Eye Spy a Rule

Summary

Students will learn to analyze a pattern and identify the rules for the pattern. They will also learn how to represent those rules.

Materials

For the class:

- *Quack and Count*

For each pair:

- *What's the Rule? I* worksheet

For each student:

30+ toothpicks, sticks, or Base Ten rods

- *2 Pattern Blocks* worksheets
- *Growing Patterns* worksheet
- *What's The Rule? II* worksheet
- *What's The Rule? III* worksheet

Additional Resources

Books

- *Quack and Count*
  , by Kieth Baker; ISBN 0-15-292858-8
- *Family Math in the Middle School Years*
  , by Virginia Thompson and Karen Mayfield-Ingram; ISBN 0-912511-29-X
- *Hundred Number Board Activities Grades 4-5*
  , by Cindy Barden; ISBN 0-7424-2780-3
- *Navigating through Algebra in Grades 3-5*
  , by Gilbert J. Cuevas and Karol Yeatts; ISBN 0-87353-500-6
- *Ordinary Mary's Extraordinary Deed*
  , by Emily Pearson; ISBN 0-87905-978-8

Background for Teachers

When students develop an understanding of patterns, they begin to create and discover a reasoning of how patterns grow, repeat, continue, or are solved. This is when students need added encouragement to promote discovery of 'rules for the pattern.' When a student understands how to represent the 'rule for the pattern,' s/he begins to develop a sense that the rule can be applied several times, and in many different ways. This gives the student prior knowledge so s/he becomes a flexible problem solver and realizes that there is a solution.

Intended Learning Outcomes

2. Become mathematical problem solvers.
3. Reason mathematically.
4. Communicate mathematically.

Instructional Procedures

Invitation to Learn

Choose one or both of the following activities to get students to think about patterns and how to describe them.

What's the Rule?

Explain how to play a game called *What's the Rule?*

Two students who have something in common are chosen to come to the front of the classroom. For example, what they have in common, or the 'rule,' may be that both students have blue tennis shoes on.

The rest of the class or audience needs to think about what the rule may be. A student from the class or audience is called on, who in turns calls on another student from the audience who they think follows the rule.

If the student called on does not fit the rule, then s/he must stand off to the side of the classroom. If s/he follows the rule, then s/he joins the two at the front of the classroom.

Have the class continue taking turns naming other students in the audience who they think follow the rule until all students who follow the rule have been named.

Some examples of rules to use: all boys or all girls, wearing something in their hair, wearing short or long-sleeved shirts, wearing shorts or long pants, wearing a watch, has short or long hair, wearing glasses, etc.

Ordinary Mary's Extraordinary Deed

Read *Ordinary Mary's Extraordinary Deed*. As you read the book, begin to write on the board the rule for how many people are exchanging good deeds. An example of this is:

1 person = 5 deeds

5 people = 25 deeds

25 people = 125 deeds

What is the Rule? (If n = number of people, then n x 5, or 5n, = the number of deeds.)

Question: How many deeds will be exchanged with 50 people? (1,250)

When finished, determine how many good deed exchanges would take place in the classroom if each student exchanged five deeds.

Instructional Procedures

Give at least 30 toothpicks to each student. Have students make a square using the toothpicks, telling how many toothpicks they used. Students add another square at the lower right corner. How many toothpicks were used? Continue this until four squares are made. Record the information given on the board.

Example:

1 square = 4 toothpicks

2 squares = 8 toothpicks

3 squares = 12 toothpicks

4 squares = 16 toothpicks

Ask students if they see a pattern in the numbers written on the board. Ask for explanations. The pattern they are seeing can be described with a rule. The rule is square x 4 = toothpick or n x 4 = y (use a variety of symbols to represent this rule).

Have students make triangles. Add one triangle at a time to the lower left vertex of the previous triangle. Continue until they come up with the rule.

Give each student several square, triangle, rhombus, hexagon, and trapezoid pattern blocks. Have them complete the first section of the *Growing Patterns* worksheet. Model how to complete the worksheet using one of the shapes and going across the row.

Have students complete the second section by making a pattern using three to five pattern blocks (e.g., square, hexagon, square, hexagon). Call on select students to tell what their pattern is.

Discuss student answers. Have them tell how they decided on the rule for their pattern.

Hand out the *What's The Rule? I* worksheet to each pair of students. Have each pair solve what numbers come next in the pattern and state the rule. Students may use pattern blocks to help

them visualize the growing pattern. (Answers: Steamship n + 2, Pattern Path 2x + 2, Drawbridge n - 1, Suns n x 6, Fish & Fins n x 2, and Building Flowers n x 4.)
For an extra challenge, give each student a *What's The Rule? II* worksheet. Have them add, subtract, and multiply to find the missing numbers. Read *Quack and Count*. As the book is read, show students that numbers can be added or subtracted from each other to find a pattern.
Give each student a *What's The Rule? III* worksheet. Have them create their own patterns and rules on their worksheet. Exchange with classmates to solve when finished.

Extensions

Create an art project where the pattern in the design grows as it repeats.
Make quilt blocks using pattern blocks and display them in the classroom.
Design a tiled floor. Use a 2" x 2" square as the main pattern piece. Have students determine how many pattern pieces are needed for a certain size of floor.

Family Connections

Have students take home extra *What's The Rule? II* and *What's The Rule? III* worksheets and complete them with a family member.
Conduct a Family Math Night at school. Invite students and family members to come in the evening to experience the fun of the math activities used in the lesson.

Assessment Plan

Have students write a summary of what they learned in their math journals. Draw patterns and write what the rule is as an example.
Have students play concentration with the *Match The Rule Game Cards*.

Bibliography

Research Basis

Kagan, S. (1994). *Cooperative Learning*. Resources for Teachers, Inc. ISBN 1-879097-10-9.
A student who is off task and misbehaving is usually a student wanting attention. In a cooperative learning atmosphere, each student is repeatedly included in a group of students working as a team to achieve the goal of being a successful individual.

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