

Making Rectangles

1. Draw a rectangle that is 18cm by 10 cm on a centimeter grid paper.
2. Cover the rectangle with base-10 blocks, using as few blocks as possible.
3. Share and discuss your strategies with your classmates.
4. Explain how this arrangement represents $18 \times 10 = 180$.
5. Now, draw a rectangle that is 14cm by 12 cm, then cover it with base-10 blocks. Remember to use as few blocks as possible.
6. Explain how this arrangement represents 14×12 (what is the answer?).

Discussion, Suggestions, Possible Solutions

In Grade 3, students have used the rectangular array to model multiplication of 2- and 3-digit numbers by 1-digit numbers. In addition, students have also studied the area of rectangles and squares in Grade 3. In this activity, using both of these ideas, they will extend their understanding of multiplication by making rectangles to model the product of two 2-digit numbers.

Ask students to draw a rectangle that is 18cm by 10 cm on a centimeter-grid paper. Ask how they will calculate the area of the rectangle (18×10), and how they can tell the actual area by looking at the base-10 blocks they used.

Ask students to cover the rectangle with base-10 blocks, using as few blocks as possible. As students share their arrangements, note that we only needed a flat and 8 longs, and we used the dimensions of these blocks (10 and 1) to represent the dimensions (factors) of the given rectangle. So, a long can be used to represent “10” in one direction and “1” in the other. Also, discuss how having all longs together instead of having them on both sides of a flat is more organized arrangement and perhaps easier to count.

Ask students to model 14×12 using base-10 blocks.

As students share their work, ask them to compare and contrast 18×10 and 14×12 . Two particular ideas we want students to note are:

- *they had to use unit blocks in 14×12 .*

- *there are two regions where longs are used*

Ask students to model other 2-digit multiplication problems using base-10 blocks, keeping in mind what makes those problems different from previous ones. For example:

- 16×13 (the product of the ones digits exceeds 10, but to make a rectangle to model this product, we must use unit blocks)
- 30×10 (more than one hundred-blocks must be used to represent one of the factors)
- 20×30 (more than one hundred-blocks must be used to represent both factors)
- 23×32 (general form, that is, neither 2-digit number is a multiple of 10)
- 24×23 (the product of the ones digits exceeds 10)
- 33×45 (each section of the rectangles contains more than 10 blocks)

In this task, it is important that students understand that:

- *the number of blocks in each section of a rectangle may be determined by the product of corresponding digits*
- *ONES \times ONES=ONES, ONES \times TENS=TENS, TENS \times ONES=TENS, and TENS \times TENS=HUNDREDS, i.e., the types of blocks to be used in each section are determined by the products of place values*

Extension:

As a ground work to help students move beyond manipulatives, ask students to just draw rectangles on a grid paper (and perhaps later on a plain paper) to represent multiplication (without using base-10 blocks).