28. FIBONACCI PATTERNS IN DESERT FLORA

Overview: Students use plant laminates and branch samples to identify species of plants that grow in specific patterns.

Objective: Students will analyze growth patterns in plants, looking for Fibonacci numbers in the patterns.

Time needed: 1-2 hours

Group Size: 2-3

Age appropriateness: 6th Grade and up

Site: Start under the Mesquite tree

Background: Fibonacci patterns are useful when used in number theory, geometry, the theory of continued fractions, and genetics. This sequence does not only apply to math and its related areas, but also to the Golden Section, a shape valued in art and architecture because of its proportions and spiral arrangement. The logarithmic spiral occurs in many of the flowers found in nature. Descartes discovered this type of spiral in 1638. The spirals in flowers and trees create a ratio related to the sequence. The English Daisy, for example, has two sets of rotating spirals; each going in a different direction. The flower has 21 spirals going in a clockwise motion and 34 in the counterclockwise motion, creating a 21:34 ratio. This ratio corresponds to the sequence found in the Fibonacci Sequence.

Materials:

Provided at the Garden
- Plant laminates
- twig/leaf samples

Provided by the classroom teacher
- Copies of information chart
- Copies of follow-up worksheet

Preparation: Run copies of charts and worksheets.

Pre Activity: Students should be familiar with identifying patterns in set of data, specifically, the study of number patterns and Fibonacci numbers. Worksheets on number patterns, posters about Fibonacci number in nature would be helpful as well as the video "Donald Duck in Mathemagic Land".

Procedure:

1. Group students.
2. Have students look over laminates and plant samples, observing the patterns in which they grow.
3. After laminates and samples have been looked over, have students find and compare their conjecture with the overall pattern of the real plant.
4. Gather the students back into a large group and compare findings.
5. The worksheet can be done in the Garden or back in the classroom.

Modifications: Any kind of plant patterns can be observed and compared.

Extensions:
1. Research Fibonacci numbers and their place in nature.
2. Identify other number patterns in plant growth.
3. Make up number patterns to fit plant growth patterns.

Reference List:
Math texts.

Time of Year: any

**This activity was created by Karen Lang.

Fibonacci Numbers Worksheet

1. Beginning with 0, list the first 25 Fibonacci numbers.

2. From your observations at the Garden, do you see any patterns in nature, even if they are not Fibonacci? Explain.

3. After studying the branches of the Mesquite tree, do you see a Fibonacci pattern in its growth? Explain.

Does it grow in a spiral or in a different kind of pattern?

4. Count the number of leaves in each turn of the Palo Verde twig. Are the leaves grouped in a Fibonacci pattern of numbers? Explain your answer.

5. Did you find any other plants with growth patterns like that of the Palo Verde tree? ...like the Mesquite tree? ...like the creosote bush? Name them.

6. Were there any other plants that could be grouped by their growth patterns? What are they?

7. Do you think it is valid to say that all plants grow in a fixed pattern? Why?

8. Is it valid to say that all plants grow in a Fibonacci pattern? Why?

9. Did you find another pattern in the growth of the plants? What was it?

10. Can you make a conjecture about all plants based on your observations in the Garden?

11. Create your own number pattern and design a plant with a growth pattern to fit the number pattern. Does your pattern look like anything you saw at the Garden? What?

12. Tell me what you learned about number patterns in nature. Come up with one way that scientists might be able to use this information. Be creative. Fantasy is encouraged.