Math Solutions
PROFESSIONAL DEVELOPMENT

The 512 Ants on Sullivan Street

A Lesson for Third Graders

by Maryann Wickett and Marilyn Burns
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This lesson is excerpted from Maryann Wickett and Marilyn Burns's new book, Teaching Arithmetic: Lessons for Extending Place Value, Grade 3 *(Math Solutions Publications, 2005). Children's understanding of place value is key to their arithmetic success with larger numbers, and this book is important for fostering their understanding. In this lesson, based on a children's book, children think about what happens to the magnitude of numbers when they double over and over and how doubling relates to addition and multiplication. They also apply their understanding of place value to solve subtraction problems.*

The students gathered around me, chatting about the book I was holding, *The 512 Ants on Sullivan Street,* by Carol A. Losi (Scholastic, 1997). I settled them down and read aloud the book's first two spreads, which introduce one ant walking away with a crumb and two ants taking part of a plum. I asked the children to predict the number of ants that would be taking food from the picnic basket on the next page. Some students thought it would be three ants, stating that there could be a pattern that increased by one ant each time. Others thought there would be four ants, suggesting a doubling pattern. A few made random guesses, thinking that there was no pattern at all to the number of ants.

I continued reading and we learned that next, four ants make off with a barbequed chip. I recorded on the board:

Number of Ants

1

2

4

As I finished recording, students waved their hands, eager to share. I called on Jessie.

Jessie said, "It's a doubling pattern. One plus one equals two. Two is next. Two plus two equals four. And four is the next number. I think the next number after that will be eight because four plus four equals eight."

I added Jessie's idea to the list:

Number of Ants

1

$2 = 1 + 1$

$4 = 2 + 2$

I read the next spread to verify that eight ants come along next, this time carrying off a bacon strip. I said, "It seems as if there is a doubling pattern. What's a way we can show a doubling pattern with multiplication?"

"Doubling is like timesing by two," Karena replied.

To be sure Karena understood the connection between doubling and multiplying by two, I nudged, "It would be helpful if you could explain your thinking and give an example."

Karena explained, "The times sign means groups of. And doubling means two of something. So instead of one plus one, you could think of it as two groups of one. You'd write that with a two, then a times sign, and then a one. That equals two just like one plus one equals two."

I pointed to 2 + 2 = 4 and asked the students, "How would I write this as a multiplication sentence?"

Christopher replied, "Two times two equals four. There are two twos, so that's two groups of two or two, two times."

With the students' help, the recording soon looked as follows:

1

$2 = 1 + 1 = 2 \times 1$

$4 = 2 + 2 = 2 \times 2$

$8 = 4 + 4 = 2 \times 4$

The children continued to make predictions about subsequent numbers of ants. I verified by reading the story and continued to record on the board. When we got to thirty-two ants, I asked, "If I wanted to put the ants into groups of ten, could I? Would I have any ants left over?"

Karlee said, "There will be ants left over, but I'm not sure why."

I said, "Put your thumb up if you agree that there will be ants left over if we put thirty-two ants into groups of ten. Put your thumb sideways if you're not sure, and put your thumb down if you think there will be no ants left over." All thumbs were up. I said, "Raise your hand if you'd like to explain why there will be leftover ants."

Olina shared, "If there's exactly a group of ten, the number ends in zero. Like ten has one group of ten and ends in zero. Twenty has two groups of ten and ends in zero. Thirty-two doesn't end in zero. It has three groups of ten and two leftover ants."

Tobias said, "You can use multiplication. Three times ten equals thirty and four times ten equals forty. Thirty-two gets skipped. I agree with Olina; there will be two ants left."

I continued reading the story and together we finished the chart we'd started showing the patterns of doubling both by adding and by multiplying by two.

Number of Ants

1

2 = 1 + 1 = 2 x *1*

4 = 2 + 2 = 2 x *2*

8 = 4 + 4 = 2 x *4*

16 = 8 + 8 = 2 x *8*

32 = 16 + 16 = 2 x *16*

64 = 32 + 32 = 2 x *32*

128 = 64 + 64 = 2 x *64*

256 = 128 + 128 = 2 x *128*

512 = 256 + 256 = 2 x *256*

Subtraction with Regrouping

I then asked, "Remember in the story when thirty-two ants hauled a wing and a leg? What if they needed fifty ants for that job? How many more ants would they need?"

When most of the students had their hands up, I called on Adama. She said, "You need eighteen. The problem could be fifty minus thirty-two, but all you have to do is start with thirty-two and count up to fifty. Thirty-two plus ten equals forty-two; then eight ones make fifty. Fifty minus thirty-two equals eighteen."

I recorded on the board:

Adama *50 – 32 =*

32 + 10 = 42

42 + 8 = 50

50 – 32 = 18

Roberto said, "You could start with thirty-two and add eight ones to make forty and then one group of ten to make fifty. Eight and ten equal eighteen, so thirty-two plus eighteen equals fifty."

I recorded:

Roberto *32 + 8 = 40*

40 + 10 = 50

10 + 8 = 18

Tina had a different strategy, and I recorded hers as well.

A Second Subtraction Problem

I then wrote on the board: *At a nearby picnic, 64 ants want to carry away a huge dill pickle. Although the ants try their best, they can't move the pickle. They decide that 100 ants could do the job. How many more ants are needed?*

I handed each student a sheet of paper and I explained, "I'm interested in knowing what each of you thinks and understands, so please do your own work."

While the students worked, I circulated through the class, observing carefully. My goal was to gain a clearer understanding of what strategies the students were using and what misconceptions they might have had. I also was interested to see which students had access to the problem and which didn't, and which students would use their understanding of place value and which would rely on the standard algorithm or another means of figuring. I was also interested in which students would solve the problem using subtraction and which would choose addition.

Roberto wrote the problem as a subtraction problem: *100 – 64.* His written explanation stated, *I add to 64 to 100 and it took me 36 fingers. That's 3 tens and 6 ones. 36.*

Keara used subtraction and her knowledge of place value to solve the problem. Although she subtracted, she did not use the standard algorithm. She subtracted the tens first and then the ones. (See Figure 1.)

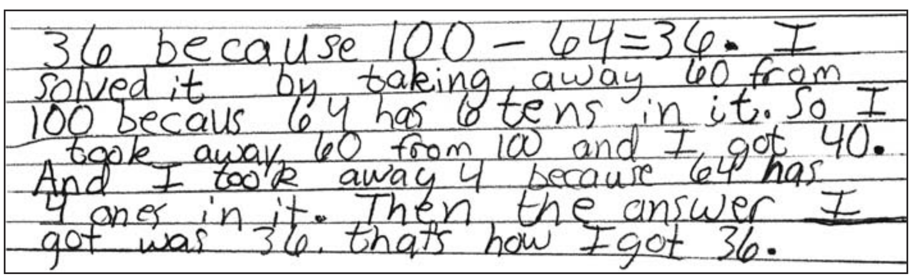

36 because 100 - 64=36. I solved it by taking away 60 from 100 becaus 64 has 6 tens in it. So I took away 60 from 100 and I got 40. And I took away 4 because 64 has 4 ones in it. Then the answer I got was 36. thats how I got 36.

Figure 1. Keara used her knowledge of place value to successfully solve the problem.

Adama first solved the problem using addition; then she used the standard algorithm as a check. (See Figure 2.)

Jessie counted on from sixty-four, using tally marks grouped in tens to help her find an answer. (See Figure 3.)

Tobias started with 64 and counted up by tens until he got to 104, for a total of four tens, or forty. Then he counted four back from 104 to get to 100. Finally, he subtracted four from the four tens, or forty, to get thirty-six. (See Figure 4.)

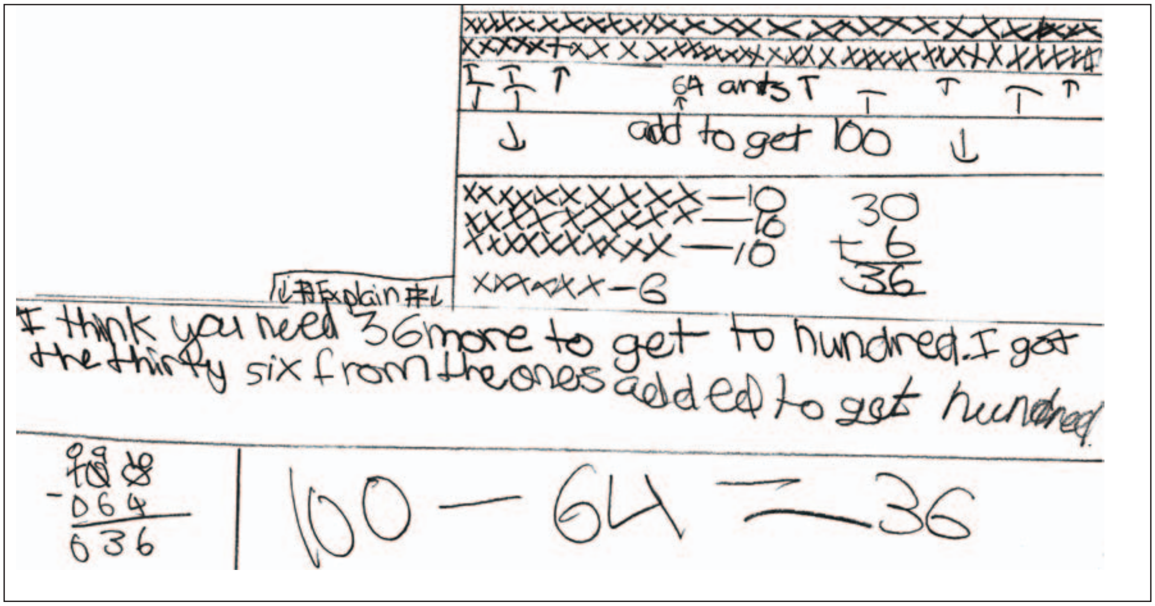


Figure 2. Adama counted on using tens and ones to find the solution.

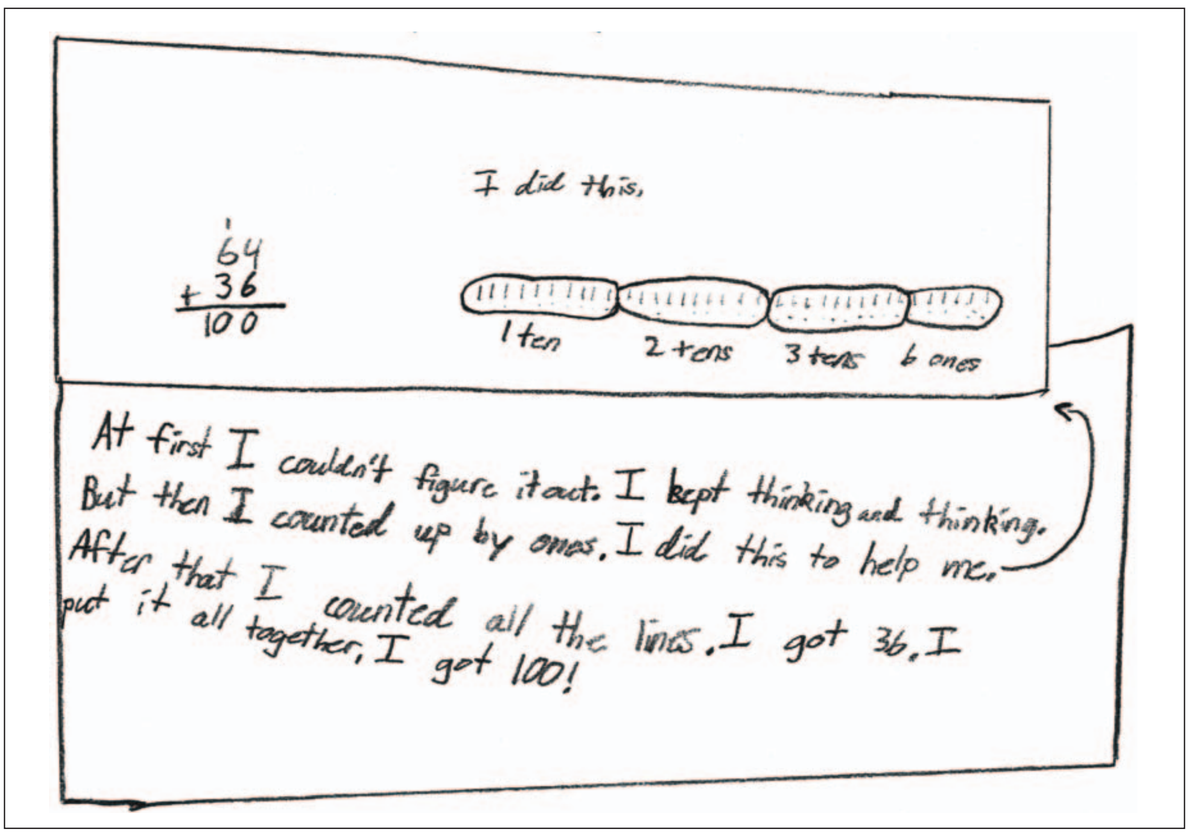
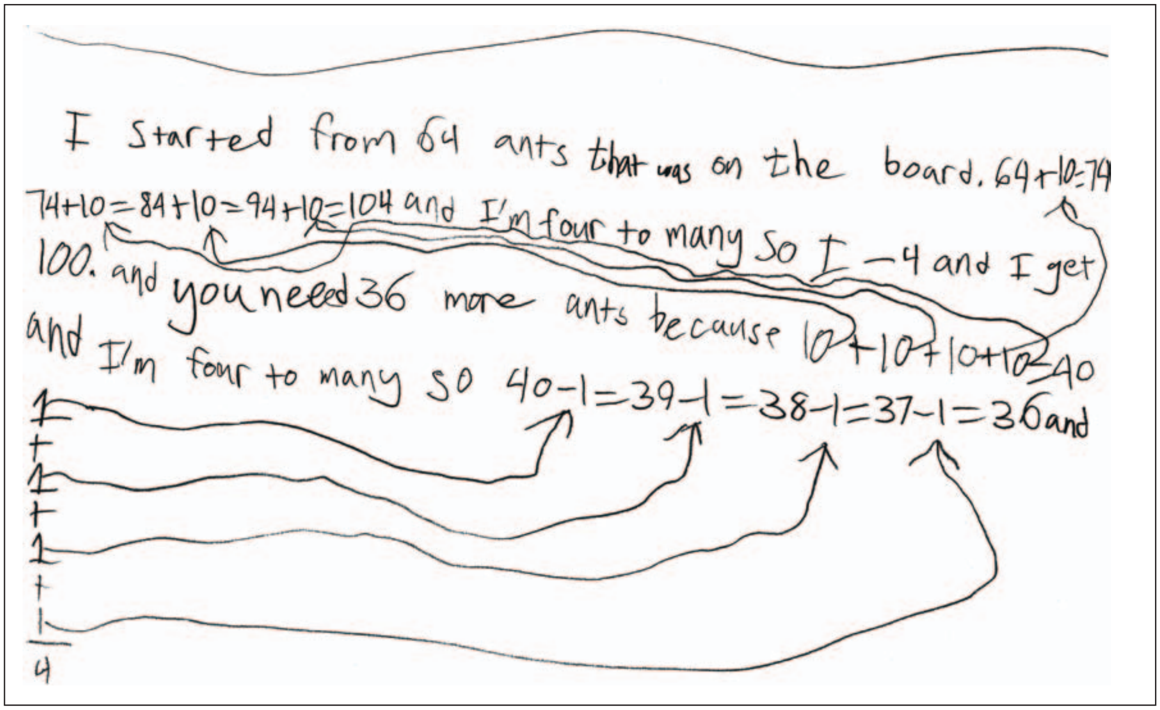


Figure 3. Jessie used tallies and added on groups of tens and ones to help her solve the problem.



I started from 64 ants that was on the board. 64+10=74
74+10=84+10=94+10=104 and I'm four to many so I −4 and I get
100. and you need 36 more ants because 10+10+10+10=40
and I'm four to many so 40−1=39−1=38−1=37−1=36 and
1
+
1
+
1
+
1
4

Figure 4. Tobias successfully solved the problem.

A few of the students needed help, and in order to give them assistance, I gave the others a third problem to solve. I wrote on the board:

> *512 ants have discovered a watermelon.*
>
> *1,000 ants are needed to carry it away.*
>
> *How many more ants are needed?*

I then gathered Jenae, Jade, and Rachel to give them help while the others went to work.