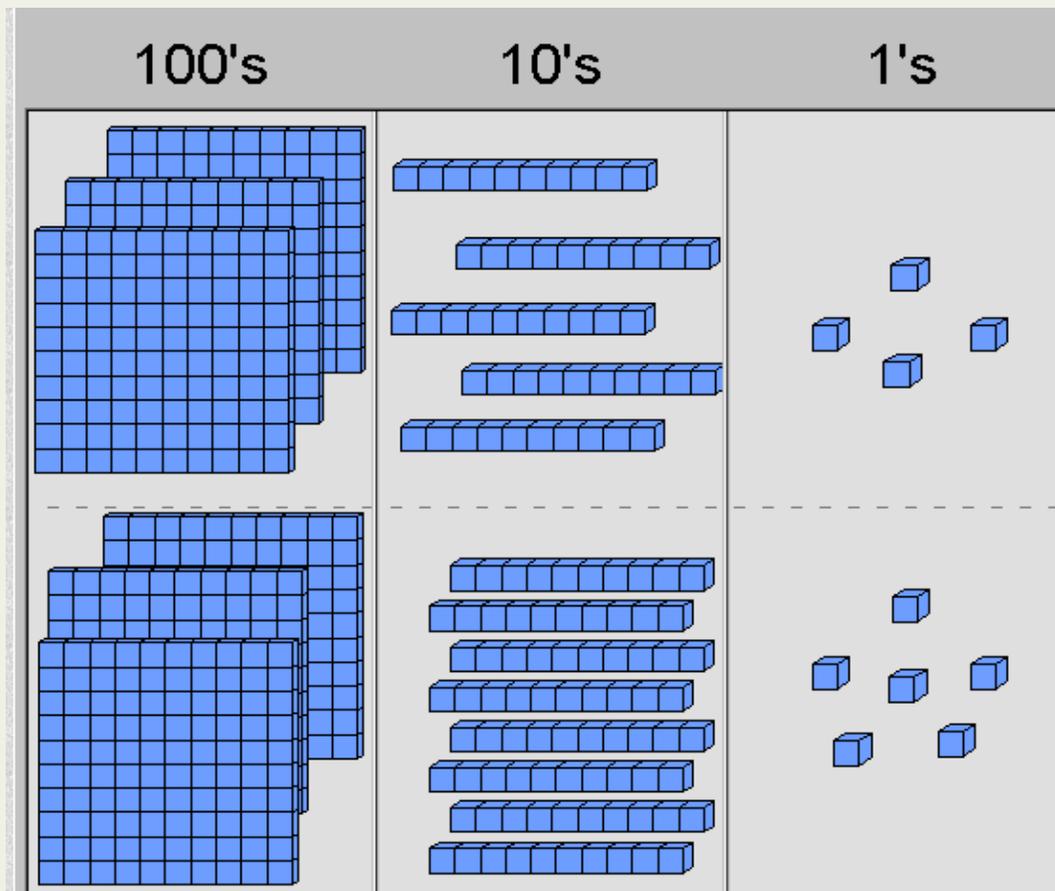


Second Grade

Adding and Subtracting



http://nlvm.usu.edu/en/nav/frames_asid_152_g_2_t_2.html

North Carolina Department of Public Instruction



Overview

The implementation of the Common Core State Standards in Mathematics (CCSSM) is both an exciting and anxious time for teachers around the country. Part of the excitement is the CCSS inclusion of both the Content Standards and the Standards for Mathematical Practice. The Standards for Mathematical Practice provide a foundation for the process skills that all K-12 students should be developing during every lesson.

Overview of the Units

The purpose of this document is to provide teachers with a set of lessons that are standards-based and align with the CCSS Content Standards and Standards for Mathematical Practice. By standards-based, we mean that students are learning mathematics by exploring mathematically-rich tasks and sharing strategies, ideas, and approaches with one another. During these lessons, the teacher's role is to truly facilitate learning by posing a task, asking questions that guide students' understanding, and assess students' mathematical understanding.

The phases of each lesson are:

- **Engage-** Students open the lesson by engaging in a brief activity to build upon students' prior knowledge.
- **Explore-** Students explore a mathematically rich task or activity that includes the main mathematical goals. During this phase, the teacher may model how to play a game or do an activity, but should not model or over teach strategies or procedures.
- **Explain-** Students discuss strategies and mathematical ideas from the Explore phase. The teacher may teach content and emphasize concepts or strategies here.
- **Elaborate-** Students complete a follow-up activity or task that extends their work from Explore and the discussion of concepts in Explain.
- **Evaluation of Students**
 - **Formative Assessment-** How can the teacher assess students during the lesson?
 - **Summative Assessment-** How can the teacher assess students' work after the lesson?

Resources on the Common Core

This document is only a starting resource as teachers begin implementing the CCSS and the Standards for Mathematical Practice. The North Carolina Department of Public Instruction has also written Unpacking Documents available at <http://www.ncpublicschools.org/acre/standards/support-tools/>. These unpacking documents provide specific descriptions of each standard as well as examples.

This project was directed by Dr. Drew Polly at UNC Charlotte. Educators who collaborated to create these documents are Gail Cotton, Ryan Dougherty, Tricia Esseck, Marta Garcia, Tery Gunter, and Kayonna Pitchford along with the DPI staff.



Unit Overview: Grade 2

Mathematical Goals

In this unit, students will:

- Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.
- Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.
- Explain why addition and subtraction strategies work, using place value and the properties of operations.
- Read and write numbers to 1000 using base-ten numerals, number names, and expanded form.

Lessons in the Unit

Part One: Counting Groups and Counting by Tens First Half of the School Year

Lesson	Title and Description
1.1	Counting Objects by Groups: Students count collections of objects in a variety of ways—by 1s, 2s, 5s, 10s. Students record their strategies. Materials: Unifix cubes or connecting cubes, collections of objects for the students to count, collections should have between 35-55 objects, collections could include books, cubes, color tiles, pencils, pennies, paper clips, paper.
1.2	Counting By 10s: Students count by tens from any given 2-digit number. Can be modified for 3-digit numbers later in the year. Materials: Ten Sticks or Base Ten Blocks, Hundreds boards, Counters, Numeral cards 1-9
1.3	Solving Story Problems: Students count by tens from any given 2-digit number and apply the skill of counting by tens to solve story problems. Materials: activity sheet, hundred blocks, ten sticks and ones, hundred boards, number cards marked 1-9, markers/counters, connecting cubes

Part Two: Adding and Subtracting 2-Digit Numbers First Half of School Year

Lesson	Title and Description
2.1	The Game of Tens and Ones: Students use ten frames and play <i>The Game of Tens and Ones</i> . Materials: ten frame cards, spinner, activity sheet, hundreds board, 2 color counters for the 100 board.

2.2	<p>Story Problems and Centers: Students work in centers to solve story problems and play games related to addition and subtraction.</p> <p>Materials: ten frame cards, 100 board for each pair of students, spinner, 2 color markers for the 100 board, optional worksheets, numeral cards 1-9, 100 boards for each pair of players, 2 color counters, activity sheets, base 10 blocks or cubes.</p>
2.3	<p>The Open Number Line: Students will use add/subtract tens to/from a given number to solve addition and subtraction word problems. The open number line is introduced as a strategy for solving the problems.</p> <p>Materials: ten strips or ten frames, activity sheet</p>
2.4	<p>Solving Problems on the Open Number Line: Students analyze 3 number line strategies for solving a compare difference unknown situation. Students then solve 2-3 problems independently using an open number line.</p> <p>Materials: examples of strategies</p>

Part Three: Exploring Three-Digit Numbers Last Quarter of the Year

Lesson	Title and Description
3.1	<p>Building Two- and Three-Digit Numbers with Arrow Cards: Students use arrow cards to develop place value understanding. Place value games are played during this lesson.</p> <p>Materials: Arrow cards--a set for each pair of students, arrow card spinner, clear spinner, paper clip, pencil, place value dice</p>
3.2	<p>Centers with Arrow Cards: Students continue to work on 2-digit and 3-digit place value concepts. Games played are Arrow Card Spin, Make the Largest Number and Get to 20. Students work in centers.</p> <p>Materials: Number cards 1-9, arrow cards, arrow card spinners, paper clip spinner, place value dice</p>
3.3	<p>Two-step Problems: Students begin solving two-step problems with 2- and 3-digit numbers.</p> <p>Materials: ten strips, activity sheets, Beat the Calculator cards, Beat the Calculator Directions, calculators</p>
3.4	<p>Centers with Story Problems: Students solve Story Problems with 2- and 3-digit numbers and complete centers activities.</p> <p>Materials: activity sheet, ten strips, Arrow Card Game, Arrow cards sets, Arrow card spinners, paper clip, place value dice, hundreds board for each pair of students, optional worksheets, spinner, 2 color counters, numeral cards 1-9, 100 boards, Beat the Calculator Cards, calculators</p>
3.5	<p>Write an Equation to Match the Story: Students mentally add and subtract 10 to/from 3-digit numbers. They use this strategy to solve story problems. Strategies for solving the problems are discussed in class.</p> <p>Materials: activity sheets</p>
3.6	<p>Find the Difference: Students play "Greatest Difference Wins" to practice subtraction with 3-digit numbers. Strategies are discussed.</p> <p>Materials: Greatest Difference Wins spinner boards, Greatest Difference Wins recording sheet</p>

3.7	<p>Greatest Difference Wins: Students play the game <i>The Greatest Difference Wins</i> and work in centers.</p> <p>Materials: Greatest Difference Wins spinner boards, Greatest Difference Wins recording sheet, Arrow Cards, Arrow Card spinner, Calculators</p>
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Common Core State Standards addressed in this unit:

Operations and Algebraic Thinking (2.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 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.¹

Numbers in Base Ten (2.NBT)

Understand place value.

- 2.NBT.1** Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. Understand the following as special cases:
- 100 can be thought of as a bundle of ten tens — called a “hundred.”
 - The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones).
- 2.NBT.2** Count within 1000; skip-count by 5s, 10s, and 100s.
- 2.NBT.3** Read and write numbers to 1000 using base-ten numerals, number names, and expanded form.
- 2.NBT.4** Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using $>$, $=$, and $<$ symbols to record the results of comparisons.

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.
- 2.NBT.7** Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds.
- 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.
- 2.NBT.9** Explain why addition and subtraction strategies work, using place value and the properties of operations.

Emphasized Standards for Mathematical Practice

In this unit all of the Standards for Mathematical Practice are addressed.

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.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning

Lesson 1.1: Counting Objects by Groups Overview and Background Information

Mathematical Goals	By the end of the lesson students will: <ul style="list-style-type: none"> count objects in groups of 2, 5, 10, eventually working mainly with groups of 10. make representations of two digit numbers relate the representation to the written numeral.
Common Core State Standards	<p>Understand place value.</p> <p>2.NBT.1 Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. Understand the following as special cases:</p> <ol style="list-style-type: none"> 100 can be thought of as a bundle of ten tens — called a “hundred.” The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones). <p>2.NBT.2 Count within 1000; skip-count by 5s, 10s, and 100s.</p> <p>2.NBT.3 Read and write numbers to 1000 using base-ten numerals, number names, and expanded form.</p> <p>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.</p>
Emphasized Standards for Mathematical Practice	<ol style="list-style-type: none"> Make sense of problems and persevere in solving them Reason abstractly and quantitatively Construct viable arguments and critique the reasoning of others Model with mathematics Use appropriate tools strategically Attend to precision Look for and make use of structure
Prior Knowledge Needed	Adding a two-digit number and a multiple of 10, mentally find 10 more or 10 less than a given two-digit number, rote count to 100 fluently, rote count by 10s
Vocabulary	tens, ones, skip count, place value
Materials	Unifix cubes or connecting cubes for the demonstration activity, chart paper, collections of objects for the students to count. Collections should be in the 35-55 range) Collections could include books, cubes, color tiles, pencils, pennies, paper clips, paper, etc.

Tasks in the Lesson

Engage	10-15 minutes
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This activity focuses on the conservation of number. Specifically, students explore the idea that the number of objects remains the same when they are rearranged.

Make a pile of Unifix cubes (between 25-32 cubes). Ask individual students to count the cubes.

Observe students as they count to see if they count one at a time or to see if they put them into groups before counting them. Some students should group them by two’s, five’s, and ten’s.

After counting the cubes one way and leaving the cubes in piles, ask, “How might we record our counting.”

Write down their suggestions so that students can see them.

For example, if the cubes are in groups of 2 and there are 28 cubes the recording could be 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28

Ask students, “Which number represents our total number of cubes?”

After the first student has counted, ask, “Is there another way to count the cubes?”

After the cubes have been counted, record the quantity. Emphasize that although we are counting the cubes in different ways, such as individually, in groups of 2, 5 or 10, we still get the same number of cubes.

Explore

10-15 minutes

Counting Collections

Explain to the students that they are going to count collections of items and record their strategy for counting. Our goal is to count them by twos or fives **and** also by tens. Ask 1-2 students to restate the task to make sure that they understand.

The teacher puts the students in pairs and gives them materials to count. As the students are working in pairs observe students, looking for students who are struggling with counting by groups and those who after the first count already know how many groups they will have in the second count.

For example, if a pair counts 42 by tens and finds out there are 4 tens and 2 two ones, a student may say, “That’s going to be 20 twos and another group of two—21 twos.

There is an optional recording format at the end of this lesson. Before the students start working, have an idea of what you will be looking for. List those behaviors at the top of the chart. Check what is observed. For example, if a student groups 38 objects into 7 groups of 5 and 3 leftovers and quickly knows that will be 3 tens and 8 ones make a note of this.

As you observe students notice which recording strategies that you will have students share later during the class discussion. Look for strategies that show tally marks, numbers ($10 + 10 + 10 + 2$) or other ways for recording the quantities.

If a pair counts their objects and records much quicker than another group have them count a third way or add more objects to their collection. If you add more objects, can students count on from their existing number to determine the amount or do they need to start over?

As students are working, questions you can ask include:

How many groups of ten (two, or five) did you make?

After you made groups, did you have any leftovers? How did you count your leftovers?

If I gave you 10 more, how many would you have?

Explain

10 minutes

After most pairs have counted their collections twice and recorded, bring the class together and have them share their counting strategies.

Have 2-3 pairs of students share their strategies. If you have a document camera students can show their work. If a document camera is not available you may want to have the pair redraw their work on chart paper during the explore time. Another way to quickly share their work is for the teacher to draw on the board or chart paper their strategy, and then have the students talk about it.

As students are sharing their strategies ask:

Why did you choose this strategy?

What does this (pointing to the representation) mean?

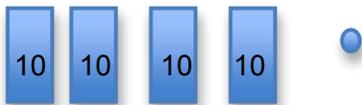
After 2-3 students have shared keep these representations up so the class can see them. Ask:

How are these strategies (representations) alike?

How are these strategies (representations) different?

Who can restate what (name) said? Or Who can explain (name’s) strategy?

You can extend the discussion by having students use a specific strategy to count objects. For example, here is an example of a representation for 41:



Have a student get out 41 cubes. Put them in tens and ones. Have the class draw a representation of 41. Students can draw their representation on individual white boards or notebook paper. If the students have math journals, record the representation in the journals.

Elaborate

10-15 minutes

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?”

Evaluation of Students

Formative: During the phases of this lesson, formative evaluation can be done using questions and points to observe.

Summative: After students count collections over several lessons or center times, give a student a collection of objects, less than 100. Ask the student to group the objects by tens and count the quantity.

Ask the student the total amount in the collection and how they know.

Have the student make a representation of the collection and how it’s organized:

Ask students what the drawings/numbers represent?

When they have their representation drawn and the number written point to one of the numbers (tens or ones) and ask where that number is in their representation.

Point to part of the representation and ask where is that in the number.

Write a number. Have the student make a representation. Ask what part each of the representation means. Have them relate it to the written number.

Plans for Individual Differences

Intervention: Students may place one object out and count by twos (five or tens). Check to see if this student can use one to one correspondence to count to 100. Do they know the sequence of numbers to 100? Can they fluently tell you what number comes before and after numbers 0-100? If a student does understand one to one correspondence but is having difficulty grouping objects and then counting by 2s, 5s or 10s, have this student use a smaller number of objects—try numbers in the teens and twenties only. Have this student only focus on one-way of counting (2s, 5s or 10s).

Extension: Some students will understand the number of tens and ones contained in a number without building the representation. These students can build numbers in the hundreds and relate the representation to the numeral.

Lesson 1.2: Counting By 10s

Overview and Background Information

Mathematical Goals	By the end of the lesson or a series of similar lessons, students will: <ul style="list-style-type: none"> • count fluently by 10s from any given number 10-90. • mentally add 10 or subtract 10 from any number 10-99. • count fluently backwards by 10s from any given number to 999 • count fluently by 100s from any given number to 999 • count fluently by 100s backwards from any given number to 999
Common Core State Standards	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.7 Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds. 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. 2.NBT.9 Explain why addition and subtraction strategies work, using place value and the properties of operations. ¹ ¹ Explanations may be supported by drawings or objects.
Emphasized Standards for Mathematical Practice	<ol style="list-style-type: none"> 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
Prior Knowledge Needed	introduction to tens and ones
Vocabulary	place value, tens, ones, compose, decompose
Materials	ten sticks, base ten blocks, hundreds boards, counters, numeral cards (1-9), pocket chart 100 board (optional), markers for 100 board

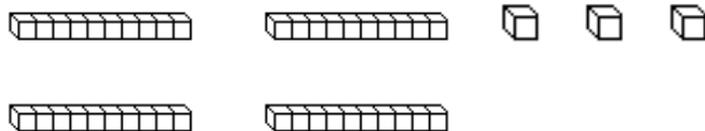
Tasks in the Lesson

Engage

10-15 minutes

Dot Sticks

Place dot sticks (attached) or place value blocks and some ones on the overhead.



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

Example: The teacher places 4 sticks of ten and 3 ones on the overhead and asks 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.

Adding Ten More Dots

Add another block of ten to the 43 (or whatever number you ended with) and ask, “How many dots are there now?”

Have students respond with a total and how they knew it.

Responses might be, “I counted 5 tens and 3 ones and knew it was 53.” Or “I started at 43 and counted on ten more 44, 45, 46...52, 53.”

The goal of this activity is for students to mentally add on ten without having to count all or count on by ones. You can support this by asking questions such as:

- “How many tens did we have at the beginning?” (4)
- “How many ones did we have at the beginning?” (3)
- “What did we add?” (a ten)
- “How many tens do we have now?” (5)
- “How many ones do we have now?” (3)
- “What is our total number?” (53)
- “How is 53 different from 43?” (there are 5 tens instead of 4 tens)

Follow up by asking students, “How much would we have if we add another ten?”

Continue this by adding tens and list the numbers on the board vertically:
43, 53, 63, 73, 83

Ask, “What do you notice about the numbers?”

Comments might be:

- The numbers always end in 3—ask why?
- The tens go 4, 5, 6, 7, 8—ask why?

We want them to understand that when we add ten, the tens place will change but the digit in the ones place stays the same.

Follow this by repeating it with another number.

As you are adding tens, use the word “compose.”

Example:

- “How many do we have now?” (57)
- “How many tens and ones do we have?” (5 tens and 7 ones).
- “So 57 is composed of 5 tens and 5 ones.”

As you add blocks of ten, have one child list the numbers and have another child mark the numbers on a large 100 board. You could also have students at their seats cover the numbers on their 100 boards.

When the teacher finishes adding the blocks of ten, have students check to see whether the numbers covered are also recorded on the board.

After you are done adding the blocks of ten, remove one block of ten at a time and have the students tell you the total.

Complete variations of this activity several times over the next few weeks. Students will get used to the pattern. However, make sure to follow-up and ask students what composes the numbers. For example, students should be able to look at 83 and tell you that it is composed of 8 tens and 3 ones. The simple recitation of the pattern does not demonstrate understanding!

Explore

15-20 minutes

Plus-Minus-Stay the Same

Demonstrate the game for students (directions are attached). As students play the game as a class, ask, "How does this game relate to the counting we have been doing with the tens and ones strips." "How does counting with these strips help you play the game?"

As the class or groups play the game observe the students to see if they:

- mentally add or subtract ten
- count on their fingers or use objects to determine 10 more or less.

If students are struggling help them through questioning by asking, "If you have 32 dots and I give you a ten strip, how many dots would you have?" If a student responds with 42 within 3-5 seconds, then help the child see the connection to this game.

If a child cannot respond ask them, "If you have 32 dots and I give you 1 more how many dots would you have?" If a child cannot respond quickly to this question he/she needs more practice with counting one more/less.

Explain

10 minutes

After the class has played Plus-Minus Stay the Same bring the class back together to discuss the game. The discussion should focus on mentally adding or subtracting ten in the context of the game.

Show a hundred board that has two numbers already marked in a row such as 32, 42. Tell them that someone drew a 6 card and a 2 card. Ask them, "Should we use the number 26 or 62?"

Students should identify that 62 is the correct number to use, because there is a 2 in the ones place. If students subtract 10 from 62 that would be 52, which means they would have 3 numbers marked in a row: 32, 42, 52.

Ask students, "Why did we want to make the number 62 instead of 26?"

Students should talk about the idea that they can change the number in the tens place, but the number in the ones place must stay the same. So, if they were trying to get to 52, they need to put a 2 in the ones place.

Example 2: Show students a game board that has 36 and 38 marked. Pull the number cards 2 and 7. Ask them, "What 2 numbers could we make?" (27 or 72). Follow-up by asking, "Which number do we want to make and why?"

Students hopefully see that the number they need to win has a 7 in the ones place, so 27 is a better choice. By making the number 27 and adding 10, they will get 37, which will give them 3 in a row.

As students are discussing, revisit the term composed and decomposed with phrases such as "37 is composed of 3 tens and 7 ones" or "we can decompose 37 into 3 tens and 7 ones."

Extending Place Value Work into Three-Digit Numbers

After 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, place a 100 block on the overhead and some tens and ones. Ask, "What is the total and how do you know?" Practice this for several numbers.

Increment numbers beyond 100. Examples:

Place a 100 block, 3 tens and 5 ones on the overhead. Add tens and have the students count (135, 145, 155, 165, 175, 185, 195, 205, etc). Take away tens and have them count backwards by tens. Discuss how they knew the total number of dots.

Place a 100 block, 5 tens and 3 ones on the overhead. Add 100 blocks and have the students count (153, 253, 353, 453). Discuss how they knew the total number of dots. Have these numbers recorded on the board and ask what they notice—the tens and ones place never change. The hundreds place increases by one each time.

Ask, "How is counting by tens in the hundreds the same as counting by tens for numbers less than 100?" They should see that the pattern is the same. Put these numbers on the board and have them discuss the pattern they see and how the patterns are alike.

21	121	521
31	131	531
41	141	541
51	151	551
61	161	561
71	171	571

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

Evaluation of Students

Formative: As the students count by tens and later 100s look for students who see the pattern and use it to count fluently. Look for students who do not see the pattern—the next number they say does not have the same number of ones as the previous number, or they count on their fingers to determine the next number.

Summative: Students work from the Elaborate section can be used to evaluate students. Subsequent tasks are also provided at the end of this lesson.

Plans for Individual Differences

Intervention:

For those who are struggling ask, "If you have 32 dots and I give you a ten strip, how many dots would you have?" If a student quickly responds 42, then help the child see the connection to adding tens.

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 32 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.

Optional Assessment Tasks:

Show 3 ten-strips and 5 ones and ask, "How many dots are there? How many tens are there? How many ones?" Place another ten-strip and ask, "How many dots now?" Continue adding ten-strips and have the student tell the total. Look for fluency in counting by tens. After adding several ten-strips ask the student how he/she knew the number of dots. You are looking for answers that indicate that he/she understands that the tens place is the only one changing.

Place 7 ten-strips and 3 ones and take away ten-strips, one at a time, asking the child the total each time. Ask how he/she knew the totals. If the child is fluent with this counting do the same with 100 blocks, tens and ones.

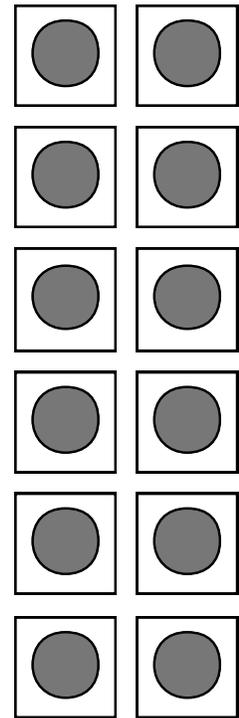
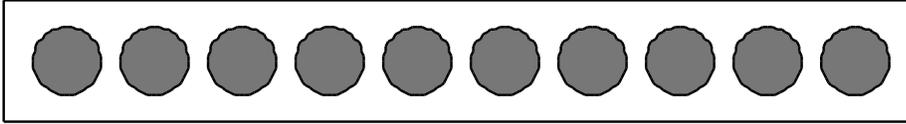
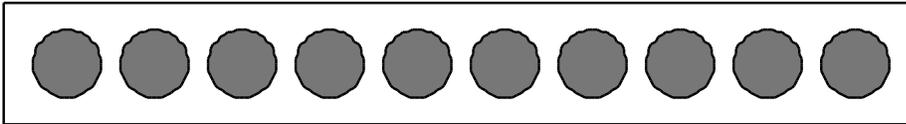
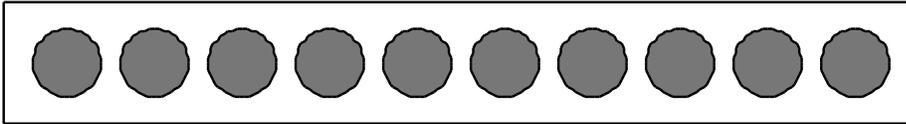
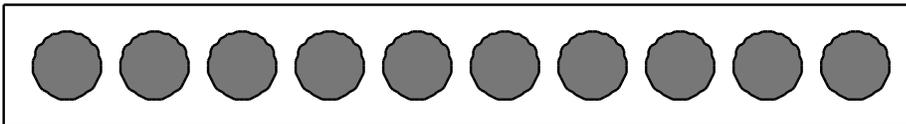
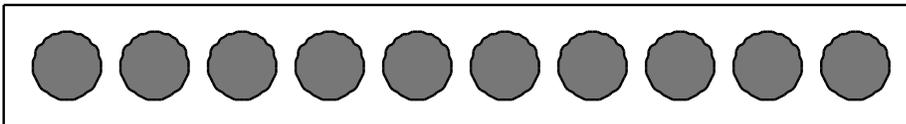
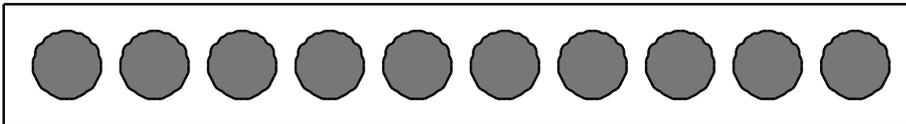
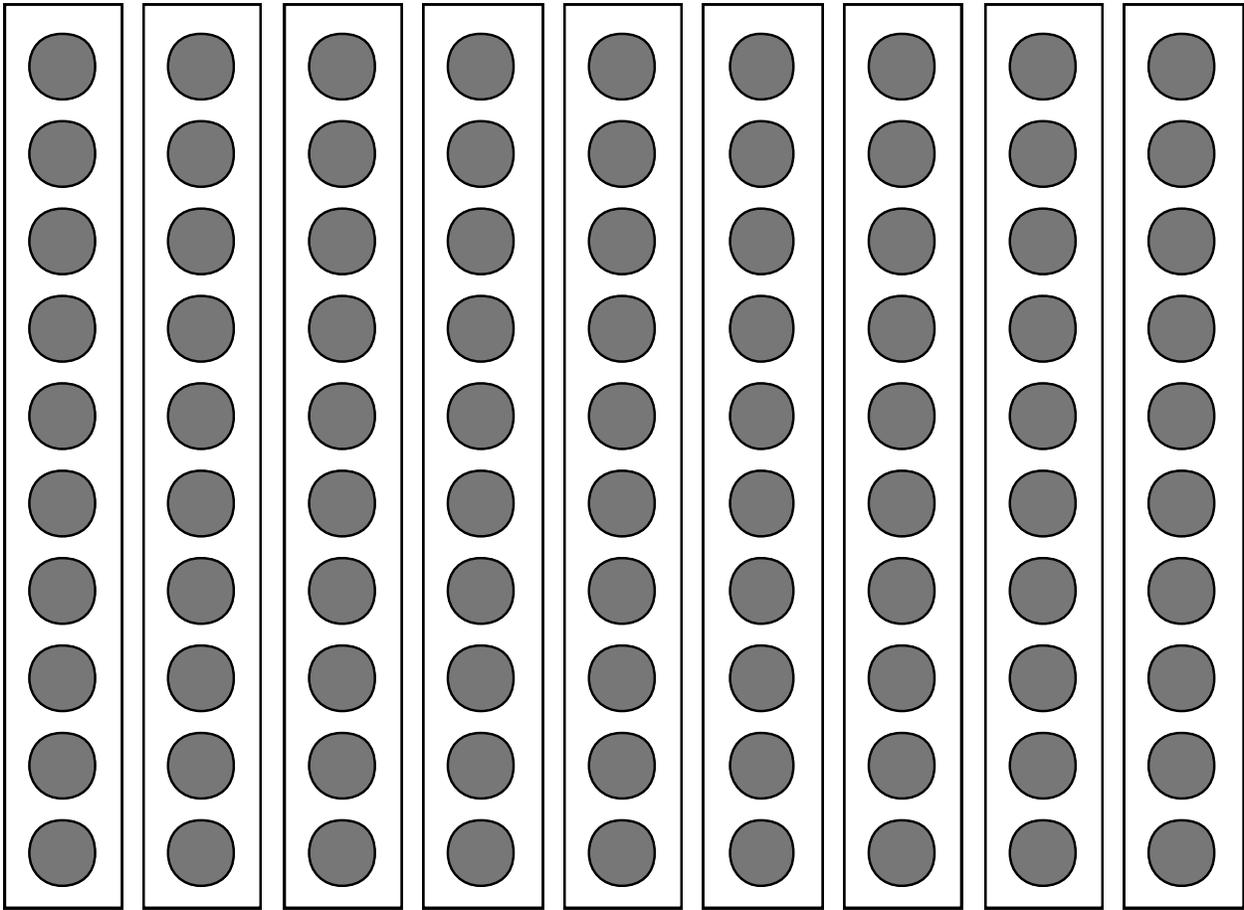
Place several 100 blocks, 1-2 tens and some ones. Keep adding tens and have the student count. Place 4 100 strips, 3 tens and 8 ones. Add 100 blocks and have the student count (take away 100 blocks and have student count backwards also.). Ask the student how he knew the next number.

Depending on the student's level of understanding for counting by 10s or 100s, give the student 2 story problems and have them mentally determine the total. The following examples have two sets of numbers. The first set of numbers is for the child who counts by tens fluently but struggles with numbers beyond 100. The second set of numbers is for the student who fluently counts by 10s and 100s.

My mother had (54, 254) buttercups planted in the garden. She added (10, 100) more buttercups. How many buttercups are now in garden? How do you know?

I counted my collection of pennies. I had (71, 571) pennies. My brother gave me (10, 100) more. How many pennies do I have now? How do you know?

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

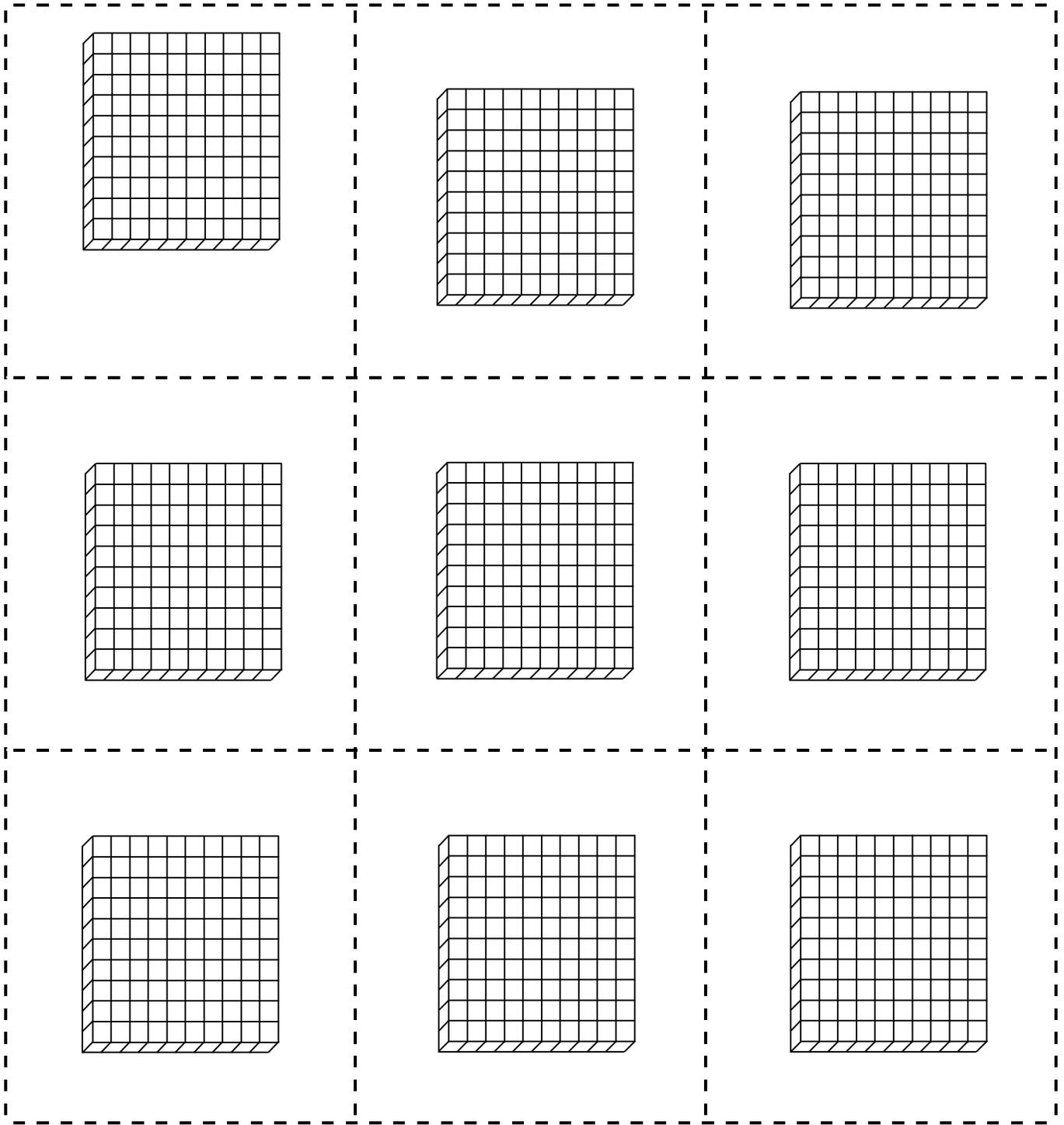
Distinct markers for each player

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.

Base 10 Blocks (hundreds)



Hundreds Board

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

0	1	2	3	4
5	6	7	8	9

Lesson 1.3: Solving Story Problems Overview and Background Information

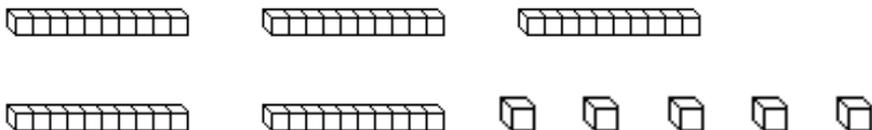
Mathematical Goals	<p>By the end of the lesson or a series of similar lessons, students will:</p> <ul style="list-style-type: none"> • Count fluently by 10s from any given number 10-90 • Mentally add 10 or subtract 10 from any number 10-99 • Adding or subtracting 10 from any given number to solve story problems <p>Later in the year, this lesson can be used to help students to:</p> <ul style="list-style-type: none"> • Count fluently by 10s from any given number to 999 • Count fluently backwards by 10s from any given number to 999 • Count fluently by 100s from any given number to 999 • Count fluently by 100s backwards from any given number to 999
Common Core State Standards	<p>Use place value understanding and properties of operations to add and subtract.</p> <p>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.</p> <p>2.NBT.7 Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds.</p> <p>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.</p> <p>2.NBT.9 Explain why addition and subtraction strategies work, using place value and the properties of operations.¹</p> <p>¹ Explanations may be supported by drawings or objects.</p>
Emphasized Standards for Mathematical Practice	<ol style="list-style-type: none"> 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
Prior Knowledge Needed	mentally adding and subtracting 10 from any two-digit number, experiences with the value of tens (4 ten sticks has a value of 40).
Vocabulary	place value, compose, decompose
Materials	Activity sheet, Hundred Blocks, ten sticks, Hundred Boards, Number Cards marked 1-9, plastic counters, snapping cubes, Two color counters

Tasks in the Lesson

Engage 20-25 minutes

Two-Digit Numbers with Ten Sticks (10 minutes)

Place 5 ten sticks and 5 ones on the overhead.



Ask students, “How many dots (cubes) do you see?” Then ask, “How did you figure this out?” Students will give various responses such as:

- I saw three tens and then two more. I know that was 5 so it’s fifty and five more. 55
- I counted 10, 20, 30, 40, 50 and it’s five ones so it’s 55.
- 10, 20, 30, 40, 50, 51, 52, 53, 54, 55

Add another 10 strip and have them determine the total (65)

Continue adding 10 strips. Go beyond 100. Discuss the pattern they hear (The ones place never changes.).

Place one ten and 8 ones on the overhead.



Ask the total and then start adding 10 strips as the class counts 18, 28, 38, etc.

Do 2-3 more numbers and point out the pattern they hear/see.

Story Problems with Two-Digit Numbers (20 minutes)

Now put this skill into a context for the students. 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.

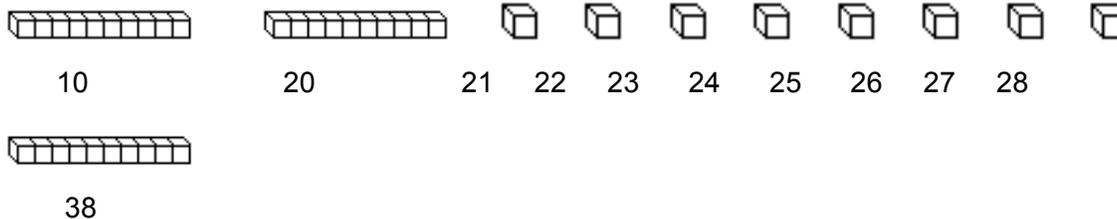
Examples of problems are below:

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:

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



Or Hold 28 in your head and add 10 more



That makes 38.

Or $20 + 10$ is 30 and then add 8 more. It's 38

Or $28 +$ one more ten is 38.

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

- 45 red pencils were on the counter. I put 10 (100) blue pencils on the counter. How many pencils were on the counter?
- 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

15-20 minutes

Solving Story Problems

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. This game was introduced to the class during the previous lesson. Remind the students that this game relates to the counting we have been doing with tens and ones strips.

Explain

10 minutes

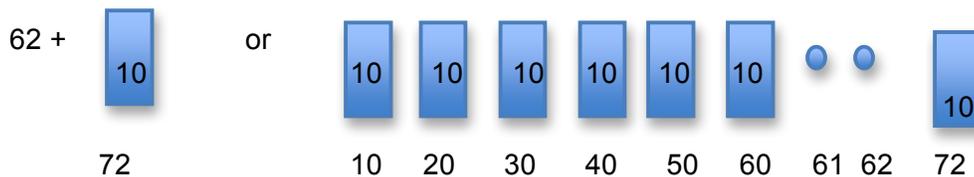
After most students have finished the worksheet, choose 2-3 students to share strategies used to solve the problems. When students share strategies emphasize how counting on by tens helps solve the problems. Help students with notating their strategies. Many students can mentally solve the problems but have difficulty showing their strategy on paper. Sharing strategies can help students with this problem. If there is a particular strategy that is shared that you would like students to develop, give the class a similar problem to practice that strategy.

Elaborate

8-10 minutes

Give the students oral Add to Result Unknown problems such as, I had 62 pieces of candy and my friend gave me 20 more. How many do I have now? ($62 + 20$).

Ask, "How did our game help us think about solving this problem." Do 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.



Depending on the time of year, students may be ready to add and subtract hundreds or tens from a three-digit number. Pose all tasks within a context of a word problem. Use Table 1 (attached to this lesson) for examples of problem types.

Evaluation of Students

Formative: As the students count by 10s and later 100s look for students who see the pattern and use it to count fluently. Look for students who do not see the pattern—the next number they say does not have the same number of ones as the previous number, or they count on their fingers to determine the next number.

Summative: Use the worksheet for a summative assessment.

Plans for Individual Differences

Intervention: For those who are struggling ask, "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.

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?

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

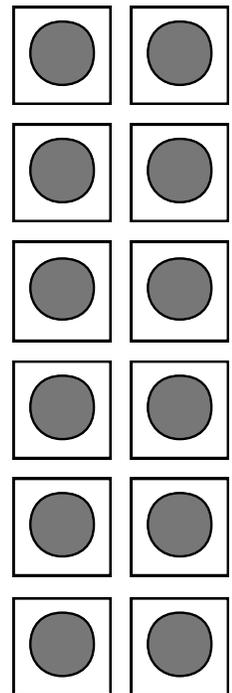
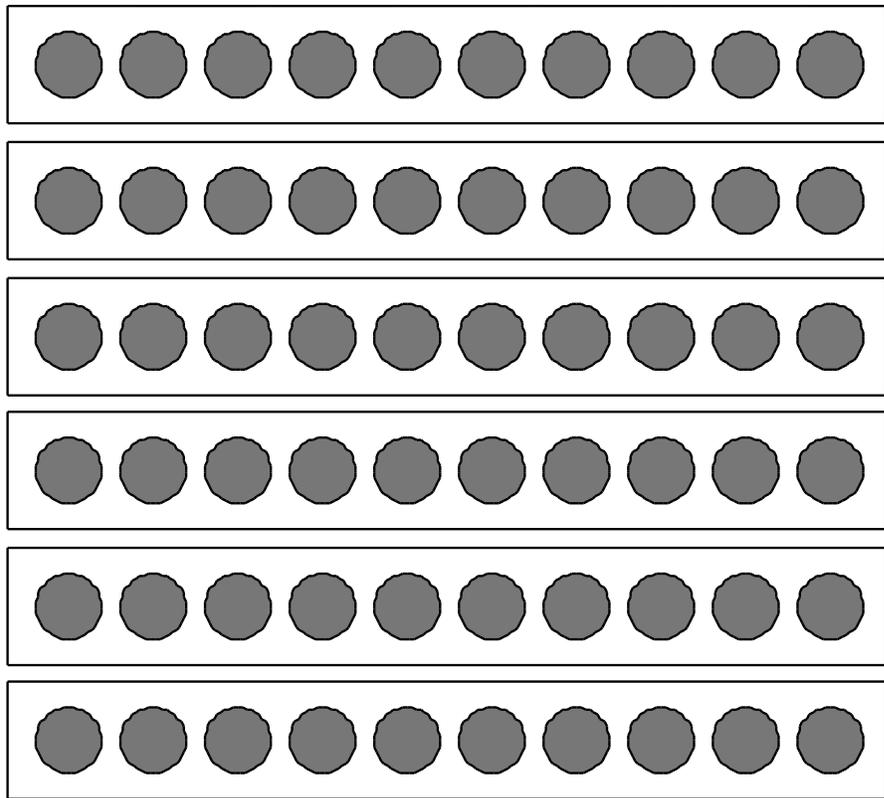
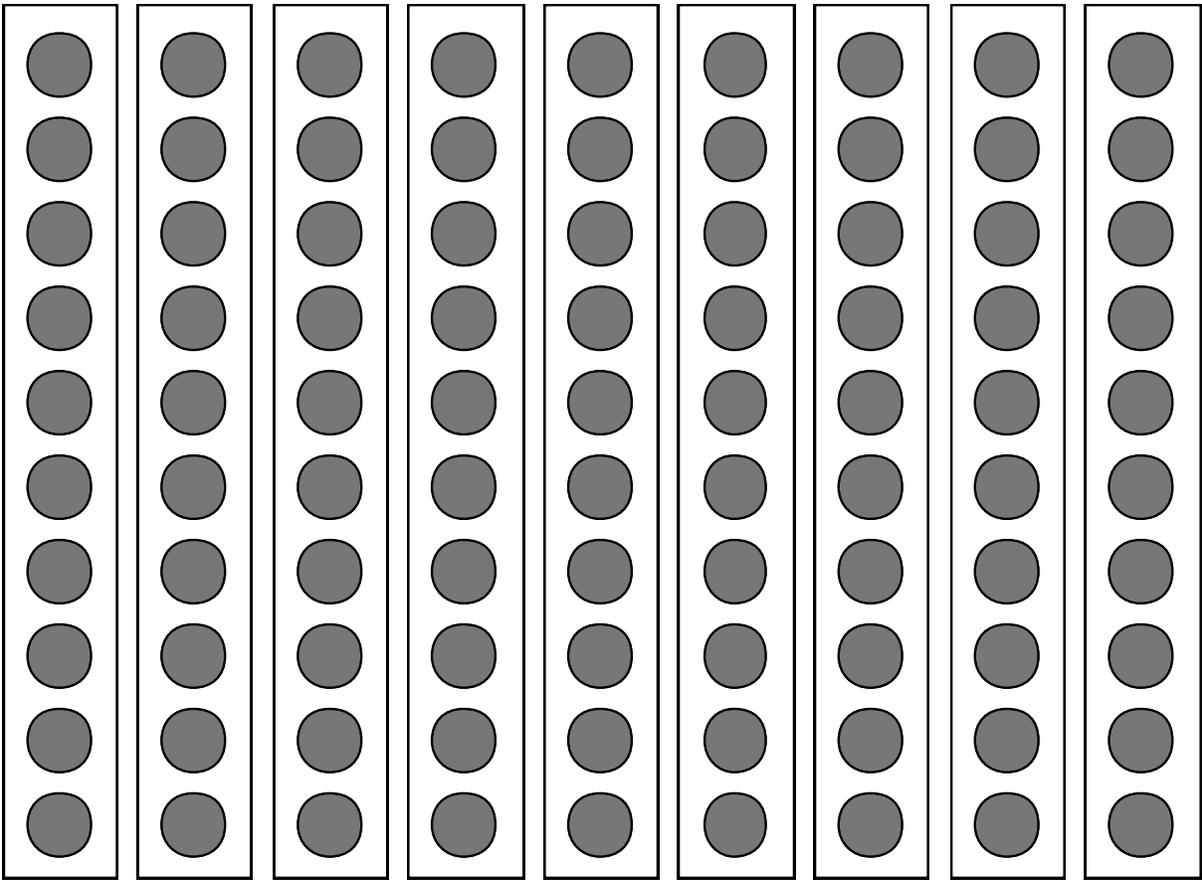
	Result Unknown	Change Unknown	Start Unknown
Add to	Two bunnies sat on the grass. Three more bunnies hopped there. How many bunnies are on the grass now? $2 + 3 = ?$	Two bunnies were sitting on the grass. Some more bunnies hopped there. Then there were five bunnies. How many bunnies hopped over to the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

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).



Plus-Minus Stay the Same

Materials

100 chart to share between 2 players

Deck of numeral cards 1-9, four of each numeral

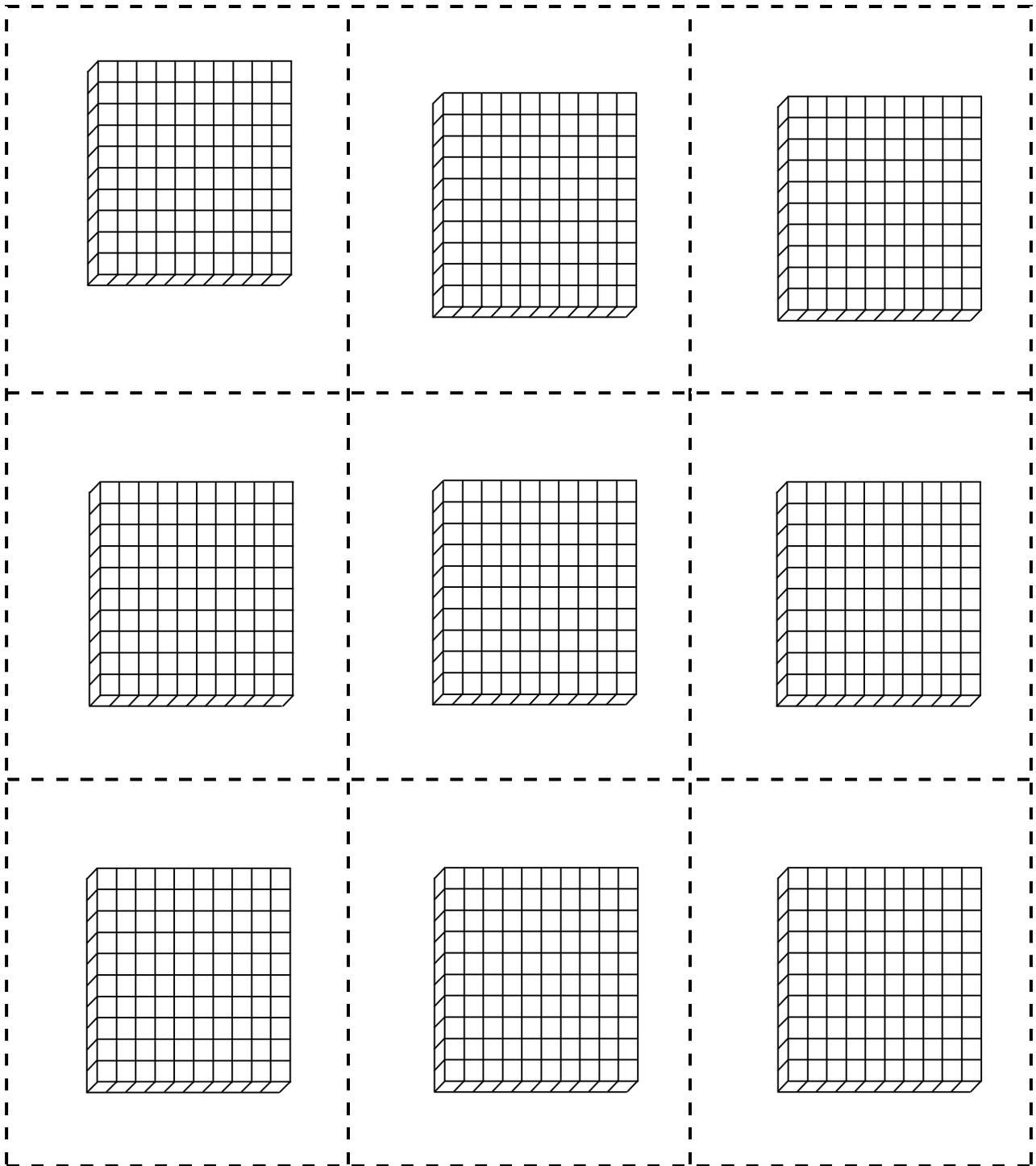
Distinct markers for each player

Players: 2

Directions

- 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.
- 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.
- 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.
- Players continue to play.
- 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.

Base 10 Blocks (hundreds)



0	1	2	3	4
5	6	7	8	9

Lesson 2.1: The Game of Tens and Ones

Overview and Background Information

Mathematical Goals	By the end of this lesson students will: <ul style="list-style-type: none"> Count by tens from any given number below 100. Add 10, subtract 10, add 1, subtract 1 from a 2-digit number
Common Core State Standards	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. 2.NBT.7 Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds. 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.
Emphasized Standards for Mathematical Practice	<ol style="list-style-type: none"> 1. Make sense of problems and persevere in solving them 2. Reason abstractly and quantitatively 4. Model with mathematics 5. Use appropriate tools strategically 6. Attend to precision
Prior Knowledge Needed	Experiences adding 1 and subtracting 1 from a given number
Vocabulary	ten frame, count by tens, tens, ones, adding, subtracting
Materials	ten frame cards, spinner, activity sheet, hundreds board, 2 color counters

Tasks in the Lesson

Engage	5-10 minutes
Quick Images	
<p>Explain that you are going to show an image and you want them to tell you how many they see. Turn the overhead off (or cover the ten frames). Place 5 full ten frames and a frame with 3 ones on the overhead and show it to the students for 2-3 seconds. Turn it off (or cover) ask them to think about the total number of dots. Show it one more time and then ask students to share the total. Have 2-3 students share how they determined the total. Do several quick images.</p> <p>Continue by asking: “Why do you think I am having you do this? Talk with your partner.” After about a minute have them share.</p> <p>Possible answers: We are counting tens, We are adding tens, We are talking about our strategies, It makes us count by tens so we won’t count by ones.</p>	

Explore

20 minutes

The Game of Tens and Ones

Introduce “The Game of Tens and Ones.” Refer to the handout for the directions. Model how to play the game on the overhead or document camera.

The first time you play the game you may not want to record the moves. Talk about the moves on the 100 board. Ask, “How can we move on the 100 board?”

Demonstrate moving by tens as opposed to moving by ones.

Play the game for 2-3 rounds. The teacher can model the game or have children come up to the overhead projector and place the marker.

Pair students up and have them play the game. Since this is the first time they have played the game do not have them record their moves. They are just learning the rules and starting to think about adding/subtracting tens and ones. Play this game each day for several days. After they have played the game for a few lessons, introduce how to record their moves. They can record their moves in their math journal or on paper. As students play the game observe them to see whether they jump by 10 or by 1.

Explain

10 minutes

Discussing The Game of Tens and Ones

After students have played the game discuss the game with the class. The discussion should focus on mentally adding or subtracting ten. After playing the game for several days also focus on the recording of moves.

Questions to facilitate the discussion include:

- Why do you think there are more 10s on the spinner?
- How does this game help you add and subtract?

Elaborate

10-15 minutes

After the discussion and several opportunities to play the game, have students record their moves on their activity sheet. For students who are ready for more of a challenge have them spin twice for each turn so that they must do two operations to the number.

For example, if they were on 37 and spun -10 and +1, students would record:

$$37 - 10 = 27, 27 + 1 = 28.$$

As students are playing the game, observe them and ask questions as they play.

Concepts to observe for and ask about include:

- How are students determining how to change the number?
- Can students tell you the number of tens and ones for a two-digit number?

Evaluation of Students

Formative: Observe the students during Quick Images.

- Do they quickly determine the number and explain their strategy?
- Do they count by tens and then ones?
- Do they know 5 groups of ten is 50 (or other combinations) without counting (10, 20, 30, 40, 50)?

During “The Game of Tens and Ones” observe students to see if they move accurately and efficiently by tens on the 100 board, or do they count each number?

Summative: Use the activity sheet attached as a summative assessment.

Plans for Individual Differences

Intervention: Work with a small group. Have the students use ten sticks and ones to add the numbers. Spin the spinner. Get a ten stick and determine the total. Mark the 100 board. Spin again. Get that many cubes. Determine the total and move on the 100 board. Continue.

Write a two-digit number. Have students build it with cubes. Cubes should already be in sticks of ten. Students can also choose numbers for each other.

Extension: Have students play the game from this lesson on a 200 board. Start game at 100.

Hundreds Board

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

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

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

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

1	2	3	4	5	6	7	8	9	10
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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

Name _____

Where do we land? (2-digit numbers)

Write an equation using +10, -10, +1, -1 to get to the target number. You can use a 100 board or 99 board to help you.

Examples: Start at 45 and end at 78. Write an equation.

$$45 + 1 = 46$$

$$46 + 10 = 56$$

$$56 + 10 = 66$$

$$66 + 10 = 76$$

$$76 + 10 = 86$$

$$86 - 10 = 76$$

$$76 + 1 = 77$$

$$77 + 1 = 78$$

$$\text{Or } 45 + 1 + 10 + 10 + 10 + 10 - 10 + 1 + 1 = 78$$

1. Start at 69. End at 83.

2. Start at 11. End at 30.

Solve these problems.

$$45 + 10 = \underline{\quad}$$

$$12 + 10 = \underline{\quad}$$

$$89 + 10 = \underline{\quad}$$

$$66 - 10 = \underline{\quad}$$

$$15 - 10 = \underline{\quad}$$

$$41 - 10 = \underline{\quad}$$

Name _____

Where do we land? (3-digit numbers)

Write an equation using +10, -10, +1, -1 to get to the target number.

Examples: Start at 145 and end at 178. Write an equation.

$145 + 1 = 146$

$146 + 10 = 156$

$156 + 10 = 166$

$166 + 10 = 176$

$176 + 10 = 186$

$186 - 10 = 176$

$176 + 1 = 177$

$177 + 1 = 178$

$Or \quad 145 + 1 + 10 + 10 + 10 + 10 - 10 + 1 + 1 = 178$

1. Start at 269. End at 283.

2. Start at 111. End at 130.

Solve these problems.

$145 + 10 = \underline{\quad}$

$612 + 10 = \underline{\quad}$

$389 + 10 = \underline{\quad}$

$166 - 10 = \underline{\quad}$

$415 - 10 = \underline{\quad}$

$241 - 10 = \underline{\quad}$

The Game of Tens and Ones

Materials

100 chart or 0-99 chart one per pair of students

2 game markers

Spinner (or die) labeled +10, +10, -10, -10, +1, -1

Directions

- Each player places a marker on the zero (or off the board if using a 100 chart) the 0-99 chart. Players take turns spinning.
- Player 1 spins and moves a marker according to the roll.
- Player 2 checks the move and agrees.
- Player 2 follows the same steps as Player 1.
- The winner is the first person to move his or her marker to 99 (or 100 if using the 100 chart).
- Players can record number sentences to match the moves.
Example: Player 1 spins +10 and moves to the 10 place.

She records $0 + 10 = 10$. On the next move she spins +1 and records $10 + 1 = 11$.

Version 2

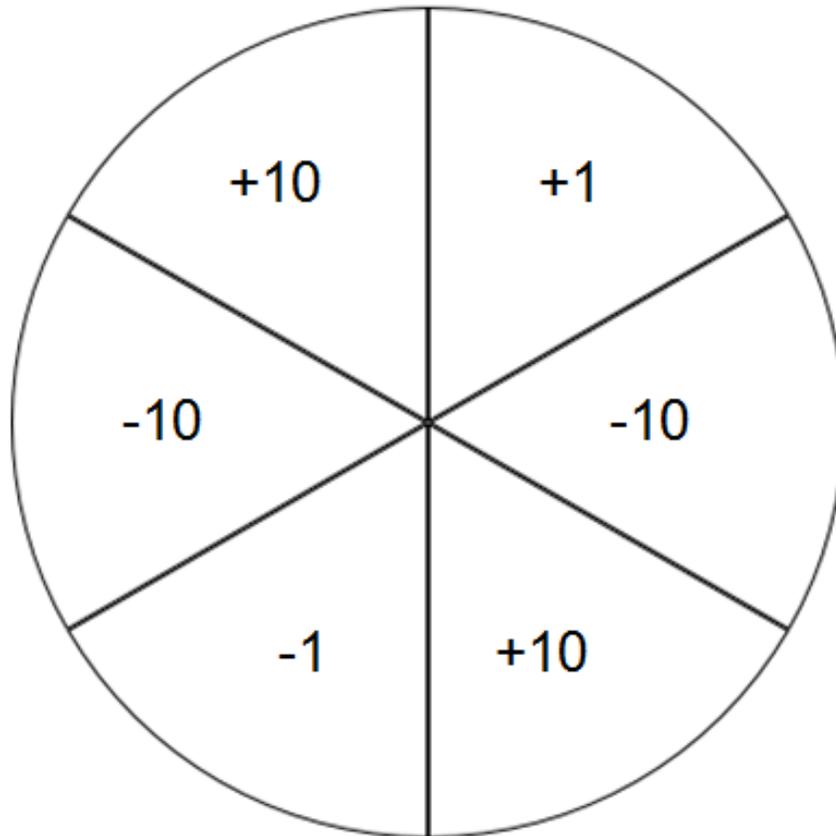
Players do not have to land exactly on 99 (or 100) to win the game. Play the game until time is up. The winner is the person who has landed on the larger number.

Version 3

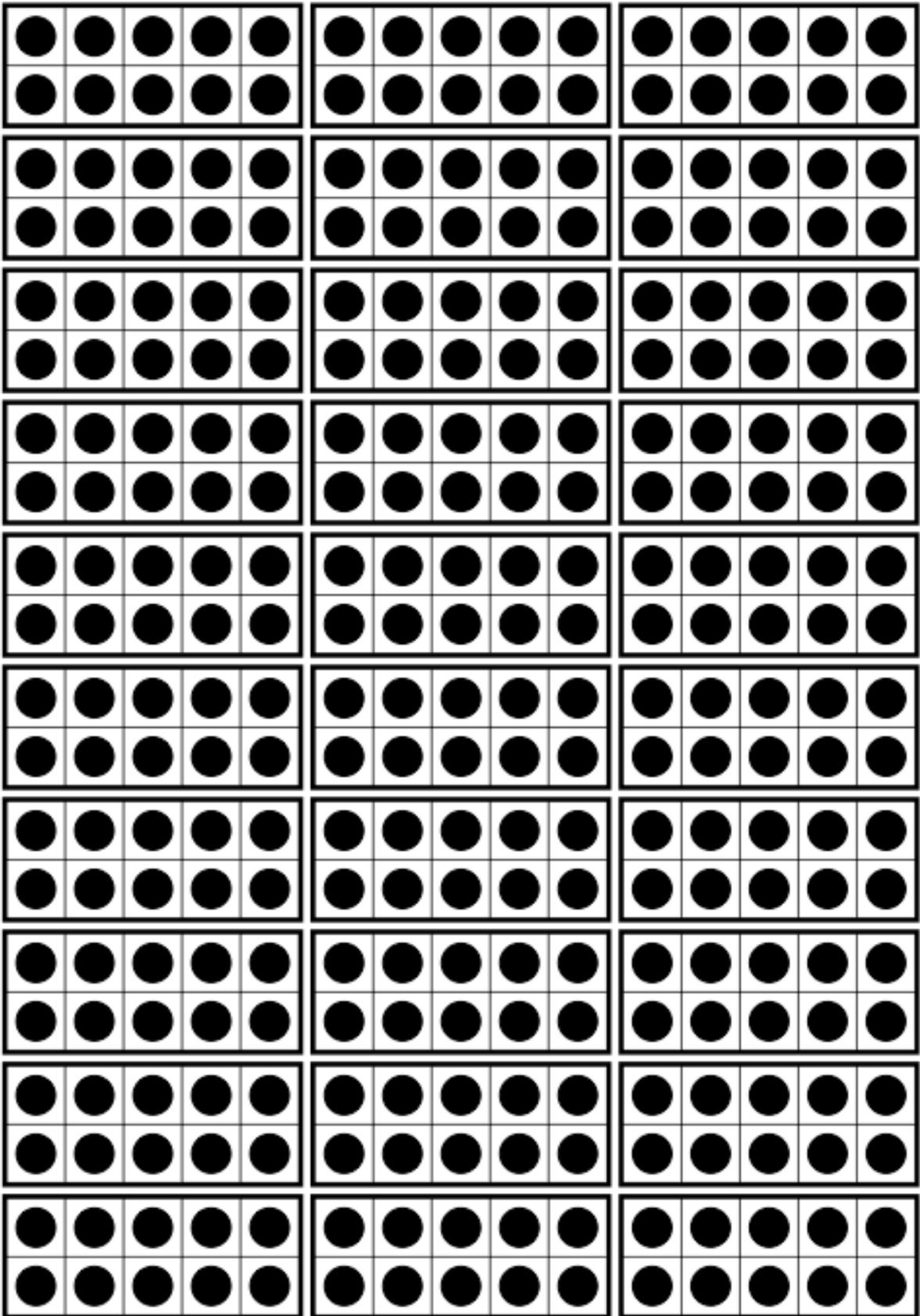
Players play on a 200 or 300 chart. Start at 100 or 200.

Adapted from : www.mathsolutions.com Marilyn Burns Education Associates.

The Game of Tens and Ones Spinner



● ● ● ● ●	● ● ● ● ●	● ● ● ● ●
● ● ● ●	● ● ● ●	● ● ● ●
● ● ● ● ●	● ● ● ● ●	● ● ● ● ●
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● ●	● ●	● ●
●	●	●



Lesson 2.2: Story Problems and Centers Introduction and Background Information

Mathematical Goals	<p>By the end of the lesson students will:</p> <ul style="list-style-type: none"> • Represent the two numbers in a 2-digit number • Represent the three numbers in a 3-digit number • Use place value to solve addition and subtraction problems • Add multiples of 10 or 100 to a 2-digit number or a 3-digit number
Common Core State Standards	<p>Represent and solve problems involving addition and subtraction.</p> <p>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, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.¹</p> <p>¹ See Glossary, Table 1.</p> <p>Understand place value.</p> <p>2.NBT.1 Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. Understand the following as special cases:</p> <p style="margin-left: 20px;">c. 100 can be thought of as a bundle of ten tens — called a “hundred.”</p> <p style="margin-left: 20px;">d. The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones).</p> <p>2.NBT.2 Count within 1000; skip-count by 5s, 10s, and 100s.</p> <p>Use place value understanding and properties of operations to add and subtract.</p> <p>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.</p> <p>2.NBT.6 Add up to four two-digit numbers using strategies based on place value and properties of operations.</p> <p>2.NBT.7 Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds.</p> <p>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.</p>
Emphasized Standards for Mathematical Practice	<ol style="list-style-type: none"> 1. Make sense of problems and persevere in solving them 3. Construct viable arguments and critique the reasoning of others 4. Model with mathematics 5. Use appropriate tools strategically 6. Attend to precision 7. Look for and make use of structure
Prior Knowledge Needed	Counting by tens from a given number
Vocabulary	hundreds, tens, ones, strategy, count by tens, count by hundreds

Materials	<p>Ten Frame Cards Center Materials The Game of Tens and Ones: Hundreds board for each pair of students, spinner, 2 color counters, Optional worksheets.</p> <p>Plus, Minus Stay the Same: Numeral cards 1-9, four of each card for each pair of players, Hundreds board for each pair of players 2 color counters, Base ten blocks.</p> <p>Story Problems: Worksheets, Base ten blocks or Ten Frame cards.</p>
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Tasks in the Lesson

Preparation for the lesson

This lesson begins with Quick Images, and then the students work in centers as the teacher works with small groups. This lesson can last for several days. Students work in different centers each day, and the teacher works with different small groups. The centers can be assigned or students can choose centers.

Activity Sheet

The activity sheet attached has options for the numbers to use. They are in parentheses. Prior to the lesson determine which numbers you want to use and edit the activity sheet.

Centers

Determine which students you need to work with based on observations and student work. The centers will be a review of concepts previously taught. Before the lesson determine the small groups that will be worked with during center time.

Possible group criteria:

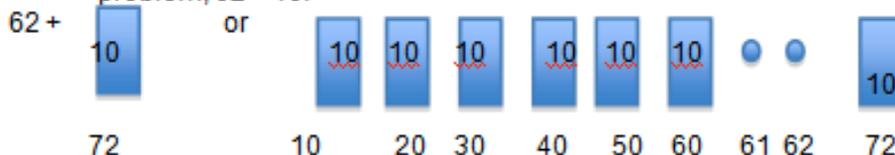
- Students who group objects by tens but continue to count by ones.
- Students who can orally count by tens from any given number (21, 31, 41, etc.) but do not apply the concept when playing games or solving problems.
- Students who group objects by tens but do not notate their work in tens and ones.

One example of notation for $11 + 60$ is



10 11 21 31 41 51 61 71

- Students who understand adding 10 to any given number and need more practice using this skill to solve problems. Here is an example of how students might represent solving problem, $62 + 10$.



- Students who can add 10 or 100 to a 3-digit number.

There are many ways to group students to work on concepts. Your formative assessment data gathered previously to this lesson will determine what skills students need to practice.

Engage

5-10 minutes

Quick Images

Lesson 4 explained how to use ten frames as quick images. In this lesson begin with quick images of 2-digit numbers.

Example:

Show 6 ten frames and a frame with 5 dots. Show for 2 seconds, cover, show again and cover. Ask students, “Who can describe the picture to me?” Allow several students to share how they determined the total (65) dots.

Follow up questions:

“How many dots were there? How do you know?”

“Who can think of a number sentence to represent our picture?”

Do several quick images. Move to numbers in the hundreds if students are ready. Use the base ten blocks (attached). After quick images go over these center activities:

- The Game of Tens and Ones
- Plus, Minus Stay the Same
- Grouping Objects
- Story Problems (Read “Plan for Individual Differences” for an explanation for the number choices.)
- Other place value games previously played in class

Explore

30-40 minutes

The centers allow students to further explore and practice their work with place value and number sense. As students are working in centers, you can either work with small groups or individual students.

Ideas for working with students. These decisions should be based on your observation and data from Lessons 1-4.

- Students who group objects by tens but continue to count by ones—have objects such as cubes and discuss ways to count them. Guide students to group them by tens. These students may not understand that when you count by tens you must have ten objects in each group.
- Students who can orally count by tens from any given number (21, 31, 41, etc.) but do not apply the concept when playing games or solving problems— have them orally count by tens and then show this with objects/cubes or draw pictures to represent what they are counting. Have students solve the problems that are the “add to result unknown” problem. An example is: Tom had 25 pennies. His sister gave him 10 more. How many pennies does he have now? Refer to the attached chart, Table 1, for an example of the add to result unknown story problem.
- Students who group objects by tens but do not notate their work in tens and ones— Have them write a 2-digit number and show it with cubes. Then talk about ways to notate this number. Ask, “How would you show this on paper?” As student share strategies talk about which ones are easier to draw. For example, when showing a ten stick to represent 10, it takes a long time to draw ten individual cubes. They may want to draw a rectangle or a stick and label it 10. This may be too abstract for some students who need more time to understand this representation.
- Students who can add 10 or 100 to a 3-digit number—Have these students work on adding larger multiples of 10 to a given number. For example, have them add $56 + 30$, $77 + 40$. If students easily add these numbers and can explain their strategy, have them add other multiples of 10 to numbers in the hundreds ($156 + 30$, $177 + 40$). Discuss how adding $156 + 30$ is like adding $356 + 30$. Or discuss how adding $56 + 30$ is the same as adding $56 + 10 + 10 + 10$.

Explain

Ongoing during centers

As students work in small groups with the teacher have students explain their strategies for solving the problems presented by the teacher.

Suggested questions:

What strategies are you using?

How do you know that your strategy makes sense?

How do you know that your answer is correct?

Elaborate

10 minutes

At the end of the lesson bring students together to briefly discuss one of the story problems. Pose one of the story problems from the activity sheet. Have students tell you their strategies used to solve the problem. Either use a document camera to show the students' work or write it so that students can visually follow their strategy.

Have a few students share their strategies. If time permits, pose a new problem and discuss ways to solve it. Keep the discussion focused on the Questions in the Explain section.

Evaluation of Students

Formative: The teacher checks student understanding through questioning during small group instruction. Anecdotal notes or a checklist can be used to collect formative assessment data.

Summative: Activity sheet from the story problem center. Make sure students show their work on the story problems.

Plans for Individual Differences

Intervention: The teacher works with small groups.

Extension: The teacher works with small groups. Students who go to the story problem center can be assigned different worksheets to complete. The teacher can create different story problems based on the student understanding. Use the attached chart (Table 1) to write different story problem types. There are some story problems attached to this lesson that can be used. The stories have numbers in parenthesis. Students (or the teacher) can determine what numbers to use. If the first number in the parenthesis is used, then the first number must be used throughout that problem. For example: I had (13, 45, 167) apples. I ate (10, 22, 67). How many apples do I have now? The student who chooses 13 must also choose 10. The student who chooses 45 must choose 22.

The first story problem sheet has Add to, Result Unknown problems.

The second story problem sheet has Add to, Change Unknown problems.

The third story problem sheet has both Add to, Result Unknown and Add to, Change Unknown problems.

Name _____

Solve each problem and show how you solved it. Use numbers, pictures or words to explain your strategy.

1. I saw (15, 67, 145) butterflies in the garden. (10, 20, 100) joined them. How many butterflies are now in the garden?

2. My class took a walk to collect leaves. The children collected (18, 41, 117) leaves. The teacher collected (10, 30, 100) more. How many leaves were collected?

3. Our class is collecting money for our field trip. On Monday we collected (25, 66, 131) dollars. On Tuesday we collected (10, 20, 50) dollars. How much money have we collected?

4. Wow, yesterday I went to the State Fair! I saw (16, 72, 278) cows. Then I saw (10, 20, 40) chickens. How many animals did I see?

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? $? + 3 = 5$
	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? $? - 2 = 3$
Take from	Total Unknown	Addend Unknown	Both Addends Unknown²
	Three red apples and two green apples are on the table. How many apples are on the table? $3 + 2 = ?$	Five apples are on the table. Three are red and the rest are green. How many apples are green? $3 + ? = 5, 5 - 3 = ?$	Grandma has five flowers. How many can she put in her red vase and how many in her blue vase? $5 = 0 + 5, 5 = 5 + 0$ $5 = 1 + 4, 5 = 4 + 1$ $5 = 2 + 3, 5 = 3 + 2$
Put Together/ Take Apart³	Difference Unknown	Bigger Unknown	Smaller Unknown
	(“How many more?” version): Lucy has two apples. Julie has five apples. How many more apples does Julie have than Lucy? (“How many fewer?” version): Lucy has two apples. Julie has five apples. How many fewer apples does Lucy have than Julie? $2 + ? = 5, 5 - 2 = ?$	(Version with “more”): Julie has three more apples than Lucy. Lucy has two apples. How many apples does Julie have? (Version with “fewer”): Lucy has 3 fewer apples than Julie. Lucy has two apples. How many apples does Julie have? $2 + 3 = ?, 3 + 2 = ?$	(Version with “more”): Julie has three more apples than Lucy. Julie has five apples. How many apples does Lucy have? (Version with “fewer”): Lucy has 3 fewer apples than Julie. Julie has five apples. How many apples does Lucy have? $5 - 3 = ?, ? + 3 = 5$

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).

Plus-Minus Stay the Same

Materials

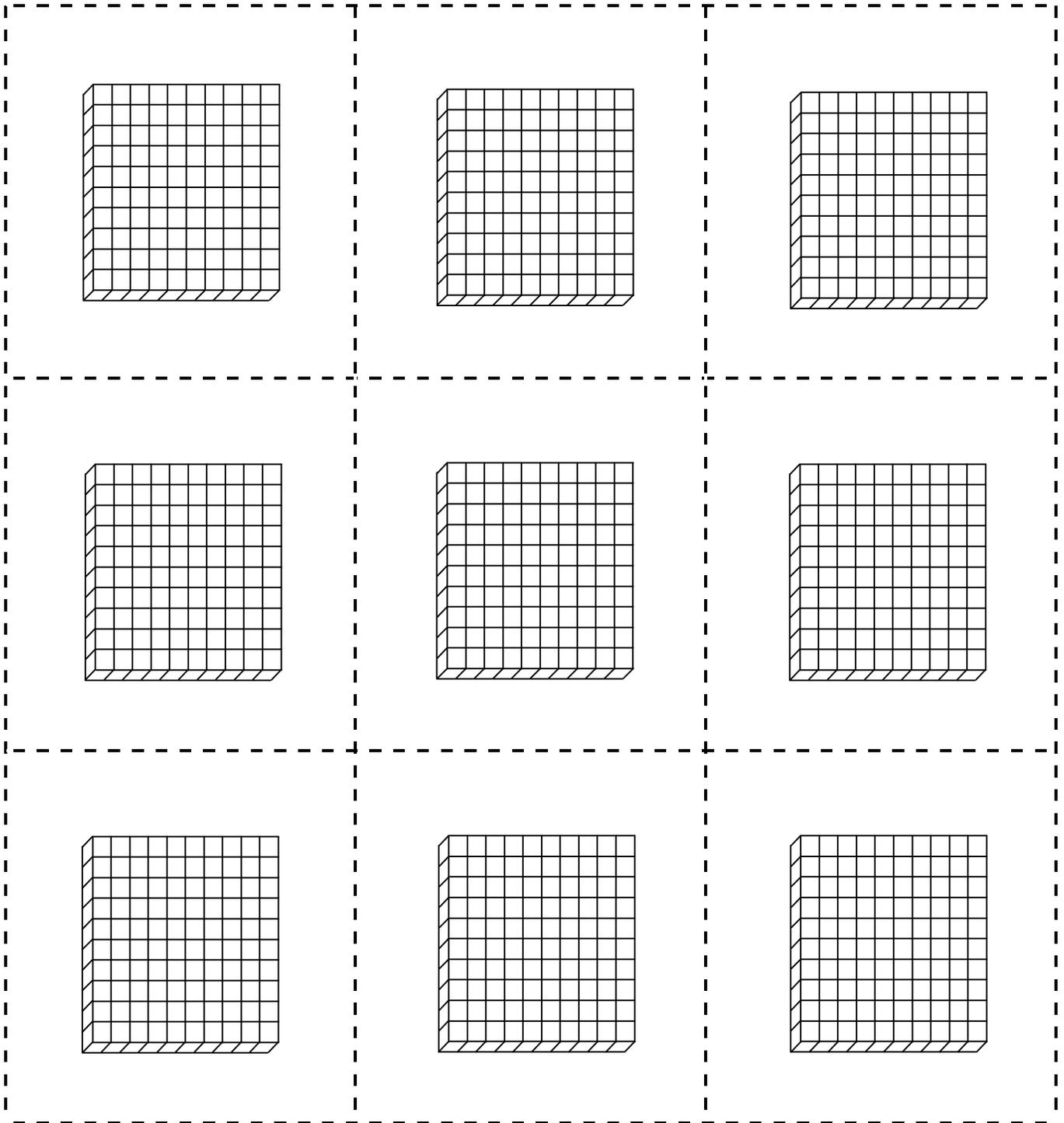
100 chart to share between 2 players
Deck of numeral cards 1-9, four of each numeral
Distinct markers for each player

Players: 2

Directions

- 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.
- Player one must decide whether to add 10 to this number, subtract 10 from this number or keep the number the same. 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.
- 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.
- Players continue to play.
- The winner is the first player to cover 3 numbers in a row. Rows can be vertical, horizontal or diagonal. Players can try to cover 4 or 5 numbers in a row.

Base 10 Blocks (hundreds)



The Game of Tens and Ones

Materials

100 chart or 0-99 chart one per pair of students

2 game markers

Spinner (or die) labeled +10, +10, -10, -10, +1, -1

Directions

- Each player places a marker on the zero (or off the board if using a 100 chart) the 0-99 chart. Players take turns spinning.
- Player One spins and moves a marker according to the roll.
- Player 2 checks the move and agrees.
- Player 2 follows the same steps as Player 1.
- The winner is the first person to move his or her marker to 99 (or 100 if using the 100 chart).
- Players can record number sentences to match the moves.
 - Example: Player 1 spins +10 and moves to the 10 place.
 - She records $0 + 10 = 10$. On the next move she spins +1 and records $10 + 1 = 11$.

Version 2

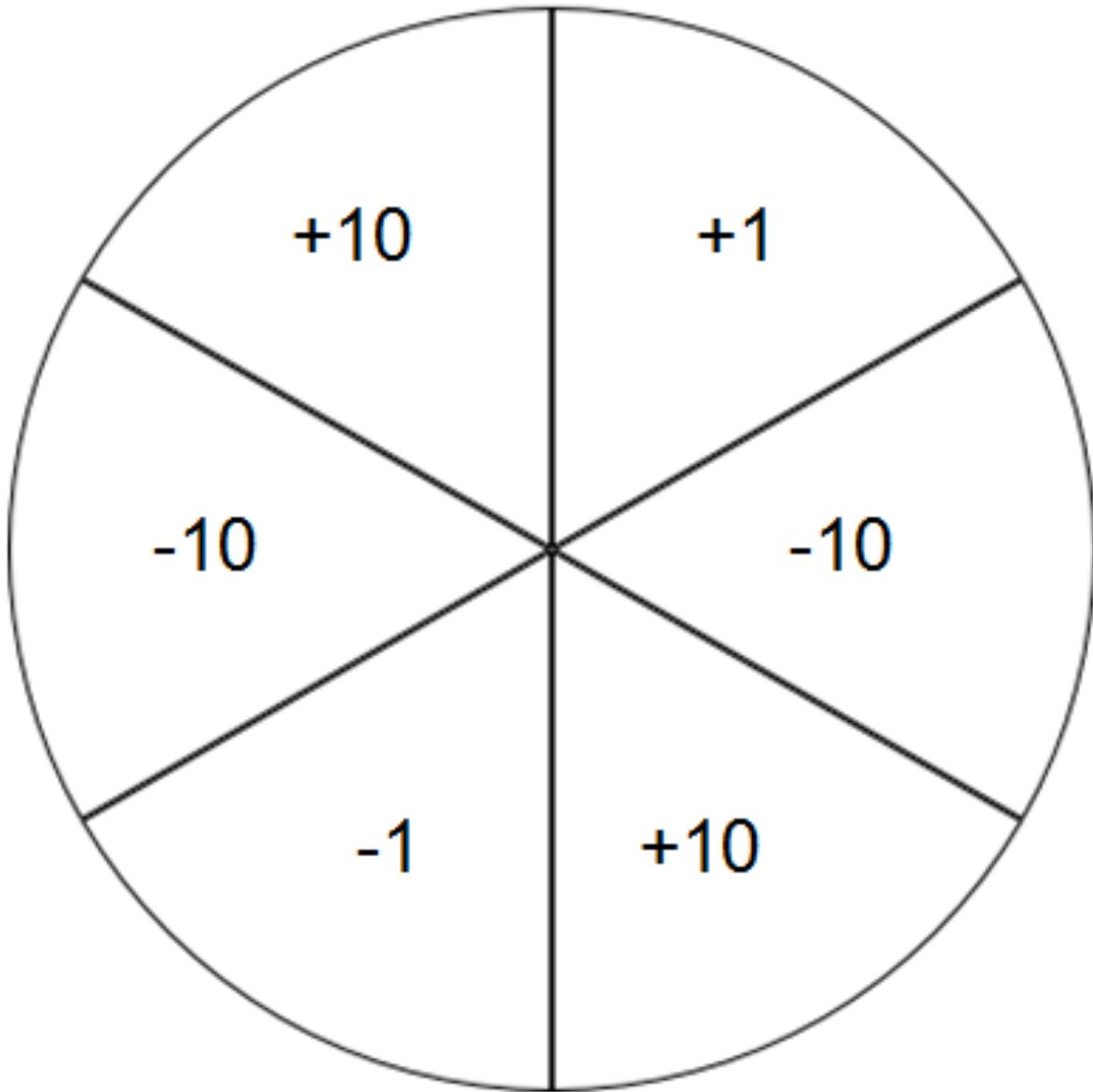
Players do not have to land exactly on 99 (or 100) to win the game. Play the game until time is up. The winner is the person who has landed on the larger number.

Version 3

Players play on a 200 or 300 chart. Start at 100 or 200.

Adapted from : www.mathsolutions.com Marilyn Burns Education Associates.

Spinner for The Game of Tens and Ones



0	1	2	3	4
5	6	7	8	9

Lesson 2.3: Solving Addition Problems on an Open Number Line Overview and Background Information

Mathematical Goals	<p>By the end of the lesson:</p> <ul style="list-style-type: none"> • Students will use a number line to accurately represent and solve story problems. • Students will communicate their strategies while solving story problems.
Common Core State Standards	<p>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 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.¹ ¹ See Glossary, Table 1.</p> <p>Understand place value. 2.NBT.2 Count within 1000; skip-count by 5s, 10s, and 100s. 2.NBT.3 Read and write numbers to 1000 using base-ten numerals, number names, and expanded form.</p> <p>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. 2.NBT.7 Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds. 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.</p>
Emphasized Standards for Mathematical Practices	<ol style="list-style-type: none"> 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 6. Attend to precision
Prior Knowledge Needed	Counting on, Adding ten to a given number, Making Ten
Vocabulary	Counting on, Adding tens, Number line
Materials	Ten strips, Worksheet

Tasks in the Lesson

Engage

3-5 minutes

Patterns in Two-Digit Numbers

Use ten strips (ten frames or base ten blocks) and ones on the overhead projector to have students count by tens.

For example:

Start by placing 4 ones on the overhead. Ask students to count with you (4).

Add a ten, students should say 14.

Continue to add tens and have students count on (24, 34, 44, 54).

Do this for 3-4 different start numbers. A student can record the numbers on the board.

Ask students, "what do you notice about the numbers that we counted?"

Emphasize that when we add 10, the digit in the ones place stays constant, but the digit in the tens changes by 1.

Repeat with a few different start numbers.

Extension with Counting Backwards

Start with a large two-digit number such as 91.

Remove tens and have students count backwards by tens (81, 71, 61, etc.).

Explore

20-30 minutes

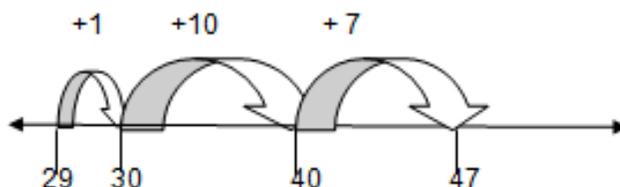
Introducing the Open Number Line

Explain to students, "We are going to use counting by tens to help us solve story problems."

Display an open number line on the board. Start at 4 and make hops of 10. Relate this to the counting they did with the ten strips (or ten frames.) The teacher can model this for several different start numbers. One way to model this is to have a student place strips on the overhead as the teacher marks counting on the number line.

An open number line is just an empty line used to record children's addition (and later subtraction) strategies. Only the numbers children use are recorded and the addition is recorded as leaps or jumps. For example, if a child's strategy for adding $18 + 29$ is to keep 29 whole and decompose the 18 into smaller pieces, the jumps on the open number line would be to start at 29, jump 10 to 39 and then jump 8 more to 47.

Another strategy is moving to a landmark or friendly number of 30. Since the jump from 29 to 30 was a jump of 1, the student needs to still jump 17 more from 30, which gets them to 47. Those jumps on the number line can be written as: $29 + 1 + 10 + 7 = 47$.



Display a story problem on the board/overhead or chart paper and read it out loud. You can change this problem to include names of students in the class. Feel free to change the numbers if the students in class need smaller/larger numbers. Easier problems have high numbers in the ones place (7, 8 or 9) so that it is easier to jump to a multiple of 10.

Example of a Story Problem

Tom and his mom are driving to the zoo. It is 75 miles away. They have already driven 36 miles. How many more miles do they have to drive? (This is an Add to, Change Unknown problem— refer to the attached table from the Common Core for examples of various problem structures.)

Have students pair-share (talk with a partner) about what the problem is asking and how they would solve it. After about 1 minute ask students to share their thoughts with the class.

Ask, “What is the problem asking?” and “How would you solve it?”

Ask, “How far away is the zoo?” Students should say 75 miles. On a number line mark 0 and mark 75.

Ask, “How far have they gone already?” Students should say 36. On the number line mark 36.

Ask, “What do we need to find?” Students should talk about finding how far 36 is from 75.

If students struggle guide them with the following questions, “Should our answer be more than or less than 75? Why?”

You could also have a student act the problem out by walking in front of the classroom.

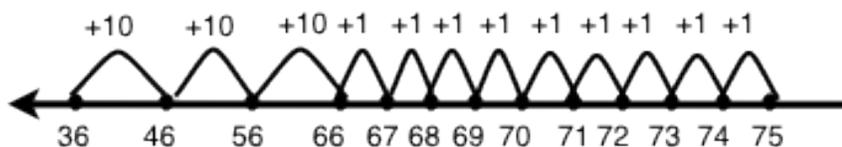
Have students share how to solve the problem.

Examples of strategies:

Start with 36 and count up until you get to 75. If a number line is posted in the class the teacher could have a student start at 36 and have the class count up by ones to 75. Keep track of the count with tally marks. If there is not a number line have the class count up to 75 and keep track with tally marks. In this lesson you want students to realize that this is not a very efficient method for solving the problem.

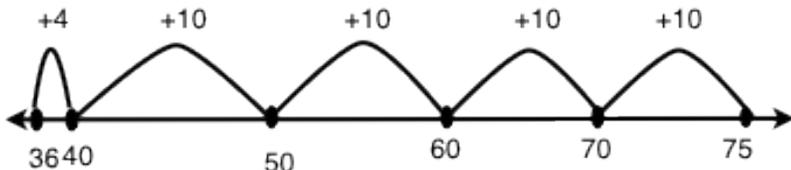
Draw an empty number line (horizontal line). Explain that is a new tool for solving problems. Include an arrow on either end to show that the number line continues indefinitely in both directions. Place a point on the number line labeled 36. Remind them about how they are counting by tens and how this is a way to count to 75 without saying all the ones. Record the jumps of ten saying, “36, 46, 56, 66, 76—oops that too far. I’ll go back to 66. How should I hop to 76?” Some students may suggest going by ones. Say, “OK 67, 68, 69, 70, 71, 72, 73, 74, 75.”

Record each number beyond 66 as individual hops.



After recording on the number line ask, “How will this (referring to the number line) help us know how far they have to drive to the zoo?” Have students come up to the number line and show the hops and how to determine the answer.

Another approach could be:



After recording the number line ask, “How will this help us know how far they have to drive to the zoo?” Have students come up to this number line and show how to use it to determine the answer.

Questions to ask?

How much farther did Tom and his mom have to drive to get to the zoo?

How do you know? Show us on the number line.

There are multiple ways to jump on the number line from 36 to 75. Other suggestions may be:

36 to 46 to 56 to 66 to 76 and then subtract 1 (36 + 10 +10 +10 +10 +10 -1)

36 to 40 to 50 to 60 to 70 to 75 (+4 +10 + 10 +10 +5)

36 to 66 to 70 to 75 (+30 +4 + 5)

Ask, “How are these strategies similar or different?” Possible responses on how they are alike:

They all jump by tens.

They start at 36 and end at 75.

Possible responses on how they are different:

One starts at 36 and jumps to a “friendly” number 40 and then jumps by tens.

One makes bigger jumps (40).

After a student has shared what the problem is asking, the teacher asks students to think of an equation that they could write for the problem that they just solved.

$36 + \underline{\quad} = 75$.

Ask, “What does the blank mean in this equation?” Answers might include: “It’s the part you figure out. It’s the answer. You have to solve 36 plus what equals 75.”

Another Story Problem

Maria and John are going to the beach. It is 68 miles away. They have already driven 31 miles. How many more miles do they have to drive?

Ask, “What equation would represent this story.”

$31 + \underline{\quad} = 68$.

Some students may know that you can subtract to solve this problem

$68 - 31 = \underline{\quad}$.

Draw an open number line on the board.

Ask, “How can we use the number line to solve the problem? Pair-share for a minute.” After pairs have discussed how to solve it. Have them work the problem, using a number line, on a white board or notebook paper.

As they are solving the problem observe students.

Look for students who

- know to start at 31.
- know how to jump by tens and label the number line.
- know how to jump by tens but do not label the number line.
- “hop” up the number line by ones.
- are not making the connection of how to use the number line to solve the problem.
- see this as a subtraction problem. Can they start at 68 and hop backwards to 31?

As you observe, choose the strategies that you want shared with the class.

Explain

10 minutes

After students have had a few minutes to solve the problem ask students to share their strategies: Show the strategies on the board that are given by the students. Let students draw the number lines or have them use the document camera to show their work.

After 2-3 different ways of using the number line are given ask:

How are these two ways alike?

How are they different?

How are we using what we know about counting by tens to work on the number line?

Note: The class discussion is critical to helping students build an understanding of how place value can be used to solve addition and subtraction problems. The open number line is a tool for students to use their knowledge of adding multiples of 10 and 100 to solve a problem. Sharing strategies and having students compare them helps students become more fluent in using place value understanding and properties of operations to add and subtract.

Elaborate

Varying

After sharing strategies have students complete the activity sheet *Solving Problems Using a Number Line*.

The teacher can have students work independently on the worksheet or work with their Think-Share partner to solve the tasks.

As the students are working look again for students who:

Do students know where to start on the number line?

Do students accurately jump by tens and label the number line correctly?

Do students know how to decompose a one-digit number to make jumps of 1 that land on a landmark (number that ends in a zero)?

Can students tell you how to use the number line to find the answer?

Do students see tasks as subtraction tasks?

Evaluation of Students

Formative: Checked through questioning during the lesson. Also formative assessment is done while students are working on the worksheet. As students are working questions to ask are;

- Why did you start here?—pointing to the number line.
- Where will you stop on the number line?
- What is the problem asking?
- How can you use the number line to find the answer to the question?

Summative: The student worksheet will be used to evaluate their initial understanding of jumping on the number line to solve the problems.

The activity sheet provides you with data on students' understanding about using the open number line. It is normal for students to struggle with the strategy the first few times they use it. Additional lessons and tasks should be given to help students further develop understanding of this method.

We suggest using data from worksheets and observations to plan future lessons.

Do students need to work with smaller numbers to get use to using the number line?

Is it clear that some students understand this strategy and others are struggling? If so, the lesson tomorrow could be a brief overview of this method and then divide the class into groups. While the teacher works with one group the other group(s) plays some of the games introduced in earlier lessons (Plus-Minus Stay the Same, The Game of Tens and Ones or other place value games).

Plans for Individual Differences

Intervention: Students who do not understand how to use the number line may use a 100 board to solve the problem. Have them start at the beginning number and move to the ending number. Observe if they move by ones or by tens? This can be related to the game, "Plus-Minus Stay the Same."

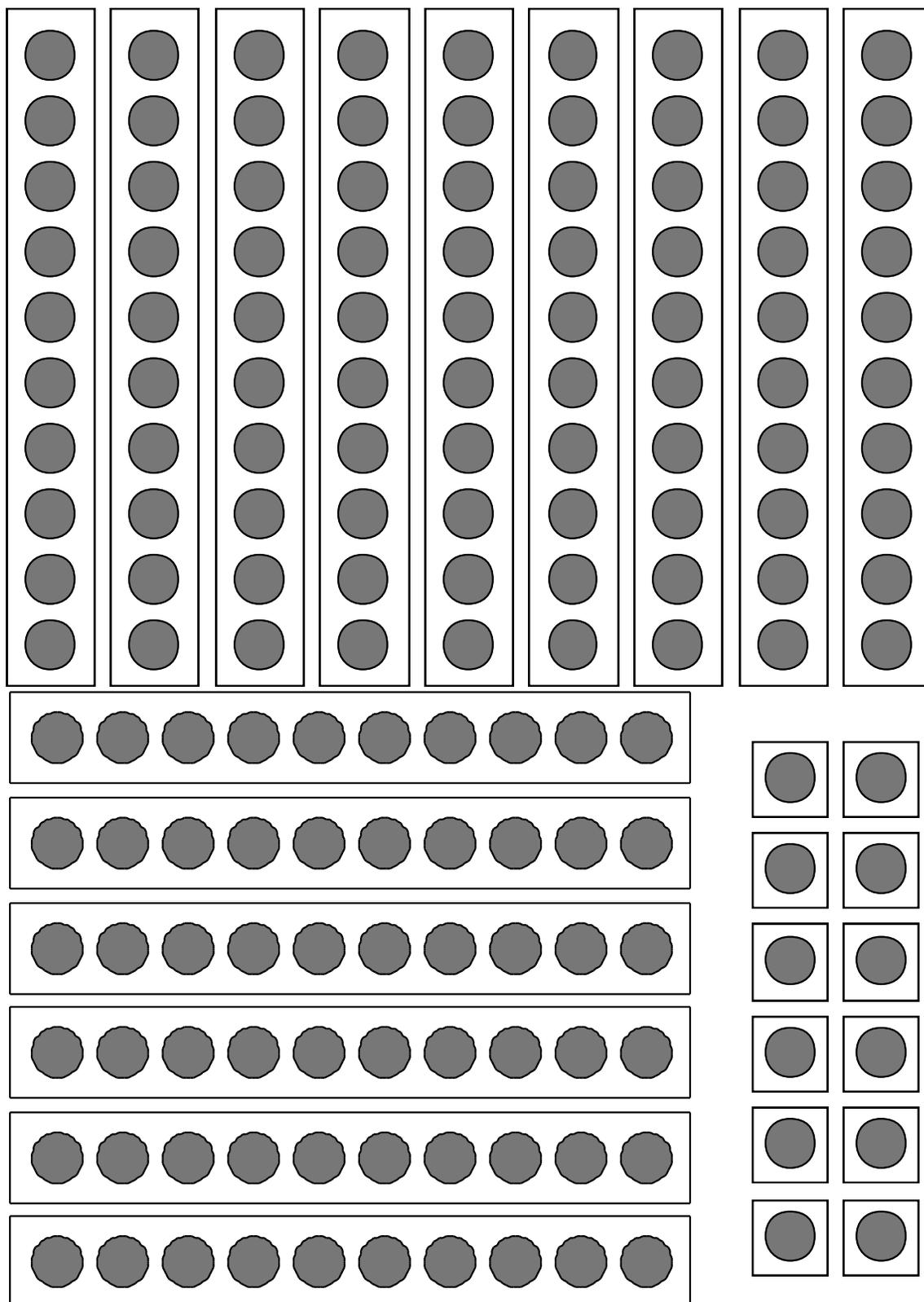
If the numbers seem too large change the numbers in the problem so they only have to move one ten and a few ones. If they then move on the number line by ones show them a jump of ten for the ten ones.

Students could use ten sticks and ones (lesson 1) to solve the problem. The teacher could help them see the relationship between the ten sticks/ones and the open number line.

Extension: Some students will be able to make jumps larger than ten—larger multiples of ten. Ask, "How would you record your moves?"

Other students will understand that they can move in tens beyond the targeted number and then subtract. For example when determining how far 56 is from 92 a student may make 4 jumps of 10 or a move of 40 and then subtract 4. Ask, "How would you record your moves on the number line?"

Ten Strips



Lesson 2.4: Solving Addition Problems on an Open Number Line Overview and Background Information

Mathematical Goals	Students count by tens to solve a problem using an open number line. By the end of the lesson or a series of similar lessons students will use a number line to solve story problems.
Common Core State Standards	<p>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 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.¹ ¹ See Glossary, Table 1.</p> <p>Understand place value. 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. 2.NBT.7 Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds. 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.</p>
Emphasized Standards for Mathematical Practices	<ol style="list-style-type: none"> 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 6. Attend to precision
Prior Knowledge Needed	Counting on, Adding ten to a given number, Using number lines to solve problems
Vocabulary	Counting on, Adding tens, Number line
Materials	Solving Problems Using a Number Line activity sheet, Cubes

Tasks in the Lesson

Engage	15-20 minutes
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Place the attached blackline on the overhead or document camera. Three strategies for solving the story problem are shown on the blackline. Students will compare and contrast the strategies.

Cover the strategies so that only the problem is showing to the class.

Read the problem to the class, Ask, “What do we know?”

After students share ideas, ask, “What do we need to know?”

Optional: Have students solve the problem or discuss how to solve the problem.

Show the strategies one at a time to the class.
After each strategy ask students to share their observations.

After all the strategies have been shown some ideas they may share are:

- All the number lines start at 41 and end at 78.
- Some of the jumps are tens and some are ones.
- The first one jumped by tens until it got to 71 and then it jumped by ones.
- The second one jumped to 48 first—that's 7 and then jumped to 78 by tens.

As students are making observations trace the path they are explaining or have them show the path.

After students have shared observations about all three solutions ask:

- If the paths are different how did they all end with the same answer?
- Where is the answer to the problem's question?

Explore**15-20 minutes**

Have students solve 2-3 problems independently using an open number line. Have the problems written on chart paper or write them on the board. Discuss each problem. After reading the first problem ask students to retell the story. Then ask students for suggestions on how to solve the problem. Have students solve the problem in their math journal or notebook paper. As students are solving the problems observe what they are doing. As the teacher is observing also be thinking about which strategies she wants shared in the class discussion.

Possible questions to ask as they work:

- Why did you start with this number?
- How do you know when to stop jumping on the number line?
- When you jump by 10s how do you know the next number?
- How did you figure out your answer?

After students successfully complete the first problem have them do one more. If a student is struggling change the numbers in the problem.

Possible problems to solve:

- Maria had 45 erasers. Her mom gave her 37 more. How many does she have now?
- David shot baskets in his driveway. Before dinner he shot 26 baskets. After dinner he shot 48 baskets. How many did he shoot?

If a student is struggling change the first problem to

- Maria had 15 erasers. Her mom gave her 10 (or 20) more. How many does she have now?

Explain & Elaborate**15 minutes**

After most students have solved the first (and possibly the second problem) have a class discussion about one of the problems. As the teacher observed the students' independent work, she chose strategies she wanted shared in the class discussion.

Gather the class back together. Draw one student's strategy on the board. Have the students explain how he/she solved it. Ask if there are any questions.

Draw another student's strategy on the board. Have the student explain how he/she solved it. Ask if there are any questions.

Ask the class, "How are these strategies alike?" After they share ask, "How are these strategies different?" If the class is engaged share one more strategy. Have the student share his/her thinking on how it was solved. Ask the class to compare the three strategies. Are two of them more alike than the third? Do they all have something in common?

Evaluation of Students

Formative: Use the observation time as formative assessment. Also as students share their observations about the strategies take note of the students who are struggling with counting by tens to solve the problems. Are there students who are still counting by ones? Do students understand where to start and stop on the number line?

Summative: Use the written work to check on student understanding. Take note of the students who are struggling with counting by tens to solve the problems. Are there students who are still counting by ones? Do students understand where to start and stop on the number line?

Are there students who take larger jumps? For example, in the problem $45 + 37$ did students start at 45 and jump 30 to 75 and then 7 more? The jump of 7 could have been 7 ones or a jump of 5 to get to 80 and then 2 more.

Plans for Individual Differences

Intervention: Have students solve the problem with ten sticks and ones. Have students work with the 100 board to solve the problem. Practice skip counting by tens and then apply this to solving a problem.

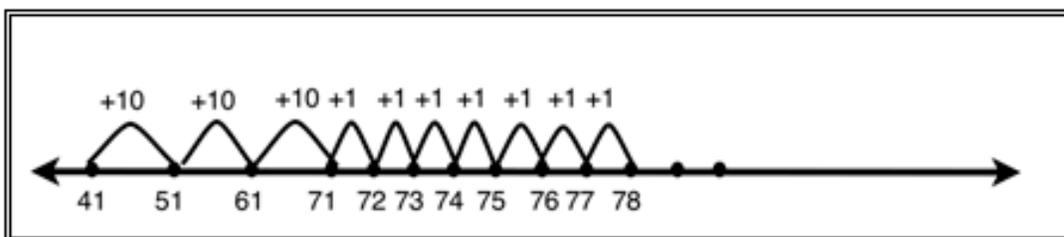
Extension:

Have students work with numbers beyond 100, including numbers with 3 addends.

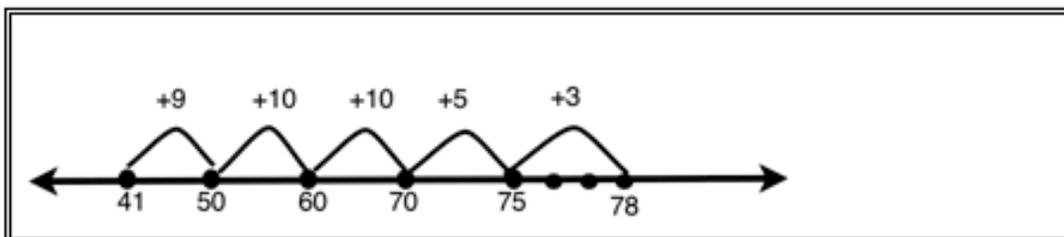
Solving Problems on a Number Line

Miguel is 41 inches tall. His sister, Maria, is 78 inches tall. How much taller is Maria than Miguel?

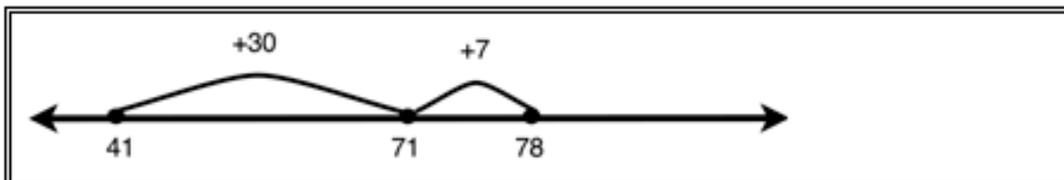
Solution 1



Solution 2



Solution 3



Lesson 3.1: Place Value, Greater Than, Less Than Overview and Background Information

Mathematical Goals	<p>By the end of the lesson students will:</p> <ul style="list-style-type: none"> • Compose and decompose hundreds, tens and ones • Add 10 and/or 100 to a number • Compare 2 2-digit and 2 3-digit numbers using $>$, $=$, and $<$ symbols
Common Core State Standards	<p>Number and Operations in Base Ten Understand place value. 2.NBT.1 Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. Understand the following as special cases:</p> <ol style="list-style-type: none"> a. 100 can be thought of as a bundle of ten tens — called a “hundred.” b. The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones). <p>2.NBT.2. Count within 1000; skip-count by 5s, 10s, and 100s. 2.NBT.3 Read and write numbers to 1000 using base-ten numerals, number names, and expanded form. 2.NBT.4 Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using $>$, $=$, and $<$ symbols to record the results of comparisons.</p> <p>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. 2.NBT.7 Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds. 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. 2.NBT.9 Explain why addition and subtraction strategies work, using place value and the properties of operations.¹ ¹ Explanations may be supported by drawings or objects.</p>
Emphasized Standards for Mathematical Practices	<ol style="list-style-type: none"> 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
Prior Knowledge Needed	counting from 0 to 100, counting on from a given number between 0 to 110, decomposing a two-digit number into tens and ones.
Vocabulary	compose, decompose, hundreds, tens, ones, greater than, less than, between
Materials	Arrow cards--a set for each pair of students. <i>Note: When copying these cards on card stock the teacher may want to run each set in a different color.</i> Arrow card spinner, Clear spinners or paper clip and pencil , place value dice.

Resource	Technology Link: Listed below are two websites that include arrow cards: http://www.ictgames.com/arrowCards_revised_v4.html http://www.curriculumsupport.education.nsw.gov.au/countmein/children_arrow_card.html
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Tasks in the Lesson

Engage	5-10 minutes
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Arrow Cards are a set of place value cards with an “arrow” on the right side. Students can organize the cards horizontally or vertically to represent numbers in expanded notation. They can overlap cards and line up the arrows to form multi-digit numbers.

Display a 50 arrow card. Ask, “What number is this?” Do this for several decade numbers that end in a zero.

Next, use two arrow cards to display a 2-digit number (50 and 6). Place the 6 over the 50 aligning the arrows. Ask, “What number is this?” (56) Take the cards apart and discuss how 56 is 50 joined with 6 which can be written as $50+6$. Continue doing several examples of 2-digit numbers.

Next, ask, “How do you think we will make a 3-digit number?” Have a child come to the front and choose the cards for a 3-digit number and have the class tell the number.

Ask, “what three numbers compose this number?”

For example, 568 would be composed of the cards 500, 60 and 8.

Show another number with the cards (612) and ask, “What three numbers are in 612?”

Follow up by asking, “What is the number in the hundreds place? What is the number in the ten’s place? What number is in the one’s place?”

After the children answer, use the arrow cards to confirm the number in the hundreds, tens and ones place.

Reinforce the idea that 612 is six hundreds, 1 ten and 2 ones or $600 + 10 + 2$.

You may need to remind the students that the arrow card with a 10 on it is still there. For example the 10 is still there behind the 600 and there is an arrow card with a 2 as well.

Explore	25-30 minutes
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Arrow Cards Activity

Give each pair of students a set of arrow cards. You can restrict them to only using two-digit numbers or let them work with three-digit numbers if they are ready.

Demonstrate how to lay the cards in rows, sequentially. Place the ones cards in a vertical line, the tens in a separate vertical line and the hundreds in a separate vertical line. This allows easy access to the cards as they work with them.

Call out numbers and have students choose the cards and hold them up. For example, say 145.

Partners choose the 100 card, 40 card and 5 card. One student puts them together, aligning the arrows and holds it up. The teacher scans the room. Call on a student to say the parts ($100 + 40 + 5$) and have partners check their cards.

Have them replace their cards into the vertical lines. The teacher continues to call out numbers.

After students are successful with this skill change what you are asking them to do. Examples:

Show me 568. (pause and allow them to build the number.) Now show me 10 more.

Show me 126. (pause and allow them to build the number.) Now show me 100 more.

Show me 147. (pause and allow them to build the number.) Now show me 10 less.

Show me 102. (pause and allow them to build the number.) Now show me 100 less.

Show me a number that is between 400 and 450.

Show me a number that is larger than 578.

Show me a number that is smaller than 310.

The examples above may be too many different ideas for student to work with within one lesson. Use these arrow cards for many lessons. You can add different concepts as the student progress in their understanding.

Arrow Card Spin Game.

Demonstrate how to play the game and how to record their answers.

Arrow Card Spin Game Rules

- The first partner spins the three spinners and builds the number indicated with arrow cards. For example, if 3 hundreds, 5 tens and 2 ones is spun, build 352.
- The second partner spins and builds their own number (128).
- Each partner writes the two numbers on their papers and places the $<$, $>$ or $=$ sign between the numbers. $352 > 128$ or $128 < 352$.

Instead of using the spinners, dice or number cards could be used.

As the students are working with partners, the teacher observes students.

- Do they easily build the numbers generated by the spinners?
- If asked, can they add 10 or 100 to a given number?
- Do they understand that within a number, such as 456, there is $400 + 50 + 6$?

Explain

10 minutes

Bring the students together to discuss the math concepts that they worked with during the Arrow Card game.

Either have students generate two three-digit numbers or provide them to students.

Ask, "Which number is larger? How do you know?"

Next, pose the following:

"What number has 3 hundreds, 12 tens and 15 ones?" (435)."

Guide students by asking them how many hundreds, tens and ones are there.

You may also guide them by providing a place value chart with columns for hundreds, tens, and ones.

If time permits, other tasks to pose include:

What number has 2 hundreds, 14 tens and 8 ones? (348)

What number has 3 hundreds, 14 tens and 19 ones? (459)

What number has 6 hundreds, 21 tens and 18 ones? (828)

Make the Largest and Smallest Number

Model this activity with your students. You need 3 numbers by using either a spinner, number cards, or a dice. You will take those 3 digits and build the largest 3 digit number and then build the smallest 3 digit number.

Example: You pull number cards that have a 3, 7 and a 6 on them.
The largest number would be 763. The smallest number would be 367.

This activity can be done two different ways.

Option 1: Whole group. You or a student generates the 3 digits, students work independently or in pairs for a few minutes to build the greatest and smallest number. As a class you go over the problem and discuss it.

Option 2: In pairs. Students work in pairs to generate the 3 digits and build the greatest and smallest number. Students discuss in their pairs.

Option 1 allows the teacher to provide more feedback and check the progress of students.

Option 2 allows students to work at their own pace and check their own work, while the teacher can spend time with different pairs.

Evaluation of Students

Formative: Observations of students.

As the teacher is observing, make notes about student understanding.

Can the students respond with the correct place value when given a number?

When given a number can the student build it?

Can the student build the number 10 more/10 less or 100 more/100 less than a given number?

Does the student use the $>$, $<$, $=$ sign correctly?

When given two 3-digit numbers can students correctly determine which number is larger?

Can students provide a logical and accurate explanation about how they know which 3-digit number is larger?

Summative: Use the game recording sheet to check for understanding.

Plans for Individual Differences

Intervention: Students having trouble with building 3-digit numbers can work with 2-digit numbers. If students are having trouble with 2 or 3-digit numbers they also build the numbers with cubes. Example: If they are working with 45 they would get the arrow cards 40 and 5, and they would build 45 with 4 tens sticks and 5 ones. The website below has students work with tens and ones.

http://www.ictgames.com/arrowCards_revised_v5.html

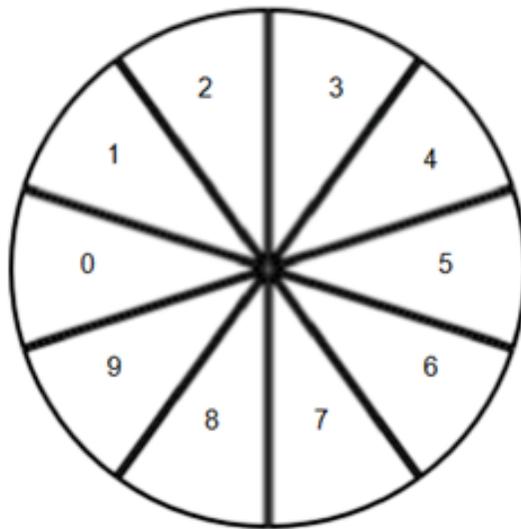
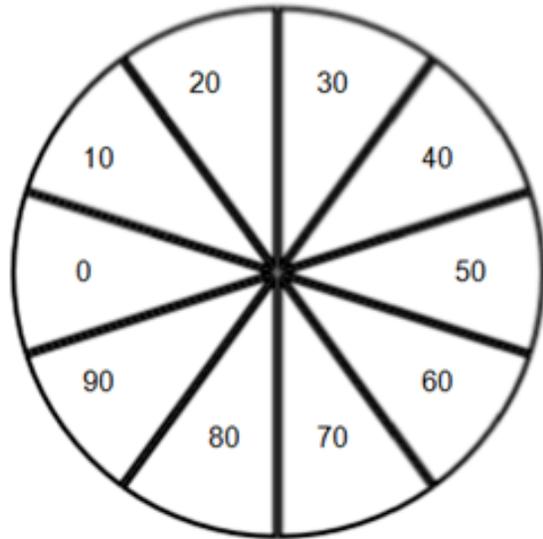
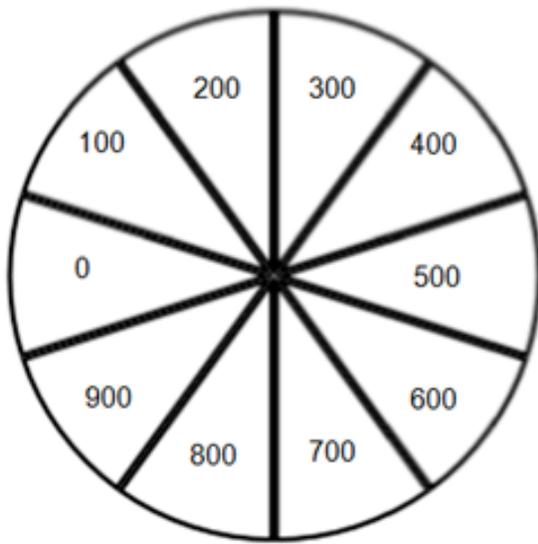
Extension: Some students may be ready to work with the arrow cards that use the thousands. Do the same activities but add the 1000s.

Have students work on websites that help build the concept of place value. Two sites using arrow cards are:

http://www.ictgames.com/arrowCards_revised_v4.html

http://www.curriculumsupport.education.nsw.gov.au/countmein/children_arrow_card.html

Arrow Card Spinners



Lesson 3.2: Place Value, Greater Than, Less Than Overview and Background Information

Mathematical Goals	<ul style="list-style-type: none"> • Decompose a three-digit number into expanded form. • Compose a three-digit number given the number of hundreds, tens, and ones. • Mentally add and subtract 10 to or from a number • Mentally add or subtract 100 to or from a number • Compare two 2-digit and two 3-digit numbers using $>$, $=$, and $<$ symbols
Common Core State Standards	<p>Number and Operations in Base Ten</p> <p>Understand place value.</p> <p>2.NBT.1 Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. Understand the following as special cases:</p> <p style="padding-left: 20px;">a. 100 can be thought of as a bundle of ten tens — called a “hundred.”</p> <p style="padding-left: 20px;">b. The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones).</p> <p>2.NBT.2 Count within 1000; skip-count by 5s, 10s, and 100s.</p> <p>2.NBT.3 Read and write numbers to 1000 using base-ten numerals, number names, and expanded form.</p> <p>2.NBT.4 Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using $>$, $=$, and $<$ symbols to record the results of comparisons.</p> <p>Use place value understanding and properties of operations to add and subtract.</p> <p>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.</p> <p>2.NBT.7 Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds.</p> <p>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.</p>
Emphasized Standards for Mathematical Practices	<ol style="list-style-type: none"> 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
Prior Knowledge Needed	Children should have a good grasp grouping by hundreds, tens and ones. They should understand that value of the digits in a number.
Vocabulary	compose, decompose, hundreds, tens, ones, greater than, less than, between

Materials	<p>Arrow cards--a set for each pair of students <i>Note: When copying these cards on card stock the teacher may want to run each set in a different color. When a card is misplaced it is easy to determine the set it came from. The Arrow Card templates are found in a previous lesson.</i></p> <ul style="list-style-type: none"> • Arrow card spinners 100s, 10s and 1s • Clear spinners placed over the spinners or place a brass fastener through a ¼" length of drinking straw and a paperclip. Insert the brad and straw into the large end of the paperclip. Keep the straw and the paperclip on the brass fastener, insert it in the midpoint hole of the spinner. Then bend each side of the fastener flap against the underside of the board. • Place value dice—optional • Number cards 1-9, 4 of each card
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Tasks in the Lesson

Before the Lesson

Prepare Arrow Cards

Arrow Cards are a set of place value cards with an “arrow” on the right side. Students can organize the cards horizontally or vertically to represent numbers in expanded notation. They can overlap cards and line up the arrows to form multi-digit numbers.

Engage

5-10 minutes

Depending on where your students ended after Lesson 6, you can use either two-digit or three-digit numbers in this part of the lesson.

Two-Digit Number

Display a 70 arrow card.

Ask, “What number is this?”

Do this for several decade numbers.

Next, use two arrow cards to display a 2-digit number (70 and 6). Place the 6 over the 70 aligning the arrows.

Ask, “What number is this?” (76)

Take the cards apart and discuss how 76 is $70 + 6$.

Three-Digit Number

Ask, “Who can remember how we could use these Arrow Cards to make a 3-digit number?”

Have a child come to the front and choose the cards to make a 3-digit number and have the class tell the number.

Take the arrow cards apart to show the parts of the number. For example, the arrow cards for 568 would be 500, 60, and 8.

Show another number with the cards (411)

Ask, “How many hundreds are in 411? How many tens? How many ones?”

After the children answer, show them the 3 Arrow Cards to confirm the digits in the hundreds, tens and ones place.

In this lesson, students will be continuing with activities from Lessons 5 and 6 in Centers.

The Centers for this lesson include:

Arrow Card Spin Game (Lesson 68)

Make the Largest and Smallest Number (Lesson 8)

Get 20 (new game). Adapted from *Investigations in Number, Data, and Space*. There is an online version of this game that a student can play against the computer.

http://www.pearsonschool.com/live/images/custom/investigations/Investigations_widget1.html

Demonstrate to students the game Get 20. This is a 2 or 3 player game.

Materials: Number cards marked 1-9, 4 of each card

Directions for Close to 20.

Deal 5 number cards face up so to each player.

When it is their turn, players choose 3 cards that add up to 20 or as close as possible.

In their math notebook they write an equation for their 3 cards.

The number of points that they earn for that round is how far they are from 20.

The goal is to finish the game with as few points as possible.

The two cards left (from the original 5) are kept and 3 cards are added for the next turn. Discard the 3 cards used.

*If students need further support they can use counters and a double ten frame or a number line.

Example:

I pull the cards 7, 9 and 4. $7+9+4 = 20$. I earn 0 points for that round since $20-20 = 0$.

I pull the cards 5, 6, and 7. $5+6+7 = 18$. I earn 2 points for that round since $20-18 = 2$.

As students are in Centers you can use that time to pull students for further instruction or collect formative assessment data about students.

Suggestions for formative assessment include:

Arrow Card	Make the Largest	Get 20
Do students correctly compose 3-digit numbers? Can they correctly tell you which 3 numbers compose a 3-digit number?	Can students correctly make the largest and smallest number? Can students explain to you how they know their number is the largest/smallest?	Can students mentally add one-digit numbers within 20? Can students communicate to you strategies that they are using to add or subtract?

Explain

10 minutes

Bring the students back together to discuss Make the Largest and Smallest Number.

Either have students generate 3 digits with dice or number cards or give students 3 digits to work with. Ask them, "How would we make the largest number?"

Students should share the idea that the largest digit should go in the greatest place.

For example, if we had the digits 3, 2 and 1, 3 is the largest digit so that should go in the greatest place, which is the hundreds place.

Likewise, students should put the second-largest digit (2) in the second-greatest place (tens).

That leaves a 1 for the ones place.

For the smallest number it would be the opposite. The largest digit goes in the smallest place. The digits 3, 2, and 1 would have 123 as the smallest number.

Extend this by giving a few more examples for students to work on and discuss.

Possible questions for the discussion:

How do we know that this is the largest number?

What would the value of this number be if we added 40? 300?

How does the value of 200 compare to the value of 20?

Elaborate

10 minutes

Introduce the activity In Between to the whole group.

Generate 3 digits. Make any number you wish and mark it on a number line. (254)

Ask students, "What number is 10 more than this number?" (264). Put on number line.

Ask students, "What number is 10 less than this number?" (244). Put on number line.

Ask students, "On your number line I want you to put two more numbers that are within 244 and 264."

Have students share. Ask, "how did you know where to put that number on the number line?"

You can repeat this with a few numbers. You can also modify this to include a wider range of numbers (100 more and 100 less rather than 10 more and 10 less).

Evaluation of Students

Formative: Observations of students during Centers.

After rolling, do they record the number correctly?

When asked what the number represents, do the students name the appropriate place value?

When given a number can the student build it?

Can the student easily build the number 10 more/10 less or 100 more/100 less than a given number?

Does the student use the $>$, $<$, $=$ sign correctly.

Summative: Collect and check their math notebooks for their work from the Centers activities. Collect their work from the In Between activity.

Plans for Individual Differences

Intervention: Students having trouble with building 3-digit numbers can work with 2-digit numbers. If students are having trouble with 2 or 3-digit numbers they should also build the numbers with cubes. Example: If they are working with 45 they would get the arrow cards 40 and 5, and they would build 45 with 4 tens sticks and 5 ones. The website below has students work with tens and ones.

http://www.ictgames.com/arrowCards_revised_v5.html

Extension: Some students may be ready to work with the arrow cards that use the thousands. Do the same activities but add the 1000s.

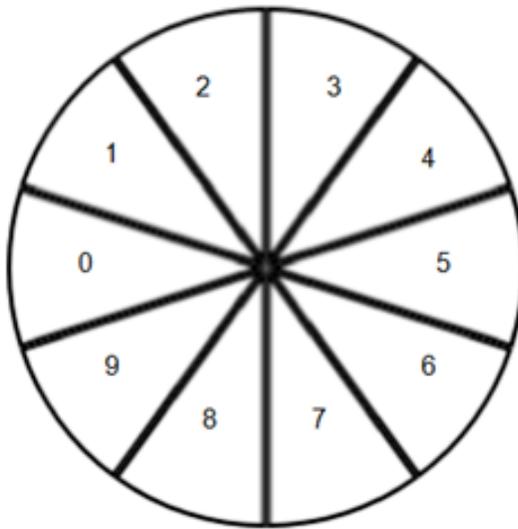
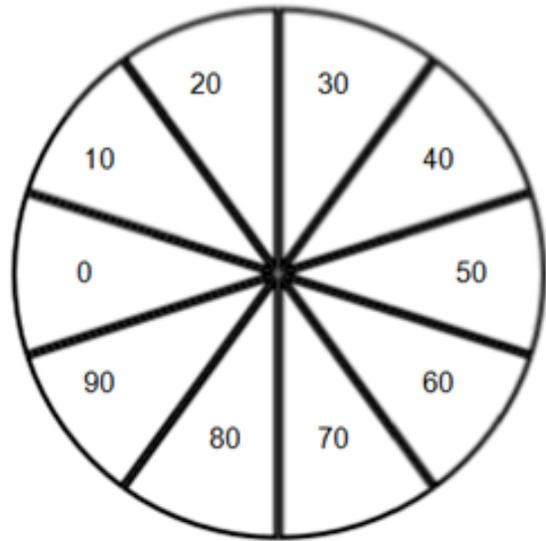
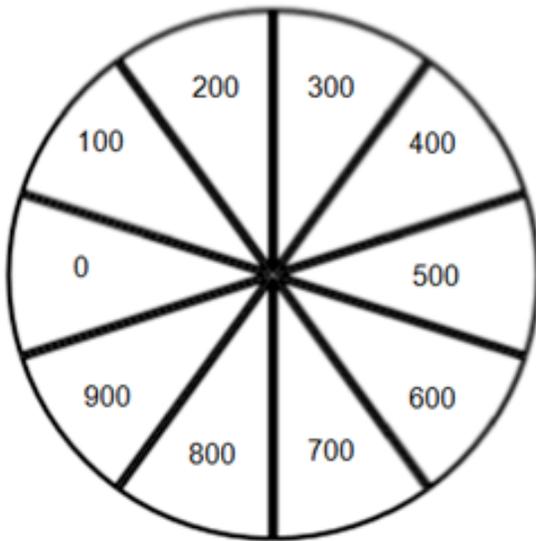
Have students work on websites that help build the concept of place value. Two sites using arrow cards are:

http://www.ictgames.com/arrowCards_revised_v4.html

http://www.curriculumsupport.education.nsw.gov.au/countmein/children_arrow_card.html

0	1	2	3	4
5	6	7	8	9

Arrow Card Spinners



Lesson 3.3: Two-Step Word Problems

Overview and Background Information

Mathematical Goals	By the end of the lesson (the lesson will be repeated many times) students will: <ul style="list-style-type: none"> • Accurately solve two-step story problems with numbers within 100. • Communicate their strategies used to solve problems
Common Core State Standards	<p>Operations and Algebraic Thinking 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 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.¹ ¹ See Glossary, Table 1.</p> <p>Number and Operations in Base Ten 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.</p>
Emphasized Standards for Mathematical Practices	<ol style="list-style-type: none"> 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
Prior Knowledge Needed	Solving one-step addition and subtraction problems within 100
Vocabulary	Tens, ones, two-step problems
Materials	ten strips, worksheets of story problems, Beat the Calculator sheet, Beat the Calculator cards, calculators

Tasks in the Lesson

Engage	25-30 minutes
<p>Adding with Tens Strips and Dots Place 4 tens strips and 5 dots (ones) on the overhead projector or document camera. Ask, “How many dots?” (45). Now add 2 ten strips and 3 ones. Ask, “How many total dots?” (68) The goal is for students to use the tens strips and ones to find the answer, so you do not need to record the numerals. “How did you find your answer?”</p> <p>Possible student responses: I added all the tens and then the ones. I counted on 45, 55, 65 and then three more.</p> <p>Ask students to write a story problem that matches these numbers and the action (adding more dots). They should write the story problem in their notebook and then tell their story to a partner.</p>	

An example would be:

There were 45 students on the playground. 23 students joined them. How many students are now on the playground?

After most students have shared a story with a partner, ask 2-3 students to share their story.

Ask, "How could I represent this story with an equation?" $45 + 23 = \underline{\quad}$.

There should still be 68 dots on the overhead projector. Next take away 35 dots.

Ask students to determine the total. (33).

Have students add onto their story in their journal and share their story with a partner to include the act of removing 35 dots.

Example: *There were 45 students on the playground. 23 students joined them. Then 35 students went inside. How many students are still on the playground?*

Have 2-3 students share their story.

Ask, "How could I represent this story with an equation?" $45 + 23 - 33 = \underline{\quad}$

Note: Teachers can leave the equation until the end of the discussion after students had written story problems with the dots. The equation is an essential part of the Common Core Standards and should be included for each task.

Put 2-3 equations on the board.

$47 + 21 - 31 = \underline{\quad}$, $47 - 21 + 31 = \underline{\quad}$, $47 + 21 + 35 = \underline{\quad}$

Have students choose an equation and create a story problem in their notebook. Students should then share with their partner.

When the class comes back together have a few students share their story problems. The class needs to listen to the story problem and choose which equation matches the story problem.

Tell the class that these stories have been two-step stories. Ask, "What do you think this means?" (There are two steps in the problem or two actions.)

Two-step problems require two steps to solve. For these types of problems, it can be especially useful for children to read and rephrase the story problem and to ask themselves what the problem is asking. Children use drawings, manipulatives and equations to help solve the problems.

Ask, "How is solving this type of problem different from solving a one-step problem?"

- The equation will have + and – or + + or - -.
- You have to read it carefully to make sure you don't miss the 2nd step

Ask, "How is solving this type of problem the same as solving a one step problem?"

- Read story problems carefully and rephrase them in their own language.
- Analyze what information is given and what is being asked.
- Represent the story problems
- Solve the problem

Next, give students problems that have a variable missing. Use the attached table of Addition and Subtraction Situations to help you create story problems.

Tell this story or have it written on the board and read it.

There were 15 frogs in the pond. Some frogs jumped out. Then 8 frogs jumped in the pond. Now there are 20 frogs in the pond. How many frogs jumped out?

Grade 2: Two- and Three-Digit Addition and Subtraction

Have students come to the front of the room and act out the problem.
Ask, “What do we have to find?” (how many frogs jumped out).
“How can we find the answer?”

Possible student responses:

Some students may say to put 15 and 8 in the pond and then see how many need to jump out so the total is 20.

Some may suggest trying different numbers in the blank to see what works.

After students have acted out the problem, have students write an equation to represent what happened in the problem. $15 - \underline{\quad} + 8 = 20$.

As you do this make sure to use the action language in the problem to help.

- “When frogs jump in, what operation should we use?”
- “When frogs jump out, what operation should we use?”

Do 2-3 other 2-step problems together.

Explore	15 minutes
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The students will solve the story problems on one of the worksheets.

There are two different sheets of story problems. Each of these sheets has numbers appropriate for the 2nd nine weeks of school. The next sheet has the same problems with smaller numbers.

Give the students a copy of the story problems. Have them read problem 1 with a partner. Say, “Talk with your partner about what you know and need to know?” After 1-2 minutes ask for comments.

Students can:

- Retell the story.
- Act out the problem.
- Write an equation.
- Solve the problem with a partner.

The students can solve the rest of the problems individually or with a partner. Students need multiple experiences solving multi-step problems. The problems on the worksheets are examples. The teacher can create additional problems to be used. As the students are working on the problems observe their strategies. Choose several students with strategies you want shared to share during the “explain” time of the lesson.

Explain	15 minutes
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After most students have solved the problems on one worksheet, bring the students together to discuss their work. Choose the problem you want to discuss. Their attention span will probably not allow discussion of all the problems. The teacher can record strategies on the board to save time and have the students explain their strategies. Questions to ask:

- What do you notice about how this strategy uses place value?
 - How are these two strategies alike/different?
 - Why did you choose this strategy?
 - Why did you start with this number?
 - What’s hard about this problem?
-

Elaborate

20 minutes

Introduce the game, “Beat the Calculator.” The rules and cards are attached to this game. Students solve the problems mentally and with a calculator. Play the game with the class. One side of the class can solve the problem mentally and the other side solves the problem with a calculator. Do this several times, switching sides for using the calculator and mentally solving the problems.

After several rounds ask, “What does this game help you do?” :

- Solve problems mentally.
- Practice using a calculator.
- Find easy numbers to solve first. Example in $8 + 6 + 2$ the students may see that adding $8 + 2$ first makes a 10 and then adding the 6 is easier.

Ask, “How do these problems relate to two-step story problems?”

After the class has worked together to solve the problems tell them that they will play the game with a partner tomorrow. This game should be played repeatedly during class time.

Evaluation of Students

Formative: As the students are working observe whether students can: write an equation, solve for an unknown, and solve two-step problems.

Summative: Use the story problem worksheet to assess student understanding.

Plans for Individual Differences

Intervention: Students who have difficulty solving the two-step problems may need to use smaller numbers so they can concentrate on the structure of the problem rather than the numbers. You can change the numbers to one digit numbers or numbers less than 20. Example: There were 5 students on the playground. 3 students joined them. Then 2 students went inside. How many students are now on the playground?

There are two versions of each worksheet. The second worksheet has the same word problems with smaller numbers.

Extension: Have students write two-step problems and have classmates solve the problems. Have students solve start unknown problems—refer to Table 1 of common addition and subtraction situations. An example: *There were some students on the playground. 36 children joined them. In a few minutes 16 students went inside. Now there are 75 students on the playground. How many students were on the playground at the start?* ($\underline{\hspace{1cm}} + 36 - 16 = 75$). Start unknown problems are harder for students to solve.

Repeating this Lesson

It is recommended that similar lessons be taught over the 2nd nine weeks. As assessment information is gathered on student understanding meet with groups of students with similar needs. Have them solve two-step problems adjusting the numbers according to their needs.

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? $? + 3 = 5$
	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? $? - 2 = 3$
Take from	Total Unknown	Addend Unknown	Both Addends Unknown²
	Three red apples and two green apples are on the table. How many apples are on the table? $3 + 2 = ?$	Five apples are on the table. Three are red and the rest are green. How many apples are green? $3 + ? = 5, 5 - 3 = ?$	Grandma has five flowers. How many can she put in her red vase and how many in her blue vase? $5 = 0 + 5, 5 = 5 + 0$ $5 = 1 + 4, 5 = 4 + 1$ $5 = 2 + 3, 5 = 3 + 2$
Put Together/ Take Apart³	Difference Unknown	Bigger Unknown	Smaller Unknown
	(“How many more?” version): Lucy has two apples. Julie has five apples. How many more apples does Julie have than Lucy? (“How many fewer?” version): Lucy has two apples. Julie has five apples. How many fewer apples does Lucy have than Julie? $2 + ? = 5, 5 - 2 = ?$	(Version with “more”): Julie has three more apples than Lucy. Lucy has two apples. How many apples does Julie have? (Version with “fewer”): Lucy has 3 fewer apples than Julie. Lucy has two apples. How many apples does Julie have? $2 + 3 = ?, 3 + 2 = ?$	(Version with “more”): Julie has three more apples than Lucy. Julie has five apples. How many apples does Lucy have? (Version with “fewer”): Lucy has 3 fewer apples than Julie. Julie has five apples. How many apples does Lucy have? $5 - 3 = ?, ? + 3 = 5$

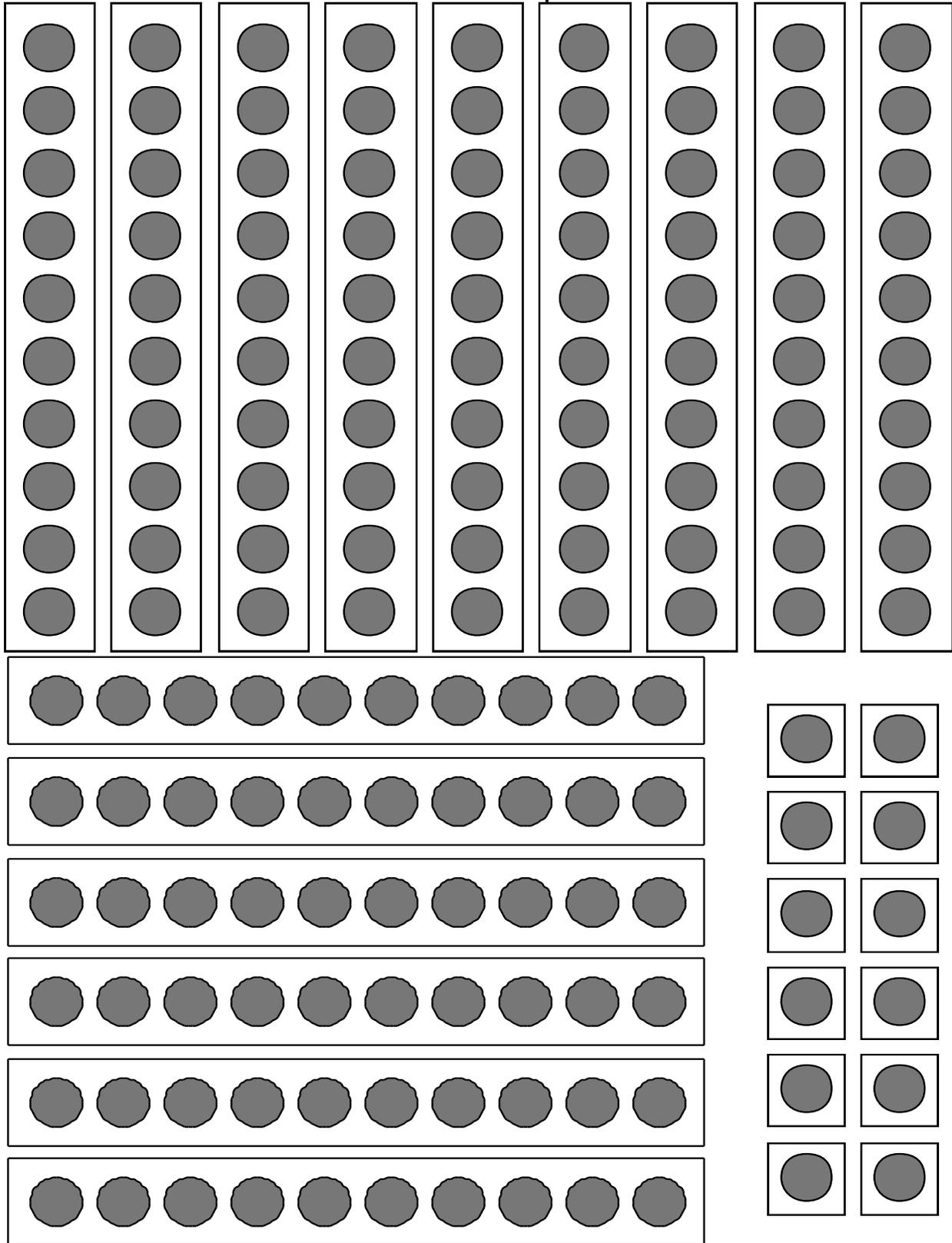
²These take apart situations can be used to show all the decompositions of a given number. The associated equations, which have the total on the left of the equal sign, help children understand that the = sign does not always mean makes or results in but always does mean is the same number as.

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).

Ten Strips



Beat the Calculator

Materials

- Calculator for each pair of students
- Deck of Beat the Calculator cards

Directions

1. Partners play together.
2. Turn over the top card in the deck.
3. Player 1 solves the problem on the calculator and records the answer.
Player 2 solves the problem mentally and records the answer.
4. Players compare answers.
5. Keep turning over the top card in the deck. Take turns using the calculator to solve the problem on the card.

Beat the Calculator Cards, Set 1

$5 + 4 + 1$	$3 + 3 + 3 + 1$
$10 + 5 + 10$	$4 + 10 + 4 + 2$
$9 + 9 + 1$	$7 + 8 + 7$
$10 + 4 + 6$	$10 + 9 + 1 + 10$
$6 + 6 + 12$	$8 + 8 + 6 + 4$

Beat the Calculator Cards, Set 2

$6 + 4 + 1$	$4 + 4 + 4 + 4$
$13 + 2 + 10$	$12 + 12 + 1$
$8 + 7 + 5$	$18 + 2 + 10$
$10 + 5 + 6$	$10 + 8 + 1 + 10$
$3 + 3 + 12$	$7 + 8 + 3 + 4$

Beat the Calculator Cards, Set 3

$5 + 5 + 1 + 1$	$8 + 4 + 2 + 1$
$14 + 6 + 10$	$5 + 10 + 5 + 2$
$19 + 9 + 1$	$17 + 3 + 7$
$11 + 9 + 6$	$9 + 1 + 10$
$16 + 4 + 12$	$18 + 18 + 2 + 2$

Beat the Calculator Cards, Set 4

$10 - 4 + 1$	$3 - 3 + 3 + 1$
$10 - 5 + 10$	$4 + 10 - 4 + 2$
$9 - 9 + 1$	$7 + 8 - 7$
$8 + 4 - 6$	$10 + 9 - 1 + 10$
$6 - 6 + 12$	$18 - 8 + 6 + 4$

Lesson 3.4: Centers with Story Problems Overview and Background Information

Mathematical Goals	<p>By the end of the lesson students will:</p> <ul style="list-style-type: none"> • Apply strategies while solving addition and subtraction problems • Compare different strategies for solving problems • Notate addition and subtracting strategies
Common Core State Standards	<p>Represent and solve problems involving addition and subtraction.</p> <p>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, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.¹</p> <p>¹ See Glossary, Table 1.</p> <p>Use place value understanding and properties of operations to add and subtract.</p> <p>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.</p> <p>2.NBT.6 Add up to four two-digit numbers using strategies based on place value and properties of operations.</p> <p>2.NBT.7 Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds.</p> <p>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.</p>
Emphasized Standards for Mathematical Practice	<ol style="list-style-type: none"> 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. Attend to precision. 6. Look for and express regularity in repeated reasoning
Prior Knowledge Needed	Students should have had some experiences breaking a three-digit number into hundreds, tens, and ones.
Vocabulary	place value, hundreds, tens, ones, skip count by tens
Materials	<p>ten strips, story problem activity sheet.</p> <p>Arrow Card Game</p> <ul style="list-style-type: none"> • Arrow cards sets, Arrow card spinners, Clear spinners or paper clip and pencil for Arrow Card Spinner <p>The Game of Tens and Ones</p> <ul style="list-style-type: none"> • Hundreds boards, Spinner, 2 color counters, activity sheets <p>Plus, Minus Stay the Same</p> <ul style="list-style-type: none"> • number cards 1-9, Hundreds boards, 2 color counters <p>Beat the Calculator</p> <ul style="list-style-type: none"> • Calculators, Beat the Calculator Cards

Tasks in the Lesson

Engage

5 minutes

Use the overhead ten strips to have students count on by tens.

Show 25 on the overhead with ten strips (2 tens, 5 ones).

Place another ten strip on the overhead and have students count on. Continue to add ten strips.

When you have 65, add two ten strips. Ask, "How many are there now? How do you know?"

Do this with several different start numbers and have student count orally. You can also remove ten strips and have students count backwards.

Use the 100 blocks with the tens strips and ones to count on beyond 100. For example put 3 100 blocks on the overhead and 3 tens. Ask, "How many are shown?" (330). Start adding 10s and have the students count; 330, 340, 350, etc. Take the tens away and have them count backwards.

Place 121 on the overhead. Add 100s and have the students count. (121, 221, 321, 421, etc.)

Ask, "What patterns do you notice when we add tens? What happens when we add 100s?"

Explore

25-30 minutes

Introducing Various Strategies

Write $37 + 40 = \underline{\quad}$ on the board. Have students tell a story problem that matches this equation. Allow 2-3 students to share.

Have students explain how they would determine the answer.

Possible responses:

- I counted on by 10s. 37, 47, 57, 67, 77.
- $30 + 40$ is 70 and then I added 7. That is 77.
- $37 + 20$ is 57 and $57 + 20$ is 77.

Ask students how adding the ten strips earlier in the lesson helps them add numbers mentally. They may say that they held 37 in their heads and then counted on by tens.

Write $28 + 41 = \underline{\quad}$. Have students share with a partner a story problem to match the equation.

Have students explain how they would determine the answer.

Possible responses:

- I first counted on by 10's. 28, 38, 48, 58, 68 and then added one more to 69.
- $20 + 40$ is 60 $8 + 1$ is 9 $60 + 9$ is 69.
- 28 plus 40 is 68. One more is 69.

Demonstrate how to model these strategies on an open number line.

Write $56 - 28 = \underline{\quad}$ on the board. Have 2-3 students share a story that matches the equation.

Have students explain how to solve the problem. Students may solve it mentally or on paper. Possible responses:

- 56, 46, 36 then subtract 8 = 28
- 56, 46, 36 then subtract 6 to get to 30 and then take away 2 more. It is 28.
- $56 - 20$ is 36, then take away 8 more

As students are sharing strategies model recording their strategies on the board. Use a number line and also show how to record the strategy with numbers.

Two examples:

$56 - 28 = \underline{\quad}$	$56 - 28 = \underline{\quad}$
$56 - 20 = 36$	$56 - 10 = 46$
$36 - 6 = 30$	$46 - 10 = 36$
$30 - 2 = 28$	$36 - 8 = 28$

Activity Sheet

Have students solve problems on the attached activity sheet or other appropriate problems. As students are solving problems observe students. There is an observation sheet (attached). Use this observation sheet or create one to keep track of student understanding or misunderstanding. When creating other problems be sure to consider various types of problems. See the Table 1 with examples of the types of problems for 2nd graders.

As students finish they can work in math centers. Possible centers are: Plus, Minus Stay the Same, The Game of Tens and Ones, Arrow Card Spin Game, Beat the Calculator, and other games played in class

Explain 15 minutes

After students have solved the problems gather the class back together. Before gathering the students choose 2-3 strategies observed on the worksheets. Either show them on the board or use a document camera to show students' work.

Ask students to look at the strategies and think about how they are alike and how they are different.

Example: $53 - 28$

$53 - 20 = 33$	$53 - 10 = 43$
$33 - 3 = 30$	$43 - 10 = 33$
$30 - 5 = 25$	$33 - 3 = 30$
	$30 - 5 = 25$

Examples of comments:

They both start with 53 and end with 25. They both break the 8 apart. They both subtracted. One takes away 20 and the other took the 20 away by taking a 10 and then another 10.

Elaborate 5 minutes

Pose another task for students to solve: $71 - 37$ or $82 - 25$.

Have students solve them and then discuss strategies.

As students solve tasks, ask them to explain their strategies. Students who finish early can solve the task using a different strategy or create a word problem to match their problem.

Evaluation of Students

Formative: Observe students as they are solving the story problems. Things to think about:

- Do students make sense of the action of the problems?
- Can they write an equation that represents the action?
- How do they solve the problem? Count by ones, add on by tens, break numbers apart by place value

Summative: The student worksheet and the tasks in Elaborate can be used.

Plans for Individual Differences

After analyzing the student work on the worksheet divide the student work into categories of student understanding. Try to limit the categories to 4. You will use these categories to work with small groups on concepts.

During the next few days teach a similar lesson (counting by 10s using ten frames, or ten strips, solving 1-2 problems together as a class, working in centers while the teacher works with small groups based on their written work.)

Intervention: Students who draw all to solve a problem or who cannot use tens to solve the problem need continued practice with counting by tens from any given number. Have them match this counting with number cubes in ten sticks.

Extension: Students who easily add and subtract can move to adding 3-digit numbers.

Grade 2: Two- and Three-Digit Addition and Subtraction

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? $? + 3 = 5$
	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? $? - 2 = 3$
Take from	Total Unknown	Addend Unknown	Both Addends Unknown²
	Three red apples and two green apples are on the table. How many apples are on the table? $3 + 2 = ?$	Five apples are on the table. Three are red and the rest are green. How many apples are green? $3 + ? = 5, 5 - 3 = ?$	Grandma has five flowers. How many can she put in her red vase and how many in her blue vase? $5 = 0 + 5, 5 = 5 + 0$ $5 = 1 + 4, 5 = 4 + 1$ $5 = 2 + 3, 5 = 3 + 2$
Put Together/ Take Apart³	Difference Unknown	Bigger Unknown	Smaller Unknown
	(“How many more?” version): Lucy has two apples. Julie has five apples. How many more apples does Julie have than Lucy? (“How many fewer?” version): Lucy has two apples. Julie has five apples. How many fewer apples does Lucy have than Julie? $2 + ? = 5, 5 - 2 = ?$	(Version with “more”): Julie has three more apples than Lucy. Lucy has two apples. How many apples does Julie have? (Version with “fewer”): Lucy has 3 fewer apples than Julie. Lucy has two apples. How many apples does Julie have? $2 + 3 = ?, 3 + 2 = ?$	(Version with “more”): Julie has three more apples than Lucy. Julie has five apples. How many apples does Lucy have? (Version with “fewer”): Lucy has 3 fewer apples than Julie. Julie has five apples. How many apples does Lucy have? $5 - 3 = ?, ? + 3 = 5$

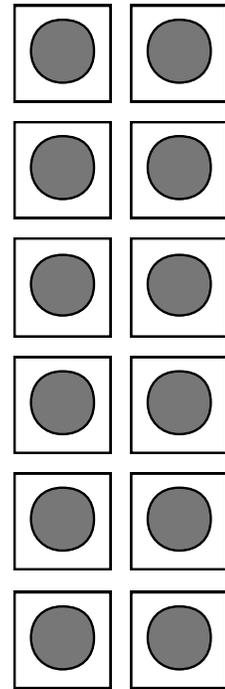
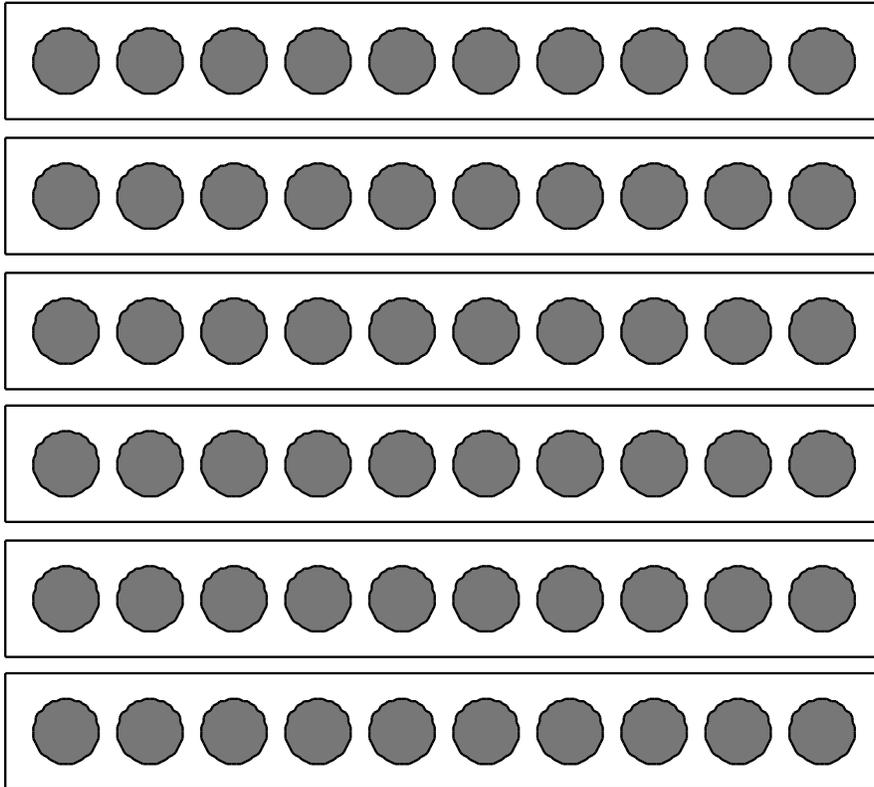
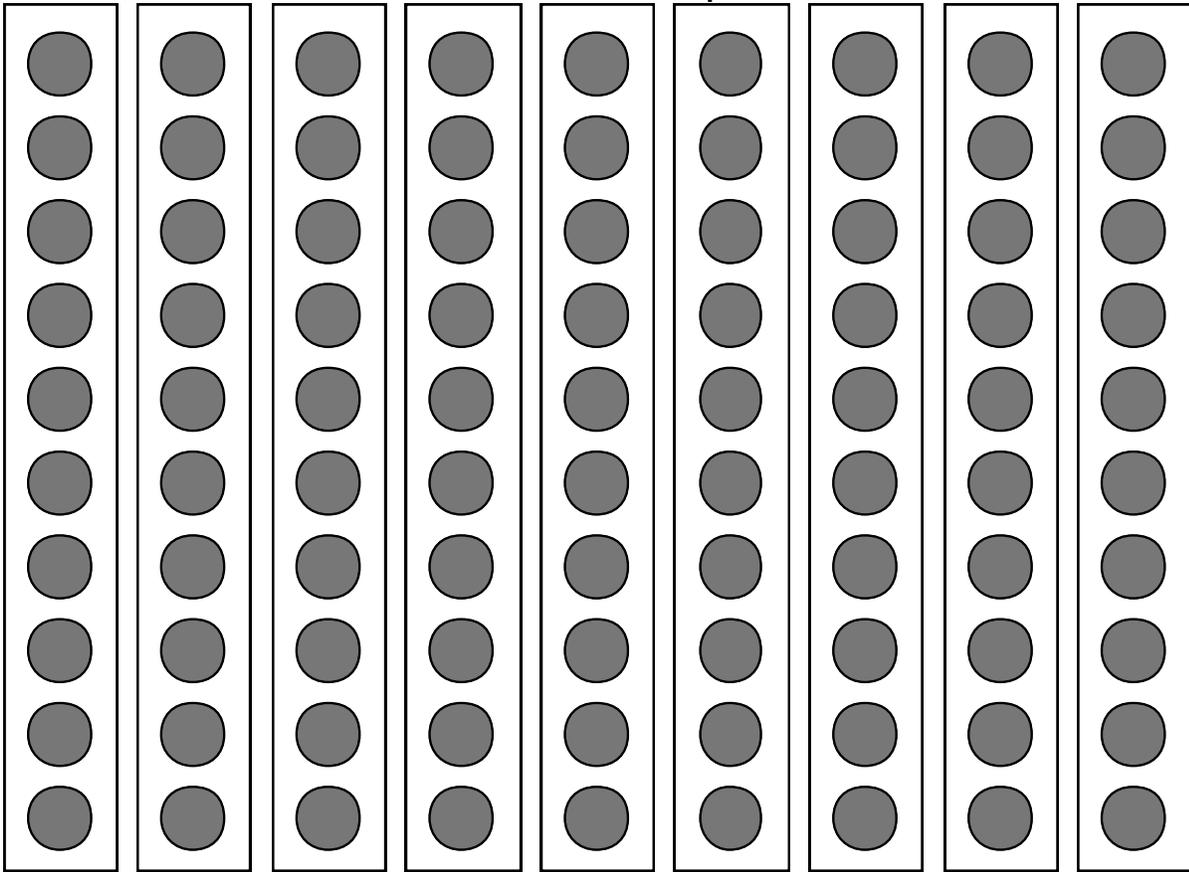
²These take apart situations can be used to show all the decompositions of a given number. The associated equations, which have the total on the left of the equal sign, help children understand that the = sign does not always mean makes or results in but always does mean is the same number as.

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).

Ten Strips



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

6. 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.
7. Player one must decide whether to add 10 to this number, subtract 10 from this number or keep the number the same. 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.
8. 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.
9. Players continue to play.
10. The winner is the first player to cover 3 numbers in a row. Rows can be vertical, horizontal or diagonal. Players can try to cover 4 or 5 numbers in a row.

The Game of Tens and Ones

Materials

100 chart or 0-99 chart one per pair of students
2 game markers
Spinner (or die) labeled +10, +10, -10, -10, +1, -1

Directions

1. Each player places a marker on the zero (or off the board if using a 100 chart) the 0-99 chart. Players take turns spinning.
2. Player One spins and moves a marker according to the roll.
3. Player 2 checks the move and agrees.
4. Player 2 follows the same steps as Player 1.
5. The winner is the first person to move his or her marker to 99 (or 100 if using the 100 chart).
6. Players can record number sentences to match the moves.
Example: Player 1 spins +10 and moves to the 10 place.
She records $0 + 10 = 10$. On the next move she spins +1 and records $10 + 1 = 11$.

Version 2

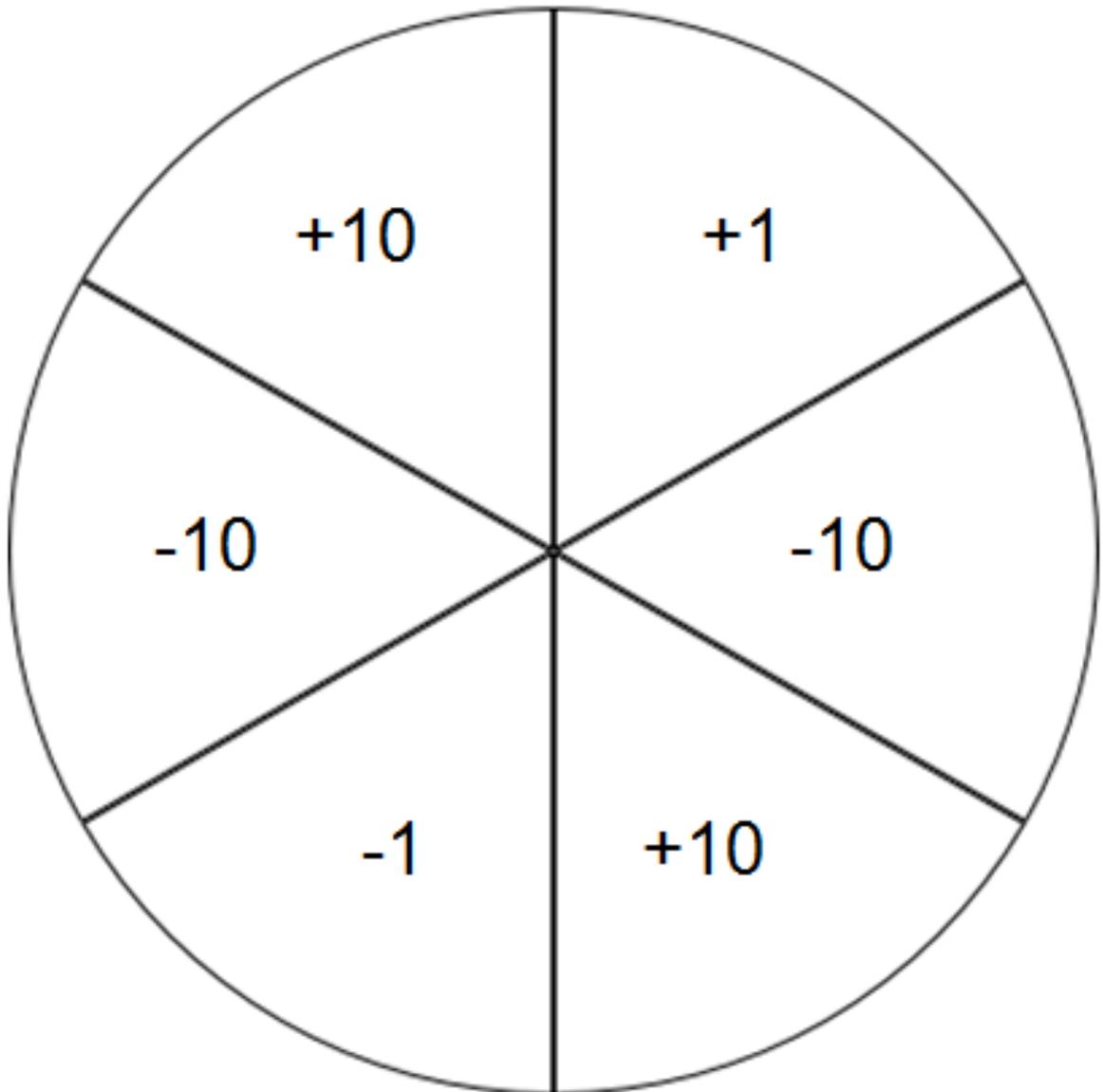
Players do not have to land exactly on 99 (or 100) to win the game. Play the game until time is up. The winner is the person who has landed on the larger number.

Version 3

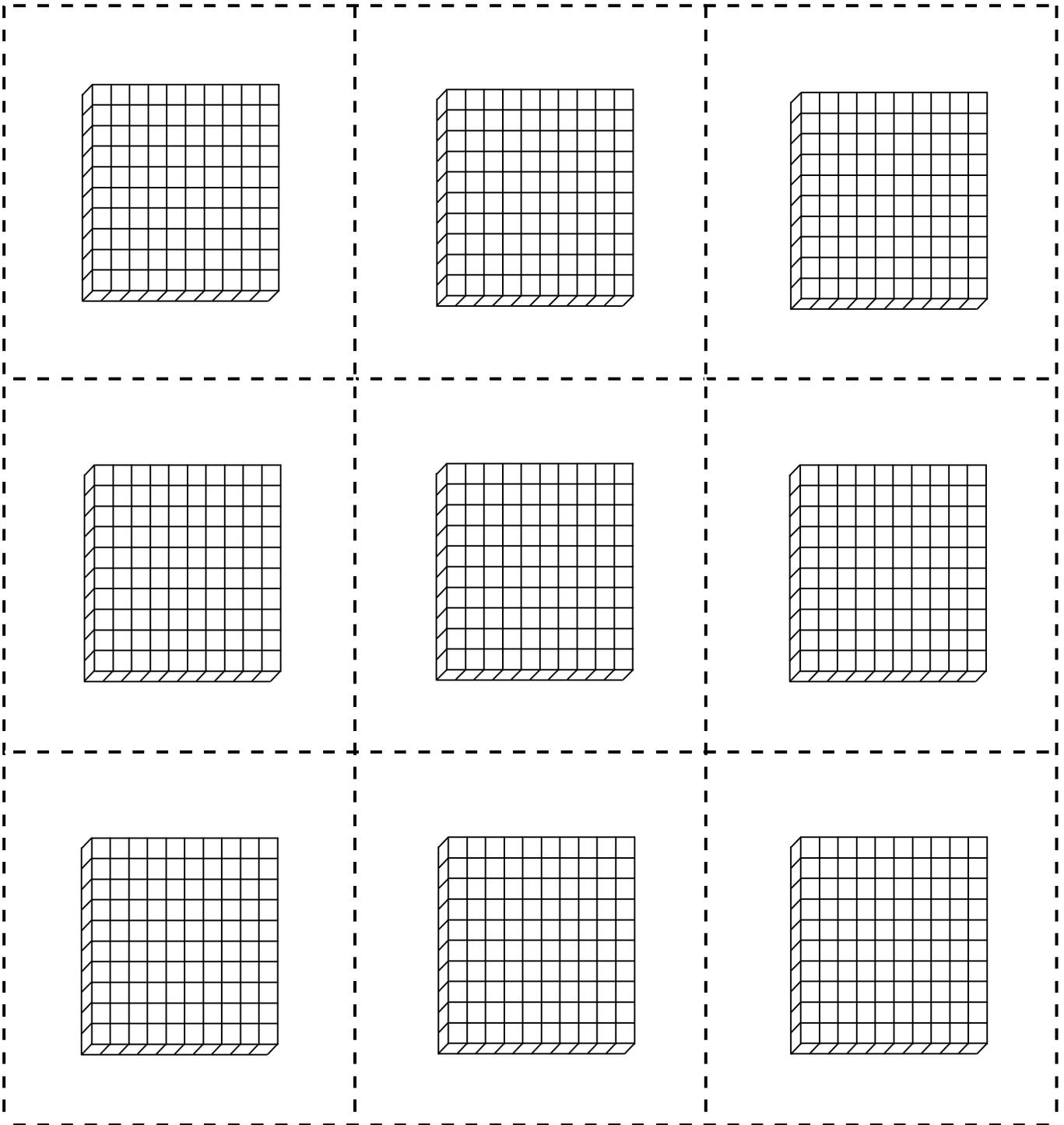
Players play on a 200 or 300 chart. Start at 100 or 200.
Adapted from: www.mathsolutions.com Marilyn Burns Education Associates.

Grade 2: Two- and Three-Digit Addition and Subtraction

Spinner



Base 10 Blocks (hundreds)



Beat the Calculator

Materials

- Calculator for each pair of students
- Deck of Beat the Calculator cards

Directions

- Partners play together.
- Turn over the top card in the deck.
- Player 1 solves the problem on the calculator and records the answer.
- Player 2 solves the problem mentally and records the answer.
- Players compare answers.
- Keep turning over the top card in the deck. Take turns using the calculator to solve the problem on the card.

Beat the Calculator Cards, Set 1

$5 + 4 + 1$	$3 + 3 + 3 + 1$
$10 + 5 + 10$	$4 + 10 + 4 + 2$
$9 + 9 + 1$	$7 + 8 + 7$
$10 + 4 + 6$	$10 + 9 + 1 + 10$
$6 + 6 + 12$	$8 + 8 + 6 + 4$

Beat the Calculator Cards, Set 2

$6 + 4 + 1$	$4 + 4 + 4 + 4$
$13 + 2 + 10$	$12 + 12 + 1$
$8 + 7 + 5$	$18 + 2 + 10$
$10 + 5 + 6$	$10 + 8 + 1 + 10$
$3 + 3 + 12$	$7 + 8 + 3 + 4$

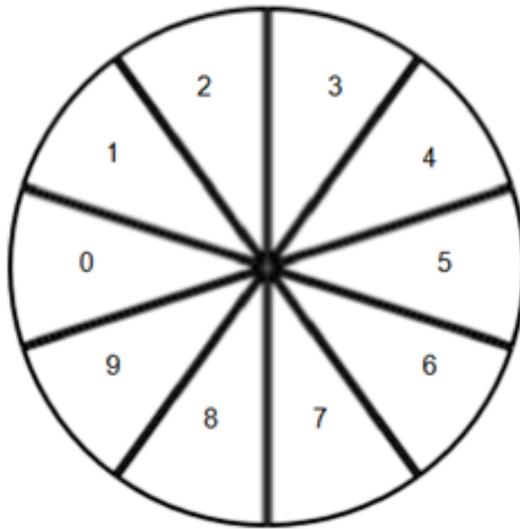
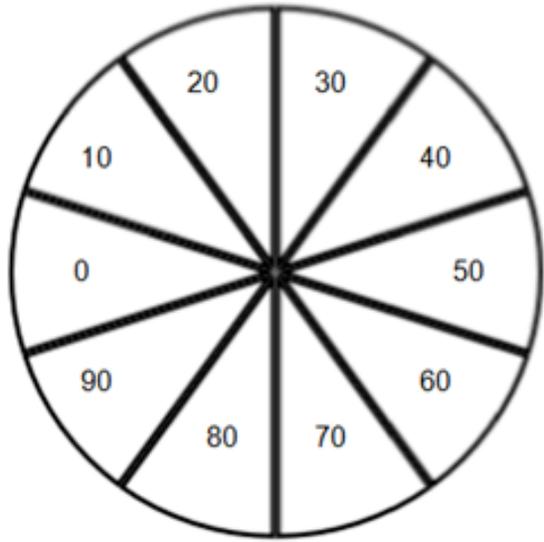
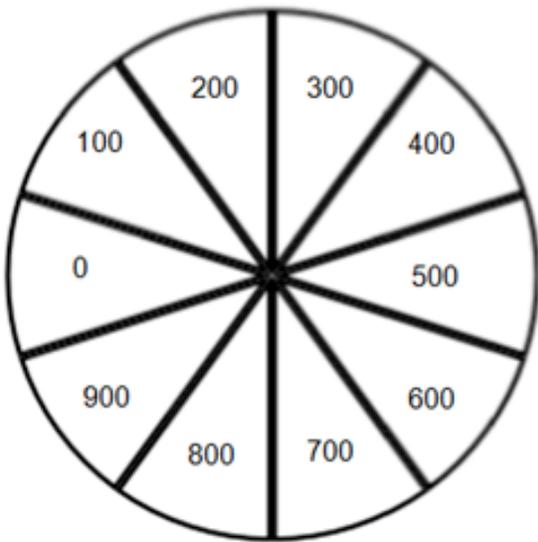
Beat the Calculator Cards, Set 3

$5 + 5 + 1 + 1$	$8 + 4 + 2 + 1$
$14 + 6 + 10$	$5 + 10 + 5 + 2$
$19 + 9 + 1$	$17 + 3 + 7$
$11 + 9 + 6$	$9 + 1 + 10$
$16 + 4 + 12$	$18 + 18 + 2 + 2$

Beat the Calculator Cards, Set 4

$10 - 4 + 1$	$3 - 3 + 3 + 1$
$10 - 5 + 10$	$4 + 10 - 4 + 2$
$9 - 9 + 1$	$7 + 8 - 7$
$8 + 4 - 6$	$10 + 9 - 1 + 10$
$6 - 6 + 12$	$18 - 8 + 6 + 4$

Arrow Card Spinners



0	1	2	3	4
5	6	7	8	9

Lesson 3.4: Using Place Value to Add and Subtract 3-digit Numbers Overview and Background Information

Mathematical Goals	<p>By the end of the lesson students will:</p> <ul style="list-style-type: none"> • Write an equation to accurately represent a problem. • Accurately solve 3-digit addition and subtraction story problems. • Communicate their strategies used while adding and subtracting 3-digit numbers
Common Core State Standards	<p>Understand place value. 2.NBT.1 Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. Understand the following as special cases:</p> <ol style="list-style-type: none"> a. 100 can be thought of as a bundle of ten tens — called a “hundred.” b. The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones). <p>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.7 Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds. 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.</p>
Emphasized Standards for Mathematical Practices	<ol style="list-style-type: none"> 1. Make sense of problems and persevere to solve 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. 6. Attend to precision 7. Make use of structure 8. Look for and express regularity in repeated reasoning
Prior Knowledge Needed	Experiences skip counting by tens or hundreds from any given number forward and backward
Vocabulary	place value, hundreds, tens, ones, number line
Materials	Activity sheet: There are two activity sheets to use with students. Use one of the activity sheets in this lesson. Teach a similar lesson within a week and use the second activity sheet.

Tasks in the Lesson

Engage

15 minutes

Have students sit in a circle. Choose a number between 300 and 400. Move clockwise. Each student should give the number that is ten less than the last number said. You should record the numbers for students to see.

Example: If the start number is 432, the teacher would record 432, 422, 412, 402, 392, 382, 372, 363, 352, 342, 332, 322, 312, 302, 292, etc.

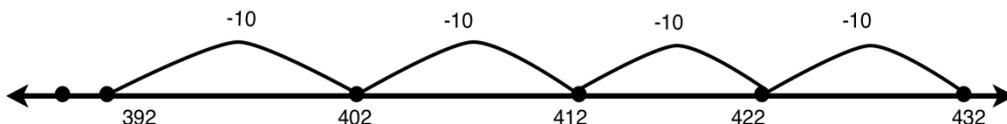
Ask, "What pattern do you see in our list?"

(The number of tens decreases by 1 each time. The ones place stays the same.)

Ask, "What happened after we said 402? Why did that happen?"

This activity can also be done increasing the tens place, counting by hundreds, counting by twenties, etc. The children should see that the ones place never changes and the tens place changes. Talk about why the hundreds place sometimes changes.

Model this counting on a number line by having students tell you what to label.



Ask, "If we were going to solve this problem, how would the number line help us think about the solution? The problem is: My brother had 432 baseball cards. He gave me 50 cards. How many cards does he have now?"

Have the students talk with a partner about solving this problem. Then have them share.

Ask, "Is there a way to solve this problem without using a number line?" Students might share using drawings of 100s, 10s and 1s. They may also use numbers in a series of equations to solve the problem. Examples:

$$432 - 10 = 422$$

$$422 - 10 = 412$$

$$412 - 10 = 402$$

$$402 - 10 = 392$$

$$392 - 10 = 382$$

$$432 - 30 = 402$$

$$402 - 10 = 392$$

$$392 - 10 = 382$$

Ask, "How are these strategies alike? How are they different?"

***Attached to this lesson plan are possible solution strategies.*

Explore

15-20 minutes

Assign students story problems to solve. Explain that they are to write an equation and show how they solved each problem. As students work on the problems the teacher walks around the class observing students and asking questions. As the teacher observes and talks with students, she chooses the strategies from the student work that she wants shared during the lesson discussion.

Possible things to observe:

- Can a student accurately write an equation to represent a problem?
- What strategies do students use to solve the problem?
- What tools, models, or representations do students use to solve the problem? (cubes, drawing 100s, 10s, 1s, number line, numbers in a series of equations, other strategy)
- Can you tell by looking at their work how the problem was solved?

Possible questions to ask:

- Why did you choose to solve it this way?
- Where is your answer in this representation?
- Why did you add (or subtract)?
- Could you solve it using a different strategy?
- What's your next step?

Explain

10-15 minutes

After most students have finished the problems gather the students back for a discussion of strategies. It is not necessary to discuss every problem. There are different reasons to choose problems to share. If there was a story problem that many students had difficulty with, discuss the problem.

Ask, "What was the story describing? Who can put the problem in their own words?" Then ask students to share strategies. The teacher should make sure the strategies shared highlight the mathematics she wants highlighted in this lesson. Using place value is a major focus of this lesson. Another reason to choose a problem to share is if there were a variety of strategies used by the students to solve the problem.

After several strategies are on the board, ask, "How are these strategies alike and how are they different?"

After discussing 1-2 problems as a class, ask partners to share one of the other problems with each other. Have each partner share the strategy. Tell students to also discuss how their strategies are alike or different.

Elaborate

10-15 minutes

Refer to the section "Intervention and Extension." Meet with small groups based on their understanding or misunderstanding. Focus small group work on specific areas to improve understanding or extending understanding.

Evaluation of Students

Formative: Make a chart (before the lesson) on observations.

Possible topics to place on the chart are:

- Can a student accurately write an equation to represent a problem?
- What strategies do student use to solve the problem?
- What tools, models, or representations do students use to solve the problem? (cubes, drawing 100s, 10s, 1s, number line, numbers in a series of equations, other strategy)
- Can you tell by looking at their work how the problem was solved?

Make notes on the chart as you observe.

Summative: Examine student work for various strategies and correct answers.

Plans for Individual Differences

Intervention and Extension

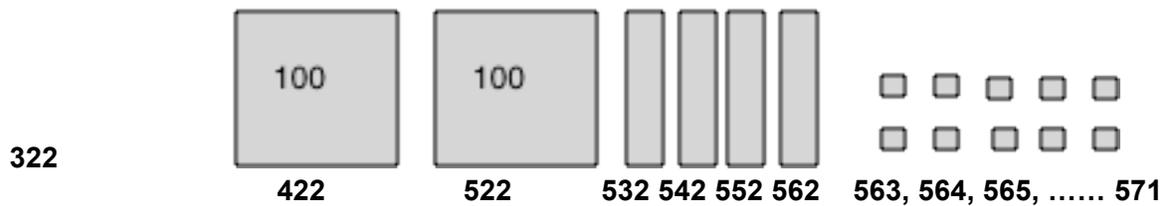
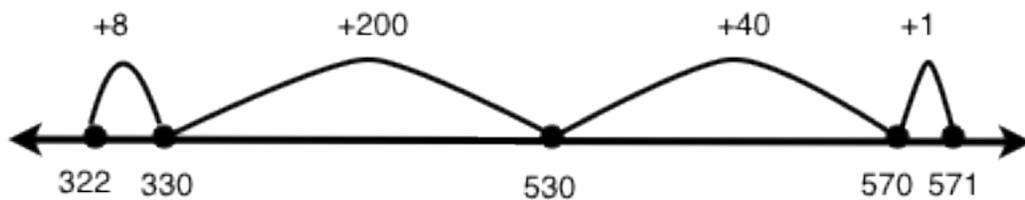
After evaluating the student work, meet with groups of students based on their misunderstandings or understandings. Meet with students who make the same types of errors.

Strategies for Solving Addition Problems

Counting Up

$322 + 249$
 $322 + 200 = 522$
 $522 + 40 = 562$
 up by 7 tens)
 $562 + 9 = 571$

$322 + \underline{\hspace{2cm}} = 571$
 $322 + 8 = 330$
 $330 + 70 = 400$ (or the student could count
 $400 + 100 = 500$
 $500 + 71 = 571$



Place Value

(using the Commutative Property)
value)

$322 + 249$
 $300 + 200 = 500$
 $20 + 40 = 60$
 $2 + 9 = 11$
 $500 + 60 + 11 = 571$

(using place

322
 $\underline{+249}$
 500
 60
 $\underline{+11}$
 571

Strategies for Solving Subtraction Problems

261-149

Keep the first number whole and subtract the second number in parts (place value)

261-149

261-100 = 161

161- 40 = 121

121- 9 = 112

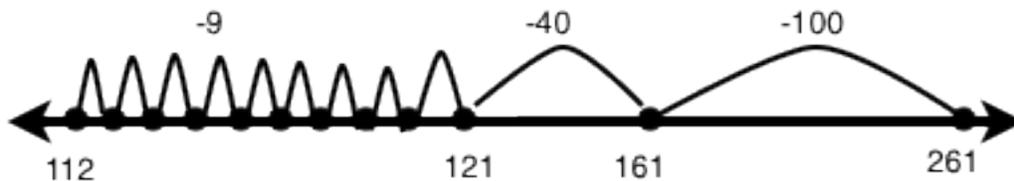
261 - 149

261 -100 = 161

161- 40 = 121

121 - 1 = 120 (the 9 was broken into 1 and 8. It is easier

120 - 8 = 112 to take away 1 form 121 to get to a multiple of ten and then take away 8.)



Place Value

If children try to subtract by breaking apart all the numbers by place value they will encounter a problem for most 2nd graders. Here is an example:

261-149

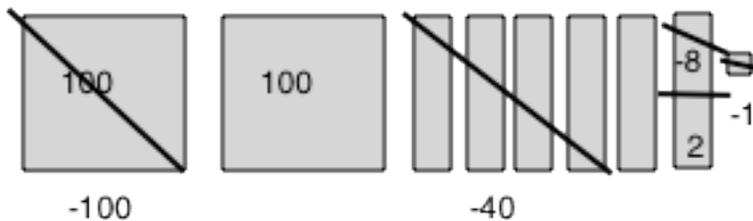
200-100 = 100

60-40 = 20

1-9 = -8

100 + 20 - 8 = 112 This is where most 2nd graders will encounter misunderstanding. Some will just turn the problem around to 9-1 and not understand why this is not how subtraction works. If a number line is posted in the class have the children start at 1 and hop back 9 jumps. They land on -8. Do not tell students that you cannot take a larger number from a smaller number. This would lay the foundation for a misunderstanding later in math. Have a class discussion about what is happening. Some students may understand that it is -8 and then use it to solve the problem. Most 2nd graders will not understand. Encourage them to use a different strategy for subtraction.

In this representation the student drew 2 100 blocks, 4 tens, and 1 one. 100 was removed and then 4 tens were removed. To take away the 9 ones, the student took away a one and then



took 8 ones from the ten. The 112 remains.

Lesson 3.5: Write an Equation to Match a Story

Overview and Background Information

Mathematical Goals	By the end of the lesson students will: <ul style="list-style-type: none"> • Write an equation to accurately represent a problem. • Accurately solve 3-digit addition and subtraction story problems. • Communicate their strategies used while solving problems.
Common Core State Standards	<p>Understand place value.</p> <p>2.NBT.1 Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. Understand the following as special cases:</p> <p>a. 100 can be thought of as a bundle of ten tens — called a “hundred.”</p> <p>b. The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones).</p> <p>Use place value understanding and properties of operations to add and subtract.</p> <p>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.</p> <p>2.NBT.7 Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds.</p> <p>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.</p>
Emphasized Standards for Mathematical Practice	<ol style="list-style-type: none"> 1. Make sense of problems and persevere to solve 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. 6. Attend to precision 7. Make Use of Structure 8. Look for and express regularity in repeated reasoning
Prior Knowledge Needed	counting by tens or hundreds from any given number, forward and backward
Vocabulary	place value, hundreds, tens, ones, representation, number line
Materials	activity sheets

Tasks in the Lesson

Engage	15 minutes
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Around the Numbers

Have students sit in a circle. Choose a number between 300 and 400. Move clockwise. Each student should give the number that is ten less than the last number said. You should record the numbers for students to see.

Example: If the start number is 432, the teacher would record 432, 422, 412, 402, 392, 382, 372, 363, 352, 342, 332, 322, 312, 302, 292, etc.

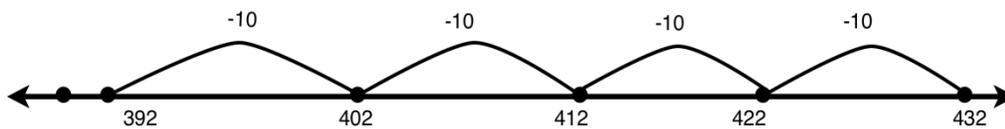
Ask, "What pattern do you see in our list?"

(The number of tens decreases by 1 each time. The ones place stays the same.)

Ask, "What happened after we said 402? Why did that happen?"

This activity can also be done increasing the tens place, counting by hundreds, counting by twenties, etc. The children should see that the ones place never changes and the tens place changes. Talk about why the hundreds place sometimes changes.

Model this counting on a number line by having students tell you what to label.



Ask, "If we were going to solve this problem, how would the number line help us think about the solution? The problem is: My brother had 432 baseball cards. He gave me 50 cards. How many cards does he have now?"

Have the students talk with a partner about solving this problem. After 1-2 minutes ask students to share their ideas.

Ask, "Is there a way to solve this problem without using a number line?" Students might share using drawings of 100s, 10s and 1s. They may also use numbers in a series of equations to solve the problem. Examples:

$$432 - 10 = 422$$

$$422 - 10 = 412$$

$$412 - 10 = 402$$

$$402 - 10 = 392$$

$$392 - 10 = 382$$

$$432 - 30 = 402$$

$$402 - 10 = 392$$

$$392 - 10 = 382$$

Ask, "How are these strategies alike? How are they different?"

***Attached to this lesson plan are possible solution strategies for solving addition and subtraction problems.*

Explore

15-20 minutes

Assign students story problems to solve. Explain that they are to write an equation and show how they solved each problem.

As students work on the problems the teacher walks around the class observing students and asking questions. As the teacher observes and talks with students, she chooses the strategies from the student work that she wants shared during the lesson discussion.

Possible things to observe:

- Can a student accurately write an equation to represent a problem?
- What strategies do students use to solve the problem?
- What tools, models, or representations do students use to solve the problem? (cubes, drawing 100s, 10s, 1s, number line, numbers in a series of equations, other strategy)
- Can you tell by looking at their work how the problem was solved?

Possible questions to ask:

- Why did you choose to solve it this way?
- Where is your answer in this representation?
- Why did you add (or subtract)?
- Could you solve it using a different strategy?
- What's your next step?

Explain

10-15 minutes

After most students have finished the problems gather the students back for a discussion of strategies. It is not necessary to discuss every problem. There are different reasons to choose problems to share. If there was a story problem that many students had difficulty with, discuss the problem.

Ask, "What was the story describing? Who can put the problem in their own words?" Then ask students to share strategies. The teacher should make sure the strategies shared highlight the mathematics she wants highlighted in this lesson. Using place value is a major focus of this lesson. Another reason to choose a problem to share is if there were a variety of strategies used by the students to solve the problem.

After several strategies are on the board, ask, "How are these strategies alike and how are they different?"

After discussing 1-2 problems as a class, ask partners to share one of the other problems with each other. Have each partner share the strategy. Tell students to also discuss how their strategies are alike or different.

Elaborate

10-15 minutes

Refer to the section "Intervention and Extension." Meet with small groups based on their understanding or misunderstanding. Focus small group work on specific areas to improve understanding or extending understanding.

Evaluation of Students

Formative: Make a chart (before the lesson) on observations. Take notes as student work. Possible topics to place on the chart are:

- Can a student accurately write an equation to represent a problem?
- What strategies do student use to solve the problem?
- What tools, models, or representations do students use to solve the problem? (cubes, drawing 100s, 10s, 1s, number line, numbers in a series of equations, other strategy)
- Can you tell by looking at their work how the problem was solved?

Summative: After collecting the problems, look for students who:

- are solving problems and can explain their strategies
- are struggling with understanding the operation used to solve the problem
- have a strategy to solve the problem but make careless computation errors.
- are struggling with understanding place value and how to use it to solve problems

Plans for Individual Differences

Intervention and Extension: After evaluating the student work, meet with groups of students based on their misunderstandings or understandings.

Strategies for Solving Addition Problems

Counting Up

$$322 + 249$$

$$322 + \underline{\hspace{2cm}} = 571$$

$$322 + 200 = 522$$

$$322 + 8 = 330$$

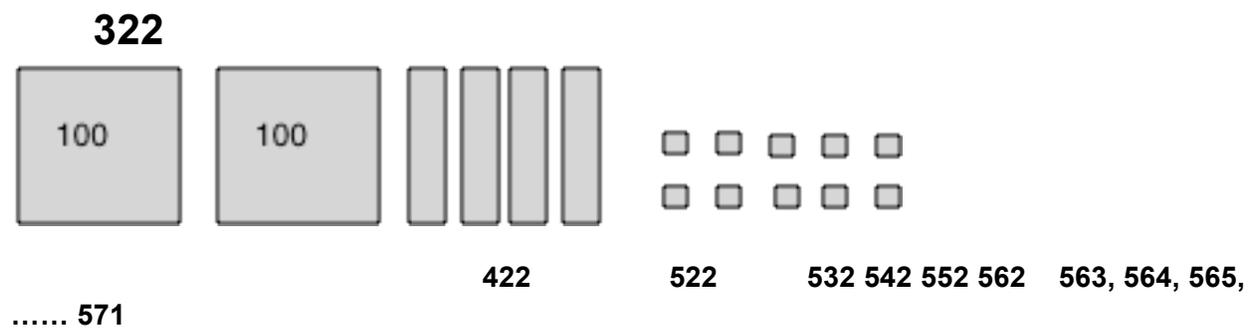
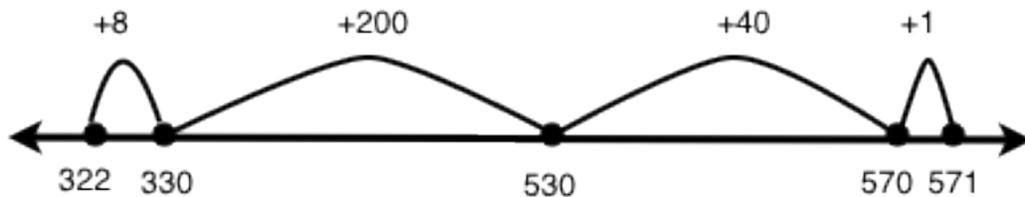
$$522 + 40 = 562$$

$$330 + 70 = 400 \text{ (or the student could count up by 7 tens)}$$

$$562 + 9 = 571$$

$$400 + 100 = 500$$

$$500 + 71 = 571$$



Place Value

(using the Commutative Property)

$$322 + 249$$

$$300 + 200 = 500$$

$$20 + 40 = 60$$

$$2 + 9 = 11$$

$$500 + 60 + 11 = 571$$

(using place value)

$$322$$

$$+249$$

$$500$$

$$60$$

$$+ 11$$

$$571$$

Strategies for Solving Subtraction Problems

$$261 - 149$$

Keep the first number whole and subtract the second number in parts (place value)

$$261 - 149$$

$$261 - 149$$

$$261 - 100 = 161$$

$$261 - 100 = 161$$

$$161 - 40 = 121$$

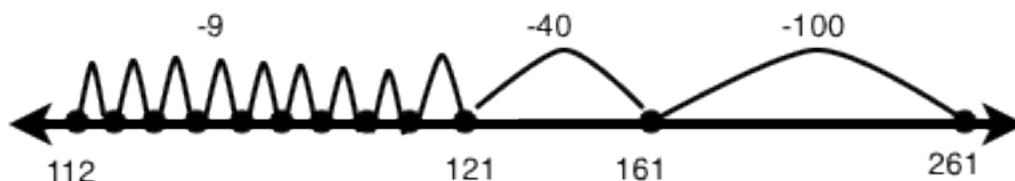
$$161 - 40 = 121$$

$$121 - 9 = 112$$

$$121 - 1 = 120 \text{ (the 9 was broken into 1 and 8. It is easier}$$

$$120 - 8 = 112 \text{ to take away 1 from 121 to get to a}$$

multiple of ten and then take away 8.)



Place Value

If children try to subtract by breaking apart all the numbers by place value they will encounter a problem for most 2nd graders. Here is an example:

$$261-149$$

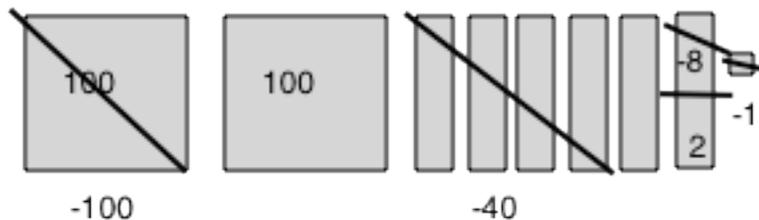
$$200-100 = 100$$

$$60-40 = 20$$

$$1-9 = -8$$

$100 + 20 - 8 = 112$ This is where most 2nd graders will encounter misunderstanding. Some will just turn the problem around to $9-1$ and not understand why this is not how subtraction works. If a number line is posted in the class have the children start at 1 and hop back 9 jumps. They land on -8. Do not tell students that you cannot take a larger number from a smaller number. This would lay the foundation for a misunderstanding later in math. Have a class discussion about what is happening. Some students may understand that it is -8 and then use it to solve the problem. Most 2nd graders will not understand. Encourage them to use a different strategy for subtraction.

In this representation the student drew 2 100 blocks, 4 tens, and 1 one. 100 was removed and



then 4 tens were removed. To take away the 9 ones, the student took away a one and then took 8 ones from the ten. The 112 remains.

Lesson 3.6: Find the Difference

Overview and Background Information

Mathematical Goals	By the end of the lesson students will: <ul style="list-style-type: none"> Subtract 2 three-digit numbers and represent a strategy for solving the problem. Communicate their strategy to classmates and the teacher
Common Core State Standards	<p>Understand place value.</p> <p>2.NBT.1 Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. Understand the following as special cases:</p> <p>a. 100 can be thought of as a bundle of ten tens — called a “hundred.”</p> <p>b. The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones).</p> <p>Use place value understanding and properties of operations to add and subtract.</p> <p>2.NBT.7 Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds.</p> <p>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.</p> <p>2.NBT.9 Explain why addition and subtraction strategies work, using place value and the properties of operations.¹</p> <p>¹ Explanations may be supported by drawings or objects.</p>
Emphasized Standards for Mathematical Practice	<ol style="list-style-type: none"> 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. 6. Attend to precision. 7. Look for and make use of structure.
Prior Knowledge Needed	understanding place value of three-digit numbers, finding 10 more, 10 less than a given number, finding 100 more, 100 less than a given number
Vocabulary	place value, representation, equation
Materials	Greatest Difference Wins spinner boards, Greatest Difference Wins sheet

Tasks in the Lesson

Engage	20-30 minutes
<p>Explain that today students will play a game that will give them practice finding the difference between 2 three-digit numbers. Demonstrate the game on the overhead or document camera. Directions for the game are at the end of this lesson.</p> <p>Show the class the spinner. Spin the 3 spinners and record the 3-digit number. Spin the 3 spinners again and record the number.</p> <p>Ask, “How can we use these two numbers in a subtraction equation?”</p>	

Have students share ideas.

Example:

If 782 and 439 were spun record, $782-439= \underline{\quad}$.

Ask, "What number story would match this equation? Turn to your partner and each of you share a story problem." Give students 1-2 minutes to share stories. Bring the class back together and ask 2-3 students to share their story.

Ask, "Is there an addition equation we could use to solve this problem?" ($439 + \underline{\quad} = 782$) Have both equations written on the board or overhead. Have students choose one of the equations (or both) and solve it on the paper or white boards

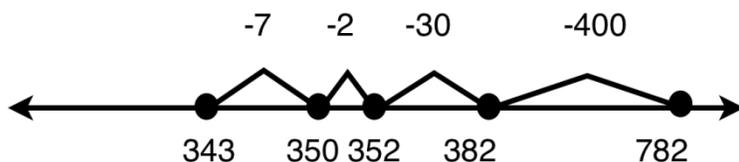
$$439 + \underline{\quad} = 782 \quad \text{or} \quad 782-439 = \underline{\quad}$$

After most students have solved the equation have them turn to a partner and share their strategy.

As the students are solving the equations and sharing with partners, walk around the class. Look for strategies you want shared with the entire class. Examples, strategies that:

- use place value
- are efficient
- generalizable strategies that will work in other problems
- two strategies that look different in appearance but mathematically are the same. For example,

$$\begin{aligned} 782 - 439 \\ 782 - 400 = 382 \\ 382 - 30 = 352 \\ 352 - 2 = 350 \\ 350 - 7 = 343 \end{aligned}$$



During the discussion make sure the use of place value to solve the problem is made explicit. When looking at two strategies, ask, "How are these strategies alike? How are they different?"

Explore

15-20 minutes

To model how to play the game Find the Difference, divide the class into two teams.

Have a student from team 1 spin two, three-digit numbers.

Have a student from team 2 spin two, three-digit numbers.

Have every student record their numbers to represent the problem, and solve the problem. Students can solve the equation with a partner or independently. After solving the problem, share with another team member to see if each got the same answer and to compare strategies.

After most students have solved the problem, bring the class back together. Record the problems on the recording sheet and compare answers. The team with the largest difference receives a point.

Continue to play several rounds.

Explain

10-15 minutes

Bring the class back together to discuss the game and strategies that were used to solve the problem. During the discussion highlight strategies with a special focus on:

- whether students subtracted or added up
- how students broke numbers up by place value
- mental math strategies that students used

Another point to emphasize is the relationship between addition and subtraction.

Ask, "What two different equations to solve this problem?"

$$439 + \underline{\quad} = 782 \quad \text{or} \quad 782 - 439 = \underline{\quad}$$

Ask, "Why can I write 2 different equations for this one problem?"

Students should be able to discuss how a subtraction problem ($782-439=\underline{\quad}$) is the same as a missing addend addition problem ($439+\underline{\quad}=782$). This is introduced in First Grade in the Common Core Standards and should also be emphasized during the Second Grade.

Elaborate

10 minutes

Give students 2 three-digit numbers. Students need to write:

- A subtraction or missing addend equation and a story problem

Students should then solve the task in two different ways. Collect this to evaluate students' progress. As students work ask them to explain their strategies. Also, feel free to pull a small group of students to provide more support during this activity.

Evaluation of Students

Formative: Checked through questioning during the class discussion. Also check on understanding while observing students as they solve problems.

Summative: Use the task from the Elaborate phase as the summative assessment.

Plans for Individual Differences

Intervention:

- Students who have difficulty working with 3-digit numbers can play the game using 2-digit numbers. Use the spinner board with tens and ones.
- Students can build numbers with base ten blocks and use them.

Extension:

- Write the scores of the two teams on the board and insert the correct sign ($<$, $>$, $=$) to show the relationship between the two numbers.
Example: $456 > 233$
 - When pairs of students play, write the scores of the two players on the board and insert the correct sign ($<$, $>$, $=$) to show the relationship between the two numbers.
Example: $456 > 233$
 - Use place value dice instead of the spinners to generate the numbers.
 - Use the thousands cubes to generate 4-digit numbers.
 - Have students solve each problem using two different strategies.
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Greatest Difference Wins

Materials

Spinner board—use transparent spinners placed over the paper spinners or place a brass fastener

through a $\frac{1}{4}$ " length of drinking straw and a paperclip. Insert the brad and straw into the large end of the paperclip. Keep the straw and the paperclip on the brass fastener, insert it in the midpoint hole of the spinner. Then bend each side of the fastener flap against the underside of the board.

Recording sheet—students can record their equations and strategies on notebook paper, white boards or the recording sheet.

Directions

Partners can work together to solve these problems. This version of the game has no winner. They are just working together to solve problems.

Another version is that both players spin and generate 2, three-digit numbers and record their equations and strategies. The person with the larger difference is the winner of that round.

1. One player spins the three spinners and records the number. For example, if 300, 40 and 2 were spun, record 342.
2. The other player spins the three spinners again and records the number. For example, if 500, 30 and 1 were spun, record 531.
3. Explain that their job is to find the difference between the two numbers, but first they have to record two different equations to show the problem. For example, the two equations students could record are $531 - 342 = \underline{\quad}$ and $342 + \underline{\quad} = 531$.
4. Players work to solve the problem two different ways. They could record their strategies using numbers, number lines, place value representations, etc.
5. Use the recording sheet for documentation of student work. The students could also record the equations on notebook paper or white boards.

Extension: Choose one equation and write a story problem that matches the equation.

This game is adapted from The Math Learning Center, Bridges in Mathematics Grade 2 Supplement.

The Greatest Difference Wins Recording Sheet

Round _____

Spin 1: _____ Spin 2: _____

Largest spin: _____ Smallest spin: _____

$$\underline{\hspace{2cm}} + \boxed{\hspace{1cm}} = \underline{\hspace{2cm}}$$

Smallest Largest

$$\underline{\hspace{2cm}} - \underline{\hspace{2cm}} = \boxed{\hspace{1cm}}$$

Largest Smallest

Strategy Used:

Round _____

Spin 1: _____ Spin 2: _____

Largest spin: _____ Smallest spin: _____

$$\underline{\hspace{2cm}} + \boxed{\hspace{1cm}} = \underline{\hspace{2cm}}$$

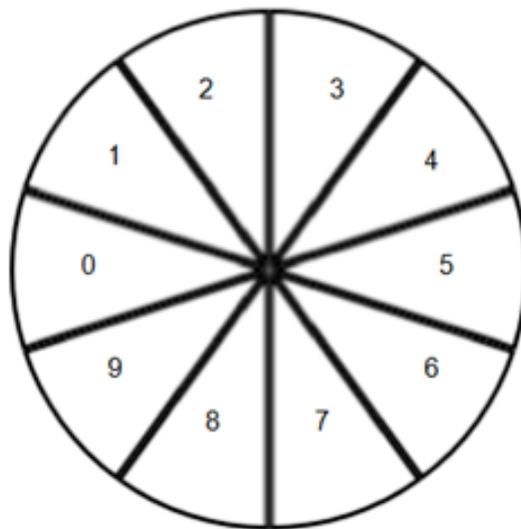
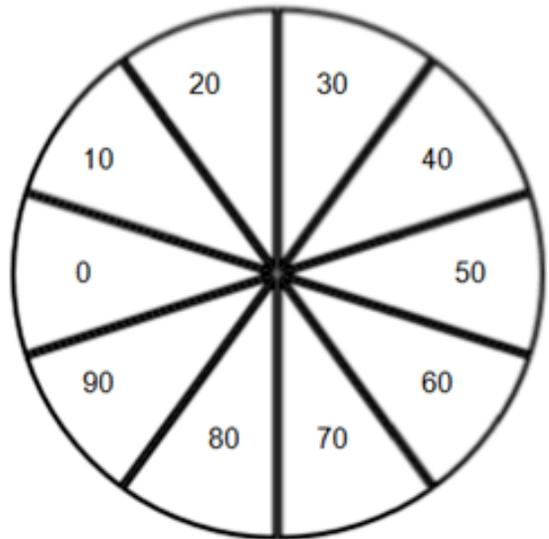
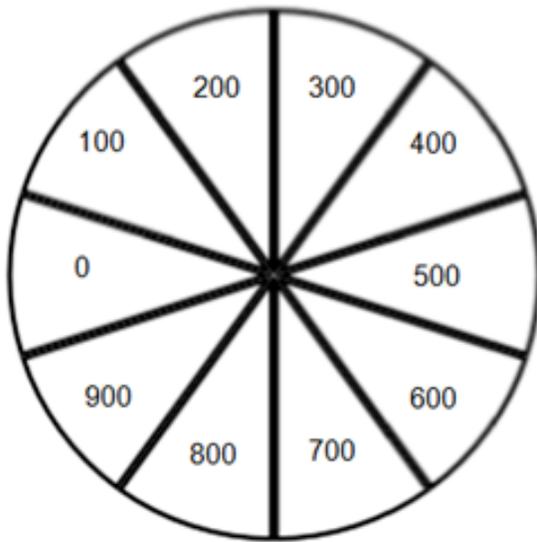
Smallest Largest

$$\underline{\hspace{2cm}} - \underline{\hspace{2cm}} = \boxed{\hspace{1cm}}$$

Largest Smallest

Strategy Used:

Spinners



Lesson 3.7: Greatest Difference Wins

Overview and Background Information

Mathematical Goals	By the end of the lesson students will: <ul style="list-style-type: none"> • Accurately subtract 2 three-digit numbers and notate their strategy for solving the problem. • Communicate their strategies that they used while solving problems.
Common Core State Standards	<p>Understand place value.</p> <p>2.NBT.1 Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. Understand the following as special cases:</p> <ol style="list-style-type: none"> 100 can be thought of as a bundle of ten tens — called a “hundred.” The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones). <p>Use place value understanding and properties of operations to add and subtract.</p> <p>2.NBT.7 Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds.</p> <p>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.</p>
Emphasized Standards for Mathematical Practice	<ol style="list-style-type: none"> 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. 6. Attend to precision. 7. Look for and make use of structure.
Prior Knowledge Needed	understanding place value of three-digit numbers, finding 10 more, 10 less than a given number; finding 100 more, 100 less than a given number
Vocabulary	place value, representation, equation
Materials	Greatest Difference Wins spinner boards, Greatest Difference Wins recording sheet, arrow Cards, calculators, white boards, markers, other games that have been played can also be used during centers

Tasks in the Lesson

Engage	10 minutes
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Revisiting Greatest Difference Wins

Review how to play “Greatest Difference Wins.” The game was played in the previous lesson.

Place the spinner on the overhead projector or document camera and have students spin to generate 2, three-digit numbers. You may also use number cards or dice instead of spinners.

Have students solve the equation on their white boards.

After solving the problem ask 3-4 students to share their strategies. As students are sharing their strategies ask the class questions such as:

- Why did he choose to ...?
- Why was it a good idea to ...?
- How does this strategy use place value?
- How are these two strategies alike? Different?
- Why did he subtract the hundreds first?

Explore

35-40 minutes

Centers with The Greatest Difference Wins

In this part of the lesson, students will be working in centers. We recommend that you have a small group during this lesson so you can provide students with support.

Model or go over the various centers. Possible ideas include:

- Greatest Difference Game
- Arrow Card Spin Game
- Creating Story Problems—Students use the Greatest Difference spinner to generate 2, three-digit numbers. After generating the numbers, write a story problem. Have a partner in the center/group read the problem to see if it makes sense and solve the problem. The writer of the problem uses a calculator to check the answer.
- Other games that have been played in class.
- Complete a page in the textbook/workbook or worksheet.
- Complete a math game activity on the computer. Two examples using arrow cards are http://www.ictgames.com/arrowCards_revised_v4.html and http://www.curriculumsupport.education.nsw.gov.au/countmein/children_arrow_card.html

While students are working independently the teacher meets with small groups of students who have similar needs in understanding subtraction of 3-digit numbers. Possible ways to group students:

- Students who are having difficulty with 3-digit subtraction and need more practice with 2-digit subtraction.
- Students who have a similar strategy for solving subtraction and need to move to a more efficient strategy.
- Students who cannot mentally subtract hundreds or tens from a given number.
- Students who efficiently subtract 3-digit numbers and need suggestions on ways to record their thinking.

Explain

10 minutes

Discussing The Greatest Difference Wins

Bring the class back together to discuss the concepts that they were working with.

To start the discussion, generate 3 digits using a spinner or number cards.

Using the 3 digits, make the largest number and the smallest number as a class.

Ask, "If we wanted to find the difference, what could we do?"

As students share strategies record their ideas so they are visible.

After a variety of strategies are posted give the students five minutes to complete the task. Tell them that they must show two different strategies.

Elaborate

10 minutes

Make the Greatest and Smallest Number

Students will complete the task given during the Explain section. While they work make note of the different strategies that they used.

If students need help, guide them with questions, such as:

“What do you know about the numbers that we are working with?”

“If we looked at things one place at a time where would we start?”

Evaluation of Students

Formative: Checked through questioning during the class discussion. Also check on understanding while observing students as they solve problems.

Summative: Collect their work from the Elaborate section for summative assessment.

Plans for Individual Differences

Intervention:

- Work with small groups based on their mathematical needs. Is there evidence of some understanding that you might build upon?
- Some students may need to build the numbers with base ten blocks and use them to solve the problems.
- Students who have difficulty working with 3-digit numbers can play the game using 2-digit numbers. Use the spinner board with tens and ones.
- Students can build the numbers with base ten blocks and use the blocks to solve the problems.

Extension:

- Use a 1000s cubes or make an additional 1000s spinner to use with Greatest Difference Wins to generate 4-digit numbers.
 - Have students solve each problem using two different strategies.
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