

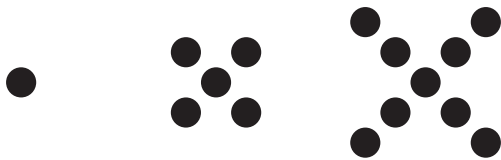
## Chapter 1 Project

# Patterns, Patterns Everywhere!

An activity to demonstrate the use of mathematical expressions to represent patterns.

Mathematics can be found in nature in the form of patterns. These patterns appear in the symmetry of snowflakes, the grouping of petals on a flower, and even the radial symmetry of a drop of water splashing into a pond. Mathematics can be used to explain and analyze these natural phenomena.

1. Consider the following pattern.



Iteration 1                  Iteration 2                  Iteration 3

d. Create an algebraic expression that represents this pattern using  $n$  to represent the number of times the pattern has been drawn.

a. Describe the pattern in words.

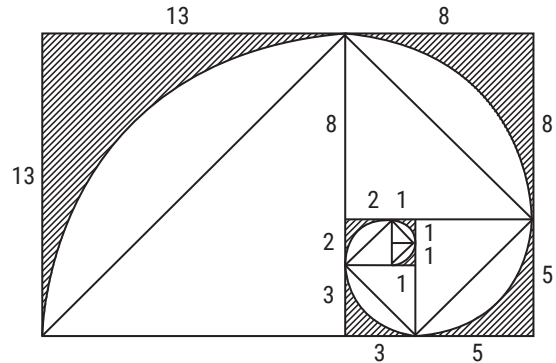
e. How many dots would be in the 100<sup>th</sup> iteration?

b. Describe the pattern using a sum of numbers for each iteration.

c. Fill in the following table using the left side as the iteration of the pattern and the right side to represent how many dots are in that iteration.

| Iteration | Number of Dots |
|-----------|----------------|
| 1         | 1              |
| 2         | 5              |
| 3         |                |
| 4         |                |
| 5         |                |
| 6         |                |
| 7         |                |
| 8         |                |
| 9         |                |
| 10        |                |

Now we'll look at the pattern formed by the shell of a chambered nautilus, which is a mollusk that lives in the South Pacific Ocean. Due to its distinctive shape, the nautilus shell has been used in art for centuries. The first image shows a cross section of a nautilus shell with a clear view of its chambers. The second image illustrates how the shape of the shell can be approximated by a series of squares that increase in size. This increase in size is a famous pattern often found in nature, the Fibonacci sequence.



2. Analyze the pattern of the nautilus shell and express the pattern with an algebraic expression. From the pictures of the nautilus shell, you can see a pattern emerge. The inside of the shell starts with a small single square that is one unit per side. Then larger and larger squares are added in a counterclockwise direction using the following number sequence. The side lengths of the squares are described by the pattern 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610 . . .
  - a. Describe the pattern in words.
  - b. Fill in the following table using the left side as the iteration of the pattern and the right to represent the side length of each square.
3. Create your own pattern. Have a classmate describe and create an algebraic expression for the pattern you created.

| Iteration | Number of Dots |
|-----------|----------------|
| 1         | 1              |
| 2         | 1              |
| 3         |                |
| 4         |                |
| 5         |                |
| 6         |                |
| 7         |                |
| 8         |                |
| 9         |                |
| 10        |                |

- c. Create an algebraic expression that represents this pattern using  $n$  to represent the number of times the pattern has been drawn.