PBS Mathline®

The Elementary School Math Project

Peddling Petals

Instructional Decisions (Patterns)

Objective

Students will be able to create, extend, and describe arithmetic patterns.

Overview of the Lesson

Using the setting of a flower-making fund-raiser, students explore a variety of patterns. Students examine the patterns in a flower design made of triangles surrounding a square. They complete a table listing the number of triangles needed to complete various flower designs. Students also make tables showing the cost of buying different cut-outs of flowers. These charts will be used once they begin their flower sale. The lesson culminates with students making brightly colored tissue paper flowers and the advertising posters.

Materials

Teacher:

- Large chart of Activity Sheet: "Sunflower Patterns"
- Paper cut-outs of squares and equilateral triangles. (The sides of the square and triangle are congruent)
- Tape

Each Student:

- Copy of Activity Sheet: "Sunflower Patterns"

- Calculator
- Copy of Activity Sheet: "Selling Small Flowers" or "Selling Large Flowers"

Each Group of 4 Students:

- Square and triangle pattern blocks (about 6 squares and 40 triangles)
- Poster board
- Different colored markers

• Procedure

Open the class with a discussion about an upcoming fund-raiser event where the students will sell tissue paper flowers which they will make. Include in this discussion ideas for advertising the flower sale. These advertising ideas should include making posters indicating when, where, and the cost of the flowers. Inform students that the posters they make will need to be decorated and that a flower border would be a most appropriate decoration for a poster advertising a flower sale.

Place a colored square on the board and tell the class that the square is the center of a flower. Ask a volunteer to come to the board and place triangles of a different color around the center to make a flower design. Students see that 4 triangles (petals) can be placed around the square to make a flower. Next place 2 squares side by side on the board and ask a student to create a new flower by placing the triangles in a similar manner around these two squares. This time students see that 6 triangles (petals) are needed to create this new flower.

Place students in groups. Give each group a copy of Activity Sheet: "Sunflower Patterns" and square and triangle pattern block pieces to use to create similar flowers. Instruct them to work as a group to complete the table and to answer the questions on the Activity Sheet.

After giving students enough time to explore the patterns and complete their charts, reassemble them into a large group. Have them post their entries on the class chart and identify and explain any patterns found. Challenge them to extend the pattern by asking what the next three numbers in the chart would be. Also, ask students to determine the number of triangles needed if 100 squares are used (202 triangles). By providing many examples students should begin to see that if the number of squares is doubled (multiplied by 2) and two more triangles are added, they will be able to determine the number of triangles for a given amount of squares. Show that there is a row of triangles on the top and a row of triangles on the bottom (2 x the number of squares) and one triangle on each end (2 more triangles).

Enter into a discussion with the class regarding how much they should charge if they are going to make and sell both large and small flowers. Students may wish to charge $0.50 for small flowers and $0.75 for large flowers. Divide the class into two groups. One half of the class will work in small groups to complete tables relating the number of small flowers sold to the cost, and the other half of the class will work in small groups to complete tables relating the number of large flowers sold to the cost. Distribute the Activity Sheets: "Selling Small Flowers" or "Selling Large Flowers" to the groups of students. Students will record the costs of selling from 1 to 20 flowers in their charts. Allow students to use calculators to complete this task. After students have completed the Activity Sheet, have them share and extend the patterns they discover.

Next, instruct students in the art of making paper flowers. This is best done by first demonstrating the process.

1. Select three colors of tissue paper about 6" x 15."
2. Working with the shortest side, fold the tissue paper back and forth like you are making a paper fan. Continue until you have folded the entire length.
3. Tightly wrap a pipe cleaner around the middle of the folded paper.
4. Separate the tissue paper by lifting each piece and pulling it toward the center to form the petals of the flower.

Have students make their posters with the flower pattern border to advertise the date time and place of their flower sale. (The flower pattern border can be traced on the poster and colored with the markers.)

The video teacher briefly introduces the Fibonacci number pattern and its relationship to nature. (See Extensions and Connections.)

Mathematically Speaking . . .

Many situations in elementary school mathematics provide teachers an opportunity to have their students create, extend and describe patterns. This is crucial to the development of algebraic concepts in the young learner. Algebra can be defined as the study of patterns. Patterns weave mathematical topics together. Through the study of patterns, children learn to see relations, and make connections, generalizations, and predictions about the world around them. In this lesson we can express the relationship between the number os squares and the number of triangles. If n is the number of squares, the number of triangles (petals) is 2n+2.

Extensions & Connections

Students may be able to create other rules that will describe the numbers generated in the patterns. For example 2(n+1).

Have students determine the number of squares needed if the number of triangles is known.

Show students the Fibonacci number pattern. Have them examine fruits, flowers, and pine cones to find the Fibonacci sequence in nature. Use Activity Sheet: "Fibonacci's Number Pattern" as a resource.

> Fibonacci de Pisa was an Italian mathematician who noticed a pattern of numbers that occurred often in nature. The sequence begins with 1, 1, 2, 3 ,5, 8, etc. The next number in the sequence is the sum of the preceding two numbers. Many patterns can be found like this on fruits, vegetables, flowers, and seed pods. For example, this sequence of numbers can be seen on the outer covering of a pineapple or counting the protrusions on a pine cone.

Have students research the patterns in Pascal's Triangle.

Resources

Mathematics & NSA: A Long Term Partnership: The Collected Learning Units of the 1995 Summer Institutes for Elementary School Teachers:
Patterns: Problem Solving, Pattern Building
Baltimore County, Maryland, July 31-August 4, 1995; Delmarva Peninsula July 10-14, 1995. Sponsored by the National Security Agency, Fort George, G Meade, Maryland.

NCTM Addenda Series/Grades K-6 • Second and Third Grade Books: Patterns
National Council of Teachers of Mathematics. Copyright 1992
Reston, Virginia.

Ideas for Online Discussion

(*Some ideas may apply to more than one standard of the* ***NCTM Professional Standards for Teaching Mathematics.)***

Standard 2: Teacher's Role in Discourse

- How can you bridge language differences to promote student discourse?

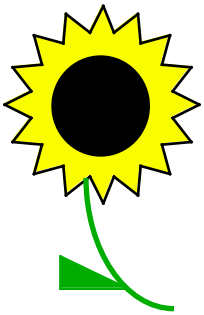
Standard 3: Students' Role in Discourse

- Cite some ways that your students have overcome language differences with their peers as they communicate with each other in small groups as well as in whole class discussions.

Standard 6: Analysis of Teaching and Learning

- The video teacher stated that she resists the temptation to tell students they have a wrong answer, but lets them realize on their own that a mistake has been made. Share your insights or similar experiences with helping students to discover their mistakes.

- How do you assess individual student learning when they are engaged in concrete activities and are assimilating the data with other members of the group?



Names in group_____

SUNFLOWER PATTERNS
PATRONES DE GIRASOLES

SQUARES / CUADRADOS (FLOWERS / FLORES)	**TRIANGLES / TRIANGULOS** (PETALS / PETALOS)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
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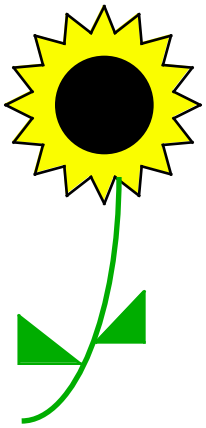

What would be the next 3 numbers in this pattern? Cuales 3 numeros siguen en este patron?) _____

SQUARES	TRIANGLES
21	
22	
23	

Explain and describe the patterns you discovered. (Explica y describe los patrones que descubras.)

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Is there a way to find out how many triangles there would be if we had 100 squares in our design? 200 squares? Hay una manera de saber cuantos triangulos va tener el diseño si hay 100 cuadros? 200 cuadros?

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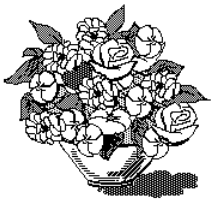

Names in group _____

SELLING SMALL FLOWERS FOR FIFTY CENTS EACH
VENDIENDO FLORES PEQUEÑAS POR CINQUENTA CENTAVOS CADA UNO

FLOWERS / FLORES	COST... / COSTO...
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

What would be the next 3 numbers in this pattern? (Cuales 3 numeros siguen en este patron?)_____

Explain and describe the patterns you discovered. (Explica y describe los patrones que descubriste.)

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Is there a way to find out how much we should charge if someone wants to buy 100 flowers? 200 flowers? (Hay una manera de saber cuanto dinero debemos de cobrar si alguien quiere comprar 100 flores? 200?)

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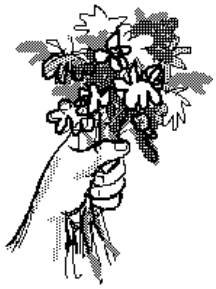

Names in group _____

SELLING LARGE FLOWERS FOR SEVENTY-FIVE CENTS EACH
VENDIENDO FLORES GRANDES POR SETENTA Y CINCO CENTAVOS CADA UNO

FLOWERS / FLORES	COST... / COSTO...
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

What would be the next 3 numbers in this pattern? (Cuales 3 numeros siguen en este patron?) _____

Explain and describe the patterns you discovered. (Explica y describe los patrones que descubriste.)

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Is there a way to find out how much we should charge if someone wants to buy 100 flowers? 200 flowers? (Hay una manera de saber cuanto dinero debemos de cobrar si alguien quiere comprar 100 flores? 200?)

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_____

Names in Group _____

Fibonacci's Number Pattern

There is a pattern named Fibonacci's number that can be found everywhere. A man named Fibonacci de Pisa noticed this pattern in nature. It goes like this...

1 1 2

1 1 2 3

1 1 2 3 5

Can you continue this pattern?

1 1 2 3 5 _____

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Fibonacci found out that you could see this number in flowers, fruits, vegetables, and animals. Look at some of the objects on the table and see if you can find some Fibonacci numbers.