THEME: ADDITION AND SUBTRACTION WITHIN 20

OPERATIONS AND ALGEBRAIC THINKING (OA)

Represent and solve problems involving addition and subtraction.

2.OA.1 Use addition and subtraction within 100 to solve one- and two-step word problems involving situation 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

Add and subtract within 20.

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.*

Work with equal groups of objects to gain foundations for multiplication.

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.

NUMBER AND OPERATIONS IN BASE TEN (NBT)

Use place value understanding and properties of operations to add and subtract.

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.

2.NBT.6 Add up to four two-digit numbers using strategies based on place value and properties of operations.

Use place value understanding and properties of operations to add and subtract.

2.NBT.9 Explain why addition and subtraction strategies work, using place value and the properties of operations. Explanations may be supported by drawings or objects.

Commentary:
By the end of Grade 1, students should be fluent with addition and subtraction facts with sums to 10. As students demonstrate understanding, skill, and ability to apply addition and subtraction to all problem situations, the range of numbers with which they work increases to 100. Problem situations include simple two-step problems for students to model and explore. Students extend their expertise with mental mathematics strategies (Table 2) initially using concrete materials and later as they continue to practice and become fluent with addition and subtraction facts including all facts through sums of 20.

This domain is not taught in isolation from the Number and Base Ten domain. Students work across domains to develop a deep understanding of addition and subtraction focusing on the instructional shifts of developing conceptual understanding, building skill and fluency, and applying addition and subtraction in problem contexts.

Students continue to use concrete models and quantitative reasoning to extend ideas of addition to seeing the structure of mathematics as they explore what happens when they add combinations of even and odd numbers. They observe what happens to the sum in each situation, using quantitative reasoning to describe why they think this is happening (why is the sum always even when I add two even numbers?), and to make generalizations about each situation. The same process happens as students begin to explore arrays and use repeated addition to begin thinking informally about multiplication.

In first grade, students used various representations to add with sums to 100 and to subtract multiples of 10 from multiples of 10. In second grade, they review these models and focus on computing mentally or in writing using various strategies. Previous work with place value and physical models can be extended to include more examples with composing tens in addition and decomposing tens in subtraction. Note the careful scaffolding of examples in Table 3. Include problems that provide a context for adding or subtracting as often as possible. Equations should be written both horizontally and vertically. Students use number sense and a variety of strategies that make sense to them to add and subtract. Encourage students to make estimates before adding or subtracting to determine if their answers ae reasonable. Note that students are not expected to use the standard algorithm for addition and subtraction until Grade 4.

Students demonstrate their understanding using place value materials, hundreds charts and extended hundred charts, and open number lines.

Instructional Resources

Math Expressions: Unit 1 (Sections: 1.1 – 121)

Manipulatives: Student Math White Boards, Hundreds Chart, two-color counters, ten frames, double ten frames, hundreds chart, number line to 20, open number line, part-part whole chart, place value chart, spinners.

Achieve The Core Fluency Resource

Digital: Think Central – Soar to Success for Below Level and Mega Math for On Level

Differentiated Instructional Activities: Pages: 9, 15, 21, 29, 35, 45, 53, 61, 69, 75, 83, 89, 95, 103, 109, 115, 125, 131, 139, 145 and 151.

Assessment Resources

Unit 1: Quick Quiz 1, 2 and 3

Unit 1 Assessment Form A and Form B

Formative: "Check for Understanding embedded in each lesson.

Addressing Student Misconceptions and Common Errors

2.OA.1

Teaching key words does not help students to develop an understanding of problem situations. Rather, by using concrete models and drawing pictures, students can relate their actions to whether the situation calls for addition or subtraction. In missing addend cases, students will determine what operation (addition or subtraction) makes the most sense to them, as either will result in a correct solution.

Students who struggle with two-step problems should work to identify missing information needed to solve the problem. While the question in the problem will focus on the final answer, identifying missing information will help students to recognize they need to perform an operation to find that information.

Addressing Student Misconceptions and Common Errors

2.OA.2

Watch for students who are making reasoning errors when working with concrete materials or objects as they begin to use more sophisticated strategies. Students may double count a number when adding or subtracting. This may occur with physical objects or pictures or using a hundreds chart. Students may decompose a number to make a ten and then incorrectly add the original addend on to the 10. The sooner such misconceptions are addressed through questions and use of concrete examples, the more likely the student is to self-correct with similar examples. Students do not have to be fluent with all of the mental strategies. They should have many opportunities to practice, explain, and compare strategies. Using the strategies that make sense to them will help students to be ready for drill and practice opportunities to become fluent with facts.

2.OA.3

Too often, the focus of even and odd numbers is on telling students (or having them recognize) that even numbers end in 0, 2, 4, 6 or 8 and odd numbers end in 1, 3, 5, 7, and 9. While these are interesting and efficient patterns, they do not define or provide a conceptual understanding of even and odd numbers. While this is not a misconception, it is important to emphasize the use of concrete experiences to develop a foundational understanding of the meaning of even and odd numbers.

2.NBT.5

Second-grade students do not need to have facility using the standard algorithm adding and subtracting. They should focus their work on developing and using efficient strategies that make sense. Although some students may be ready to write equations, composing tens when regrouping in addition and decomposing tens when regrouping in subtracting may be challenging to other students. Concrete representations, number lines, and hundreds charts will help students to develop a deeper understanding of the process of regrouping than only following rote procedures.

Addressing Student Misconceptions and Common Errors Cont.

2.NBT.6

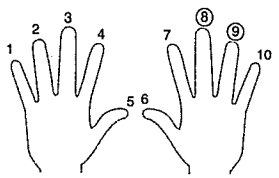
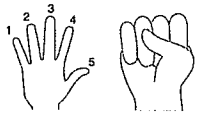
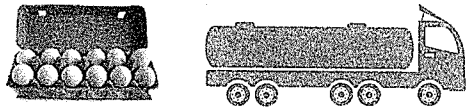
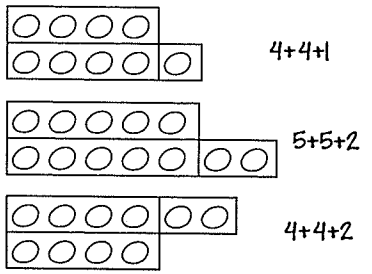
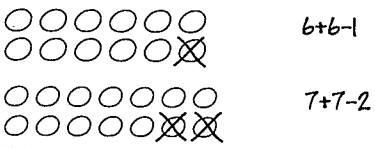
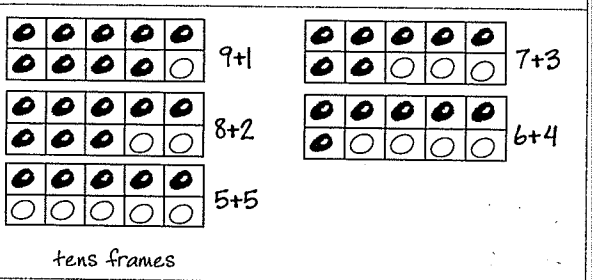
Students who struggle with adding strings of numbers should begin with three addends with no regrouping. If necessary, they can use physical models to help keep track of the sums. Move to examples using four addends with no regrouping. As students are ready, include examples with regrouping. Encourage students to use strategies that make sense to them. Help students using inefficient strategies to make connections to more efficient strategies. Note that some strategies are more difficult to follow when written out and make more sense when explained orally.

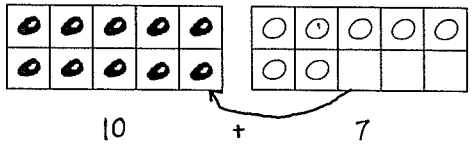
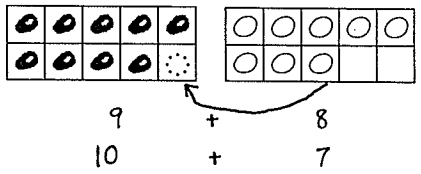
2.NBT.9

Some students may still struggle with solving word problems in a variety of situations. Support their thinking by asking what they know, what they want to find out, and how they might solve the problem. It is really important for these students to ask themselves if their answer is reasonable. You may want to help by reversing the situation for them. Giving students opportunities to explain their thinking even when incorrect, provides opportunities for them to self-correct.

Source: The Common Core Mathematics Companion: The Standards Decoded (What They Say, What They Mean, How to Teach Them)
Authors: Ruth Harbin Miles and Lois A. Williams, 2016 NCTM

Table 2 Addition and Subtraction Fact Strategies

ADDITION STRATEGIES	EXPLANATION	EXAMPLES	MODEL
Count on 1 or 2 Grades: K, 1	Count on 1 or 2 more to an addend. First use with materials; eventually move to mentally counting on.	3 + 1 Student counts "three....four" 7 + 2 Student counts "seven....eight....nine"	
Add zero Grades: K, 1	Any addend plus zero equals the addend.	5 + 0 = 5	
Doubles Grades: K, 1	Add a number to itself.	4 + 4 = 8 6 + 6 = 12 9 + 9 = 18	
Doubles plus 1 or 2 Grades: 1, 2	Double the smaller addend and add 1 or 2.	4 + 5 Think 4 + 4 + 1 5 + 7 Think 5 + 5 + 2 6 + 8 Think 6 + 6 + 2	
Doubles minus 1 or 2 Grades: 1, 2	Double the larger addend and subtract 1 or 2.	6 + 5 Think 6 + 6 – 1 7 + 5 Think 7 + 7 – 2	
Combination for ten Grade: 1	Recognize number combinations that add to 10.	1 + 9 = 10 9 + 1 = 10 2 + 8 = 10 8 + 2 = 10 3 + 7 = 10 7 + 3 = 10 4 + 6 = 10 6 + 4 = 10 5 + 5 = 10	

ADDITION STRATEGIES	EXPLANATION	EXAMPLES	MODEL
Add ten Grade: 1	Note and use patterns when adding 10 to a single-digit number.	10 + 7 = 17 8 + 10 = 18 3 + 10 = 13	
Make a ten Grades: 1, 2	Decompose one of the addends to make a sum of 10 in the fact.	9 + 8 Think 9 + 1 + 7 7 + 5 Think 7 + 3 + 2	

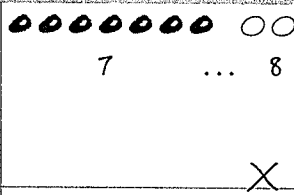
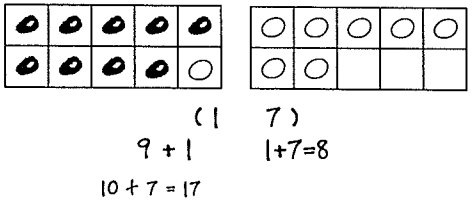
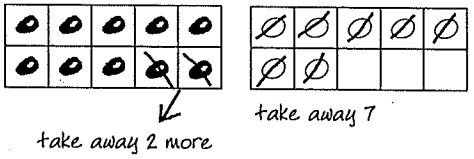
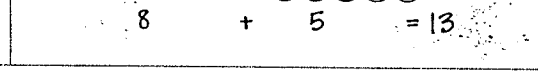
SUBTRACTION STRATEGIES	EXPLANATION	EXAMPLES	MODEL
Count up 1 or 2 Grades: 1, 2	Begin with the addend and count up to get to the total.	Works with facts in which the difference is only 1 or 2 9 – 7 Think seven ..... eight, nine so 9 – 7 = 2	
Count back 1 or 2 Grades: 1, 2	Begin with the total and count back one or two to get to the missing addend.	Works with facts subtracting 1 or 2. 9 – 2 Think nine ..... eight, seven so 9 – 2 = 7	
Build to 10 (think addition) Grades: 1, 2	Add up to 10 and then add the rest of the way to find the difference.	17 – 9 Think 9 + 1 = 10 and 10 + 7 = 17 7 + 1 = 8 so 17 – 9 = 8	
Back off from 10 Grades: 1, 2	Count back to 10 and then count back the rest of the way.	17 – 9 Think 17 – 7 = 10 I still need to take off 2 more 10 – 2 = 8	
Use related addition facts Grades: 1, 2	Once students know addition facts they can think of subtraction as finding a missing addend.	13 – 8 Think 8 + ____ = 13	

Table 3 Scaffolding Addition and Subtraction

As you plan examples for addition, keep in mind how to scaffold examples with regrouping. Some students may need this broken into smaller concepts while others may be able to make generalizations. What is particularly important is to give students the opportunity to solve each type of example by making sense of the numbers and using various representations.

Grade Level	Description	Example
K 1 2	1 digit + 1 digit	9 + 7
1	2 digit + 1 digit; no regrouping	23 + 6
1	Add 2 digit number + a multiple of 10	33 + 50
1	2 digit + 2 digit; no regrouping	33 + 25
1 2	2 digit + 1 digit with regrouping	35 + 7
1 2	2 digit + 2 digit regrouping	25 + 26
2	3 digit + 1 and 2 digit; no regrouping	372 + 7
2	3 digit plus 1 digit; regroup ones to tens	345 + 8
2	3 digit plus 2 digit; regroup ones to tens	356 + 38
2	3 digit plus 2 digit; regroup tens to hundreds	428 + 26
2	3 digit plus 2 digit; regroup ones to tens and tens to hundreds	567 + 48
2	3 digit + 3 digit; no regrouping	256 + 121
2	3 digit plus 3 digit; regroup ones to tens	234 + 126
2	3 digit plus 3 digit; regroup tens to hundreds	154 + 162
2	3 digit plus 3 digit; regroup ones to tens and tens to hundreds	274 + 247

As you plan examples for subtraction, keep in mind how to scaffold examples with regrouping. Some students may need this broken into smaller concepts while others may be able to make generalizations. What is particularly important is to give students the opportunity to solve each type of example by making sense of the numbers and using various representations.

Grade Level	Description	Example
K 1 2	Subtraction facts in two forms subtract missing addend	5 – 2 = 3 2 + ___ = 5
1	Subtracting multiples of 10 from multiples of 10	50 – 20 20 + ___ = 50
2	Subtract 1 digit from 2 digits; no regrouping	27 – 4 4 + ___ 27
2	Subtract 2 digits from 2 digits; no regrouping	78 – 45

Grade Level	Description	Example
2	Subtract 1 digit from 2 digits with regrouping	45 – 9
2	Subtract 1 digit from 3 digits; no regrouping	427 – 2
2	Subtract 2 digits from 3 digits; no regrouping	568 – 35
2	Subtract 1 digit from 3 digits; regroup tens to ones	342 – 7
2	Subtract 2 digits from 3 digits; regroup tens to ones	348 – 64
2	Subtract 2 digits from 3 digits; regroup hundreds to tens	639 – 275
2	Subtract 2 digits from 3 digits; regroup hundreds to tens and tens to ones	534 – 275
2	Subtract 3 digits from 3 digits; no regrouping	453 – 222
2	Subtract 3 digits from 3 digits; regroup tens to ones	453 – 226
2	Subtract 3 digits from 3 digits; regroup hundreds to tens	627 – 345
2	Subtract 3 digits from 3 digits; regroup hundreds to tens and tens to ones	732 – 556