Science of Summer Family Activities

Numbers in Nature

Overview

This simple 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 you see how math and science converge in nature, you'll never look at a flower (or tree branch or snowflake) in the same way again!

Materials

- calculator
- camera
- magnifying glass
- notepad
- Post-it® Sticky Cork Board
- Post-it® Flags
- push pins

Terminology

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).

Fractal: 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, lightening bolts).

Activities

Patterns, patterns everywhere!

- The next time you're in your garden or on a hike in the woods, pay close attention to the patterns in nature. 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."
- Take photos, sketch drawings, count petals and leaves, crunch the numbers on a calculator or in your head 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 you see a pattern in nature, see if you can replicate it on your board.

Discussion points

What is the Fibonacci sequence?

- It is a pattern of numbers found in the natural world. 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 as well. Patterns of spirals can be found in seeds and leaves. Pinecones, pineapples and the seeds in the center of a sunflower are 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.

What are fractals?

- A fractal is a never-ending pattern found in nature. 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 lightening 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.

Links

Fractal Foundation: Inspiring Interest in Science, Math & Art
http://fractalfoundation.org/

17 Captivating Examples of Fractals in Nature
http://webecoist.com/2008/09/07/17-amazing-examples-of-fractals-in-nature/