Math 2100 – Spring 2020

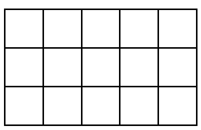
Lab 2

Names:

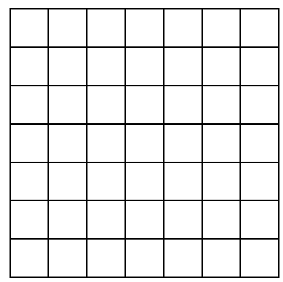
In mathematics, **algorithms** are step-by-step procedures you follow to arrive at a solution. This lab is intended to help you gain a deeper perception into our algorithms for multiplication and division.

1. You will recall we used a rectangular array model to demonstrate multiplication. For each of the following rectangles, give the factors that are multiplied and the product.

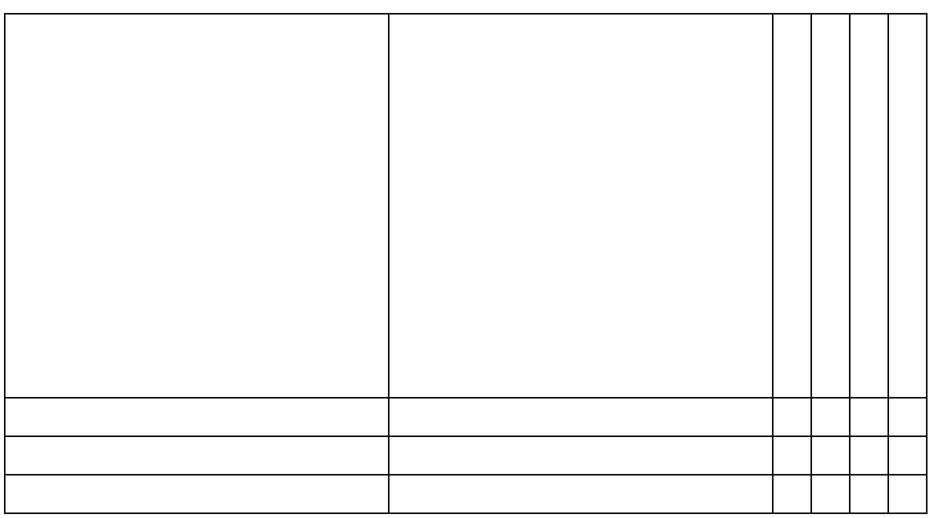
   a.

   b.

2. A rectangular array can also model the product of larger numbers. We will use base ten pieces to assist us. Each group should get 2 flats, 10 longs, and 12 units. Construct the image below.

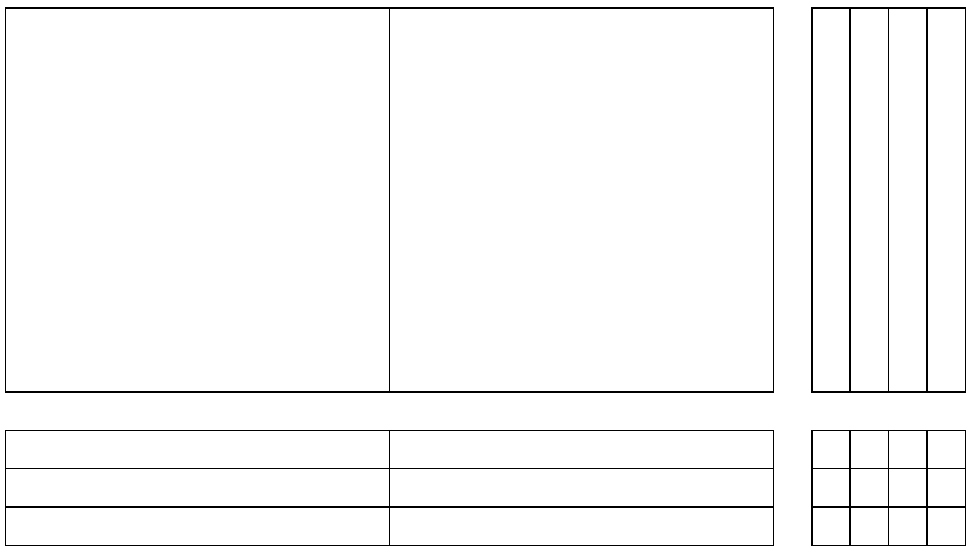


a. Label the dimensions of this rectangle.

b. What multiplication problem is modeled here?

c. When the pieces representing the area are combined what number does the area represent?

3. If we separate the pieces as seen in the picture below, we form 4 rectangles.



a. Label the dimensions and area of each of these rectangles.

b. In the **intermediate** multiplication algorithm we write four partial products as, as shown here. Explain how the algorithm is related to these rectangles.

$$\begin{array}{r} 24 \\ \times 13 \\ \hline 12 \\ 60 \\ 40 \\ 200 \\ \hline 312 \end{array}$$

c. Write out the standard algorithm for 24×13. Then make a sketch of base piece rectangles that model the partial products in this algorithm. Clearly label your drawing.

4. Consider the division problem $38 \div 3$.

a. Write out the usual long division algorithm for this problem. As you do it, record your thinking next to your work. That is, what thought do you have at each step?

b. Using the fewest possible base ten pieces, represent 38. Now divide those pieces into three equivalent piles. Do you have any leftover? Draw a sketch below.

Each pile has ____ longs and ____ units, with ____ units left over. The number of leftover units is called the remainder.

$38 \div 3$ = ____ longs and ____ units, remainder ____ or $38 \div 3$ = ____, R ____.

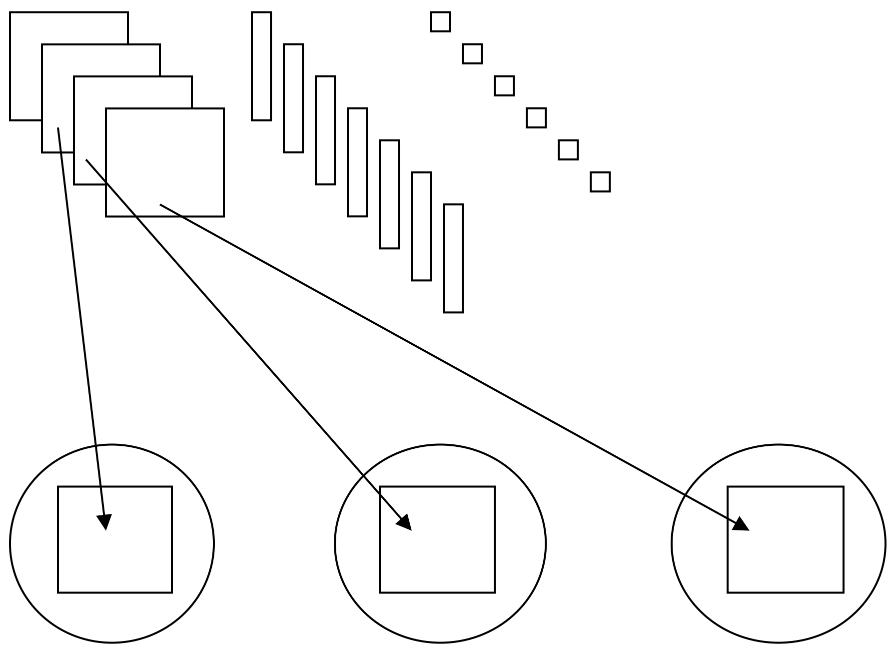
c. How does the method in part (b) relate to the long division algorithm in part (a)?

d. Now write out the long division algorithm for $38 \div 4$. As you do this problem, write out your thought process.

e. Divide the base ten pieces representing 38 into four parts. Make a sketch of this and show any remainder.

f. Why is this problem more difficult than $38 \div 3$? Discuss the difficulty in terms of both the algorithm and the base piece model.

5. Now we will demonstrate the standard algorithm with base ten pieces. We will be using the sharing approach to division. We will model $476 \div 3$. Below is the first step modeled but write out the algorithm.



Think: "1 flat in each of the 3 groups. I evenly distributed the flats among 3 groups with 1 flat left over."

a. In terms of the base-piece model, what does the 3 written beneath the 4 represent? Why do we write 3 in this position?

b. In terms of the base-piece model, what does the 1 written beneath the 3 represent?

c. What do we do with the one flat that is unused?

d. The next step in the algorithm is "Bring down the 7." How is this represented with the base ten pieces?

e. Finish the model on the next page showing each step as above.

6. Both #4 and #5, above, use base 10 blocks and the sharing approach to division. Briefly talk about how the measurement approach to division would be different for these two problems. Which method do you prefer? Which method do you think your students would prefer?