30.1 Multiplication - Worksheet 1

1 Calculate $4 \cdot 6$ using A groups of B and an integer chip diagram.

2 Calculate $-3 \cdot 5$ using A groups of B and an integer chip diagram.

3 Calculate $5 \cdot (-2)$ using A groups of B and an integer chip diagram.

4 Calculate $-4 \cdot (-5)$ using A groups of B and an integer chip diagram.

30.2 Multiplication - Worksheet 2

1 Calculate $3 \cdot 6$ using A groups of B and a movement diagram.

2 Calculate $4 \cdot (-2)$ using A groups of B and a movement diagram.

Which way should you be facing?

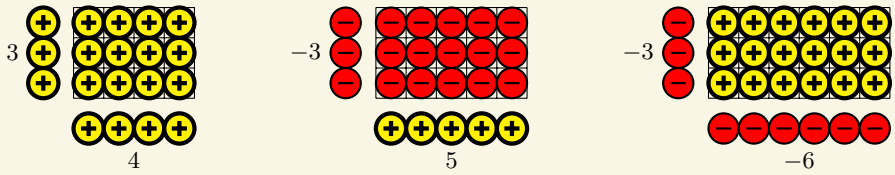
3 Calculate $-3 \cdot 5$ using A groups of B and a movement diagram.

4 Calculate $-5 \cdot (-4)$ using A groups of B and a movement diagram.

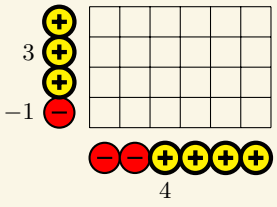
30.3 Multiplication - Worksheet 3

1 Represent $5 \cdot 6$ using a rectangle and determine the product by determining the area.

2 The concept of counting up the area doesn't really make sense if we start to involve negative numbers. However, we can mix the integer chips with the basic multiplication rules in order to create pictures with "signed" areas. What this means is that each block of area counts as either a positive or negative. You only need to maintain the basic rule of signs for each box. Here are some examples.

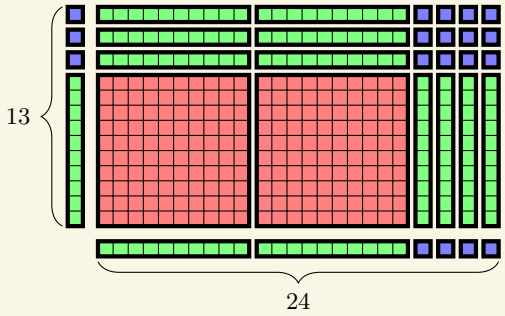


Something that's interesting about this approach is that is remains consistent even if we more complex expressions. Use the grid below to draw a signed area diagram for the the product $(3 + (-1)) \cdot (-2 + 4))$. Calculate the result by counting the values in the grid and then by directly simplifying the expression.



30.4 Multiplication - Worksheet 4

1 In the same way that we used base-10 blocks to help us to organize information for addition and subtraction, we can also use them for organizing information for multiplication. When working with larger numbers, we can use organize the calculation of areas using the base-10 blocks to measure the side lengths instead of using individual squares.



Use the diagram to determine the product $24 \cdot 13$.

You should be able to count up the value mentally by working through the diagram in an organized manner.

2 Draw a diagram with base-10 blocks to calculate $14 \cdot 32$.

3 Visualize a diagram with base-10 blocks to calculate $14 \cdot 12$.

Stay organized by thinking of an organized way to think through the diagram.

30.5 Multiplication - Worksheet 5

1 We are going to analyze the "standard" multiplication algorithm. There are actually several multiplication algorithms, and it's not necessarily the case that the way it's presented here is the way you learned it. But this is the most common way it's taught in the United States.

Most people who can do this calculation have a difficult time describing it in terms other than the specific steps. (For example, multiply this by that, then this by that, then make sure you write a zero...) But we want to take the time to actually understand why these steps are what they are. To help, we are going to put the standard algorithm side-by-side with the grid method.

There is also the lattice algorithm, the "peasant" algorithm, and the box/grid method, to name a few.

Remember that we used the grid method when multiplying polynomials and that it's reflecting the idea that multiplication is an area.

$$\begin{array}{r} {\scriptstyle 1\ \ } \\ {\scriptstyle 5\ \ } \\ 37 \\ \times\, 28 \\ \hline 296 \\ +740 \\ \hline 1036 \end{array}$$

	30	7
20	600	140
8	240	56

If you are unfamiliar with this multiplication algorithm, you may want to find an online video that describes it.

In performing the standard algorithm, you compute four separate multiplication calculations: 7×8, 3×8 (don't forget the carried terms), 7×2, and 3×2 (again, don't forget the carried terms). Explain how the four boxes in the grid method correspond to the four products in the standard algorithm. Be sure to explain the roles of the zeros after the numbers in the grid method compared to the standard algorithm.

2 In the "middle" portion of the standard algorithm, we come across the numbers 296 and 740. Those numbers do not directly appear in the grid method, but those values do correspond to a certain aspect of the grid method. Explain how you can get the numbers 296 and 740 from the grid method.

3 The last step of the standard algorithm is to add the two values from the "middle" portion. The last step of the grid method is to add the values in the boxes together. Verify that you get the same result using both methods.