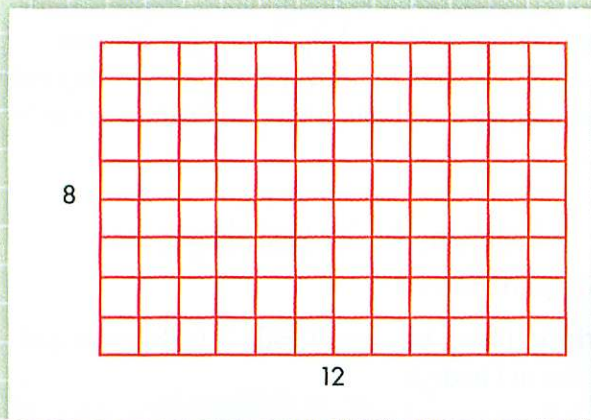


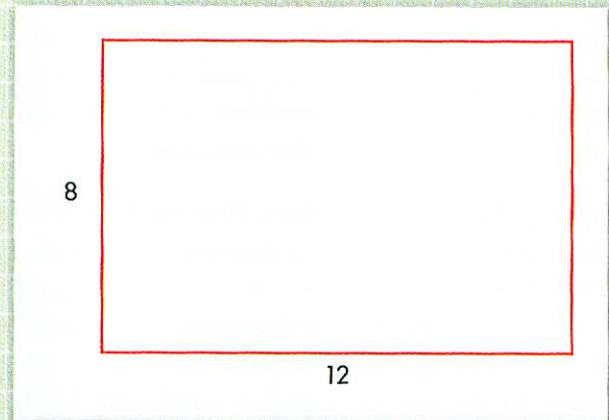
## Visualizing Arrays

In order to use rectangular arrays to visualize breaking up a multiplication problem, students must be able to see that the lengths of the sides of the rectangle represent factors, and the area represents the product. Evidence from research and practice indicates that fully understanding this relationship takes time and experience. As adults, we are so familiar with the relationship between the area of a rectangle and the length of its sides that we may not realize that the relationship is not necessarily obvious to students.

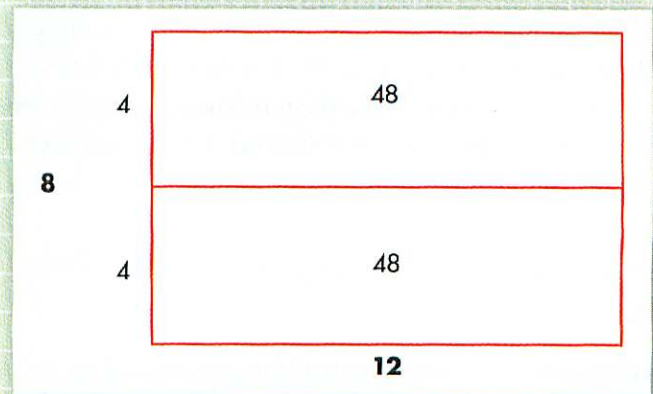
As students are learning to visualize how a rectangular array represents multiplication, they use arrays that show all the individual units of the area. Students can describe the area in terms of the dimensions of the rectangle. For example, in this rectangle, there are 8 rows with 12 squares in each row.

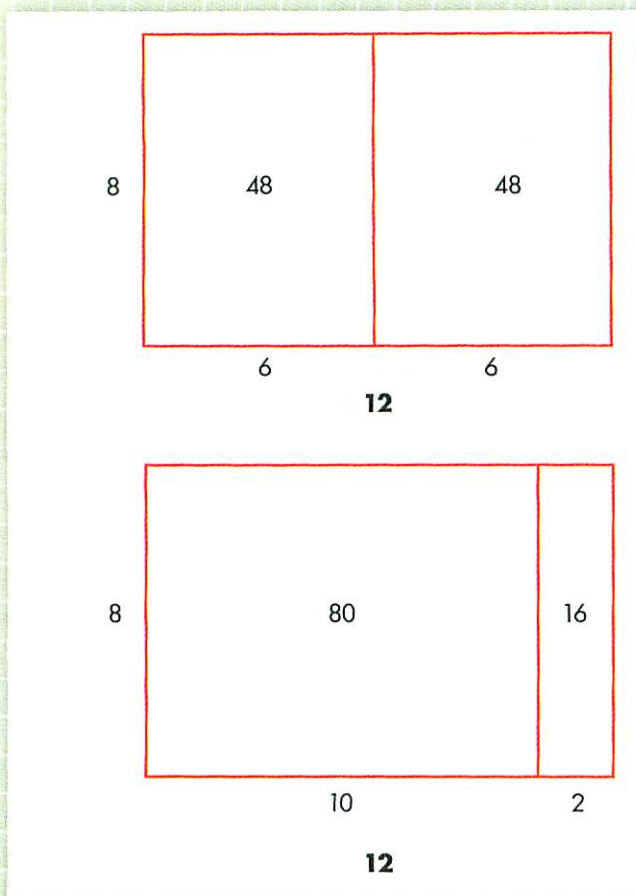


In order to help students visualize a rectangular array to represent any multiplication problem, you will introduce unmarked arrays (arrays without a grid of units) in Investigation 1. Thus, for the problem  $8 \times 12$ , you can draw an unmarked array like this:



Students can use the unmarked array to help them think through the ways they might break up the array to help them solve the problem.





At first, you should present unmarked arrays with sides drawn to fairly closely represent the relative proportion of the numbers in the multiplication expression, as in the first array for  $8 \times 12$  above. Students are learning to use and visualize arrays, so using correct proportions in the diagram helps some students visualize how the array represents multiplication. Eventually, when students are more confident about sketching an unmarked array to help them think through how to solve a problem, you and your students may sketch the arrays without trying to be as accurate about showing the relative length of the sides.

It is essential that students thoroughly understand how an array represents a multiplication (or division) expression before they use an unmarked array to solve problems. For a multiplication expression such as  $8 \times 12$ , they must be able to explain where the 8 is in the representation, where the 12 is, and why the area of the rectangle is the product of these two numbers.

As a transition between marked and unmarked arrays, you can add tick marks along two sides of the rectangle.

