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Lesson 9

Missing Number Puzzles

Overview

In this lesson, students work with puzzles that are pieces of a hundreds chart. The focus, which is on just a portion of the chart, helps students concentrate on where a particular number is in relation to the numbers around it. Students think about how the numbers on the chart are related, both by tens in columns and by ones in rows.

Related Lessons

You might teach the following lessons first:

- L-1 Building the Hundreds Chart (Version 1)
- L-2 Building the Hundreds Chart (Version 2)
- L-4 Building a Wacky Hundreds Chart

Consider this game as a follow-up:

- G-5 Don't Get Lost

Key Questions

- Where do you start on a new puzzle? Is there one square on each puzzle that makes a better starting place than the others?
- Are any of the puzzles harder than others? Which ones? Why?
- What shapes are the easiest puzzles?

Time

30 to 40 minutes

Materials

Missing Number Puzzles (Reproducible 12, Sets 1–4) copied on cardstock or other stiff paper, laminated, and cut out

dry-erase markers, one for each pair of students (for puzzle option)

Missing Number Puzzles (Reproducible 12, 1 of Sets 1–4), 1 copy per student (for worksheet option)

Missing Number Puzzles Assessment (Reproducible 13), 1 per student

Common Core State Standards

For connections to the Common Core State Standards, see pages xxi through xxxix.

Teaching Directions

Introduce

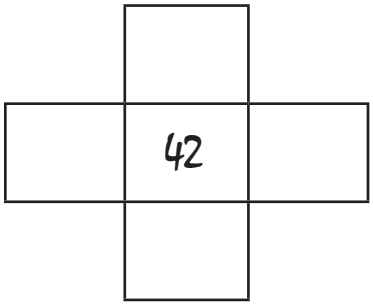
1. Gather students together to introduce the lesson. Begin with the puzzle in the shape of a plus sign (see Reproducible 12, Set 3). Project or place the enlarged version of this puzzle where all students can see it.
2. Explain to students, "This is a puzzle piece for a game you're going to play today called *Missing Number Puzzles.* Can you tell what this piece is a part of ? Does it remind you of anything?"

   Examples of Student Thinking

   "It looks like a plus with forty-two in the middle."

   "I think it looks like a T, but there's a number in the middle."

   If students do not connect it with a hundreds chart, explain, "This is a small part of a hundreds chart. It looks like I just copied this one tiny piece, but I erased all the numbers around the forty-two."
3. Tell students that their job is to decide which numbers are missing from each piece of the chart and fill them in.
4. Ask for a student volunteer to fill in one of the empty boxes on the puzzle and to explain how she knows which number goes there.



Example of Student Thinking

"I know that forty-one comes before forty-two, so it goes in the box before forty-two."

5. Continue eliciting numbers for the puzzle until it is complete. Each time a student fills in a number, ask her to explain her thinking.

   Examples of Student Thinking

   "I think forty-three goes after the forty-two, because that's what you say when you count: forty-one, forty-two, forty-three."

   "I know that thirty-two goes on top of forty-two because it's like when we played the *Wacky Hundreds Chart* game (L-4). When the number is ten less it goes on top of the other number."

Explore

6. Now it's the students' turn to work in pairs and complete the puzzles. Hand out two laminated puzzles for every pair of students, along with a dry-erase marker (or hand out copies of one of the entire sets in Reproducible 12).

7. Explain that students will work together to fill in the missing numbers. Next, they will use a hundreds chart to check their puzzle to be sure they have filled in the correct numbers. Last, students will erase their puzzles before returning them to a central location and choosing two more puzzles on which to work.

8. Display Directions for Missing Number Puzzles for everyone to see.

   Directions for Missing Number Puzzles

   1. Fill in the numbers on your puzzles.
   2. Check your puzzle by looking at a complete hundreds chart.
   3. Erase the numbers on your puzzles.
   4. Return your puzzles and choose two more.

9. Circulate in the classroom as students are working on their puzzles. Ask the key questions listed at the beginning of this lesson.

Teaching Tip

Options for Practice

There are two options for students' independent practice with Missing Number Puzzles. One option is simply to photocopy the sets in Reproducible 12 and have students work alone or with a partner to fill in the missing numbers on their "worksheets." A second option is to reproduce the same sets on heavy paper, laminate them, and cut out the individual puzzles. Then have students record on the puzzles using a dry-erase marker. In this way, students concentrate on one puzzle at a time and, because the puzzles are nonconsumable, you can put them in a center to be solved again later.

Summarize

10. After students have had the chance to complete at least three puzzles, call them back together. Use the key questions to lead a short discussion about how the puzzles relate to previous lesson experiences (L-1 *Building the Hundreds Chart* (*Version 1*), L-2 *Building the Hundreds Chart* (*Version 2*), and L-4 *Building a Wacky Hundreds Chart*).

11. Explain to the class that the puzzles will be put in a center (math station) for future exploration. Although students may have solved several of the puzzles, they benefit from repeating mathematical experiences several times, and often deepen their understanding the second or third time they work on a puzzle.

Teaching Tip

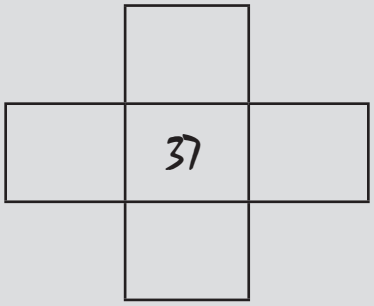
Assessment

After the Missing Number Puzzles have been in your math stations for two weeks or so, you may want to use Missing Number Puzzles Assessment (Reproducible 13) as an assessment to determine how well your students are able to use what they know about the hundreds chart to fill in the missing numbers.

Teacher Reflection

My Experiences with *Missing Number Puzzles*

I introduced Missing Number Puzzles with the puzzle that looks like a plus sign. I drew it on the easel, large enough for the class to see, with boxes big enough to write inside. This puzzle is simple in that it involves moving straight up and down one column and across one row, in the same way most of the previous lessons and games do. I asked students, "Can you tell where it looks like this puzzle came from? Does it remind you of anything?"



Tia responded, "It looks like a piece of the hundreds chart cut out!"

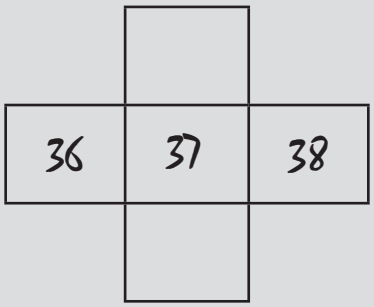
I then asked, "What numbers do you think should go in the squares?" I gave the class a few minutes to think about their answers, and then I called on Ben.

"I think next to the thirty-seven should be thirty-eight; on the right side, because thirty-eight comes after thirty-seven," Ben declared.

Several students nodded to indicate their agreement, so I had Ben come up and write *38* on the puzzle.

Shazia spoke next. "So on the other side it should be thirty-six, so it goes thirty-six, thirty-seven, thirty-eight across."

Shazia came up and wrote *36* in the box next to the thirty-seven.



I asked the class if they agreed with Shazia's thinking.

Diamond said, "I agree with Shazia and Ben. Now it looks like part of the hundreds chart with the corners missing."

"What do you think should go in this box and why do you think that?" I asked, pointing to the box above thirty-seven.

Demetrius raised his hand. "I think it's twenty-seven because it's just like the *Arrow Arithmetic* game. When you go up in a column it's ten. I counted thirty-seven, thirty-six, thirty-five, thirty-four, thirty-three," Demetrius explained as he kept track with his fingers, "thirty-two, thirty-one, thirty, twenty-nine, twenty-eight, twenty-seven." He pointed triumphantly at the box and wrote *27* above the thirty-seven. (**Note:** The game to which Demetrius is referring is Lesson L-3, *Arrow Arithmetic.*)

"So that means forty-seven goes under thirty-seven because it's ten more," Kiara said. "That finishes the puzzle!"

"What could we use to check ourselves to be sure we've filled in the puzzle correctly?" I inquired further.

"We could just look at a real hundreds chart," Nia suggested. Because I have a basket with laminated hundreds charts always available to students at the front of the room, we quickly passed out the charts and agreed that the puzzle was filled in correctly.

I then directed students to turn their hundreds charts face down on the floor before starting the next puzzle. I showed students the following:

"Here's another puzzle with just one number in it. It's a piece of the hundreds chart, just like the last puzzle. You have to figure out what numbers go in the other spaces. Who wants to tell us a number that fits into this puzzle?" I asked. I gave everyone a few quiet moments to think, then called on Grace.

"I think sixty-three goes next to sixty-four, because it's one less than sixty-four," Grace mused.

Nia nodded and added, "And fifty-three goes on top of sixty-three. It's ten less than sixty-three."

Trevon finished the puzzle by writing *52* in the last empty square.

I assigned each student a partner with whom to work and passed out two laminated puzzles and one dry-erase marker to each pair. I explained that partners needed to discuss how to fill in the puzzle before using the dry-erase marker. I reminded them to check their work by looking at a hundreds chart when they were finished, then they needed to clean off the laminated puzzles and come get two more from the basket filled with extra puzzles. The students eagerly got to work while I circulated around the room, observing and asking key questions.

Correlations to the Common Core State Standards: Kindergarten

CCSS Domain and Standard	L-1, Building the Hundreds Chart (Version 1)	L-2, Building the Hundreds Chart (Version 2)	L-3, Arrow Arithmetic	L-4, Building a Wacky Hundreds Chart	L-5, One More or One Less	L-6, Ten More or Ten Less	L-7, Hundreds Chart Riddles	L-8, Look, Quick!	L-9, Missing Number Puzzles	L-10, From Here to There	G-1, Number Chart Bingo!	G-2, Too High, Too Low	G-3, Fill It Up!	G-4, Mystery Squares	G-5, Don't Get Lost	G-6, Hippety Hop	G-7, Race to 100	G-8, 101 and Out!	G-9, The Larger Difference	G-10, How Far Away?
Counting and Cardinality																				
Know number names and the count sequence.																				
K.CC.1. Count to 100 by ones and by tens.	X			X	X			X												
K.CC.2. Count forward beginning from a given number within the known sequence (instead of having to begin at 1).	X	X	X	X	X			X	X		X		X	X	X					
K.CC.3. Write numbers from 0 to 20. Represent a number of objects with a written numeral 0–20 (with 0 representing a count of no objects).							X	X	X				X		X					

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Count to tell the number of objects. K.CC.4. Understand the relationship between numbers and quantities; connect counting to cardinality. When counting objects, say the number names in the standard order, pairing each object with one and only one number name and each number name with one and only one object. Understand that the last number name said tells the number of objects counted. The number of objects is the same regardless of their arrangement or the order in which they were counted.	X							X		X										

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Understand that each successive number name refers to a quantity that is one larger.								X		X										
K.CC.5. Count to answer "how many?" questions about as many as 20 things arranged in a line, a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1–20, count out that many objects.																				
Compare numbers.																				
K.CC.6. Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.[1]							X			X	X	X								

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K.CC.7. Compare two numbers between 1 and 10 presented as written numerals.							X				X									
Number and Operation in Base Ten																				
Work with numbers 11–19 to gain foundations for place value.																				
K.NBT.1. Compose and decompose numbers from 11 to 19 into ten ones and some further ones (e.g., by using objects or drawings), and record each composition or decomposition by a drawing or equation (such as 18 = 10 + 8); understand that these numbers are composed of ten ones and one, two, three, four, five, six, seven, eight, or nine ones.							X	X			X					X				

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Operations and Algebraic Thinking **Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.**																				
K.OA.1. Represent addition and subtraction with objects, fingers, mental images, drawings,[1] sounds (e.g., claps), acting-out situations, verbal explanations, expressions, or equations.	X	X	X		X	X			X	X	X		X	X						
K.OA.2. Solve addition and subtraction word problems, and add and subtract within 10 (e.g., by using objects or drawings to represent the problem).					X		X			X	X									

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K.OA.3. Decompose numbers less than or equal to 10 into pairs in more than one way (e.g., by using objects or drawings), and record each decomposition by a drawing or equation (e.g., 5 = 2 + 3 and 5 = 4 + 1). K.OA.4. For any number from 1 to 9, find the number that makes 10 when added to the given number (e.g., by using objects or drawings), and record the answer with a drawing or equation. K.OA.5. Fluently add and subtract within 5.																				

Correlations to the Common Core State Standards: First Grade

CCSS Domain and Standard	L-1, Building the Hundreds Chart (Version 1)	L-2, Building the Hundreds Chart (Version 2)	L-3, Arrow Arithmetic	L-4, Building a Wacky Hundreds Chart	L-5, One More or One Less	L-6, Ten More or Ten Less	L-7, Hundreds Chart Riddles	L-8, Look, Quick!	L-9, Missing Number Puzzles	L-10, From Here to There	G-1, Number Chart Bingo!	G-2, Too High, Too Low	G-3, Fill It Up!	G-4, Mystery Squares	G-5, Don't Get Lost	G-6, Hippety Hop	G-7, Race to 100	G-8, 101 and Out!	G-9, The Larger Difference	G-10, How Far Away?
Operations and Algebraic Thinking **Represent and solve problems involving addition and subtraction.** 1.OA.1. Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing with unknowns in all positions (e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem).			X							X	X					X	X			

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1.OA.2. Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20 (e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem).			X								X									
Understand and apply properties of operations and the relationship between addition and subtraction.																				
1.OA.3. Apply properties of operations as strategies to add and subtract.[2] *Examples: If 8 + 3 = 11 is known, then 3 + 8 = 11 is also known. (Commutative property of addition.) To add 2 + 6 + 4, the second two numbers can be added to make a ten, so 2 + 6 + 4 = 2 + 10 = 12. (Associative property of addition.)*		X	X							X							X	X	X	

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1.OA.4. Understand subtraction as an unknown-addend problem. *For example, subtract 10 – 8 by finding the number that makes 10 when added to 8. Add and subtract within 20.* **Understand and apply properties of operations and the relationship between addition and subtraction.**										X							X	X	X	X
1.OA.5. Relate counting to addition and subtraction (e.g., by counting on 2 to add 2).	X	X	X	X				X	X	X	X		X	X		X	X			X

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1.OA.6. Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on; making ten (e.g., 8 + 6 = 8 + 2 + 4 = 10 + 4 = 14); decomposing a number leading to a ten (e.g., 13 – 4 = 13 – 3 – 1 = 10 – 1 = 9); using the relationship between addition and subtraction (e.g., knowing that 8 + 4 = 12, one knows 12 – 8 = 4); and creating equivalent but easier or known sums (e.g., adding 6 + 7 by creating the known equivalent 6 + 6 + 1 = 12 + 1 = 13).																			

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Work with addition and subtraction equations.																				
1.OA.7. Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false. For example, which of the following equations are true and which are false? 6 = 6, 7 = 8 – 1, 5 + 2 = 2 + 5, 4 + 1 = 5 + 2.			X					X								X			X	
1.OA.8. Determine the unknown whole number in an addition or subtraction equation relating three whole numbers. *For example, determine the unknown number that makes the equation true in each of the equations 8 + ? = 11, 5 = _ – 3, 6 + 6 = _.*		X	X							X	X						X		X	X

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Number and Operation in Base Ten																				
Extend the counting sequence.																				
1.NBT.1. Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral.	X	X	X																	
Understand place value.																				
1.NBT.2. Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases:	X					X	X	X	X		X			X	X		X	X		
10 can be thought of as a bundle of ten ones—called a "ten."																				

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The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones. The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones). 1.NBT.3. Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and <.							X				X	X						X	X	

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Use place-value understanding and properties of operations to add and subtract. 1.NBT.4. Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10, 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 and explain the reasoning used. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten.		X	X	X		X	X		X	X	X		X	X	X	X	X	X	X	X

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1.NBT.5. Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used.		X	X	X		X			X		X		X	X	X		X			X
1.NBT.6. Subtract multiples of 10 in the range 10–90 from multiples of 10 in the range 10–90 (positive or zero differences), 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 and explain the reasoning used.		X	X			X					X						X			

Correlations to the Common Core State Standards: Second Grade

CCSS Domain and Standard	L-1, Building the Hundreds Chart (Version 1)	L-2, Building the Hundreds Chart (Version 2)	L-3, Arrow Arithmetic	L-4, Building a Wacky Hundreds Chart	L-5, One More or One Less	L-6, Ten More or Ten Less	L-7, Hundreds Chart Riddles	L-8, Look, Quick!	L-9, Missing Number Puzzles	L-10, From Here to There	G-1, Number Chart Bingo!	G-2, Too High, Too Low	G-3, Fill It Up!	G-4, Mystery Squares	G-5, Don't Get Lost	G-6, Hippety Hop	G-7, Race to 100	G-8, 101 and Out!	G-9, The Larger Difference	G-10, How Far Away?
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]		X	X				X		X	X	X				X		X		X	X

(continued)

CCSS Domain and Standard	L-1, Building the Hundreds Chart (Version 1)	L-2, Building the Hundreds Chart (Version 2)	L-3, Arrow Arithmetic	L-4, Building a Wacky Hundreds Chart	L-5, One More or One Less	L-6, Ten More or Ten Less	L-7, Hundreds Chart Riddles	L-8, Look, Quick!	L-9, Missing Number Puzzles	L-10, From Here to There	G-1, Number Chart Bingo!	G-2, Too High, Too Low	G-3, Fill It Up!	G-4, Mystery Squares	G-5, Don't Get Lost	G-6, Hippety Hop	G-7, Race to 100	G-8, 101 and Out!	G-9, The Larger Difference	G-10, How Far Away?
Add and subtract within 20.																				
2.OA.2. Fluently add and subtract within 20 using mental strategies.[2] By end of Grade 2, know from memory all sums of two one-digit numbers.			X								X						X			
Number and Operation 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.		X	X	X		X	X		X	X	X		X	X	X	X	X	X	X	X

(continued)

CCSS Domain and Standard	L-1, Building the Hundreds Chart (Version 1)	L-2, Building the Hundreds Chart (Version 2)	L-3, Arrow Arithmetic	L-4, Building a Wacky Hundreds Chart	L-5, One More or One Less	L-6, Ten More or Ten Less	L-7, Hundreds Chart Riddles	L-8, Look, Quick!	L-9, Missing Number Puzzles	L-10, From Here to There	G-1, Number Chart Bingo!	G-2, Too High, Too Low	G-3, Fill It Up!	G-4, Mystery Squares	G-5, Don't Get Lost	G-6, Hippety Hop	G-7, Race to 100	G-8, 101 and Out!	G-9, The Larger Difference	G-10, How Far Away?
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.		X	X				X											X		

(continued)

CCSS Domain and Standard	L-1, Building the Hundreds Chart (Version 1)	L-2, Building the Hundreds Chart (Version 2)	L-3, Arrow Arithmetic	L-4, Building a Wacky Hundreds Chart	L-5, One More or One Less	L-6, Ten More or Ten Less	L-7, Hundreds Chart Riddles	L-8, Look, Quick!	L-9, Missing Number Puzzles	L-10, From Here to There	G-1, Number Chart Bingo!	G-2, Too High, Too Low	G-3, Fill It Up!	G-4, Mystery Squares	G-5, Don't Get Lost	G-6, Hippety Hop	G-7, Race to 100	G-8, 101 and Out!	G-9, The Larger Difference	G-10, How Far Away?
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]						X				X				X			X		X	X