NVACS: Operations and Algebraic Thinking

In Second Grade, students must:

2.OA.A1 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.

2.OA.B.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.

2OA.C.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

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2.OA.C.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

2.OA.1 –

Students use their understanding of addition to build fluency with addition and subtraction within 100. They solve problems within 100 by applying their ability to use models, manipulatives, and/or drawings for addition and subtraction, and they develop, discuss, and use efficient, and accurate 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 strategies that are appropriate for the context of the problem and the numbers involved to mentally calculate sums and differences for numbers with only tens or only hundreds. They develop and use efficient strategies to compute sums and differences of whole numbers using their understanding of place value and properties of operations. There are four structures or problem types that students will encounter:

Join/Add to Problems: quantities are joined together or added.

Separate/Take Away Problems: quantities are removed or taken away.

Part-Part-Whole Problems: two parts that are conceptually or mentally combined into one whole.

Comparison Problems: comparing two quantities.

Structures of Addition and Subtraction Problems

Part-Part-Whole	Join	Separate	Compare
Whole Unknown *At the pond, 3 ducks were in the water and 2 ducks were on the shore. How many ducks were at the pond?* 3 + 2 = ☐	**Result Unknown** *Three ducks were in the water. Two more ducks got in the water. How many ducks were in the water altogether?* 3 + 2 = ☐	**Result Unknown** *Five ducks were in the water. Three ducks went on the shore. How many ducks were still in the water?* 5 – 3 = ☐	**Difference Unknown** *Three ducks were in the water and 2 ducks were on the shore. How many more ducks were in the water than on the shore?* 3 – 2 = ☐
Part Unknown *Five ducks were at the pond. Three ducks were in the water and the rest were on the shore. How many ducks were on the shore?* *(Either part can be unknown)* 3 + ☐ = 5	**Change Unknown** *Three ducks were in the water. Some more ducks got in the water. Now there are 5 ducks in the water. How many ducks got in the water?* 3 + ☐ = 5	**Change Unknown** *Five ducks were in the water. Some ducks went on the shore. Now there are 2 ducks in the water. How many ducks went on shore?* 5 – ☐ = 2	**Larger Unknown** *There is 1 more duck in the water than on the shore. There are 2 ducks on the shore. How many ducks are in the water?* *(Can also be written with fewer)* 2 + 1 = ☐
Both Parts Unknown *Five ducks were at the pond. How many might be in the water and how many might be on the shore?* 5 = 0 + 5 5 = 5 + 0 5 = 1 + 4 5 = 4 + 1 5 = 2 + 3 5 = 3 + 2	**Initial Unknown** *Some ducks were in the water. Two more ducks got in the water. Now there are 5 ducks in the water. How many ducks were in the water to start with?* ☐ + 2 = 5	**Initial Unknown** *Some ducks were in the water. Three ducks went on shore. Now there are 2 ducks in the water. How many ducks were in the water to start with?* ☐ – 3 = 2	**Smaller Unknown** *There is 1 fewer duck on the shore than in the water. There are 3 ducks in the water. How many ducks are on the shore?* *(Can also be written with more)* 3 – 1 = ☐

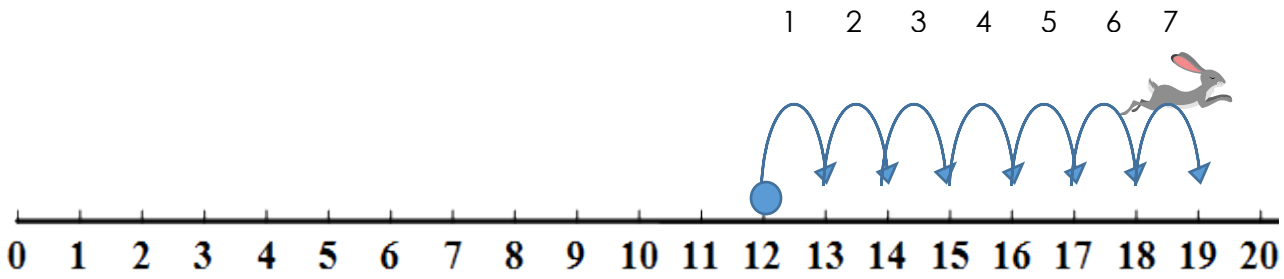
Second Grade students will work with these problem types in both 1-step and 2-step story problems.

Chart by John VandeWalle

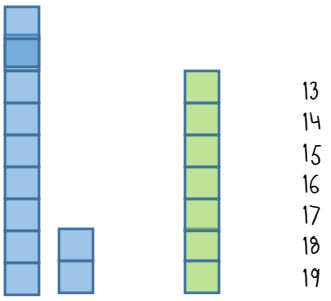
Story Problems As students progress through second grade, they select and accurately apply methods that are appropriate for the context. Students utilize models, manipulatives, and/or drawings to help determine what is happening in the context of the story. Students will work with one and two step addition and subtraction story problems.

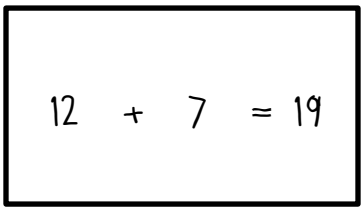
ONE STEP PROBLEM (with a variety of tools)

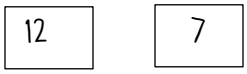
For example: There were 12 rabbits in the garden. 7 rabbits joined them in the afternoon. How many rabbits were in the garden in the afternoon?



Student: I thought about the 12 rabbits so I started on 12 and then hopped on 7 more and I landed at 19 so I know that 12 + 7 = 19.







Student: I knew there were 12 rabbits to begin with so I made a 10 stick and 2 singles and that is 12. Then I put 7 singles over here. And then I said 12 and counted on 13, 14, 15, 16, 17, 18, 19 and so I have 19 all together because 12 and 7 are 19.

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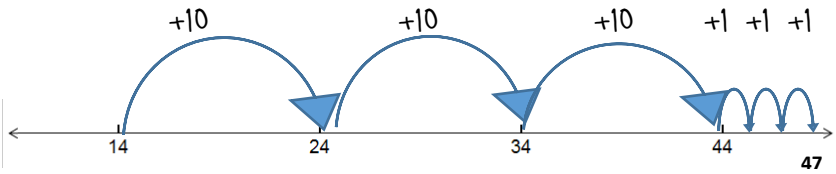
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Student: There are 12 rabbits so I started at the 12 and covered it with my cube. I added 7 more cubes because the story says 7 more rabbits came in the afternoon. That made 19 rabbits.

ONE STEP PROBLEM (with a variety of strategies)

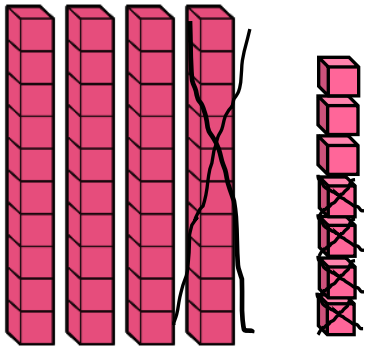
For example: Some students were planting seeds in the garden. 14 more came to help them. Now there are 48 students in the garden. How many students were in the garden to start with?



Student: I looked at the numbers and thought about "Some number and 14 makes 47". So I made my number line start at 14. And then I jumped by 10's like 24, 34, 44, and then I was close so I said 45, 46, 47. I counted my jumps by 10's and I had 3 jumps of 10 and that's 30. I had 3 jumps of 1 and that's 3. I added the 30 and the 3 and I got 33. So now I know that

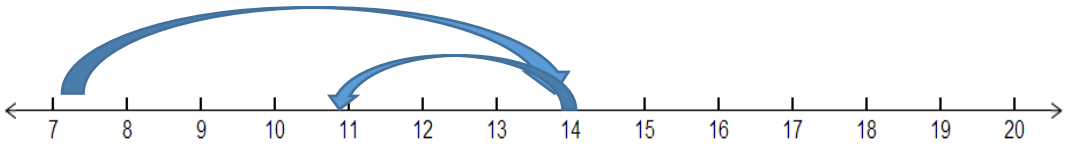
$33 + 14 = 47$

Student: I said the problem says there were 47 at the end. So I drew 4 tens and 7 ones. Then I took away the 14 kids that were at the beginning and there were 33 left so that means that 33 more came.



TWO STEP PROBLEMS

For example: There are 7 students in the lunchroom. 7 more students come in. After a few minutes, some students leave. There are now 11 students in the lunchroom. How many students left the lunchroom? Use drawings and equations to show your thinking.



Student: I started at 7 and added 7 more so I got to 14. Then I counted back until I got to 11 and that was 3. So I know that 3 left the cafeteria. So,

7 + 7 = 14 - 3 = 11 So 3 students left the lunchroom

2.OA.2-

Second graders internalize math facts and develop the fluency needed by repeatedly using strategies That make sense to them. Students who have fluency with math facts are accurate, flexible, and efficient. Students must have efficient strategies to recall sums from memory.

Addition Strategies:
Doubles
Near Doubles
Up and Over 10

Subtraction Strategies:
Think Addition
Down and Over 10
Take From 10

Example: 9 + 4 = ?

Up and Over 10

I knew that 4 is 3+1 so I took the 1 and added it to the 9 and got 10. Then I added in the 3 and I had 13.

Doubles

I know that 9 is 5+4 so I just took the 4 in the 9 and the 4 in the problem and said the double of 4 is 8 and then added the 5 and that's 13.

13 – 9 = ?

Think Addition

I know that 4 + 9 is 13 so

13 – 9 is 4.

Take From 10

To make it easier I just added 1 to each number so it made it 14 – 10 and that made it super easy. 14 – 10 = 4 so 13-9 is 4.

2.OA.3-

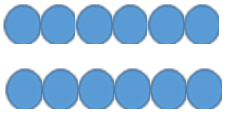
Students use their understanding of doubles and apply it to the concepts of odd and even numbers. Students will have had experience breaking a number apart (decomposing) into two equal numbers or double addition facts such as 12 = 6+6 and then recognize that 12 is an even number. Students will use manipulatives such as counters and cubes before moving to pictorial representations such as circles or arrays.

For example: Is 12 an even number? Defend your answer.

I counted 12 counters and paired them up by 2's. None were left over so it's even.

I counted 12 counters and put them into 2 equal groups and there were 6 in each group so that's equal.

I drew 12 circles and matched them up. Since they all match up, I know 12 is even.



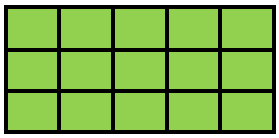
I know that the 12 is the double of 6 and 6+6 is 12 and that means 12 is even.

2.0A.4-

Students use rectangular arrays to work with repeated addition which is a foundation for multiplication which they will tackle in third grade. A rectangular array is an arrangement of objects in rows and columns. Students will explore arrays using concrete objects like counters as well as pictorial representations on paper.

NOTE: The commutative property of multiplication students can add either by the rows or the columns and still arrive at the same solutions.

For example: What is the total numbers of squares below?



I saw there are 3 counters in each of the columns and there are 5 columns so I just added

3+3+3+3+3= 15.

I could see there are 5 squares in each row and there are 3 rows so I said

5+5+5 = 15.