4.3.1 How can I simplify?

Combining Like Terms Math 7

Mathematics can be used to describe patterns in the world. Scientists use math to describe various aspects of life, including how cells multiply, how objects move through space, and how chemicals react. Often, when scientists try to describe these patterns, they need to describe something that changes or varies. Scientists call the quantities that change **variables**, and they represent them using letters and symbols.

In this course, you will spend time learning about variables, what they can represent, and how they serve different purposes. To start, you will use variables to describe the dimensions and areas of different shapes. You will begin to organize the descriptions into **algebraic expressions**.

As you work with your teammates, use these questions to help focus your team's discussion:

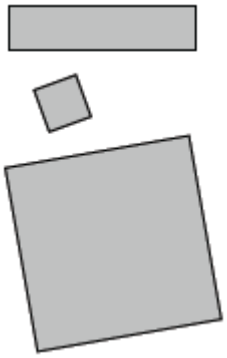
- How can you organize groups of things?
- What is the area?
- Which lengths can vary?

And think about the following learning goals:

- I can apply properties of operations to add, subtract, factor, and expand linear expressions with rational coefficients (EE1)
- SMP #5: Use appropriate tools strategically
- SMP #7: Look for and make use of structure

1. AREA OF ALGEBRA TILES

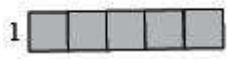
Your teacher will provide your team with a set of **algebra tiles**. Remove one of each shape from the bag and put it on your desk. Trace around each shape on your paper. Look at the different sides of the shapes.



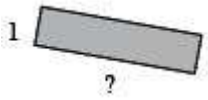
a. With your team, discuss which shapes have the same side lengths and which ones have different side lengths. Be prepared to share your ideas with the class. On your traced drawings, color-code lengths that are EXACTLY the same. If you are unsure, ask for help.

b. Each type of tile is named for its area. In this course, the smallest square will have a side length of 1 unit, so its area is 1 square unit. This tile will be called "one" or the "unit tile." Can you use the unit tile to find the EXACT side lengths of the other rectangles? Why or why not?

c. If the side lengths of a tile can be measured exactly, then the area of the tile can be calculated by multiplying these two lengths together. The area is measured in square units. For example, the rectangle to the right is made up of 5 unit tiles. You know the rectangle measures 1 unit by 5 units. What is the area of the rectangle?



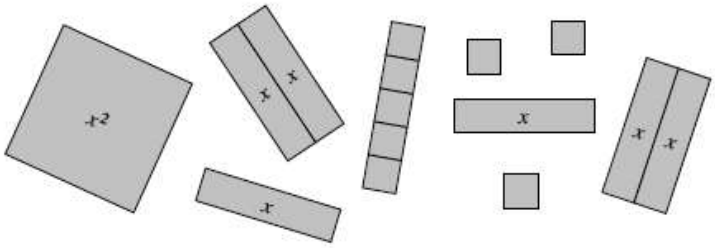
d. The tile to the right has one side length that is exactly one unit long. Can you say the other side is exactly 3 units long? Exactly 4? If the other side length cannot have an exact numerical value, what can it be called?



e. If the unknown length is called "*x*," label the side lengths of each of the three algebra tiles you traced. Find each area and use it to name each tile. Be sure to include the name of the type of units it represents.

2. When a collection of algebra tiles is described with mathematical symbols, it is called an **algebraic expression**. Take out the tiles shown in the picture below. Then work with your team to do the following tasks.

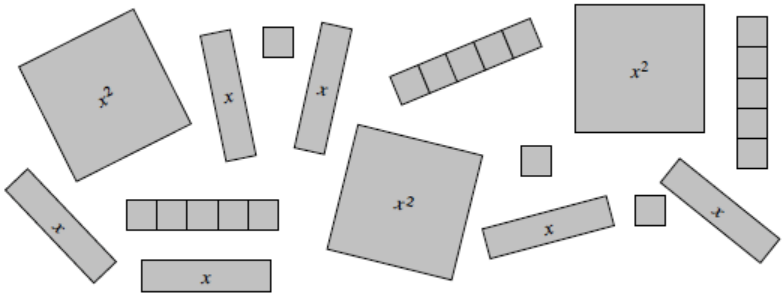
a. Use mathematical symbols (numbers, variables, and operations) to record the area of this collection of tiles.



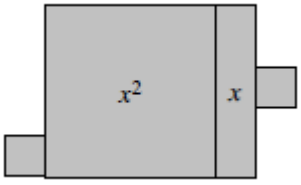
b. Write at least three different algebraic expressions that represent the area of this tile collection.

3. Put the tiles pictured in each collection below on your table. Then work with your team to find the area as you did in **problem 2**.

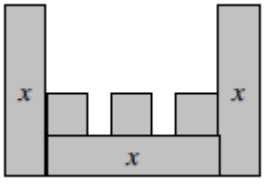
Collection A



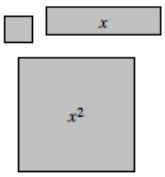
Collection B



Collection C



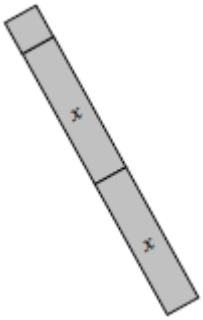
4. The perimeter of each algebra tile can be also written as an expression using variables and numbers.



a. Write at least two different expressions for the perimeter of each tile shown at right.

b. Which way of writing the perimeter seems clearest to you? What information can you get from each expression?

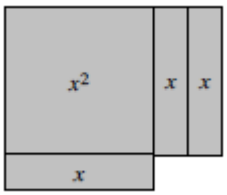
c. Lianna wrote the perimeter of the collection of tiles to the right as $2x + 1 + 1 + 1 + 2x + 1$ units.
Her teammate Jonah wrote it as $4x + 4$.
How are their expressions different?



d. Which expression represents the perimeter?

5. The expressions that you have written to represent area and perimeter are made up of **terms** that are separated by addition and subtraction.

a. Write an expression for the perimeter of the figure at right.



b. How many x lengths are represented in the expression in part (a)? How many unit lengths?

c. **Combining like terms** (like terms contain the same variable raised to the same power) is a way of simplifying an expression. Rewriting the perimeter of the shape above as $P = 4x + 6$ **combines** the separate x-terms as $4x$ and combines the units in the term 6.

d. If you have not already done so, combine like terms for the perimeter expressions that you wrote in **problem 4.**