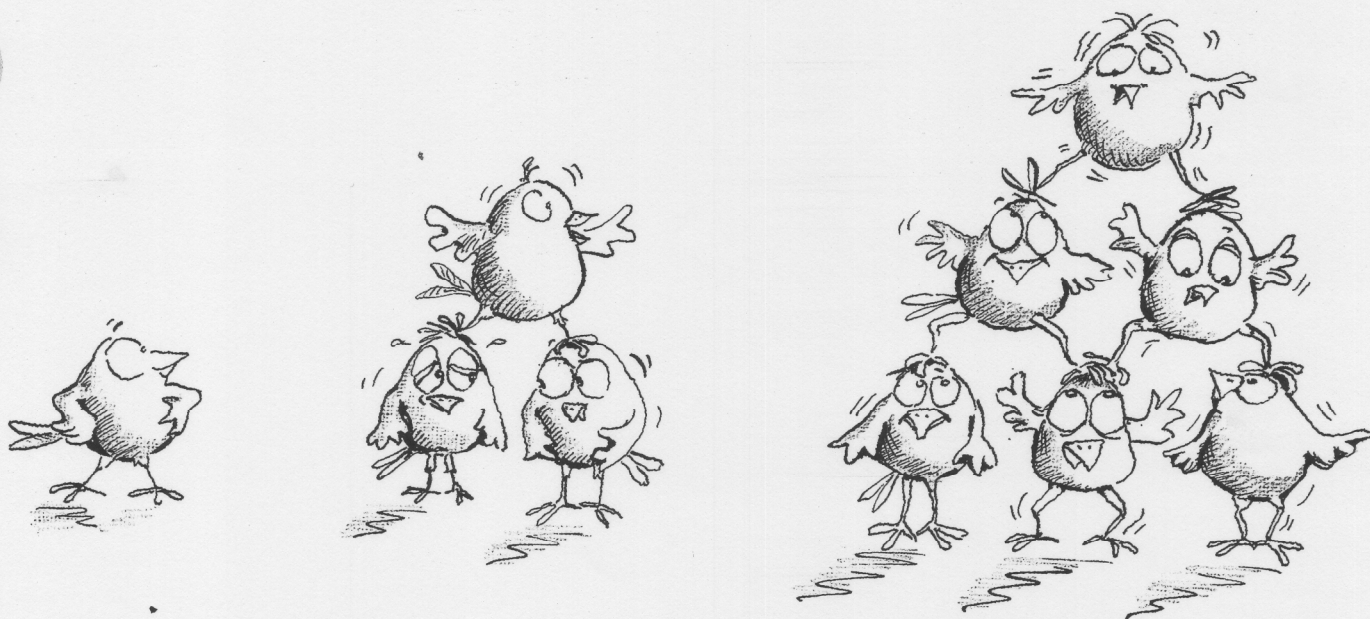




Patterns to Graphs

There are connections between geometric patterns, number patterns, and graphs on coordinate grids. In this activity, you will explore number patterns that geometric patterns generate, and see what happens when you plot patterns on a coordinate graph.

Recognizing patterns is extremely important in all branches of mathematics, not to mention in everyday life. Finding the algebraic relationship or rule, or *function*, that connects two sets of numbers is a very important skill that can be applied in all fields that use mathematics. For example, every lighthouse has its pattern of flashing lights for identification; many musical compositions are built from patterns of chords.



MATERIALS

toothpicks or small sticks

beans, buttons or other markers

graph paper (page 247 or 248)

WHAT'S THE MATH?

Connecting geometric patterns to algebraic rules and graphs.

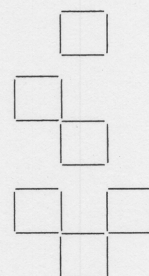
Please email your responses to
your math teacher.

How

Building Patterns

- Make a square using four toothpicks or sticks.

Add another square at the lower right corner. Add another square at the upper right corner of the last. Continue the pattern, adding one square each time. Make a table to record the pattern, the number of squares, and the number of toothpicks used at each step.



STEP #	PATTERN	# OF SQUARES	# OF TOOTHPICKS
1		1	4
2		2	8
3		3	12
4		4	16

Note: # means number

- Study the results in your table. If you continued until the 10th step, how many squares would there be in the pattern? How many toothpicks? What about the 20th step? How do you figure out the number of squares? The number of toothpicks? Can you explain how to do this to another group?

- What if someone wants to know how many squares and toothpicks for any number of steps? Can you describe what you get in general? Suppose you are at the n th step. How many squares would there be? (There would be n squares.)

What about the number of toothpicks? Did you discover the pattern for toothpicks is four times the number of squares? When we are at the n th step, the number of squares is n and the number of toothpicks is $4 \times n$ or $4n$. Or we can say that the rule for finding the number of toothpicks in this pattern is $4n$.

Patterns to Graphs

Making a Graph

- Let's see how we can use the numbers from the pattern to make a graph. Look at the part of your table that lists the step number and the number of toothpicks. Write the numbers in pairs.


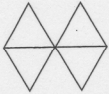
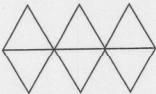
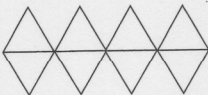



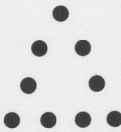


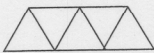



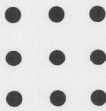
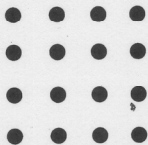

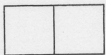
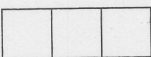
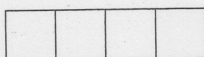
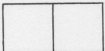
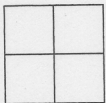
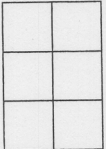
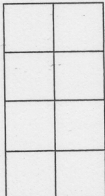


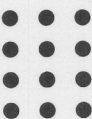
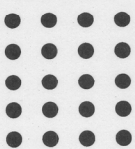



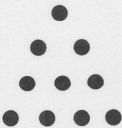
STEP # n	# OF SQUARES	# OF TOOTHPICKS	$(n, t = 4n)$
1	1	4	(1, 4)
2	2	8	(2, 8)
3	3	12	(3, 12)
4	4	16	$\begin{matrix} \cdot & \cdot \\ \cdot & \cdot \\ \cdot & \cdot \end{matrix}$

Note: The points you have plotted all fit the rule $t = 4n$, that is the number of toothpicks is equal to the number of the step, or term, $\times 4$. Number pairs like (0.5, 2) and (1.5, 6), (0.4, 1.6) fit the more general rule: $y = 4x$; but because we are talking about only whole squares and whole toothpicks here, we can only plot the points that the step numbers, or terms, give us. The graph for this pattern will look like a series of dots on some of the intersections of the grid paper. When you plot the general rule, $y = 4x$, you can connect the dots to form a straight line.

- Plot the pairs on a coordinate graph. Do you see a pattern?
- What happens when you write number pairs for the step numbers and number of squares? What does this graph look like?
- Try Pattern A on the *Pattern Page*. Build it. Record your results and make pairs and plot the Step # and number of triangles. Then make pairs for the Step # and number of toothpicks and plot those points.
- Try the other patterns on the *Pattern Page*. What shapes of graphs do you have if you connect the points? Are they all straight lines?
- Can you create a pattern that does not result in a straight line? ■

Please email your responses
to your Math teacher.

Patterns to Graphs

	1st STEP	2nd STEP	3rd STEP	4th STEP	5th STEP
A					
B					
C					
D					
E					
F					
G					
H					
I	