▼1.3▼ Introduction to the Lab Gear

the Lab Gear

The Lab Gear blocks come in two colors, yellow and blue.

THE YELLOW BLOCKS

The yellow blocks represent whole numbers, such as 1, 5, or 25.

1. Use the Lab Gear to represent these quantities. Write down what blocks you used.
   a. 13   b. 21

2. Find as many different numbers as possible that can be represented by using exactly three yellow blocks.

3. ◆— Write some numbers that *cannot* be represented by the Lab Gear. Explain why you believe this to be true.

You will soon learn to use the Lab Gear for negative numbers. Later, you will use the Lab Gear to work with fractions.
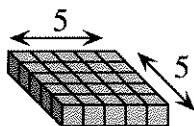
Notice that the block that represents 25 is a 5-by-5 square.

> **Notation:** In algebra, the multiplication 5 times 5 is written $5 \cdot 5 = 25$, or $5(5) = 25$. Do not use x to indicate multiplication—it could be confused with the letter x. When handwriting, use a dot, and when typing or using a computer, use an asterisk: $5 * 5 = 25$. In this book, we will use the dot.
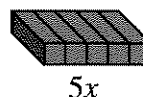
THE BLUE BLOCKS

The blue blocks represent *variables*. All the Lab Gear variables are related to these two blocks.

x y

Variables are usually named by letters. Since the names x and y are used most often in algebra, they have been chosen to name the variables in the Lab Gear.

4. Write a way to remember which block is x and which block is y.

$5x$

This block represents $5 \cdot x$ (which is usually written as $5x$). The reason it is $5x$ can be seen by counting the number of x's that make it. Another way to see it is to notice that it is a rectangle. In a rectangle, the area is equal to the length times the width. Using the corner piece, we can measure the $5x$ block, and see that its dimensions are 5 and x, and its area is $5x$ square units.
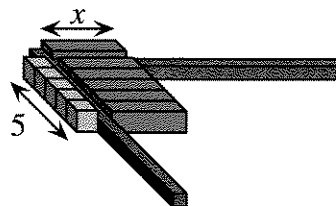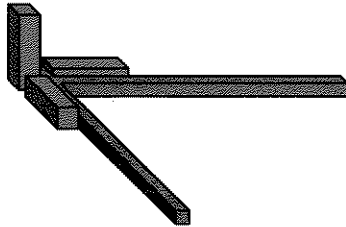
5. Using the corner piece, find the measurements of each of these blocks in terms of x and y. Sketch each block. Label each one with its dimensions and area.
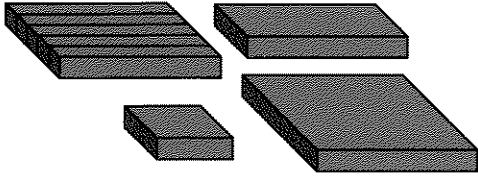
> **Notation:** In algebra, $5 \cdot x$ is written $5x$, and $x \cdot y$ is written xy. (When no operation is indicated, multiplication is understood.) $x \cdot x$ is abbreviated x^2, and read x *squared,* or *the square of x.*

6. Explain why x^2 is read *the square of x.*

The following figure shows $x \cdot x \cdot x$ in the corner piece. There is a block whose measurements in three dimensions (length, width, height) match those shown.

7. Which block would fit in the corner piece with those measurements? What shape is it?

8. In algebra the quantity $x \cdot x \cdot x$ is read x *cubed,* or *the cube of x.* Why do you think it is called that?

9. Use the corner piece to find the length, width, and height of each of the remaining blocks in terms of x and y.
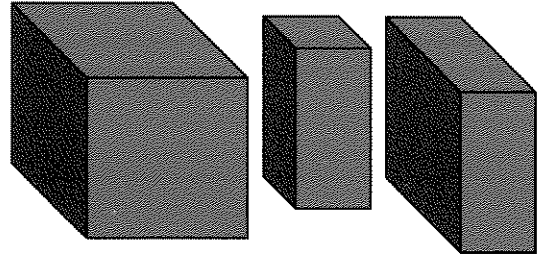
10. **Summary** Sketch each Lab Gear block, and label it with its name. Keep these labeled sketches in your notebook for future reference. (However, if you forget the name of a block, you don't need to look it up. Just measure it, using the corner piece.)

11. Sketch what each of the following would look like with the Lab Gear. If an expression is impossible to show with the Lab Gear, explain why.
    a. $x^2 + x^2 + 3$
    b. $x^2y + xy$
    c. $x + x^2 + x^3$
    d. $x^3 + x^4$

DISCOVERY *HANDSHAKES*

12. There are nine teachers at a math department meeting. They decide to shake hands with each other before starting the meeting. Each teacher is to shake hands exactly once with each other teacher. How many handshakes does it take? Explain your answer and how you arrived at it.

(Hint: You may use sketches to help you solve the problem. A good approach is to start out by counting the handshakes if there are two, three, four, five people at the meeting, and by looking for a pattern.)