
Nature's Patterns

Activity Overview

Students find observations in nature that express Fibonacci number patterns and other geometric patterns.

Objectives

Students will:

- Identify Fibonacci numbers and geometric patterns in nature.
- Use observational skills.
- Explore how components of plants/trees are arranged and developed.
- Think creatively about natural patterns possible influences on art, science and engineering

Subjects Covered

Science, Math and Art

Grades

9 through 12

Activity Time

30 minutes for observation and
30 minutes for discussing results

Season

Late spring, Summer and Fall

Materials

Graphing paper or drawing paper, and pencils

State Standards

Math:

Use reasoning abilities (A.4.1, A.8.1, A.12.1)

Communicate mathematical ideas (A.4.2), logical arguments (A.8.2, A.12.2)

Connect mathematical learning with other subjects (A.4.3)

Use vocabulary, symbols, notation (A.4.4)

Explain solutions to problems (A.4.5)

Analyze non-routine problems (A.8.3)

Develop effective oral & written presentations (A.8.4)

Background

Through exploration of school grounds and natural areas, students can discover how nature is filled with mathematical patterns. One particular pattern is the Fibonacci sequence of numbers that is developed by adding the last two digits in the sequence to find the next number (0, 1, 1, 2, 3, 5, 8, 13, ...). This sequence is named after its founder, who originally developed it to find out how fast rabbits could breed in ideal circumstances. Due to its tendency to be found among many aspects of nature, it has been referred to as “the law of nature.” It can be seen expressed in the branching of plants and trees, spirals in shells, pinecones, and seed heads, and in leaf and petal arrangements.

Activity Description

Steps:

1. Review Fibonacci sequence of numbers and explain some examples of how nature reflects this sequence of numbers.
2. Take a few sheets of graphing or plain paper and explore a natural area to find Fibonacci number patterns and any other pattern you may encounter.
3. Draw plants, trees, or other natural objects that reflect these patterns. Label/number the parts of your drawing to show that you understand how nature expresses the pattern.
4. As a class, discuss your observations. Were patterns found that did not express Fibonacci numbers? Explain how your drawings represent Fibonacci number patterns, geometric patterns, or any other type of pattern discovered. How do you think natural patterns influence art, science and engineering?

Extensions

- Explore reasons why nature may “use” Fibonacci numbers and other patterns as a means of arranging itself. For example, why are leaves arranged in such a way on its stem? If you look down at a plant from above, you will notice that leaves do not directly overlap so that each leaf has maximum access to sunlight.
- Take photographs of flowers, trees, etc., and the Fibonacci number patterns and other geometric patterns.

Additional Resources

- Fibonacci numbers and nature: www.mcs.surrey.ac.uk/Personal/R.Knott/Fibonacci/fibnat.html
- Slides of Fibonacci numbers in nature with pictures and diagrams: <http://britton.disted.camosun.bc.ca/fibslide/jbfibslide.htm>

Nature's Patterns (con't.)

Explain mathematical concepts, procedures, & ideas (A.8.5)

Read & understand mathematical texts (A.8.6)

Analyze non-routine problems & arrive at solutions (A.12.3)

Develop effective oral & written presentations (A.12.4)

Organize work & present mathematical procedures & results (A.12.5)

Science:

Use scientific themes to explain physical & chemical interactions (C.8.4)

Use science themes to explain physical word (D.12.11)

Investigate structure & function of organisms (F.8.1)

Understand species changes & diversity (F.12.6)

Art:

Apply learning about life, nature, physical world, people to create art (K.8.3, K.12.3)

Understand and use nature and designs as source for new ideas (L.8.4, L.12.4)

- Interactive investigation of the Fibonacci number series in nature:www.learner.org/exhibits/renaissance/fibonacci/
- Garland, Trudi Hammel. (1998). *Fibonacci fun: Fascinating activities with intriguing numbers*. Dale Seymour Publications

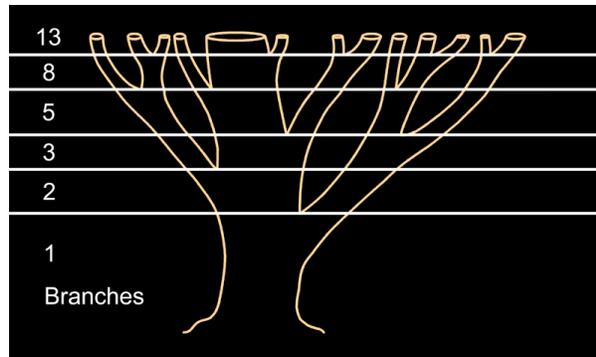
Assessments

- Look at a set of patterns and identify the Fibonacci patterns.
- Explain how nature “uses” Fibonacci patterns as an advantage in competition and survival.
- How could Fibonacci patterns in nature inspire works of art, science, inventions, etc?

Nature's Patterns

Branching

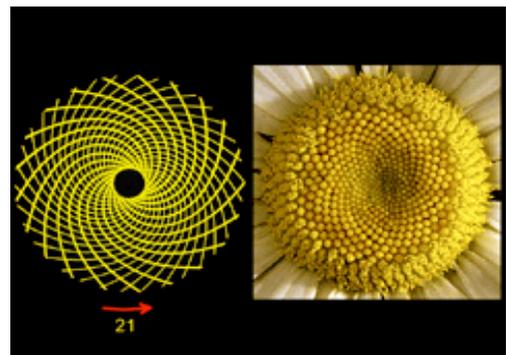
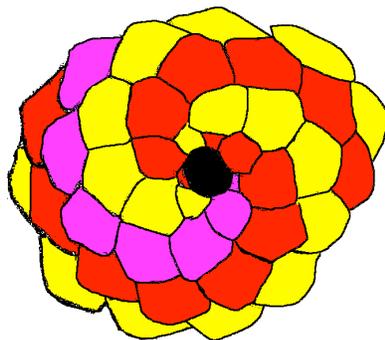
At any point in development, the number of new growths/shoots or branches on a tree or plant is a Fibonacci number.



<http://britton.disted.camosun.bc.ca/fibslide/jbfibslide.htm>

Spirals

The number of spirals going in the same direction on a pinecone or seed head is a Fibonacci number.



<http://www.mcs.surrey.ac.uk/Personal/R.Knott/Fibonacci/fibnat.html>

<http://britton.disted.camosun.bc.ca/fibslide/jbfibslide.htm>

Nature's Patterns

Leaf/Petal Arrangement

The number of leaves and petals found on plant or flower is often a Fibonacci number.

Trillium (3 Petals)

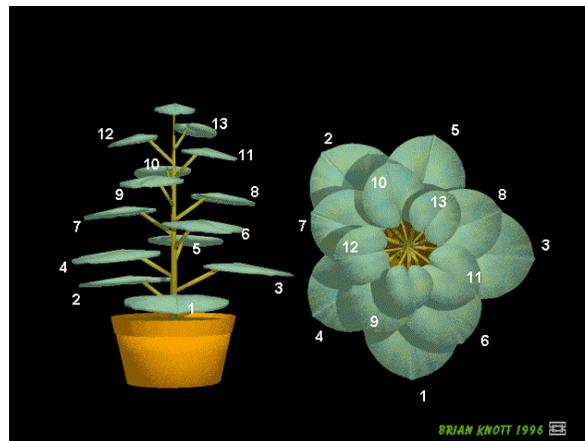


Shasta Daisy (21 Petals)



<http://britton.disted.camosun.bc.ca/fibslide/jbfbfslide.htm>

This computer generated picture shows how a plant leaves can be numbered to represent how it expresses a Fibonacci number.



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