Grade 2 Math Unit 1-Operations and Algebraic Thinking

UNIT OVERVIEW

Second grade work centers around 4 Critical Focus Areas. This unit addresses work from 2 areas, #1 Extending understanding of base-ten notation and #2 Building fluency with addition and subtraction. (See Connections for further explanation).

This unit connects to work in 5 clusters:
-Represent and solve problems involving addition and subtraction * (See Connections for further explanation)
-Add and subtract within 20
-Work with equal groups of objects to gain foundations for multiplication **
- Understand place value ***
- Understand place value and properties of operations to add and subtract ****

Students will:
-solve one-and two-step word problems
-fluently add and subtract within 20 using mental strategies
-fluently add and subtract within 100 using strategies based on place value
-add up to four two-digit numbers using strategies based on place value and properties of operations
-skip count by 2s, 5s, 10s,

STANDARDS

CC_Common Core State Standards - Mathematics (2010) - Grade 2
Domain 2.OA Operations and Algebraic Thinking
Cluster Statement: Represent and solve problems involving addition and subtraction.
Standard 2.OA.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.

Cluster Statement: Add and subtract within 20.
Standard 2.OA.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.

Cluster Statement: Work with equal groups of objects to gain foundations for multiplication.
Standard 2.OA.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.
Standard 2.OA.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.

Domain 2.NBT Number and Operations in Base Ten
Cluster Statement: Understand place value
Standard 2.NBT.2 Count within 1000; skip-count by 5s, 10s, and 100s.
Cluster Statement: Use place value understanding and properties of operations to add and subtract.
Standard 2.NBT.5 Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

CONTENT ELABORATIONS

2.OA.1	**2.OA.1** calls for students to add and subtract numbers within 100 in the context of one and two step word problems. Students should have ample experiences working on various types of problems that have unknowns in all positions including *Results Unknown, Change Unknown and Start Unknown*. Refer to *Table 1 in CCSS* Model Curriculum for additional examples. It is important to attend to the difficulty level of the problem situations in relation to the position of the Unknown. *Result Unknown, Total Unknown, and Both Addends Unknown* problems are the least complex for students. The next level of difficulty includes *Change Unknown, Addend Unknown, and Difference Unknown*. The most difficult are *Start Unknown* and *versions of Bigger and Smaller Unknown* (compare problems). Second graders should work on ALL problem types regardless of the level of difficulty. This standard also calls for students to solve one- and two-step problems using drawings, objects and equations. Students can use place value blocks or hundreds charts, or create drawings of place value blocks or number lines to support their work. This standard focuses on developing an algebraic representation of word problem through addition and subtraction. The intent is NOT to introduce traditional algorithms or rules, but to "**make meaning**" of operations. Word problems that are connected to students' lives can be used to develop fluency with addition and subtraction. Problem solving should be a focus of math instruction. **MP.1, MP.2, MP.3, MP.4, MP.5, MP.8** should be emphasized.
2.OA.2	**2.OA.2** mentions the word fluency when students are adding and subtracting numbers within 20. Fluency means accuracy, efficiency (within 4-5 seconds), and flexibility (using strategies such as making 10 or breaking apart numbers). Research indicates that teachers can best support students' memorization of sums and differences through varied experiences making 10, breaking numbers apart and working on mental strategies, rather than repetitive timed tests. **MP.2, MP.7, MP.8** should be emphasized.

2.OA.3	**2.OA.3** calls for students to apply their work with doubles addition facts to the concept of odd or even numbers. Students should have ample experiences exploring the concept that if a number can be decomposed into two equal addends, then that number is an even number. Students should explore this concept with concrete objects before moving towards pictorial representations such as circles or arrays. Students explore odd and even numbers in a variety of ways including the following: students may investigate if a number is odd or even by determining if the number of objects can be divided into two equal sets, arranged into pairs or counted by two. After these experiences, students may discover that they only need to look at the digit in the ones place to determine if a number is odd or even since any number of tens will always split into two even groups. **MP.2, MP.3, MP.7, MP.8** should be emphasized.
2.OA.4	**2.OA.4** calls for students to use rectangular arrays to work with repeated addition. this is a building block for multiplication in 3rd Grade. Students should explore this concept with concrete objects as well as pictorial representations on grid paper or other drawings. Based on the commutative property of addition, students can add either the rows or the columns and still arrive at the same solution. Students may arrange any set of objects into a rectangular array. Geoboards can also be used to demonstrate rectangular arrays. Students then write equations that represent the total as the sum of equal addends. **MP.2, MP.3, MP.7, MP.8** should be emphasized.
2.NBT.2	**2.NBT.2** calls for students to count within 1,000. This means that students are expected to "count on" from any number and say the next few numbers that come afterwards. This standard also introduces skip counting by 5s and 100s. Students are introduced to skip counting by 10s in Grade 1. Students should explore patterns of numbers when they skip count. Students need many opportunities counting, up to 1000, from different starting points. They should also have many experiences skip counting by 5s, 10s and 100s to develop the concept of place value. The use of the 100s chart may be helpful for student to identify the counting patterns. The use of money (nickels, dimes, dollars) or base ten blocks may be helpful visual cues. The ultimate goal is to be able to count in multiple ways with no visual support. **MP.2, MP.6, MP.7, MP.8** should be emphasized.
2.NBT.5	**2.NBT.5** mentions the word fluently when students are adding and subtracting numbers within 100. Fluency means accuracy (correct answer), efficiency (reasonable steps and time in computing), and flexibility (using strategies such as making 10 or breaking numbers apart). This standard calls for students to use pictorial representations or strategies to find the solution. Students who are struggling may benefit from further work with concrete objects (e.g., base ten blocks). Students should have experiences solving problems written both horizontally and vertically. They need to communicate their thinking and be able to justify their strategies both verbally and with paper and pencil. Addition strategies based on place value: adding by place value, incremental adding, compensation Subtraction strategies based on place value: adding up, incremental subtracting, subtracting by place value Properties that students should know and use are: Commutative property of addition, Associative property of addition and Identity property of 0. **MP.2, MP.6, MP.7, MP.8** should be emphasized.

UNIT VOCABULARY

add	doubles	subtract
addend	near doubles	related facts
sum	count back	missing addends
count on	difference	fact family
skip count	repeated addition	even
equal groups	array	odd
		regroup

BIG IDEAS

ENDURING UNDERSTANDINGS

ESSENTIALS QUESTIONS

Choose a few questions based on the needs of your students

- Joining, removing, part-part-whole, and comparing problems can be modeled.
- The order of addends may be changed and the result will not change. However this is not true for subtraction.
- The grouping of addends may be changed and the result will not change. However this is not true for subtraction.
- Addends can be decomposed and regrouped differently to simplify adding.
- Addition and subtraction are inverse (opposite) operations.
- Solutions may be solved and checked by using the inverse relation between addition and subtraction of numbers.
- Mental math strategies may be used to solve problems involving numbers.
- Problems involving numbers may be simplified by using the commutative, associative, and identity properties.
(Students are not expected to learn the terms, just the principles.)
- Problems can be solved in a variety of ways such as modeling, counting strategies, or number facts.
- Problems and solutions can use various representations, including concrete objects, pictures, number sentences, and words.
- There are similarities between skip counting and repeated addition.
- Repeatedly adding the same quantity, using a grouping picture or forming a rectangular
array is strategies for representing repeated addition equations.
- Arrays are a way of representing both repeated addition and skip counting.
- Arrays should be identified in rows and then columns.
- Explore and be able to explain even and odd numbers while using manipulatives.
- An even number can be decomposed into two equal addends.
- Double addition facts assist in recognizing even numbers.

- What strategies can I use to add and subtract?
- How can equal groups help me add?
- How can I add two-digit numbers?
- How can I subtract two-digit numbers?

CONNECTIONS

In **Critical Focus Area #1** students extend their understanding of the base-ten system. This includes ideas of counting in fives, tens, and multiples of hundreds, tens, and ones, as well as number relationships involving these units, including comparing. Students understand multi-digit numbers (up to 1000) written in base-ten notation, recognizing that the digits in each place represent amounts of thousands, hundreds, tens, or ones (e.g., 853 is 8 hundreds + 5 tens + 3 ones).
In **Critical Focus Area #2**, students use their understanding of addition to develop fluency with addition and subtraction within 100. They solve problems within 1000 by applying their understanding of models for addition and subtraction, and they develop, discuss, and use efficient, accurate, and generalizable methods to compute sums and differences of whole numbers in base-ten notation, using their understanding of place value and the properties of operations. They select and accurately apply methods that are appropriate for the context and the numbers involved to mentally calculate sums and differences for numbers with only tens or only hundreds.

* 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.
** 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.
*** This cluster is connected to Extend the counting sequence and Understanding 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.
****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.

Standards for Mathematical Practice (SMP)
MP.1 Make sense of problems and persevere in solving them
MP.2 Reason abstractly and quantitatively
MP.3 Construct viable arguments and critique the reasoning of others
MP.4 Model with mathematics
MP.5 Use appropriate tools strategically
MP.6 Attend to precision
MP.7 Look for and make use of structure (Deductive reasoning)
MP.8 Look for and express regularity in repeated reasoning (Inductive Reasoning)

Represent and solve word problems involving addition and subtraction

	CONTENT	SKILLS
2.OA.1	Use addition and subtraction within 100 to solve one- and two-step word problems	Use addition and subtraction within 100 to solve one- and two-step word problems 1. use a variety of representations to represent one-step problems (objects, drawings, number lines, equations) 2. solve addition and subtraction contextual problems in which the result, total or both addends are unknown 3. solve addition and subtraction word problems in which the addend or change is unknown 4. solve comparison problems with the difference unknown 5. solve problems in which the start is unknown and versions of bigger and smaller unknown 6. solve two-step problems in which student must add or subtract within the same problem 7. justify answer to problems

Add and subtract within 20

CONTENT	SKILLS

2.OA.2	Fluently add and subtract within 20 using mental strategies	Fluently add and subtract within 20 using mental strategies 1. Use the strategy of 'counting on' to add 2. use the strategy of 'making 10' and decomposing a number to add and subtract 3. use the strategy of 'creating an easier problem' with known sums/differences or compatible numbers to add and subtract 4. use the relationship between addition and subtraction to solve problems
Work with equal groups of objects to gain foundations for multiplication		
CONTENT		**SKILLS**
2.OA.3	Determine whether a group of objects (up to 20) has an odd or even number of members.	Determine whether a group of objects (up to 20) has an odd or even number of members. 1. recognize that in groups of even numbers objects will pair up evenly 2. recognize that in groups of odd numbers objects will not pair up evenly 3. determine whether a group of objects is odd or even, using a variety of strategies (e.g., pairing objects, pictorial representations) 4. generalize the fact that all even numbers can be formed from the addition of 2 equal addends 5. count a group of objects up to 20 by 2s 6. write an equation to express a given even number as a sum of two equal addends
2.OA.4	Use addition to find the total number of objects arranged in rectangular arrays.	Use addition to find the total number of objects arranged in rectangular arrays. 1. arrange any set of objects into a rectangular array to demonstrate repeated addition (up to 5 x 5) 2. use pictorial representations on grid paper to demonstrate repeated addition 3. write an equation to represent the total as the sum of equal addends
Understand place value		
CONTENT		**SKILLS**
2.NBT.2	Count within 1000	Count within 1000 1. 'Count on' from any number and say the next few numbers that come afterwards. 2. Count back from any number and say the next few numbers that come afterwards. 3. Identify counting patterns in a hundreds chart when skip counting 4. Skip count by 10s using dimes and place value blocks 5. Skip count by 100s using dollars and base ten blocks 6. Skip count by 5s using nickels as a visual cue
Use place value understanding and properties of operations to add and subtract		
CONTENT		**SKILLS**

2.NBT.5	Fluently add and subtract within 100	Fluently add and subtract within 100 1. know strategies for addition based on place value (e.g., adding by place value, incremental adding, compensation) 2. know strategies for subtraction based on place value (e.g., adding up, incremental subtracting, subtracting by place value) 3. know strategies for addition and subtraction based on operations (e.g., Commutative property of addition, Associative property of addition, Identity property of 0) 4. Communicate understanding why some properties work for some operations and not for others. 5. know strategies for addition and subtraction based on the relationship between addition and subtraction 6. choose a strategy (place value, properties of operations, and/or the relationship between addition and subtraction) to fluently add and subtract within 100 7. demonstrate fluency when adding and subtracting (accuracy, efficiency and flexibility)

UNIT RESOURCES

Math Common Core State Standards
McGraw-Hill, **My Math** Chapters 1-4
Number Talks by Sherry Parrish
Georgia Math Framewoks; Grade 2, Unit 2 & 6
Debbie Diller Math Work Stations materials and process
Manipulatives - including, but not exclusively: pattern blocks, snap cubes, counting disks, counting bears, a variety of counters, buttons, base ten blocks, dot dice, numeral dice, spinners, number cards, five and ten frames, dominoes