Activity Overvirew
Students find observations in nature that express Fibonacco 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 mintues 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:

*Adapted to California by Return of the Natives•CSU Monterey Bay

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 thebonacci 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

- 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?

Branching

Nature's Patterns

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

New points of growth (branches) on a tree

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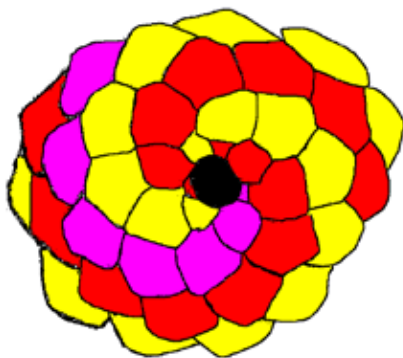
Spirals

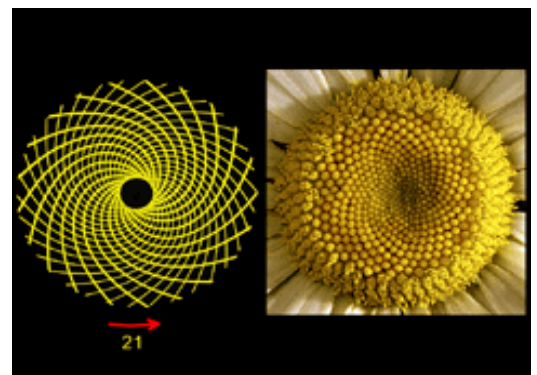The number of spirals going in the same direction on a pinecone or seed head is a Fibonacci number.

Pinecone spirals   Seed Head of Daisy Bloom

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

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

Leaf/Petal Arrangment

Nature's Patterns

The number of leaves and petals found on plant or flower is often a Fibonacci number.
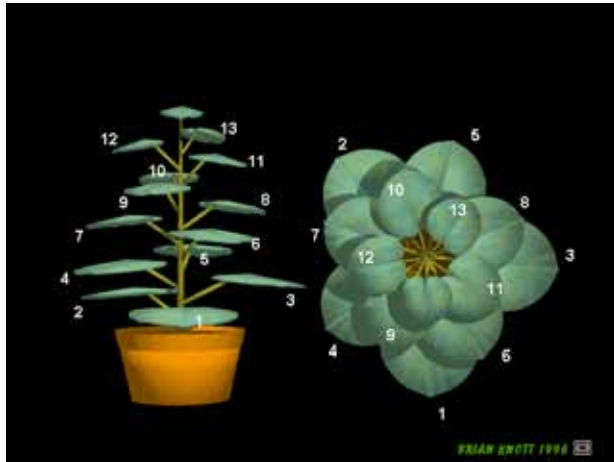
Trillium (3 Petals)   Shasta Daisy (21 Petals)

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

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

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