LESSON

3·3 Find Partial Products

How can we use arrays to find partial products? How can we use packed blocks to find partial products?

Students build rectangular arrays with single blocks. They separate the arrays along place value lines to identify partial products. They record the partial products. Students also build 1-digit × 2-digit problems with packed blocks and identify partial products.

Objectives

- To recognize the validity of the distributive property through the use of physical models
- To identify the partial products corresponding to each place in a 1-digit by 2-digit multiplication problem
- To express a multiplication problem as the sum of two or more partial products

Materials

Each group will need:

- 300 single blocks and holders (small and medium)
- 1 whole number mat
- 1 piece of string (approx. 24 inches long)

- 1 transparency of the whole number mat (p. A2) (optional)
- 1 *Split the Work and Make It Easy!* activity sheet **per student**
- 1 blank sheet of paper **per student**

◆ Class Introduction 30 MIN.

- Distribute the materials to groups of students. Present several problems for students to model as arrays with single blocks:

4 × 16 **5 × 13** **6 × 12**

Have students describe the arrays in rows and columns. (For example, some students may build “4 rows of 16” while others may build “4 columns of 16.”)

For each array, have students find the total number of blocks (the product) by packing them.

How can you find the total number of blocks in the 4 x 16 array?
(Strategies might include: count by 4’s, add each row or column, pack all the blocks, etc.)

Is there a way to see the total without counting all the blocks?

- To follow up on the question, present another 1-digit x 2-digit problem for students to model as an array of single blocks:

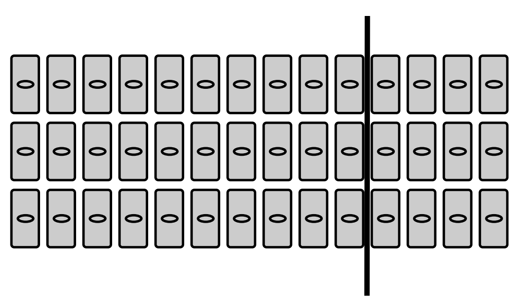
3 × 14

This time have students use the string to split the array into two parts - two smaller arrays - according to place value.

$$3 \times 14 = 3 \times (10 + 4)$$

$$3 \times 14 = (3 \times 10) + (3 \times 4)$$

3 x 10

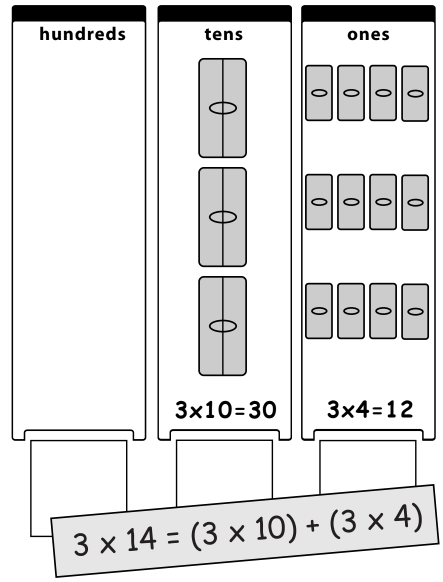


3 x 4

3 x 14 = (3 x 10) + (3 x 4)

With the array separated in this way, students can see the total by using the facts they already know: $3 \times 10 = 30$ and $3 \times 4 = 12$.

Have students name the product for the 3×14 array: $30 + 12 = 42$. Then have them pack the blocks to see that indeed the product is 42 (4 blocks-of-10 and 2 ones).



- Model the same problem with packed blocks. The separation into partial products by place value is more obvious when the problem is modeled this way.

$$3 \times 14 = (3 \times 10) + (3 \times 4)$$

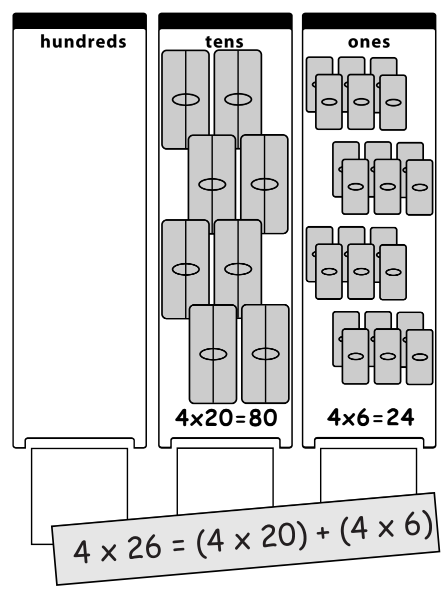
Again, have students name each partial product (i.e., $3 \times 10 = 30$ and $3 \times 4 = 12$). Then ask them to name the product $3 \times 14 = 30 + 12$, so $3 \times 14 = 42$.

Have students pack the blocks to check this answer.

Discuss why it is useful to find partial products:

How does it help to find partial products? *(If we can separate the original problem into partial products that we already know, it's easy to find the product for the original problem by adding the partial products.)*

Why do we find partial products by place value? *(This method allows us to use the facts we already know and to extend them for multiples of 10.)*



- Do more examples. For each problem, have students model the problems with packed blocks. They can choose to make an array as well, but it takes much more time.

4×26	**6×39**	**7×28**
$4 \times (20 + 6)$	**$6 \times (30 + 9)$**	**$7 \times (20 + 8)$**

Have students identify partial products using place value, and then name the product for the problem. For example:

$4 \times 26 = (4 \times 20) + (4 \times 6)$
$4 \times 26 = (4 \times 2$ tens$) + (4 \times 6$ ones$)$
$4 \times 26 = (8$ tens$) + (24$ ones$)$
$4 \times 26 = 80 + 24$
$4 \times 26 = 104$

◆ Group Activity 20 MIN.

- Distribute the activity sheets, *Split the Work and Make it Easy!* Have students work in pairs.

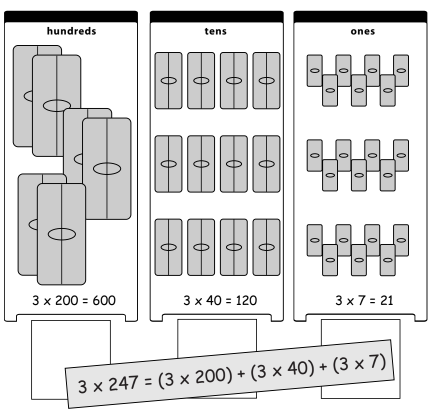
  In this activity, pairs of students are presented with several 1-digit × 2-digit problems. Students model each problem with blocks, then each student picks one of the partial products to solve.

  (Students may choose to make arrays rather than use packed blocks. If so, it will probably take them longer to complete the activity.)

◆ Closure 20 MIN.

- Discuss the problems from the activity sheet, then present a 1-digit × 3-digit problem:

  3 × 247



  Discuss a block model for this problem, then use packed blocks to model 3 groups of 247. Explain the need for partial products:

Of course we could find the answer by packing these blocks. However, most of the time we won't have blocks available, so we need to find a way to multiply using the numbers.

  Have students share ideas for finding the partial products for this problem. Remind them to think about using place value.

3 × 247 = (3 × 200) + (3 × 40) + (3 × 7)
3 × 247 = (3 × 2 hundreds) + (3 × 4 tens) + (3 × 7 ones)
3 × 247 = (6 hundreds) + (12 tens) + (21 ones)
3 × 247 = 600 + 120 + 21
3 × 247 = 741

- Use examples to explain the distributive property. Explain how the first factor is "distributed" over the parts of the second factor. For example:

3 × 14 = 3 × (10 + 4)
3 × 14 = (3 × 10) + (3 × 4)

3 × 247 = 3 × (200 + 40 + 7)
3 × 247 = (3 × 200) + (3 × 40) + (3 × 7)

◆ Assessment

- Do students build arrays and separate them along place value lines?
- Do students use packed blocks to model 1-digit × 2-digit problems?
- Do students identify partial products using place value?
- Do students name the partial products and add them together to find the product for a given problem?
- Do students extend their thinking about partial products to 1-digit × 3-digit problems?

Name

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Split the Work and Make It Easy!

Use blocks to model each problem. Separate the problems into partial products. Write the partial products and fill in the blanks. Use a separate sheet to draw what you did for the first problem.

1. $4 \times 19 =$ ______

   *Draw your block model for this problem on a separate sheet.

   I solved one partial product, _____ $\times$ _____ = ______.

   My partner solved the other partial product, _____ $\times$ _____ = _____.

   The answer to the problem is: _____.

2. 5×28

   I found one partial product, _____ $\times$ _____ = ______.

   My partner found the other partial product, _____ $\times$ _____ = _____.

   The answer to the problem is: _____.

3. 3×47

   I found one partial product, _____ $\times$ _____ = ______.

   My partner found the other partial product, _____ $\times$ _____ = _____.

   The answer to the problem is: _____.

4. 6×32

   I found one partial product, _____ $\times$ _____ = ______.

   My partner found the other partial product, _____ $\times$ _____ = _____.

   The answer to the problem is: _____.

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