

Numbers in Nature



OVERVIEW

This activity helps build appreciation for the complex structures found in the natural world. Examining the design of a simple fern or pine cone can unlock the mysteries of the universe. Once your young scientist sees how math and science converge in nature, they will never look at a flower, tree branch, or snowflake in the same way again!

OBJECTIVES

Students will be able to:

- Identify patterns in nature.
- Share examples of patterns in nature.
- Find the area of various household objects.
- Use math to determine if a pattern follows the fibonacci sequence.

BACKGROUND INFORMATION

Make sure facts are updated and correct

Scientific and mathematical patterns are everywhere you look. Count the number of petals on a flower and you'll see that most follow the Fibonacci sequence, also known as "Nature's numbering system." The first two Fibonacci numbers are 0 and 1, and each remaining number is the sum of the previous two. Can you see the pattern in these numbers? 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144 ($0 + 1 = 1$, $1 + 1 = 2$, $1 + 2 = 3$, $2 + 3 = 5$, and so on...)

Many things in nature are shaped in spirals that follow the Fibonacci sequence. Patterns of spirals can be found in seeds and leaves. Pinecones, pineapples and the seeds in the center of a sunflower are other examples. If you look closely, you'll see they have one set of spirals going in a clockwise direction, and a second set of spirals going counterclockwise. If you count the spirals, you'll see the two sets add up to two adjacent Fibonacci numbers.

Another common pattern in nature is a fractal. The exact same shape is replicated in a process called "self similarity." The pattern repeats itself over and over again at different scales. For example, a tree grows by repetitive branching. This same kind of branching can be seen in lightning bolts and the veins in your body. Examine a single fern or an aerial view of an entire river system and you'll see fractal patterns.



MATERIALS

- Calculator
- Camera
- Magnifying glass
- Notepad
- Post-it® Sticky Cork Board
- Post-it® Flags or push pins

HOME ACTIVITY

Patterns, patterns everywhere!

- Take your young scientist in the backyard, in a garden, or on a hike. Pay close attention to the patterns in nature.
- Take photos, sketch drawings, and count petals and leaves. Use a calculator or mental math to see if the patterns follow the Fibonacci sequence. Take in the beauty and marvel at how math, science and art come together in the natural world.

Make a fractal board

- Hang a Post-it® Sticky Cork Board on your kitchen wall or other high-traffic area and have family members make fractal patterns with push pins or Post-it® Flags. After the young scientist sees a pattern in nature, see if they can replicate it on the board.

VOCABULARY

- **Fibonacci sequence:** The sequence of numbers (0, 1, 1, 2, 3, 5, 8, 13, . . .) in which each successive number is equal to the sum of the two preceding numbers. On most types of flowers, the number of petals follows the Fibonacci sequence (i.e., there might be 5, 8, 13 or 24 petals).
- **Inquiry skills:** A geometric pattern that is repeated at ever smaller scales to produce irregular shapes and surfaces that cannot be represented by classical geometry. Fractals are used in computer modeling of irregular patterns and structures in nature (e.g., snowflakes, tree branches, coastlines, lightning bolts).

THOUGHT/CONVERSATION STARTERS

- What patterns have you noticed in nature?
 - Consider all responses. Ask your young scientist to tell you more about the pattern.
- What is the Fibonacci sequence?
 - It is a sequence of numbers found in the natural world (0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144).



- What are fractals?
 - A fractal is a never-ending pattern found in nature. The pattern repeats itself over and over again at different scales.

DOCUMENT THE LEARNING IDEA

This is a good time to introduce your young scientist to documenting observations with a camera. Using a mobile device, capture favorite patterns discovered. Work together to create a digital collage or a video with the photos collected. Encourage your young scientist to share their knowledge by adding their explanation of learning to the video. Bring the creation to share with the class.

CONTINUE MAKING CONNECTIONS

Today's activity can be continued in other spaces. On the next trip anywhere, ask your young scientist to look for patterns in nature. Have conversations with your young scientist about the patterns you discover together.

LINKS TO EXPLORE

Fractal Foundation: Inspiring Interest in Science, Math & Art

<http://fractalfoundation.org/>

Dublin Arts Council: Fractals- Patterns in Nature

<https://www.dublinarts.org/featured-items/fractals-patterns-in-nature/>