Sample Computation Concept:

Use Place-Value Understanding and Properties of Addition and Subtraction to Add and Subtract

College and Career Ready Standards Addressed

2.NBT.7 Add and subtract within 1,000, 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.

Activity One: Using Base-10 Blocks for Addition

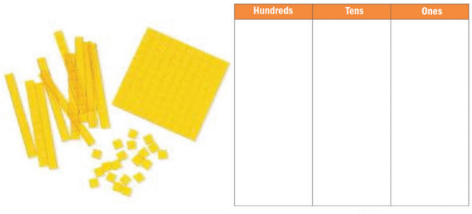
Purpose: To relate concrete objects to a written method for adding and subtracting 3-digit numbers

Principles of Intensive Intervention Illustrated:

- Provide concrete learning opportunities (including use of manipulatives).
- Provide explicit error correction, and have students repeat the correct process.
- Use precise, simple language to teach key concepts or procedures.
- Use explicit instruction and modeling with repetition to teach a concept or demonstrate steps in a process.
- Provide repeated opportunities to practice each step correctly.

Materials:

- Base-10 blocks (see Supplemental Materials)
- Place-value mat with columns for hundreds (flats), tens (rods), ones (units) (see Supplemental Materials)



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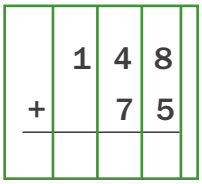
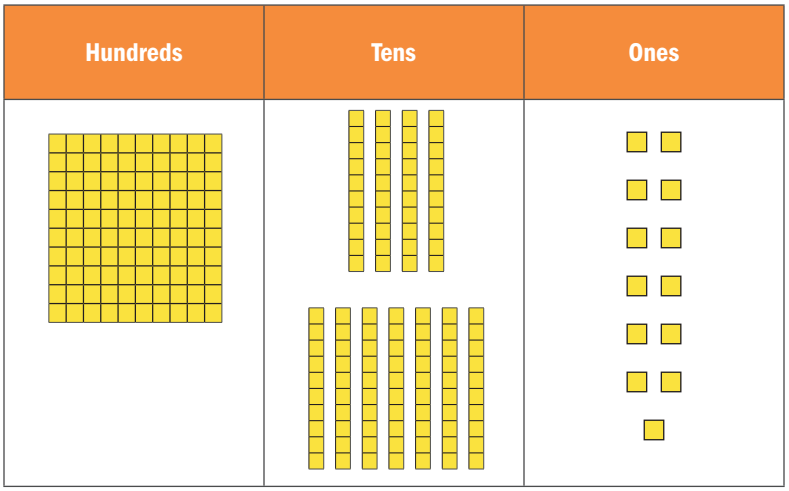
- Paper and pencil or dry-erase board
- Worksheet: Place-Value Computation: Addition (for extra practice)

Modeling:

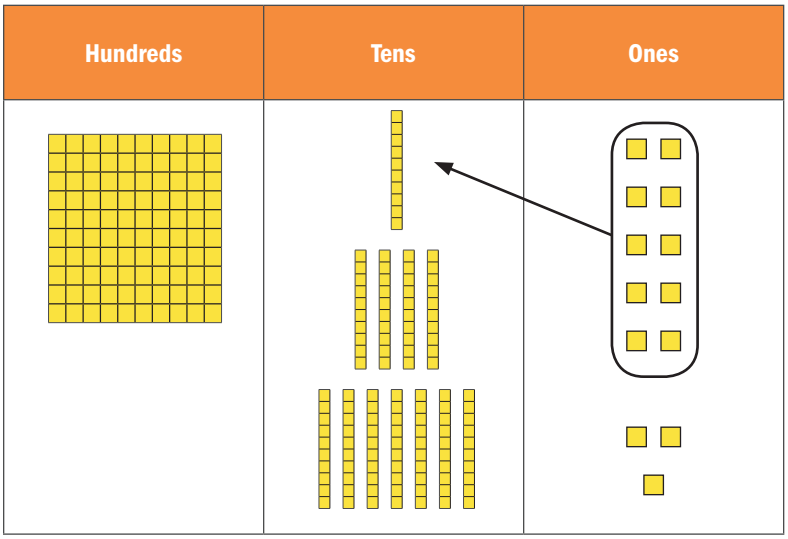
1. Explain to the student that base-10 blocks can be used to demonstrate addition of multidigit numbers.
2. Write a multidigit addition problem (e.g., 148 + 75). Use graph paper or notebook paper turned sideways to line up place values of the addends.



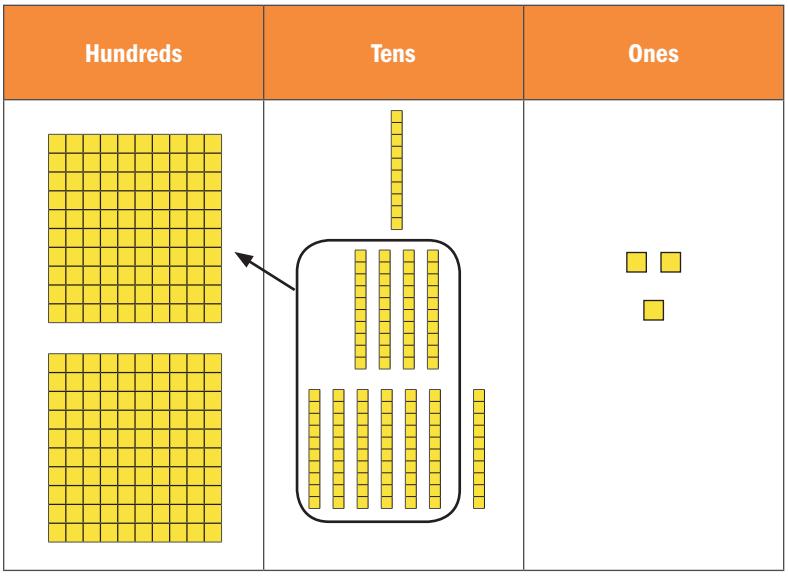
3. Represent each addend using base-10 blocks on the place-value mat.



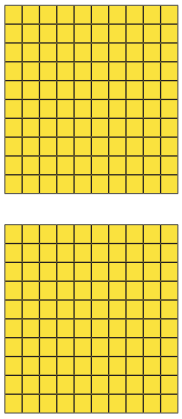
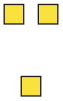
4. Start in the ones column of the place-value mat and add together all ones (units). If greater than 9, exchange 10 ones for 1 ten (rod) and put the rod in the tens column. Refer to the written problem. Add 8 + 5 in the ones column, write 3 below the equal sign (horizontal line) and write the digit 1 above the tens column. Make it clear to the student by pointing to the written problem and the objects on the place-value mat and show how they correspond.



5. Move to the tens column on the place-value mat. Add together all tens (rods), including the extra ten added by exchanging the 10 ones. If more than 9, exchange for 1 hundred (flat) and place it in the hundreds column. Refer to the written problem. Add 4 + 7 + 1 in the tens column, write 2 below the horizontal line and write the digit 1 above the hundreds column. Make it clear to the student how the written problem and place-value mat correspond.



6. Move to the hundreds column on the place-value mat. Add together all hundreds (flats), including the extra hundred added by exchanging the 10 tens. Refer to the written problem. Add 1 +1 in hundreds column, write 2 below the horizontal line. Make it clear to the student how the mat and the written problem correspond.

Hundreds	Tens	Ones
		

7. Have the student read the completed problem:
   148 + 75 = 223.
   Provide <u>at least</u> two more examples (e.g., 216 + 50; 309 + 111).

	1	1	
	1	4	8
+		7	5
	2	2	3

Guided Practice:

1. Have the student write down the multidigit addition problem (e.g., 318 + 56). Use graph or lined paper, if needed, to maintain place-value columns.
2. Student represents both addends on the place-value mat.
3. Beginning with the ones column, student adds all ones (units), exchanging for tens (rods) if possible. Student completes the ones column of the written problem.
4. Student repeats with the tens column, then the hundreds column.
5. Student reads the completed answer.
6. Repeat with two more examples (e.g., 602 + 205; 472 + 328).

Corrective Feedback:

Example 1

Student response: The student adds 8 + 5 in the ones column and writes 13 below the horizontal line.

Teacher feedback: Use graph paper so that only 1 digit can be written in each place-value column. Or, have the student estimate the sum before adding and then have him or her judge the reasonableness of the answer. Have the student demonstrate the correct process before moving on.

Activity Two: Using Base-10 Blocks for Subtraction

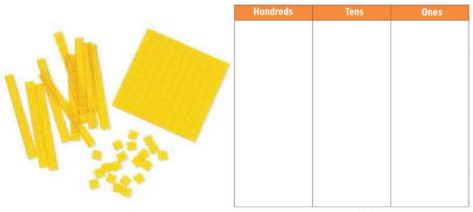
Purpose: To relate concrete objects to a written method for adding and subtracting 3-digit numbers

Principles of Intensive Intervention Illustrated:

- Provide concrete learning opportunities (including use of manipulatives).
- Provide explicit error correction, and have students repeat the correct process.
- Use precise, simple language to teach key concepts or procedures.
- Use explicit instruction and modeling with repetition to teach a concept or demonstrate steps in a process.
- Provide repeated opportunities to practice each step correctly.

Materials:

- Base-10 blocks (see Supplemental Materials)
- Place-value mat with columns for hundreds (flats), tens (rods), ones (units) (see Supplemental Materials)



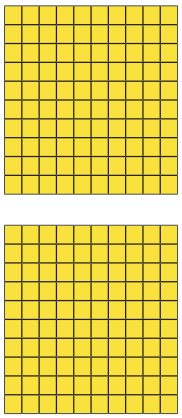
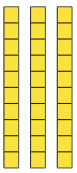
- Paper and pencil or dry-erase board
- Worksheet: Place-Value Computation: Subtraction (for extra practice)

Modeling:

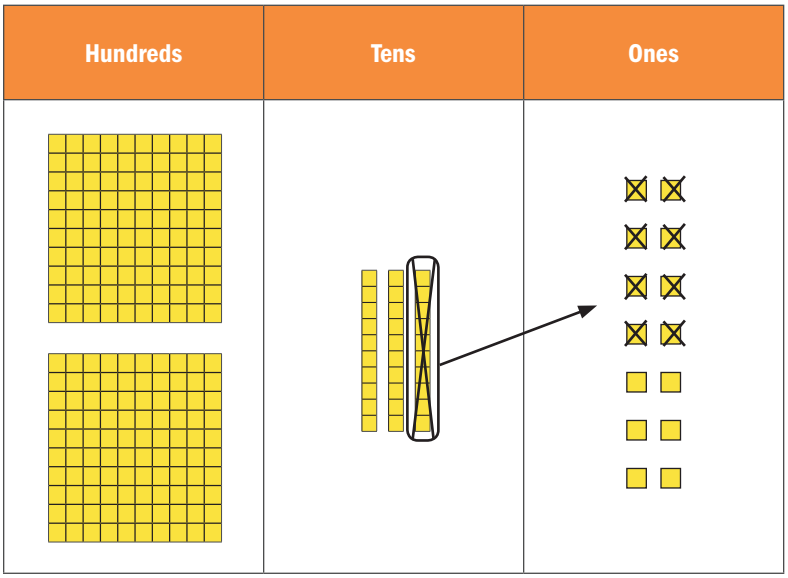
1. Explain to the student that base-10 blocks also can be used to demonstrate subtraction of multidigit numbers.
2. Write a multidigit subtraction problem (e.g., 234 – 88). Use graph paper or notebook paper turned sideways to line up place values of minuend (starting amount) and subtrahend (amount begin subtracted).

	2	3	4
–		8	8

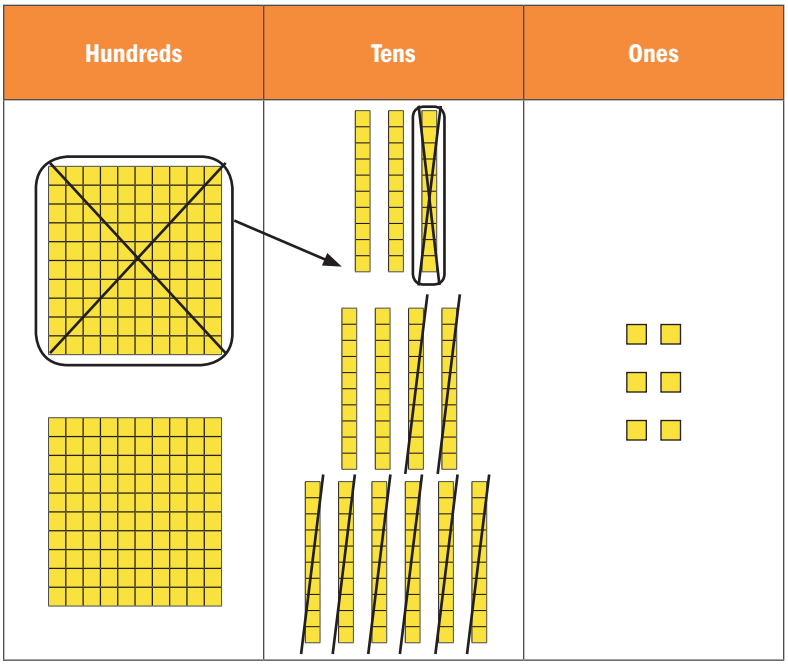
3. Represent the minuend (234) with base-10 blocks on the place-value mat (4 ones = 4 units, 3 tens = 3 rods, 2 hundreds = 2 flats).

Hundreds	Tens	Ones
		

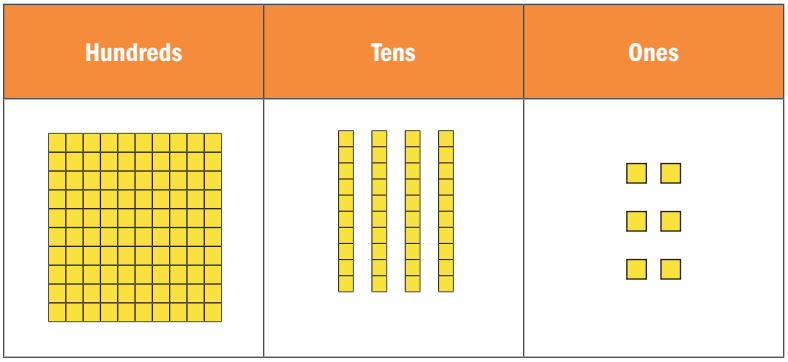
4. Refer to the written problem. Remind the student to start in the ones column when subtracting. In this example, it is not possible to subtract 8 ones from 4 ones; it's necessary to exchange 1 ten (rod) for 10 ones (units). Demonstrate for the student with manipulatives on the place-value mat. After exchanging 1 ten for 10 ones, there are now 2 tens instead of 3 tens and there are 14 ones instead of 4. It is now possible to subtract 8 ones and have 6 ones remaining. Model the steps on the written problem: Cross out the 3 in the minuend and write a 2, then write a 1 in front of the 4 to show 14 ones. Then, write a 6 below the equal sign (horizontal line) in the ones column to show there are 6 ones remaining.



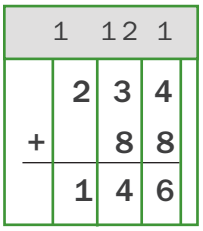
5. Refer to the written problem. In the tens column, it is not possible to subtract 8 tens from 2 tens. Exchanging 1 hundred (flat) for 10 tens (rods) is necessary. Demonstrate for the student with manipulatives on the place-value mat. After exchanging 1 hundred for 10 tens, there is 1 hundred (flat) remaining instead of 2 hundreds, and there are 12 tens (rods) instead of 2 tens. Subtract 8 tens (rods) from 12 tens and have 4 tens remaining. Model on the written problem: Cross out the 2 in the minuend and write a 1, then write a 1 in front of the 2 to show 12 tens. Then, write a 4 below the horizontal line in the tens column to show there are 4 tens remaining.



6. Move to the hundreds column on the place-value mat. Refer to the written problem. It is not necessary to subtract any hundreds, and so the amount of hundreds remains the same (1). Write 1 below the horizontal line in the hundreds column. Make it clear to the student how the base-10 blocks and the written problem correspond.



7. Have the student read the completed problem: 234 – 88 = 146.



Provide at least two more examples (e.g., 718 – 462; 803 – 250).

Guided Practice:

1. Have the student write down the multidigit subtraction problem (e.g., 739 – 215). Use graph or lined paper, if needed, to maintain place-value columns.
2. The student represents the minuend (i.e., the initial, or starting, amount: 739) on the place-value mat.
3. Beginning with the ones column, the student subtracts the ones (units), exchanging for tens (rods) if necessary. The student completes the ones column of the written problem.
4. The student repeats the procedure with the tens column, then the hundreds column.
5. The student reads the completed answer.
6. Repeat with two more examples (e.g., 932 – 87; 226 – 101).

Corrective Feedback:

Example 1

Student response: Student always subtracts the smaller number from the larger number, rather than the subtrahend (i.e., amount being subtracted) from the minuend (i.e., initial, or starting, amount). For example, for 234 – 88, student subtracts 4 from 8 in the ones column, 3 from 8 in the tens column, and answers 254.

Teacher feedback: Have the student estimate the difference before completing his or her work and then compare the estimate to the incorrect answer. Point out to the student that it is not possible to subtract an amount from a given number and end up with more than the starting amount. Have the student demonstrate the correct process before moving on.

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Sample Computation Concept:

Use Place-Value Understanding and Properties of Operations to Perform Multidigit Arithmetic

College and Career Ready Standards Addressed

4.NBT.5 Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations.

4.NBT.6 Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.

Activity One: Using Base-10 Blocks for Multiplication

Purpose:

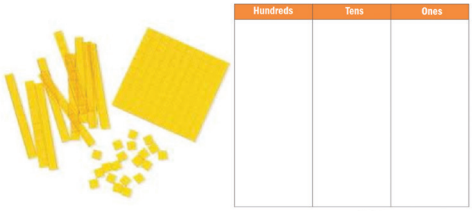
To relate concrete objects to a written method for multiplying and dividing multidigit numbers.

Principles of Intensive Intervention Illustrated:

- Provide concrete learning opportunities (including use of manipulatives).
- Provide explicit error correction, and have students repeat the correct process.
- Use precise, simple language to teach key concepts or procedures.
- Use explicit instruction and modeling with repetition to teach a concept or demonstrate steps in a process.
- Provide repeated opportunities to practice each step correctly.

Materials:

- Base-10 blocks (see Supplemental Materials)
- Place-value mat with columns for hundreds (flats), tens (rods), ones (units) (see Supplemental Materials)



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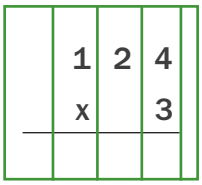
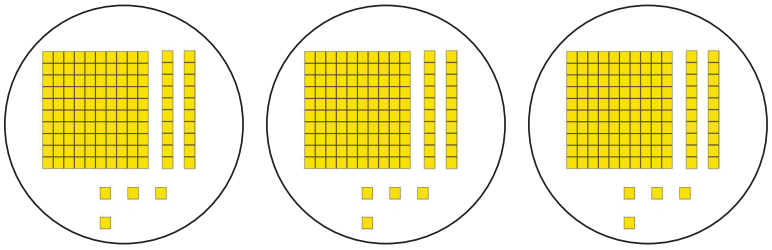
- Paper and pencil or dry-erase board
- Worksheet: Place-Value Computation: Multiplication (for extra practice)
- Example: Place-Value Computation: Multiplication (see Supplemental Materials)

Modeling:

1. Explain to the student that base-10 blocks can be used to demonstrate multiplication of multidigit numbers.
2. Write a multiplication problem (e.g., 124 × 3). Use graph paper or notebook paper turned sideways to line up place values of the factors.

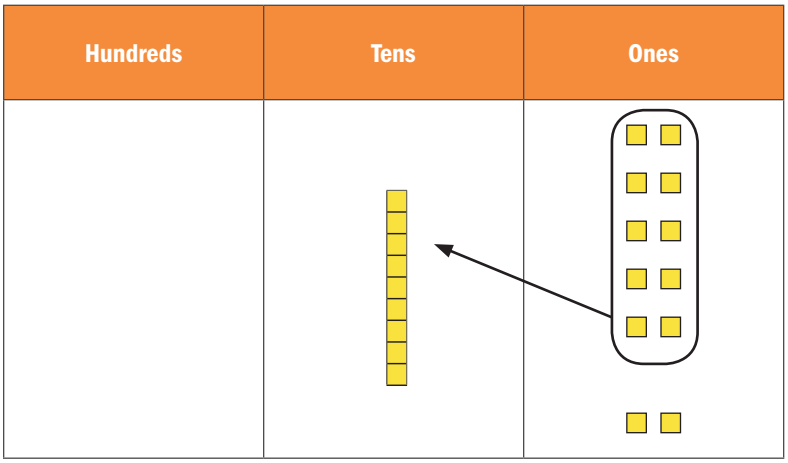


3. Remind student that
   - 124 × 3 can be read as "124 groups of 3."
   - Because of the commutative property of multiplication, the order of the factors can be reversed to 3 × 124.
   - 3 × 124 can be read as "3 groups of 124."
4. To show 3 groups of 124, place 3 paper plates on the table to represent the three groups.
5. Count out 124 in base-10 blocks (i.e., 1 flat, 2 rods, 4 units) for each group and place them on the paper plates; each of the 3 paper plates will have 1 flat (100), 2 rods (20), and 4 units (4).



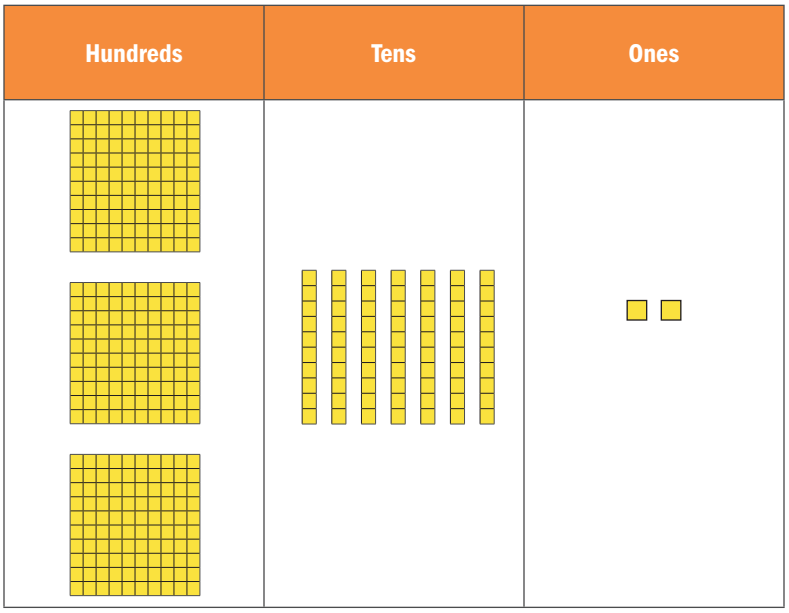
6. Use the place-value mat to represent the product. Emphasize that multiplication is repeated addition (124 × 3 = 3 × 124 = 124 + 124 + 124) and with addition, we add units in the ones column first; with multiplication, we also begin with ones. Combine the ones and place them on the mat.

7. Combining the 3 groups of 4 ones (units) yields 12 ones (units); exchange 10 ones (units) for 1 ten (rod) and move it to the tens column. On paper, write 2 in ones place below the equal sign (horizontal line) and write 1 in the tens column (this "reminder number" is a prompt to student to add the amount after multiplying in the next column), above the 2.



8. Next, combine all tens (rods) and place them on the mat. Write 7 in the tens column below the horizontal line to show 7 tens. Repeat with all the hundreds (flats). Write 3 below the horizontal line to show 3 hundreds. Have the student read the completed problem: 124 × 3 = 3 × 124 = 372.

	1		
	1	2	4
	x		3
	3	7	2



9. Provide at least two more examples (e.g., 282 × 4; 109 × 6) using base-10 blocks to demonstrate the written procedure.

Guided Practice:

1. Have the student write down the multiplication problem (e.g., 118 × 5). Use graph or lined paper, if needed, to maintain place-value columns.
2. The student uses the commutative property to change the problem to 5 groups of 118.
3. The student places 5 paper plates on the table and uses base-10 blocks to show 118 (i.e., 1 flat, 1 rod, 8 units) on each of the 5 plates.
4. Beginning with ones (units), the student adds all the ones (units), exchanging for tens (rods) as appropriate. The student completes the ones column of the written problem.
5. The student repeats with the tens column, then the hundreds column.
6. The student reads the completed answer: 118 × 5 = 590.
7. Repeat with at least two more examples (e.g., 452 × 2; 199 × 4).

Corrective Feedback:

Example 1

Student response: Student adds the "reminder" number to the next column and then multiplies, rather than multiplying and then adding the reminder number.

Teacher feedback: Write the "reminder" number below the equal sign (horizontal line) of the written problem, to remind the student to add the number just before recording a product. Have the student demonstrate the correct process before moving on.

Activity Two: Using Base-10 Blocks for Division

Purpose:

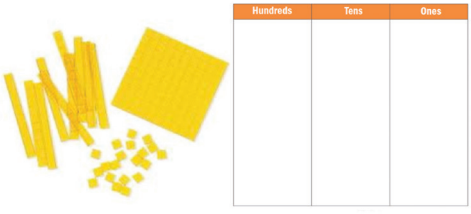
To relate concrete objects to a written method for multiplying and dividing multidigit numbers.

Principles of Intensive Intervention Illustrated:

- Provide concrete learning opportunities (including use of manipulatives).
- Provide explicit error correction, and have students repeat the correct process.
- Use precise, simple language to teach key concepts or procedures.
- Use explicit instruction and modeling with repetition to teach a concept or demonstrate steps in a process.
- Provide repeated opportunities to practice each step correctly.

Materials:

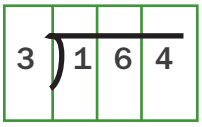
- Base-10 blocks (see Supplemental Materials)
- Place-value mat with columns for hundreds (flats), tens (rods), ones (units) (see Supplemental Materials)



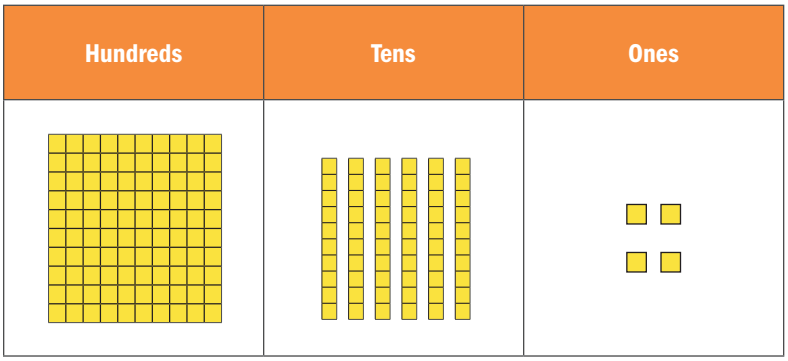
- Paper and pencil or dry-erase board
- Worksheet: Place-Value Computation: Division (for extra practice)
- Example: Place-Value Computation: Division (see Supplemental Materials)

Modeling:

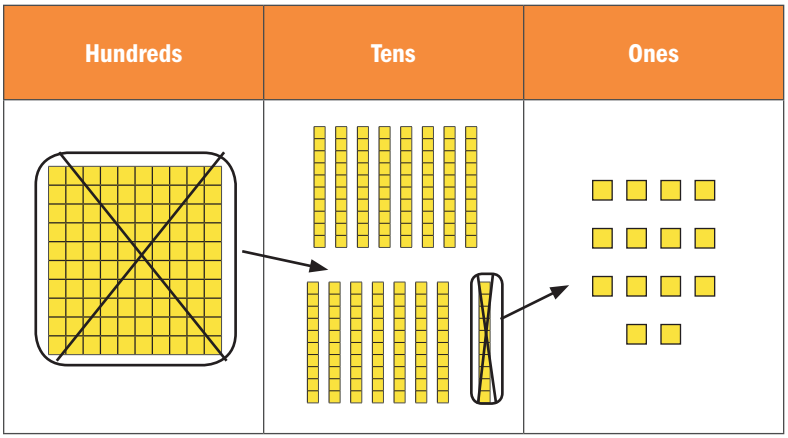
1. Explain to the student that base-10 blocks also can be used to demonstrate division of multidigit numbers.
2. Write a multidigit division problem (e.g., 164/3). Use graph paper or notebook paper turned sideways to line up place values of the dividend (amount to be divided) and divisor (amount divided by).



3. Represent the dividend (164) with base-10 blocks on the place-value mat (4 ones= 4 unites, 6 tens = 6 rods, 1 hundred = 1 flat).



4. Explain that the problem is to divide 164 into 3 groups. Place 3 paper plates on the table to represent the 3 groups.
5. Remind the student that in the case of division, to always start with the largest value in the dividend (i.e., the amount being divided); in this example: 100. Point to 1 flat. Emphasize that it is not possible to share 1 flat with 3 groups; the solution is to exchange 1 hundred (flat) for 10 tens (rods) and combine them with the 6 tens (rods) already on the mat. Now, share 16 tens (rods), one at a time, among the 3 groups. Each group has 5 rods, with 1 rod left over. Write a 5 above the bar over the 6 in the dividend.



6. Emphasize that it is not possible to share 1 rod with 3 groups; the solution is to exchange 1 ten (rod) for 10 ones (units) and combine them with the 4 units already on the mat. Now, share 14 ones (units) evenly with the 3 groups. Each group has 4 units, with two units left over. Write a 4 above the bar over the 4 in the dividend.
7. Show student the 2 leftover ones (units). Have the student read the completed problem: 164 divided by 3 = 54 R 2.
8. Provide at least two more examples (e.g., 723/5; 698/4).

Guided Practice:

1. Have the student write down multidigit division problem (e.g., 607/3). Use graph or lined paper, if needed, to maintain place-value columns.
2. Student represents dividend (607) on the place-value mat; student places 3 plates on the table to represent the divisor.
3. Beginning with the hundreds, the student evenly shares among groups, exchanging for tens (rods) if necessary. The student writes the number of hundreds divided into each group on the written problem.
4. Student repeats with the tens, then the ones.
5. Student reads the completed answer.
6. Repeat with at least two more examples (e.g., 932/2 ; 226/4).

Corrective Feedback:

Example 1

Student response: Student has a difficult time remembering the multiple steps of a division algorithm while simultaneously trying to remember multiplication and division basic facts.

Teacher feedback: Provide a graphic organizer or mnemonic (e.g., **D**ad, **M**other, **S**ister, **B**rother for **Divide, Multiply, Subtract, Bring down**) to help the student remember the procedural steps. Have the student demonstrate the correct process before moving on.

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