Using place value discs to teach multi–digit multiplication

Volume 19 | Gr. 3-5
Time: 45-60 mins.

CCSS.Math.Content.4.NBT.B.5
Multiply a whole number of up to four digits by a 1-digit whole number, and multiply two 2-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

CCSS.Math.Content.5.NBT.A.1
Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and ¹⁄₁₀ of what it represents in the place to its left.
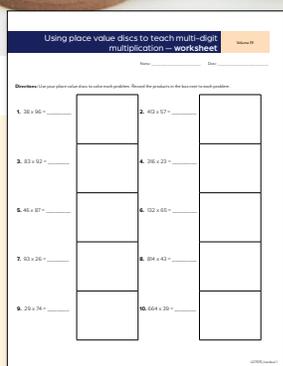
Content
Use place value discs to break down multi-digit multiplication problems into each of its given parts. In doing this, students will gain a more firm understanding of not just multiplication, but expanded form as well. Utilizing this method will give students another tool and method for solving more complex problems.

Objectives
Students will...
- Apply their knowledge of place value to solving multi-digit multiplication problems
- Solve multi-digit multiplication problems using a new method
- Examine each numerical value within a given multi-digit multiplication problem.

Materials list
- Sensational Math™ Place Value Discs 10-Value Student Set **(TB24433)**
- Nasco Place Value Disc Complete Classroom Set **(TB27029)**
- Worksheet and answer key (attached with lesson plan download)
- Bingo Templates (not included)

Introduction

1. Get students in the multiplication zone by having them warm up with a couple rounds of multiplication bingo. Distribute the bingo templates, then have students fill in the templates with the numbers that you have written on the board. Make sure students use a number only once, and that they know that they will not use all of the numbers.

   Numbers for the Board: 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 15, 16, 18, 20, 24, 25, 27, 28, 30, 32, 35, 36, 40, 42, 45, 48, 49, 54, 56, 63, 64, 72, 81

2. Once students have filled in the boards, randomly name the following multiplication problems and have them cross off or cover the correct answer to the given problem. You can play bingo for 5-in-a-row, blackout, 4 corners, or any way you choose.

   Multiplication Problems: (2 x 1), (3 x 1), (2 x 2), (1 x 5), (2 x 3), (4 x 2), (3 x 3), (2 x 5), (3 x 4), (7 x 2), (5 x 3), (4 x 4), (3 x 6), (4 x 5), (8 x 3), (5 x 5), (3 x 9), (5 x 6), (4 x 8), (6 x 6), (8 x 5), (6 x 7), (5 x 9), (8 x 6), (7 x 7), (9 x 6), (7 x 8), (9 x 7), (8 x 8), (8 x 9), (9 x 9)

Activity

1. Begin with **32 x 42**. Ask students how many tens and ones are in 32 (3 tens and 2 ones). Have them take three of the red tens discs and two of the white ones discs and put them at the top of their desks. Follow the same procedure with 42 (4 tens and 2 ones; four red tens discs and two white ones discs). This set of discs should go below the first set of discs on the students' desks.

2. Students will need to multiply each number in the bottom set of numbers by each number in the top set of numbers. To prepare for this, draw a box on the board where you will write the four products you will come up with as you solve the problem. Tell students they will always start at the bottom right, which is the 2 in 42. Take that and multiply it by the two above it. 2 x 2 = 4, so write 4 in the box.

32 x 42

3. Next, multiply the 2 in 42 by the other number in the top row, which is 30. Since 30 x 2 = 60, write 60 in the box. If students struggle with this, ask them what 3 x 2 is, then add the 0 to the end to get 60.

4. Now it's time to multiply the 40 on the bottom by both top numbers. First is 40 x 2. Write 80 in the box. Finally, 40 x 30. Point out to students that since there are two 0s in the factors, their answer must have two 0s. Start by figuring out what 4 x 3 is, then add the two 0s to the end of the answer to get 1,200. Write that product in the box.
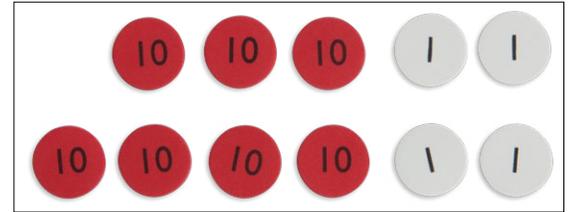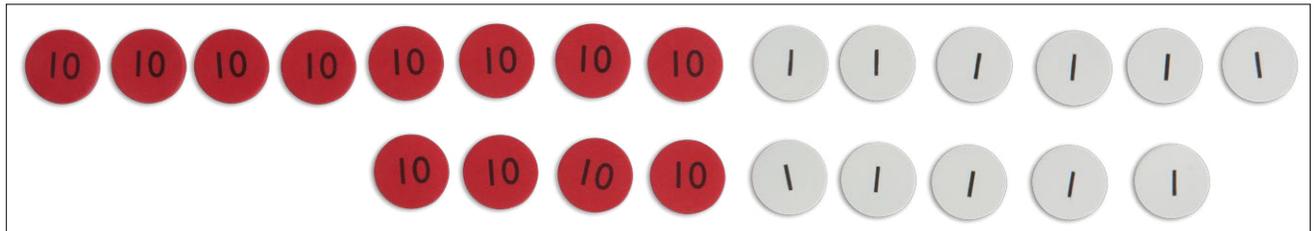
86 x 45

5. When multiplying a two-digit number by a two-digit number, students will need to come up with four products, since 2 digits times 2 digits = 4. They will now need to add the four products together (1,200 + 80+ 60 + 4 = 1,344). Use a calculator to double-check the answer.

6. Now work through **86 x 45.** First, students need to represent the numbers with place value discs. Start by using eight red tens discs and six white ones discs to make 86, then use four red tens discs and five white ones discs to make 45. Since this problem multiplies a two-digit number by a two-digit number, there will be four products total to this problem.

7. Ask students where they need to begin to solve the problem (*bottom right*). They should multiply 5 x 6 and get 30, which can be written in the box on the board. They should next continue with the 5 in 45 and multiply it by the 80 on top to get 400, which can also be written on the board.

8. Students should move on to the 40 in 45, beginning by multiplying 40 x 6, then 40 x 80. Those two products should also be written in the box on the board (240 and 3,200).

9. Add the four products together to get the total (3,200 + 240 + 400 + 30 = 3,870). Use a calculator to double-check the answer.

10. Move on to a three-digit number multiplied by a two-digit number by writing 729 x 62 on the board. Following the same procedure, students should begin by representing the numbers with place value discs (729 as seven orange hundreds discs, two red tens discs, and nine white ones discs; 62 as six red tens discs and two white ones discs). See if students can determine how many products they will need to come up with to solve this problem (3 digits times 2 digits = 6). Some students may think they only need five products, so explain that since this is a multiplication problem, they need to multiply the number of digits in the top number by the number of digits in the bottom number.

11. Students will need to begin with the number in the bottom right (2). The first problem is 2 x 9. The second problem will be 2 x 20, and the third problem will be 2 x 700. The products that should be written in the box are 18, 40, and 1,400.

12. Now the 60 needs to be multiplied by everything in the top row. The three problems are 60 x 9, 60 x 20, and 60 x 700. To make solving the last problem easier, remind students that they can multiply 7 x 6 first, then add the correct number of 0s (there are three 0s in 60 x 700). The three products that should be written on the board are 540, 1,200, and 42,000.

13. It's time to add the products together. To make it easier, arrange the products with the greatest number on top and the least number on bottom. It should look like this: 42,000 + 1,400 + 1,200 + 540 + 40 + 18 = 45,198. Double-check the answer with a calculator.

Practice

Distribute the worksheet. Tell students that five of the problems require a two-digit number to be multiplied by a two-digit number, and the other five problems require a three-digit number to be multiplied by a two-digit number. Tell students they will need to record the products they come up with for each part of the problem as well as the answer. Review with students how many products they will need for each type of problem (four products for 2-digit times 2-digit problems and six products for 3-digit times 2-digit problems).

Checking for Understanding

Give students about five minutes to work on the worksheet, then check their understanding with this line of questioning that goes along with problems 1 and 2.

Problem 1

1. How did you make 38? (*3 red tens discs and 8 white ones discs*)
2. How did you make 96? (*9 red tens discs and 6 white ones discs*)
3. What two numbers did you multiply together first? (*6 x 8 to get 48*)
4. What did you multiply next? (*6 x 30 to get 180*)
5. What did you multiply next? (*90 x 8 to get 720*)
6. What did you multiply next? (*90 x 30 to get 2,700*)
7. What did you do with the products of 48, 180, 720, and 2,700? (*added them all together to get a final sum of 3,648*)

413 x 57
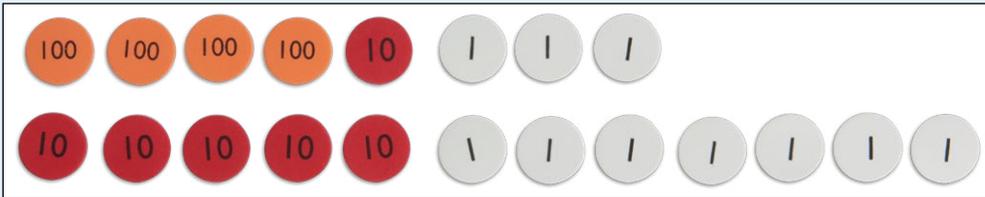
Problem 2

1. How did you make 413? (*4 orange hundreds discs, 1 red tens disc, and 3 white ones discs*)
2. How did you make 57? (*5 red tens discs and 7 white ones discs*)
3. What two numbers did you multiply together first? (*3 x 7 to get 21*)
4. What next? (*7 x 10 to get 70*)
5. What numbers next? (*7 x 400 to get 2,800*)
6. What numbers did you multiply next? (*50 x 3 to get 150*)
7. What numbers next? (*50 x 10 to get 50*)
8. What numbers next? (*50 x 400 to get 20,000*)
9. Why does this problem have more products than problem 1? (*we're multiplying a 3-digit number by a 2-digit number in this problem*)
10. What do you get when you add all the products together? (*23,541*)

Intervention

- Use 2-digit times 1-digit numbers before working with 2-digit times 2-digit numbers to get students familiar with the process of multiplying this way. When students are more familiar, continue on with this lesson.

Extension

- Have students explore with larger numbers and even with decimals. The process is the same no matter the number of digits or the places that are present in the problem.

Name: _____   Date: _____

Directions: Use your place value discs to solve each problem. Record the products in the box next to each problem.

1. 38 x 96 = _____

2. 413 x 57 = _____

3. 83 x 92 = _____

4. 316 x 23 = _____

5. 46 x 87 = _____

6. 132 x 65 = _____

7. 93 x 26 = _____

8. 814 x 43 = _____

9. 29 x 74 = _____

10. 664 x 39 = _____

Directions: Use your place value discs to solve each problem. Record the products in the box next to each problem.

1. 38 x 96 = 3,648

48
180
720
2,700

2. 413 x 57 = 23,541

21
70
2,800
150
500
20,000

3. 83 x 92 = 7,636

6
160
270
7,200

4. 316 x 23 = 7,268

18
30
900
120
200
6,000

5. 46 x 87 = 4,002

42
280
480
3,200

6. 132 x 65 = 8,580

10
150
500
120
1,800
6,000

7. 93 x 26 = 2,418

18
540
60
1,800

8. 814 x 43 = 35,002

12
30
2,400
160
400
32,000

9. 29 x 74 = 2,146

36
80
630
1,400

10. 664 x 39 = 25,896

36
540
5,400
120
1,800
18,000