**Solving Story Problems**

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| In this lesson students use place value strategies to solve story problems related to addition, subtraction, and place value.  |

**NC Mathematics Standard(s):**

**Represent and solve problems.**

**NC.2.OA.1** Represent and solve addition and subtraction word problems, within 100, with unknowns in all positions, by using representations and equations with a symbol for the unknown number to represent the problem, when solving:

* One-Step problems:
* Add to/Take from-Start Unknown
* Compare-Bigger Unknown
* Compare-Smaller Unknown
* Two-Step problems involving single digits:
* Add to/Take from- Change Unknown
* Add to/Take From- Result Unknown

**Use place value understanding and properties of operations.**

**NC.2.NBT.5** Demonstrate fluency with addition and subtraction, within 100, by:

* Flexibly using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.
* Comparing addition and subtraction strategies, and explaining why they work.
* Selecting an appropriate strategy in order to efficiently compute sums and differences

**NC.2.NBT.8** Mentally add 10 or 100 to a given number 100–900, and mentally subtract 10 or 100 from a given number 100–900.

**Additional/Supporting Standards:**

**NC.2.NBT.2** Count within 1,000; skip-count by 5s, 10s, and 100s.

**NC.2.NBT.1** Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones.

* Unitize by making a hundred from a collection of ten tens.
* Demonstrate that the numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds, with 0 tens and 0 ones.
* Compose and decompose numbers using various groupings of hundreds, tens, and ones.

**NC.2.NBT.3** Read and write numbers, within 1,000, using base-ten numerals, number names, and expanded form.

**Standards for Mathematical Practice:**

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively
3. Construct viable arguments and critique the reasoning of others
4. Model with mathematics
5. Use appropriate tools strategically

**Student Outcomes:**

* I can count forward and backward by 10s for any number between 10-99.
* I can add or subtract multiples of 10 while solving story problems.
* I can count forward and backward by 10s for any number between 100-999.
* I can add or subtract multiples of 100 while solving story problems.

**Math Language:**

**What words or phrases do I expect students to talk about during this lesson?**

 Add, Count, Group, Join, Multiples, Ones, Subtract, Take Away, Tens, Hundreds

**Materials:**

* Activity sheet, Hundred Blocks, ten sticks, Hundred Boards, Number Cards marked 1-9, plastic counters, snapping cubes, Two color counters
* Base ten blocks, Hundreds board, primary number cards, counters for game pieces for follow-up activities.

**Advance Preparation**:

* Gather materials

**Launch:**

Dot Sticks (10-15 minutes)

Display dot sticks (attached) or place value blocks and some ones.

Ask students, “How many are there?” “How do you know?”

Example: The teacher places 4 sticks of ten and 3 ones and ask students, “How many dots do you see?” Then ask, “How did you figure it out?”

Students might say, “I saw 4 sticks of ten and knew that was 40 and then added three more; 41, 42, 43.” Or “I saw 2 tens and knew that was 20. Then I saw 2 more tens and knew that was 20 more. 20 + 20 is 40. 40 plus the 3 ones is 43.”

Have a student write the numeral 43 on the board.

The teacher should do 2-3 of these examples, paying attention to whether students understand how to count the tens and ones and correctly determine the total quantity.

**Explore:**

**Story Problems with Two-Digit Numbers** (20 minutes)

Read a story problem to them and have them talk with a partner about how to solve this problem or have them solve it on paper or their white board. Then share their strategy. Before posing the problems think about the number combinations that will work well for the strategy of adding 10 or 100 to a number. Also think about the different types of addition situations (add to, put together or compare). Use Table 1, from The Common Core State Standards for Mathematics for examples of these problems. The table is attached to this lesson.

Examples of problems are below:

The number in parentheses is a suggestion if you want students to use numbers greater than 99. You may want to write these problems on chart paper or the board. Record strategies for showing how the problem was solved. Examples of recording strategies are shown for the first problem.

Possible problems:

Add to Result Unknown:

1. 28 (128) children were standing in the cafeteria line. 10 children joined them. How many children are in the line?

Possible strategies:

 10 20 21 22 23 24 25 26 27 28



 38

Students may also mentally reason about 28 plus by saying things such as:

 “I put 28 in my head and added 10 more which makes 38.”

“20 plus 10 is 30 and then add 8 more. It’s 38.” or

“28 plus one more ten is 38.”

1. I had 56 (256) rocks in my collection. I walked in the woods and collected 10 (100) more. How many rocks do I now have?

Put Together Total Unknown

1. 45 red pencils were on the counter. I put 10 (100) blue pencils on the counter. How many pencils were on the counter?
2. 35 angel wing seashells were on the beach. The waves washed 10 (100) Scotch bonnet seashells on the sand. How many seashells were on the sand?

While you are incrementing or decrementing by 10s or 100s ask, “How does this counting by tens help you add 10 or 100 to a number?”

Explore (Part 2)

Solving Story Problems in Partners or Small Groups (13-15 minutes)

Have students solve the problems on the activity sheet. Students may want to use ten strips to help them solve the problems. They also could use Unifix cubes in sticks of ten to solve the problems.

There are three versions of the worksheet. The first worksheet has students just add or subtract tens. The second worksheet has students add or subtract multiples of ten. The third worksheet is more challenging and has students work with numbers beyond 99. Students add or subtract multiples of 10.

As students work on the problems observe students. Look for students who

* struggle to interpret the problems
* struggle with recording their strategy but can mentally solve the problem
* easily solve the problems and record strategies
* cannot add on to a given number

When students finish the worksheet have them work with another student to play Plus-Minus-Stay the Same (introduced in earlier lesson). Remind the students that this game relates to mentally skip counting by multiples of (10 or 100).

**Discuss:**

Discussion Problem Solving Strategies (8-10 minutes)

After most students have finished the worksheet, choose 2-3 students to share strategies used to solve the problems. When students share strategies ask questions to emphasize and focus on how counting on by tens helps solve the problems, as opposed to having to count all. For example, “When you added 35 plus 10 how did you know you could start at 35 instead of counting from zero?”

Help students with recording and notating their strategies as you facilitate the discussion. Many students can mentally solve the problems but have difficulty showing their strategy on paper.

If there is a particular strategy that is shared that you would like students to focus on, conclude the discussion by giving students a follow-up problem to practice that strategy.

**Additional Activities (20-30 minutes)**

 **Follow-up Story Problems**

Students need primary number cards. Students select two primary number cards and make a two-digit number (3 and 6 could be 36 or 63). Students then put that number into a story problem and choose whether they will add or subtract the numbers.

I had \_\_ pieces of candy and my friend (gave me/ gave away) 20 more. How many do I have now? (62 + 20 or 62 - 20).

Students solve several problems that involve adding and subtracting multiples of ten to help students connect this game and the ten strips to adding and subtracting multiples of ten in a story problem. Have students make a representation of the problem in their math journal or on a whiteboard.

62 + or

10

10

10

10

1 0

10

10

10

 72 10 20 30 40 50 60 61 62 72

Depending on the time of year, students may be ready to add and subtract hundreds or tens from a three-digit number. Students would draw 3 number cards instead of 2 for this activity and put the number within the context of a word problem. Use Table 1 (attached to this lesson) for examples of problem types.

**Place Value with Three Digit Numbers (teacher-led small group)**

If students have demonstrated success with two-digit numbers you can move them into mentally adding/subtracting 10 or 100 to/from a given number between 100 and 999.

After most students are fluent adding and subtracting by tens, display 9 tens and 2 ones (value of 92). Ask, “What is the total and how do you know?” “If we added 1 more ten how many would we have?” Do this a few more times with numbers ranging from 91 to 98.

Display a 100 block, 1 ten and 2 ones. Add 100 blocks and have the students determine the value of the blocks. Continue to add 100s until you get to 512. Ask students to tell you how they determined the value of the blocks. Record the value of the numbers so students can help to make sense of the pattern-

112

212

312

412

Help students discover that the hundreds place increases by one each time and the number of tens and ones stays constant. If needed do this with a few more starting numbers between 111 and 119.

**Collections of Objects**

Give students another collection of objects. Have students make groups of 10, and record the quantity two different ways. Recordings could include tallies, rectangles and singles, bundles of ten, or an equation (10+10+10+1+1= 32).

While students are working, ask some of the following questions: What does this drawings/numbers represent? When they have their representation drawn and the number is written, point to one of the numbers (tens or ones) and ask, “Where is that number in this representation?” Point to part of the representation and ask, “Where is that in the number?”

**Building Two-Digit Numbers**

Give students primary number cards and base ten blocks. Students pick two number cards and make a two-digit number: a 5 and a 3 could be 35 or 53. Students then build those two-digit numbers with base ten blocks, record the number and a picture of the blocks. They continue to do this during the center.

**Hundreds Board Bingo**

Students use primary number cards and a hundreds board. Students pick two number cards, make a two-digit number, and then cover the number up on the hundreds board with a game piece. The goal is to cover up 5 consecutive numbers- vertical, horizontal, or diagonal.

**Evaluation of Student Understanding**

Informal Evaluation:

Observe the students during various activities to see how they are solving story problems with a focus on whether they are able to count on or count back or if they need to count their entire set of objects.

Formal Evaluation/Exit Ticket:

Activities during the lesson can be used as a formal evaluation. If you would like an exit ticket consider giving students the task, “I have 35 pencils. If my friend gives me 20 more pencils how many pencils do I now have?”

**Meeting the Needs of the Range of Learners**

**Intervention:** For those who are struggling work with smaller numbers below 50. Also have conversations such as, “If you have 51 dots and I give you a ten strip, how many dots would you have?” If a student quickly responds 61, then help the child see the connection to the game.

Those who can add one and subtract one from a given number but cannot fluently count by tens may need to practice in a small group with the ten strips. He/she may also need to build two-digit numbers with the Unifix cubes “bundling” the sticks of ten.

If a child cannot respond quickly ask, “If you have 61 and I give you 1 more how many would you have?” If a child cannot respond quickly to this question he/she needs more practice with counting one more/less.

**Extension:** Students who can easily add or subtract by 10s can use this knowledge to add 20s, 30s and

other multiples of ten to a given number.

**Possible Misconceptions/Suggestions:**

|  |  |
| --- | --- |
| **Possible Misconceptions** | **Suggestions** |
| Students may reverse a number, e.g., stating that 32 is 2 tens and 3 ones. | Provide either place value blocks or ten frame cards to help students make sense of the idea that a ten is a group of ten ones.  |
| Students may struggle determining whether to add or subtract.  | Students need concrete objects such as base ten blocks or ten strips. Use smaller numbers and have students discuss with classmates and you about the action of the problem to determine whether they should add or subtract.  |

Solving Story Problems

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Solve each problem. Show how you solved it using words, pictures or numbers.

1. 29 children were sitting on the bus. 10 more children got on the bus. How many students are on the bus now?
2. 83 pebbles were in the fish tank. Mrs. Jones took some out to clean the fish tank. Now there are 73 pebbles in the tank. How many did she take out?
3. 45 red apples and 10 green apples are on the table. How many apples are on the table?
4. 91 students are in the media center looking for books. 10 students leave the media center. How many students are now in the media center?
5. 36 seashells are on the beach. A wave washes away 10 seashells. How many are now on the beach?
6. There were 33 children in the cafeteria. 10 children got hotdogs. The rest got hamburgers. How many got hamburgers?

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Solve each problem. Show how you solved it using words, pictures or numbers.

1. 29 children were sitting on the bus. 30 more children got on the bus. How many students are on the bus now?
2. 83 pebbles were in the fish tank. Mrs. Jones took some out to clean the fish tank. Now there are 43 pebbles in the tank. How many did she take out?
3. 45 red apples and 50 green apples are on the table. How many apples are on the table?
4. 91 students are in the media center looking for books. 70 students leave the media center. How many students are now in the media center?
5. 36 seashells are on the beach. A wave washes away 20 seashells. How many are now on the beach?
6. There were 63 children in the cafeteria. 30 children got hotdogs. The rest got hamburgers. How many got hamburgers?

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Solve each problem. Show how you solved it using words, pictures or numbers.

1. 129 children were sitting on the bus. 20 more children got on the bus. How many students are on the bus now?
2. 283 pebbles were in the fish tank. Mrs. Jones took some out to clean the fish tank. Now there are 173 pebbles in the tank. How many did she take out?
3. 345 red apples and 40 green apples are on the table. How many apples are on the table?
4. 191 students are in the media center looking for books. 30 students leave the media center. How many students are now in the media center?
5. 336 seashells are on the beach. A wave washes away 100 seashells. How many are now on the beach?
6. There were 533 children in the cafeteria. 200 children got hotdogs. The rest got hamburgers. How many got hamburgers?

Glossary, Table 1. Common addition and subtraction situations.1

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Result Unknown** | **Change Unknown** | **Start Unknown** |
| **Add to** | Two bunnies sat on the grass. Three more bunnies hopped there. How many bunnies are on the grass now?2 + 3 = ? | Two bunnies were sitting on the grass. Some more bunnies hopped there. Then there were five bunnies.How many bunnies hopped over to the first two?2 + ? = 5 | Some bunnies were sitting on the grass. Three more bunnies hopped there. Then there were five bunnies. How many bunnies were on the grass before?? + 3 = 5 |
| **Take from** | Five apples were on the table. I ate two apples. How many apples are on the table now? 5 – 2 = ? | Five apples were on the table. I ate some apples. Then there were three apples. How many apples did I eat?5 – ? = 3 | Some apples were on the table. I ate two apples. Then there were three apples.How many apples were on the table before?? – 2 = 3 |
|  | **Total Unknown** | **Addend Unknown** | **Both Addends Unknown2** |
|  | Three red apples and two | Five apples are on the table. | Grandma has five flowers. |
|  | green apples are on the table. | Three are red and the rest | How many can she put in her |
| **Put Together/ Take Apart3** | How many apples are on the table?3 + 2 = ? | are green. How many apples are green?3 + ? = 5, 5 – 3 = ? | red vase and how many in her blue vase?5 = 0 + 5, 5 = 5 + 0 |
|  |  |  | 5 = 1 + 4, 5 = 4 + 1 |
|  |  |  | 5 = 2 + 3, 5 = 3 + 2 |
|  | **Difference Unknown** | **Bigger Unknown** | **Smaller Unknown** |
|  | (“How many more?” version): | (Version with “more”): | (Version with “more”): |
|  | Lucy has two apples. Julie has | Julie has three more apples | Julie has three more apples |
|  | five apples. How many more | than Lucy. Lucy has two | than Lucy. Julie has five |
|  | apples does Julie have than | apples. How many apples | apples. How many apples |
|  | Lucy? | does Julie have? | does Lucy have? |
| **Compare4** | (“How many fewer?” version): | (Version with “fewer”): | (Version with “fewer”): |
|  | Lucy has two apples. Julie has | Lucy has 3 fewer apples than | Lucy has 3 fewer apples than |
|  | five apples. How many fewer | Julie. Lucy has two apples. | Julie. Julie has five apples. |
|  | apples does Lucy have than | How many apples does Julie | How many apples does Lucy |
|  | Julie? | have? | have? |
|  | 2 + ? = 5, 5 – 2 = ? | 2 + 3 = ?, 3 + 2 = ? | 5 – 3 = ?, ? + 3 = 5 |

2These take apart situations can be used to show all the decompositions of a given number. The associated equations, which have the total on the left of the equal sign, help children understand that the = sign does not always mean makes or results in but always does mean is the same number as.

3Either addend can be unknown, so there are three variations of these problem situations. Both Addends Unknown

is a productive extension of this basic situation, especially for small numbers less than or equal to 10.

4For the Bigger Unknown or Smaller Unknown situations, one version directs the correct operation (the version using more for the bigger unknown and using less for the smaller unknown). The other versions are more difficult.

1Adapted from Box 2-­‐4 of Mathematics Learning in Early Childhood, National Research Council (2009, pp. 32, 33).

Dot Sticks




## Plus-Minus Stay the Same

Materials

100 chart to share between 2 players

Deck of numeral cards 1-9, four of each numeral Distinct markers for each player

**Players**: 2

Directions

1. Decide which player will go first. The first player chooses 2 numeral cards from the deck. Determine which card is the tens digit and which card is the ones digit. For example, if 2 and 4 are drawn the player can use these cards as 24 or 42.
2. Player one must decide whether to keep the number the same and mark it, add 10 to this number, or subtract 10 from this number. After the decision is made, player 1 covers the number on his/her chart. For example, if the player decides to use 42 the player can cover 42, 32, or 52.
3. Player two chooses two numeral cards from the deck, determines the number, and decides whether to add 10 to the number, subtract 10 from the number or stay with the number. Player 2 covers the number on the 100 chart.
4. Players continue to play.
5. The winner is the first player to cover 3 numbers in a row. Rows can be vertical, horizontal or diagonal. The game can be made more difficult by having students cover 4 or 5 numbers in a row.

Possible Sheet for Anecdotal Notes Grouping Objects by 2s, 5s or 10s

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Student Names**  | **Counts objects by ones. Does not understand grouping.**  | **Groups objects by (2s, 5s 10s) but when counting the total counts by ones**  | **Groups objects by (2s, 5s, 10s) & easily determines the total**  | **Groups objects by 2s, 5s or 10s; uses that information to determine how many groups will be in a different arrangement**  |  |
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Primary Number Cards

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| --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 0 | 1 | 2 |
| 3 | 4 | 5 | 3 | 4 | 5 |
| 6 | 7 | 8 | 6 | 7 | 8 |
| 9 | 0 | 1 | 9 | 0 | 1 |
| 2 | 3 | 4 | 2 | 3 | 4 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 5 | 6 | 7 | 5 | 6 | 7 |
| 8 | 9 | 0 | 8 | 9 | 0 |
| 1 | 2 | 3 | 1 | 2 | 3 |
| 4 | 5 | 6 | 4 | 5 | 6 |
| 7 | 8 | 9 | 7 | 8 | 9 |

**Hundreds Board**