Grade 1 Math Unit 1 - Operations and Algebraic Thinking

UNIT OVERVIEW

In grade 1, instructional focus should focus on four critical areas. This unit is connected to Focus #1, **Developing understanding of addition, subtraction, and strategies for addition and subtraction within 20.** (See Connections for further explanation)

There are 4 clusters within this unit:
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

STANDARDS

CC_Common Core State Standards - Mathematics (2010) - Grade 1
Domain 1.OA Operations and Algebraic Thinking
Cluster Statement: Represent and solve problems involving addition and subtraction.
Standard 1.OA.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.
Standard 1.OA.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.

Cluster Statement: Understand and apply properties of operations and the relationship between addition and subtraction.
Standard 1.OA.3 Apply properties of operations as strategies to add and subtract.
Standard 1.OA.4 Understand subtraction as an unknown-addend problem.

Cluster Statement Add and subtract within 20 .
Standard 1.OA.5 Relate counting to addition and subtraction (e.g., by counting on 2 to add 2).
Standard 1.OA.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).

Cluster Statement: Work with addition and subtraction equations.
Standard 1.OA.7 Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false.
Standard 1.OA.8 Determine the unknown whole number in an addition or subtraction equation relating to three whole numbers.

CONTENT ELABORATIONS

1.OA.1	1.OA.1 builds on work in Kindergarten by having students use a variety of mathematical representations (e.g., objects, drawings, and equations) during their work. The unknown symbols should include boxes and pictures, and not letters. **Teachers should be cognizant of the different types of problems and ensure students have experience with all types. (CCSS Glossary, Table 1)** 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)* . Use informal language (and, minus/subtract, the same as) to describe joining situations (putting together) and separating situations (breaking apart). A helpful strategy is for students to recognize sets of objects in common patterned arrangements (0-6) to tell how many without counting (subitizing). Contextual problems that are closely connected to students' lives should be used to develop fluency with addition and subtraction. The level of difficulty for these problems can be differentiated by using smaller numbers (up to 10) or larger numbers (up to 20). **MP.1, MP.2, MP.3, MP.4, MP.5, MP.6, MP.8** are emphasized**.**
1.OA.2	**1.OA.2** asks students to add (join) 3 numbers whose sum is less than or equal to 20, using a variety of mathematical representations. This objective does address multi-step word problems. To further students' understanding of the concept of addition, students create word problems with 3 addends. They use properties of operations and different strategies to find the sum such as: counting on and counting on again, making tens, using "plus 10, minus 1" to add 9, decomposing numbers between 10 and 20 into 1 ten plus some ones to facilitate adding the ones, using doubles, and using near doubles. **MP.1, MP.2, MP.3, MP.4, MP.5, MP.6, MP.7, MP.8** are emphasized.
1.OA.3	**1.OA.3** calls for students to apply properties of operations as strategies to add and subtract. This unit will focus on the use of Identity Property of addition, Identity Property of subtractions, the commutative property of addition and associative property of addition. Students do not need to use formal terms for these prroperties. Students need several experiences investigating whether the commutative property works with subtraction. The intent is not for students to experiment with negative numbers but only to recognize that taking 5 from 8 is not the same as taking 8 from 5. **MP.2, MP.7, MP.8** should be emphasized.
1.OA.4	**1.OA.4** asks for studnets to use subtraction in the context of unknown addend problems. When determining the answer to a subtraction problem, 12-5, students think, "If I have 5, how many more do I need to make 12?" Encouraging students to record this symbolically, 5 + ? = 12, will develop their understanding of the relationship between addition and subtraction. Some strategies they may use are counting objects, creating drawings, counting up, using number lines or 10 frames to determine an answer. Refer to CCSS Glossary Table 1 to consider the level of difficulty of this standard. **MP.2, MP.7, MP.8** should be emphasized.
1.OA.5	**1.OA.5** asks students to make a connection between counting and adding and subtraction. Students use various counting strategies, including counting all, counting on and counting back. This standard calls for students to move beyond counting all and become comfortable at counting on and counting back. Students multiple experiences with counting may hinder their understanding of counting on and counting back as connected to addition and subtraction. To help them make these connections when students count on 3 from 4, they should write this as 4 + 3 = 7. When students count back (3) from 7, they should connect this to 7 - 3 = 4 **MP.2, MP.7, MP.8** are emphasized.
1.OA.6	**1.OA.6** is strongly connected to all standards in this domain. It focuses on students being able to fluently add and subtract numbers to 10 and having experiences adding and subtracting within 20. By studying patterns and relationships in addition facts and relating addition and subtraction, students build a foundation for fluency with addition and subtraction facts. Adding and subtracting fluently refers to knowledge of procedures, knowledge of when and how to use them appropriately, and skill in performing them flexible (use of different strategies), accurately and efficiently. The use of objects, diagrams, and various strategies will help students develop fluency. It is important for students to be able to use a *variety* of strategies when adding and subtracting numbers within 20. Students should have ample experiences modeling these operations before working on fluency. Teachers could differentiate using smaller numbers. Also, it is important to move beyond strategy of counting on, which is considered a less important skill than the ones in this standard (1.OA.6) Consider implementing **Number Talks** by Sherry Parrish. **MP.2, MP.7, MP.8** are emphasized.

1.OA.7	**1.OA.7** calls for students to work with the concept of equality by identifying whether equations are true or false. Therefore, students need to understand that the equal sign does not mean "answer comes next", but rather that the equal sign signifies a relationship between the left and right side of the equation. Interchanging the language of "equal to" and "the same as" as well as "not equal to" and "not the same as" will help students grasp the meaning of the equal sign. Students should understand that "equality" means "the same quantity as". In order for students to avoid the common pitfalls about the equal sign, students need to be able to: -express their understanding of the meaning of the =, -accept sentences other than a+b=c as true. (a=a, c=a+b, a=a+0, a+b=b+a) -know that the equal sign represents a relationship between 2 equal quantities, -compare expressions without calculating Experiences determining if equations are true or false help develop these skills. Initially students develop an understanding of the meaning of equality using models. However, the goal is for students to reason at a more abstract level. At all times students should justify their answers, make conjectures and make estimations. Once students have a solid foundation of the key skills, they can begin to rewrite true/false statements using symbols, > and <. **MP.2, MP.3, MP.6, MP.7** are emphasized.
1.OA.8	**1.OA.8** extends the work that students do in **1.OA.4** by relating addition and subtraction as related operations for situations with an unknown. This standard builds upon the "think addition" for subtraction problems. (14-6=? is 6 plus ? is 14. I know that 6 plus 8 is 14, so that means that 14 minus 6 is 8) Students need to understand the meaning of the equal sign and know that the quantity on one side of the equal sign must be the same quantity on the other side of the equal sign. They should be exposed to problems with the unknown in different positions. Having students create word problems for given equations will help them make sense of the equation and develop strategic thinking. **MP.2, MP.6, MP.8** are emphasized.

UNIT VOCABULARY

add	sum	subtract
part	zero	difference
whole	in all	minus (-)
addition number sentence	same	subtraction
equal (=)	true / false	number sentence
plus (+)	related facts	compare
count on	doubles	count back
number line	doubles minus 1	fact family
addends	doubles plus 1	missing addend

BIG IDEAS

ENDURING UNDERSTANDINGS

ESSENTIALS QUESTIONS
Choose a few questions based on the needs of your students

Students develop strategies for adding and subtracting whole numbers based on their prior work with small numbers.
- Students use a variety of models, including discrete objects and length-based models (e.g., cubes connected to form lengths), to model add-to, take-from, put-together, take-apart, and compare situations. They will use these models to develop meaning for the operations of addition and subtraction, and to develop strategies to solve arithmetic problems with these operations.
- Students understand connections between counting and addition/subtraction (e.g., adding two is the same as counting on two).
- Students use properties of addition to add whole numbers and to create and use increasingly sophisticated strategies based on these properties (e.g., "making tens") to solve addition and subtraction problems within 20.
- By comparing a variety of solution strategies, students will build an understanding of the relationship between addition and subtraction.
- Students think of whole numbers between 10 and 100 in terms of tens and ones (especially recognizing the numbers 11 to 19 as composed of a ten and some ones).

How do you add numbers?
- How do you subtract numbers?
- How do I use strategies to add numbers?
- What strategies can I use to subtract?

CONNECTIONS

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

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 problems involving addition and subtraction

CONTENT	SKILLS

	CONTENT	SKILLS
1.OA.1 **1.OA.2**	Use addition and subtraction within 20 to solve word problems.	Use addition and subtraction within 20 to solve word problems. 1. use a variety of representations to represent word problems (objects, drawings and equations) 2. use boxes or pictures to represent the unknowns in an equation 3. solve addition and subtraction contextual problems in which the result, total or both addends are unknown 4. solve addition and subtraction word problems in which the addend or change is unknown 5. solve comparison problems with the difference unknown 6. solve problems in which the start is unknown and versions of bigger and smaller unknown 7. use informal language (and, minus/subtract, the same as) to describe joining situations and separating situations 8. use the addition symbol to represent joining situations 9. use the subtraction symbol to represent separating situations 10. solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20 11. create word problems with 3 addends

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

	CONTENT	SKILLS
1.OA.3	Apply properties of operations as strategies to add and subtract.	Apply properties of operations as strategies to add and subtract. 1. use mathematical tools, such as cubes and counters and representations such as the number line and a 100 chart to model properties of operations 2. understand and apply the identity property of addition (e.g., 6 = 6 + 0) 3. understand and apply the identity property of subtraction (e.g., 9 - 0 = 9) 4. understand and apply Commutative propert of addition (e.g., 4 + 5 = 5 + 4) 5. understand and apply Associative property of addition (e.g., 3 + 9 + 1 = 3 + 10 = 13)
1.OA.4	Understand subtraction as an unknown-addend problem.	Understand subtraction as an unknown-addend problem. 1. determine the answer to a subtraction problem by posing an unknown-addend question. (e.g., 12 - 5; "If I have 5, how many more do I need to make 12?" 2. use strategies such as counting objects, drawings, counting up, number lines or ten frames to determine an answer.

Add and subtract within 20

	CONTENT	SKILLS
1.OA.5	Relate counting to addition and subtraction	Relate counting to addition and subtraction 1. use the 'counting all' strategy to add and subtract numbers up to 20 2. use the 'counting on' strategy to add and subtract numbers up to 20 3. use the 'counting back' strategy to add and subtract numbers up to 20
1.OA.6	Use a variety of strategies to add and subtract within 20.	Use a variety of strategies to add and subtract within 20. 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 to add and subtract 4. use the relationship between addition and subtraction to solve problems

Work with addition and subtraction equations

	CONTENT	SKILLS
1.OA.7	Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false.	Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false. 1. use the equal sign to represent a relationship regarding quantity between one side of the equation and the other 2. model equations using cubes, counters, drawings, etc. to determine if equations are true or false 3. justify answer for equations with operation on the left side of the equal sign and answer on the right side (5 + 3 = 8) 4. justify answer for equations with operation on the right side of the equal sign and the answer on the left side (8 = 3 + 5) 5. justify answer for equations with numbers on both sides of the equal sign (8 = 8) 6. justify answer for equations with operations on both sides of the equal sign (5 + 3 = 2 + 6) 7. compare expressions without calculating 8. rewrite true/false statements using the symbols < and >
1.OA.8	Determine the unknown whole number in an addition or subtraction equation relating three whole numbers	Determine the unknown whole number in an addition or subtraction equation relating three whole numbers 1. recognize part-part-whole relationships of addition and subtraction equations 2. determine the unknown whole number in an addition or subtraction equation with three whole numbers

UNIT RESOURCES

McGraw-Hill, **My Math** Chapters 1-4

Number Talks by Sherry Parrish

Georgia Math Frameworks, Grade 1 Unit 5

http://www.readwritethink.org/classroom-resources/lesson-plans/giant-story-problems-reading-146.html

http://www.k-5mathteachingresources.com/math-journals.html

http://www.ncesd.org/Page/983

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