Represent and solve problems involving addition and subtraction (Standard 2.OA.1).

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, *for example, by using drawings and equations with a symbol for the unknown number to represent the problem*.

Concepts and Skills to Master

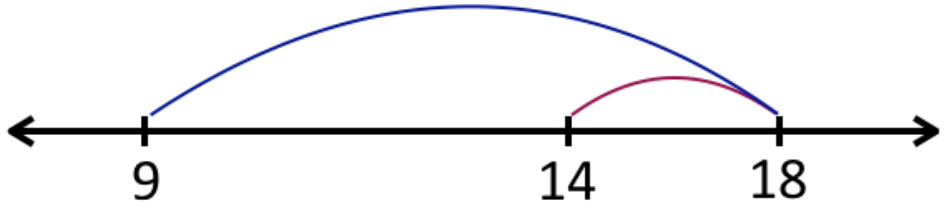
- Differentiate between one-step and two-step word problems (Two-step word problems may include two addition operations, two subtraction operations, or both an addition and subtraction operation in the same word problem)
- Determine the operation(s) based on the actions in the context of one-step and two-step word problems (avoid relying on keyword strategies)
- Use numbers and symbols to represent word problems (+, -, =, and a variety of symbols for unknowns)
- Solve the following addition and subtraction situations as well as situations listed in Standards K.OA.2 and 1.OA.1. (See: TABLE 1. Common addition and subtraction situations):
  - **Add To/Start Unknown**: Some bunnies were sitting on the grass. 3 more bunnies hopped there. Then there were 8 bunnies. How many bunnies were on the grass before? (? + 3 = 8)
  - **Take From/Start Unknown**: Some apples were on the table. I ate 3 apples. Then there were 37 apples. How many apples were in the table before? (? - 3 = 37)
  - **Compare/Larger Unknown**: Lucy has 12 fewer apples than Julie. Lucy has 26 apples. How many apples does Julie have? (12 + 26 = ?)
  - **Compare/Smaller Unknown**: Julie has 12 more apples than Lucy. Julie has 38 apples. How many apples does Lucy have? (? + 12 = 38, 38 - 12 = ?)

Teacher Note: Second grade is the first time students solve two-step word problems.

Related Standards: Current Grade Level	Related Standards: Future Grade Levels
2.NBT.5 Fluently add and subtract within 100 **2.NBT.6** Add up to four two-digit numbers **2.NBT.7** Add and subtract within 1,000 using concrete models **2.NBT.9** Explain why addition and subtraction work **2.MD.5** Use addition and subtraction within 100 to solve word problems involving length **2.MD.8** Solve word problems involving money **2.MD.10** Solve problems involving data presented in a graph of up to four categories	**3.MD.2** Solve word problems with all operations involving measurement **3.MD.3** Solve one-step and two-step problems involving information presented in graphs **3.OA.8** Solve two-step word problems involving all operations **4.OA.3** Solve multi-step whole number word problems involving all operations **4.NF.3** Understand addition and subtraction of fractions as joining and separating parts

Critical Background Knowledge from Previous Grade Levels

- Solve word problems with three addends (1.OA.2)
- Solve word problems involving addition and subtraction within 20 (1.OA.1)
- Add and subtract within 20 using a variety of strategies (1.OA.6a)
- Solve addition and subtraction word problems within 10 (K.OA.2)

Academic Vocabulary	
join, add, add to, combine, put together, addition, plus, sum, total, separate, take from, take apart, take away, minus, subtract, difference, equal to, compare, unknown	
Suggested Models	Suggested Strategies
Two-Step Example: There are 9 students in the cafeteria. 9 more students come in. After a few minutes, some students leave. There are now 14 students in the cafeteria. How many students left the cafeteria? Use drawings and equations to show your thinking.  	• Mental strategies for fluency within 20 • Making ten • Decomposing a number leading to a benchmark number • Use the relationship between addition and subtraction • Create equivalent but easier or known sums (compensation, doubles plus one, doubles minus one) • Apply the commutative or associative properties of addition • Students may create their own word problems verbally • Use drawings, objects, and equations • Use a bar model • Part/Part/Whole
Image Source: http://www.dpi.state.nc.us/docs/curriculum/mathematics/scos/2.pdf	

Fluently add and subtract within 20 (Standard 2.OA.2)

Standard 2.OA.2 Fluently add and subtract within 20.
a. Add and subtract within 20 using mental strategies such as counting on; making ten *(for example, 8 + 6 = 8 + 2 + 4 = 10 + 4 = 14)*; decomposing a number leading to a ten *(for example, 13 – 4 = 13 – 3 – 1 = 10 – 1 = 9)*; using the relationship between addition and subtraction *(for example, knowing that 8 + 4 = 12, one knows 12 – 8 = 4)*; and creating equivalent but easier or known sums *(for example, adding 6 + 7 by creating the known equivalent 6 + 6 + 1 = 12 + 1 = 13)*.
b. By the end of Grade 2, know from memory all sums of two one-digit numbers.

Concepts and Skills to Master

- Add within 20 using mental strategies
- Subtract within 20 using mental strategies (see standard 1.OA.6 for a list of mental strategies)
- Understand subtraction as an addition problem with an unknown addend
- Know from memory all sums of two one-digit numbers (it is not expected for students to know sums of two-digit addends from memory)
- Apply addition and subtraction strategies flexibly, accurately and efficiently

Teacher Note: "Know from memory" does not necessarily mean "memorize." Students may memorize addition and subtraction facts or apply mental strategies to retrieve facts. Teachers can best support student fluency with sums and differences through varied experiences of composing and decomposing numbers, making 10, and working on mental strategies, rather than repetitive timed tests. This standard supports students as they fluently solve addition and subtraction problems with multi-digit numbers in other standards within second grade and in future grades. Developing fluency with one-digit addends is a foundation for extending strategies when adding and subtracting multi-digit numbers.

Related Standards: Current Grade Level	Related Standards: Future Grade Levels
2.OA.1 Use addition and subtraction within 100 in one-step and two-step word problems	**3.OA.8** Solve two-step word problems
2.NBT.5 Fluently add and subtract within 100	**3.OA.9** Identify arithmetic patterns including in addition tables
2.NBT.6 Add up to four two-digit numbers	**3.NBT.2** Fluently add and subtract within 1,000
2.NBT.7 Add and subtract within 1,000	**4.OA.3** Solve multi-step whole number word problems
	4.OA.5 Generate a number pattern that follows a given rule
	4.NBT.4 Fluently add and subtract multi-digit whole numbers

Critical Background Knowledge from Previous Grade Levels

- Add and subtract within 20. Demonstrate fluency for addition and subtraction within 10 (1.OA.6)
- Use addition and subtraction within 20 to solve all types of word problems (1.OA.1)
- Solve word problems with three addends (1.OA.2)
- Apply properties of operations as strategies to add and subtract (1.OA.3)
- Understand subtraction as an unknown-addend problem (1.OA.4)
- Relate counting to addition and subtraction (1.OA.5)

Academic Vocabulary

add, addend, compose, plus, total, subtract, minus, decompose, difference, equation

Suggested Models	Suggested Strategies
Example: 9 + 5 = __ Counting On: I started at 9 and then counted 5 more. I landed on 14. Decomposing a Number Leading to a Ten: I know that 9 and 1 is 10, so I broke 5 into 1 and 4. 9 plus 1 is 10. Then I have to add 4 more, which gets me to 14. **Example: 13 - 9 = __** Using the Relationship between Addition and Subtraction: I know that 9 plus 4 equals 13. So 13 minus 9 equals 4. Creating an Easier Problem: Instead of 13 minus 9, I added 1 to each of the numbers to make the problem 14 minus 10. I know the answer is 4. So 13 minus 9 is also 4.	• Counting on: 8 + 4 = □ (8 … 9, 10, 11, 12) • Counting back: 12 - 4 = □ (12 … 11, 10, 9, 8) • Making tens: 5 + 7 = □ (5 = 2 + 3 so 3 + 7 = 10 and 10 + 2 = 12) • Doubles: 6 + 6 = □ • Doubles plus/minus one: 6 + 7 = □ (6 + 6 + 1 or 7 + 7 – 1) • Decomposing a number leading to a ten: 15 – 7 = □ (15 – 5 = 10 and 10 – 2 = 8) • Working knowledge of fact families/related facts: 3 + 9 = 12 so 12 – 9 = 3 • Use number lines

Fluency within 20

Fluency in each grade involves a mixture of just knowing some answers, knowing some answers from patterns (for example, adding 0 yields the same number), and knowing some answers from the use of strategies. It is important to push sensitively and encouragingly toward fluency of the designated numbers at each grade level, recognizing that fluency will be a mixture of these kinds of thinking which may differ across students. (https://commoncoretools.files.wordpress.com/2011/05/ccss_progression_cc_oa_k5_2011_05_302.pdf)

Fluency of all one-digit sums include the following facts:

0+0	1+0	2+0	3+0	4+0	5+0	6+0	7+0	8+0	9+0
0+1	1+1	2+1	3+1	4+1	5+1	6+1	7+1	8+1	9+1
0+2	1+2	2+2	3+2	4+2	5+2	6+2	7+2	8+2	9+2
0+3	1+3	2+3	3+3	4+3	5+3	6+3	7+3	8+3	9+3
0+4	1+4	2+4	3+4	4+4	5+4	6+4	7+4	8+4	9+4
0+5	1+5	2+5	3+5	4+5	5+5	6+5	7+5	8+5	9+5
0+6	1+6	2+6	3+6	4+6	5+6	6+6	7+6	8+6	9+6
0+7	1+7	2+7	3+7	4+7	5+7	6+7	7+7	8+7	9+7
0+8	1+8	2+8	3+8	4+8	5+8	6+8	7+8	8+8	9+8
0+9	1+9	2+9	3+9	4+9	5+9	6+9	7+9	8+9	9+9

Work with equal groups of objects to gain foundations for multiplication (Standards 2.OA.3–4).

Standard 2.OA.3 Determine whether a group of objects (up to 20) has an odd or even number of members, (*for example, by pairing objects or counting them by twos*). Write an equation to express an even number as a sum of two equal addends.

Concepts and Skills to Master

- Apply work with doubles to the concept of odd and even
- Understand that numbers that can be decomposed into equal addends are even numbers
- Understand and represent an even number as an amount that can be made of two equal parts with no leftovers
- Understand and represent an odd number as a number that is not even and cannot be made into two equal whole number parts

Teacher Note: The number endings of 0, 2, 4, 6, and 8 are only an interesting and useful pattern or observation and should not be used as the definition of an even number. (Van, . W. J. A., & Folk, S. (2008). Elementary and middle school mathematics: Teaching developmentally. Toronto: Pearson Allyn and Bacon.p.292)

Related Standards: Current Grade Level	Related Standards: Future Grade Levels
2.OA.4 Use addition to find the total number of objects arranged in arrays and write an equation to express the sum of equal addends **2.NBT.2** Count within 1,000	**3.OA.2** Interpret whole-number quotients as equally shared groups or an equal number of groups **3.OA.3** Use multiplication and division to solve word problems involving equal groups **3.OA.9** Identify arithmetic patterns and explain them using properties of operations

Critical Background Knowledge from Previous Grade Levels

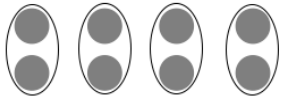
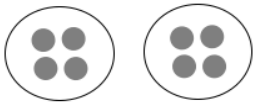
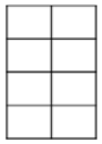
- Understand the meaning of the equal sign (1.OA.7), use doubles to add within 20 (1.OA.6), count to 120 (1.NBT.1)
- Use matching or counting strategies to determine whether groups are equal (K.CC.6)

Academic Vocabulary

odd, even, equal, equation, compose, doubles, sum

Suggested Models

Example: Is 8 an even number? Justify your thinking.

Student A	Student B	Student C	Student D	Student E
I grabbed 8 counters. I paired the counters up into groups of 2. Since I didn't have any counters left over, I know that 8 is an even number. 	I grabbed 8 counters. I put them into 2 equal groups. There were 4 counters in each group, so 8 is an even number. 	I drew 8 boxes in a rectangle that had two columns. Since every box on the left matches a box on the right, I know that 8 is even. 	I drew 8 circles. I matched one on the top with one on the bottom. Since they all match up, I know that 8 is an even number. 	I know that 4 plus 4 equals 8, so 8 is an even number

Suggested Strategies

- Build rectangular arrays, pair objects and skip count by twos, relate doubles to even numbers, use ten-frames to determine if a number is even or odd, place up to 20 objects in two equal groups, use a hundreds chart

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Work with equal groups of objects to gain foundations for multiplication (Standards 2.OA.3–4).

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.

Concepts and Skills to Master

- Use rectangular arrays to work with repeated addition
- Write an addition equation representing an array as a sum of equal addends
- Understand that the total number of objects can be found by using repeated addition
- Write repeated addition equations to match arrays

Teacher Note: This is an essential standard to prepare students for understanding multiplication in 3rd grade.

Related Standards: Current Grade Level	Related Standards: Future Grade Levels
2.OA.3 Determine whether a group of objects has an even or odd numbers of members **2.G.2** Partition a rectangle into rows and columns of same-size squares and count to find the total number of squares	**3.OA.1** Interpret the products of whole numbers by looking at the number of groups and number in a group **3.OA.2** Interpret whole-number quotients as equally shared groups or an equal number of groups **3.OA.3** Use multiplication and division to solve word problems involving equal groups **3.OA.5** Apply properties of operations as strategies to multiply and divide **3.OA.6** Understand the relationship between multiplication and division **4.NBT.5, 4.NBT.6** Multiply and divide whole numbers using equations, rectangular arrays, and/or area models

Critical Background Knowledge from Previous Grade Levels

- Use addition and subtraction within 20 to solve word problems (1.OA.1)
- Solve word problems that call for addition of three whole numbers (1.OA.2)
- Add and subtract within 20 (1.OA.6)
- Use counting to answer questions about “how many” (K.CC.5)
- Solve addition and subtraction word problems within 10 (K.OA.2)

Academic Vocabulary

rectangular array, repeated addition, row, column, equation, sum, addend

Suggested Models	Suggested Strategies
 This array can be viewed as as 4 + 4 = 8 or 2 + 2 + 2 + 2 = 8	• Build rectangular arrays with up to 25 objects • Use graph paper to draw rectangular arrays • Use ink daubers to make arrays • Use flexible equations to represent the total (see Suggested Models to the left)