or four fractional parts without regard to the fact that the parts have to be equal shares, e.g., a circle divided by two equally spaced horizontal lines represents three thirds.



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 Second Grade Critical Area of Focus #4**, Describing and analyzing shapes**. More information about this critical area of focus can be found by clicking here.

This cluster connects to *Reason with shapes and their attributes* in Grade 1, and to *Develop understanding of fractions as numbers* and *Reason with shapes and their attributes* in Grade 3.