March 13-15, 1997

Geometry: Beyond Pencil and Paper

Grade Level: Fourth Grade
Presented by: Renee L. Ogle, Taylorsville Elementary, Taylorsville Elementary, IN
Length of Unit: 20-25 days

I. ABSTRACT

This unit teaches geometry through the use of geoboards, grid paper, tracing paper, origami, objects in the home, and the grocery store to bring an understanding to students that geometry is a part of their lives.

II. OVERVIEW

A. Core Knowledge Topics to be Addressed:

Planes and Rays

2. Angles

3. Perpendicular Lines

4. Parallel Lines

5. Triangles

6. Quadrilaterals and Diagonals

7. Circles

8. Similar Figures

9. Area and Perimeter

10. Solids

11. Volume

12. Points on a Grid

B. Skills to be Taught:

1. Each student can describe, model, draw, and classify two and three dimensional geometric figures.

Each student can find the perimeter, area, and volume of simple figure through various approaches, including unit square coverings, measurement, and computation.

3. Each student can examine and compare given geometric figures, and identify such properties as congruency, similarity, symmetry, points, segments, angles, and planes.

4. Each student can measure length and capacity; use these measurements in computations, and judge the

reasonableness of results.

Each student can collect, organize, and describe data; create graphs and charts from that data, and recognize and predict patterns.

C. Student Objectives:

1. The student will be able to identify a line segment, line, or ray.

2. The student will be able to identify two lines as parallel, intersecting, or perpendicular.

3. The student will be able to identify plane figures, polygons, and their parts.

4. The student will be able to identify space figures and their parts.

5. The student will be able to identify an angle, name the sides and vertices, and describe it relative to a right angle.

6. The student will be able to identify figures as congruent, similar, and symmetrical.

7. The student will be able to identify the circumference, radius, and diameter of a circle realizing it is not a true polygon, but a closed figure.

The student will be able to find the area of a figure by counting square centimeters and by multiplying.

The student will be able to find the perimeter of a figure by adding the lengths of the sides of a polygon.

10. The student will be able to find the volume of a rectangular prism.

11. The student will be able to name the location of points on grids with ordered pairs.

III. BACKGROUND KNOWLEDGE

A. Essential Books

1. Hirsch Jr., E.D. What Your Fourth Grader Needs to Know. New York:

Doubleday, 1992. ISBN 0-385-4118-9.

2. Mathematics in Action -Fourth Grade. New York: Macmillan/McGraw-Hill,

1992. ISBN 0-02-109013-0/4.

3. Van Cleave, Janice. Geometry for Every Kid. New York: John Wiley &

Sons, Inc., 1994. ISBN 0-471-31141-3.

IV. RESOURCES

A. Helpful Books for Material and Ideas

1. Araki, Chiyo. Origami in the Classroom, Book II. Rutland, VT: Charles E. Tuttle Co., 1968.

Bennett, Albert, Eugene Maier and L. Ted Nelson. Math and the Mind's Eye. Salem, OR: The Math Learning Center, 1988.

Kenneway, Eric. Complete Origami. New York: St. Martin's Press, 1987. ISBN 0-312-00898-8.

Kneissler, Irmgard. Origami. Chicago: Children's Press, 1992. ISBN 0-516-09261-8.

Lewis, Shari and Lillian Oppenheimer. Folding Paper Masks. New York: E.P. Dutton & Co., 1965.

Nakano, Dokuohtei. Easy Origami. New York: Puffin Books, 1985. ISBN 0-14-036525-7.

Needham, Kate. The Usborne Book of Origami. London: Usborne Publishing, 1992.

Temko, Florence. Paper Tricks. New York: Scholastic, 1988. ISBN 0590-41129-2.

B. Teacher Activity Books

Irvin, Barbara. Geometry and Fractions with Tangrams. Lincolnshire, IL: Learning Resources, Inc., 1995. ISBN 1-56911-972-4.

Irvin, Barbara. Geometry and Fractions with Pattern Blocks. Lincolnshire, IL: Learning Resources, Inc., 1995. ISBN 1-56911-975-9.

Milliken, Linda. China Activity Book. Dana Point, CA: Milliken-Edupress, 1994. ISBN 1-56472-069-1.

Seymour, Dale and Ed Beardslee. Critical Thinking Activities in Patterns, Imagery, Logic. Palo Alto, CA: Dale Seymour Publications, 1988. ISBN 0-86651-440-6.

C. Magazine Article Activities

Crump, Irving. "Sweet Shapes Scavenger Hunt Activity." The Mailbox June/July 1996: 31-32.

Hambright, Peggy. "Edible Explorations." The Mailbox December 1996: 24-29.

D. Essential and Helpful Materials

Ruler

Compass

Geoboard and Rubber Bands

Geoboard Recording Paper

Graph Paper

Index Cards

Plastic Straws

Paper Clips

Coffee Filter Papers

Yarn

Glue

12. Construction Paper

13. Pattern Blocks

14. Tangram Pieces
15. Clear Plastic Drinking Glasses
16. Recycled Christmas Cards
17. Geometric Solid Models
18. Individually Wrapped Candies
19. Origami Paper
20. Dotted Grid Paper
21. Crackers
22. Round Cookies
23. Small Cardboard Boxes
24. Eyedroppers
25. Transparent Grid Sheets
26. Pretzels
27. Sugar Cubes

V. LESSONS

A. Lesson One: Lines, Line Segments, and Rays

1. Objective/Goal

The student will be able to identify a line segments, line, or ray.

Materials

Index cards with line, line segments, or rays

Ruler, pencil, and paper

Graph paper

Yarn

Glue

Construction paper

Prior Knowledge for Students

Knowledge of flat figures--circles, rectangles, triangles, etc.

Key Vocabulary

A line is a straight path that has no definite length and goes on forever in both directions.

A line segment is a part of a line. It follows a straight path between two points, called endpoints.

A ray is a part of a line with one endpoint. It follows a straight path that goes on forever in only one direction. A ray's name starts with its endpoint.

Procedures/Activities

Teacher: Discuss the differences between lines, line segments, and rays. Define definitions on the overhead or chalkboard. Show or give examples of each. Talk about how each is labeled. Emphasize the starting point in labeling a ray. On the overhead or chalkboard show two examples of a line segment (draw only one true line segment, make the other curved or angled). Have children identify which of the two is the real segment. Follow the same procedure with a line and a ray.

Teacher: Using index cards, prepare pictures of lines, line segments, and rays. Have students to categorize the cards.

Students: Categorize the cards on lines, line segments, and rays that the teacher has prepared.

Teacher: Give students directions using lines and line segments to demonstrate an optical illusion. This activity is taken from Geometry for Every Kid, page 8.

Students: Follow the teacher's directions to draw the optical illusion. Which segment appears longer? Try the activity with your parents tonight. You assume the role of teacher with your parent being the student.

Students: Using graph paper, draw a picture of a sports playing field. Show any special geometric shapes or figures it uses. This activity is taken from MAC activity 150 from the Macmillan/McGraw Fourth Grade Textbook.

Evaluation/Assessment

Using a ruler, yarn, scissors, and glue the student can construct and label a line, line segment, and a ray on construction paper.

The student draws the optical illusion correctly on paper.

B. Lesson Two: Parallel, Intersecting, and Perpendicular Lines

Objective/Goal:

The student will be able to identify two lines as parallel, intersecting, or perpendicular.

Materials

Rulers

Yarn

Glue

Construction Paper

Pretzel sticks

Prior Knowledge for Students

Students know the differences between lines, line segments, and rays.

Key Vocabulary

Lines that meet or cross each other and have only one point in common are called **intersecting lines.**

Two lines that intersect to form a right angle are **perpendicular lines.**

Lines that do not intersect and are always the same distance apart are called **parallel lines**.

Procedures/Activities

Teacher: Discuss each of the terms parallel, intersecting, and perpendicular lines. On the overhead or chalkboard show examples of each. Discuss characteristics of each type of line.

Students: Draw an example of each kind of pairs of lines: parallel, intersecting, or perpendicular.

Students: Give examples of objects we see that are parallel lines, perpendicular lines, or intersecting lines.

Parents: When on a walk or drive, see if you and your child can find examples of parallel, intersecting, or perpendicular lines.

Evaluation/Assessment

Using pretzel sticks provided by the teacher, the students can demonstrate parallel, intersecting, and perpendicular lines.

Using the same construction paper in the previous lesson, with rulers, yarn, and glue add parallel lines, intersecting lines, and perpendicular lines.

C. Lesson Three: Plane Figures

Objective/Goal:

The student will be able to identify plane figures, polygons, and their parts.

Materials

Transparent Overhead Shapes

Plastic Pattern Blocks

Yarn

Glue

Index Cards

Geoboards + Rubber Bands

Plastic or Paper Tangram Pieces

Centimeter Grid Paper

Plastic Drinking Straws

Small Paper Clips

Circular Objects for Tracing

Recycled Christmas Cards

Prior Knowledge for Students

Difference between open and closed

Meaning of line segment

Key Vocabulary

A flat surface that goes on in all directions is a **plane**.

Polygons are closed plane figures with sides that are line segments.

An **equilateral triangle** has three equal sides.

A **quadrilateral** is a four-sided figure formed by four line segments.

A **trapezoid** has one pair of parallel lines.

A **parallelogram** has two pairs of parallel lines

A **rectangle** is a parallelogram that has four right angles.

A **square** is a special type of rectangle with four congruent sides.

Procedures/Activities

Teacher: Explain the definition of a plane and a polygon. Use overhead shapes and pattern blocks to show examples (triangle, quadrilateral, pentagon, hexagon, decagon, square, rectangle). Remind the students that a polygon is a closed plane figure with sides of line segments.

Students: In pairs or groups of four, use pattern blocks to form figures.

Students: With pattern blocks, construct polygons with 3,4,5,6,7, and 8 sides. Trace around your figures. Compare and contrast the figures you have made. Look in your math book to see if you can name each figure that you made.

Students: With yarn, rulers, scissors, markers, and glue, experiment with the construction of polygons. You may or may not want to glue your creations to paper. Name each figure.

Teacher: Write the names of different polygons on index cards.

Students: Work in a group of three. Use the polygon cards made by the teacher. The first student picks a card, the second student identifies the number of sides the figure has. The third students draws the figure. Trade roles as often as you wish.

Students: Use the classroom geoboards to construct polygons with different number of sides. Have a classmate try to name the polygons you create. Compare with the other students.

Teacher: Provide students with tangram pieces to form figures.

Students: Using tangram pieces form different kinds of polygons. Name your figure.

Students: Using centimeter grid paper draw polygons of 3, 4, 5, 6, 7, and 8 sides.

Teacher: Provide students with drinking straws and paper clips. Instruct the students on the construction of two triangles. (This activity is taken from Geometry for Kids, pages 33-35.) Describe each triangle. Do they have the same size sides, the same angles, etc.? On the overhead the teacher defines an equilateral, isosceles, and scalene triangle. Which types of triangles did you make?

Students: With a partner play "Shape Up!" (This is an enrichment activity from Mathematics in Action, page 311B.)

Teacher: Introduce the students to the definition and shape in identifying types of quadrilateral figures. Using chart paper and contrasting colors of construction paper, cut out examples of each. Display in the classroom for reference.

Students: Look around the classroom to see if any objects are quadrilateral figures. Make a chart with the headings of square, rectangle, parallelogram, etc. List any objects you find at home or school and list it under its shape.

Parent: Help your child locate any objects that are quadrilateral in your home. Ask your child what he/she defines as a quadrilateral shape.

Students: Construct your Christmas Ornament Ball. Cut out twenty circles of the same size from recycled Christmas cards. On the back of the picture side, use your ruler and draw an equilateral triangle. Fold up edge from drawn triangle to form a tab. Starting with five circles, staple the tabs together. Where they form a point, staple. Continue with groups of five and staple. When finished, use the hold punch and yarn to hang on the Christmas tree. You can also use a darning needle and yarn.

Parent: Recycle your used Christmas cards for your child's class to use for their Christmas Ball Ornament activity.

Parent: Help your child search at home, while driving, or in other places for plane figures, polygons, triangles, etc.

Evaluation/Assessment

Given a worksheet with shapes of plane figures, the students can name the figure.

Given a worksheet with descriptions of sides, the students can identify the polygon.

D. Lesson Four: Space Figures

Objective/Goal

The student will be able to identify space figures and their parts.

Materials

Geometric Solid Models

b. Patterns for cube, square pyramid, and triangular prism

Magazines

d. Individually wrapped candy pieces

Prior Knowledge for Students

Plane figures

Key Vocabulary

The **vertex** is the point where two sides of the polygon meet.

An **edge** is a line segment where two faces of a space figure meet.

c. The **face** is a flat surface or plane region of a space figure.

Procedures/Activities

Teacher: Display a variety of real objects or models of geometric solids, including rectangular prisms, cones, spheres, pyramids, and cubes. Compare and contrast the figures. Name other objects that are shaped in the same way.

Teacher: Explain why space figures are drawn with dotted lines. Help students understand the meaning of face, vertex, and edge. Talk about which is like a plane figure, which is like a line segment, and which is like a point.

Teacher: Provide students with patterns to construct space figures of a cube, square pyramid, and triangular prism. Instruct students to fold on dotted lines and name each shape. (There is an excellent triangular prism pattern in the book Geometry for Kids on p. 167. Math and the Mind's Eye has an excellent pattern from Unit V, Activity 8 to make a cube using grid paper.)

Students: Using your pattern, fold along dotted lines and form to construct your space figure. Identify each type you have made.

Teacher: From Critical Thinking Activities in Patterns, Imagery, Logic direct students to complete Imagery Cube Patterns. These can be found on p. 67.

Students: Complete your Cube Patterns. If you can't visually figure out the pattern, use your scissors. Cut out cube and fold. Identify the pattern.

Teacher: Provide paper, magazines, glue, and other materials for construction of space figures.

Students: Look at the space figures the teacher has provided. Categorize, compare, and contrast each.

Parent: Donate a bag of individually wrapped candy for geometry lesson on space figures.

Teacher: Have children observe closely their candy sample(s) and match it with one of the space shaped figures we have studied. This activity is detailed in "Sweet Shapes Scavenger Hunt Activity" written by Irving Crump from The Mailbox.

Students: Complete your scavenger hunt survey sheet through observation of your candy.

Evaluation/Assessment

The student will construct a space figure book that includes pyramid, cube, cone, cylinder, sphere, and rectangular prism. Label each figure with the name, number of faces, number of vertices, and number of edges. The student may draw the figures or find pictures of each.

E. Lesson Five: Angles

Objective/Goal:

The student will be able to identify an angle, name the sides and the vertices, and describe it relative to a right angle.

Materials

laminated Paper or Tagboard

Paper Fasteners

Origami Paper

Plastic or Paper Tangram Pieces

Prior Knowledge for Students

The meaning of the terms: perpendicular, intersecting, and vertex

Key Vocabulary

An **angle** is the figure formed when two rays that have the same endpoint or straight lines meet.

An **acute angle** is an angle measuring less than 90 degrees.

An **acute triangle** is a triangle in which all angles measure less than 90 degrees.

An **obtuse angle** is an angle that measures greater than 90 degrees.

An **obtuse triangle** is a triangle with one angle measuring greater than 90 degrees.

A **right angle** is an angle that measures 90 degrees.

A **right triangle** is a triangle that has one 90-degree angle.

Procedures/Activities

Teacher: Define and demonstrate the composition of an angle. Have student create an angle with his/her arms. Draw on overhead or on the chalkboard several examples of right, acute, and obtuse angles. Demonstrate the protractor as a tool for measure the degree of the angle.

Teacher: Provide two strips of paper fastened at the end with a paper fastener. Demonstrate this model as a right angle; talk about other angles being greater or less than a right angle. Use the terms acute and obtuse.

Students: Experiment with the angle model. Make a right angle; one greater, one less. With a partner close your eyes. Your partner than forms either a right, acute, or obtuse angle. Use only your sense of touch to identify whether it is right, acute, or obtuse.

Students: With a ruler draw and label a right angle, an obtuse angle, and an acute angle. Label the vertex with a red marker or crayon.

Students: Look at the alphabet letter E, F, H, L, T, V, and X. See if you can detect the angles in each letter. Make each letter fairly large on a piece of paper. Use a blue crayon to shade every acute angle. Use a red crayon to shade every obtuse angle. Use a black crayon to trace the rays that make a right angle.

Students: paper art activity--using Origami paper, create pigs, elephants, cats, sailboats, etc. Follow instructions very carefully from your Origami book. Once you have made your Origami creation write a

short story with your object becoming the main character. Think of an adventure, an intriguing setting, and rich details to add to the excitement of your writing. Proofread, edit, and print your final copy on the computer or in your best handwriting.

Students: Using the tangram pieces your teacher provided, measure and record their angles.

Evaluation/Assessment

Using the construction paper and yard from Lessons One and Two to form and label an example of an acute, right, and obtuse angle.

F. Lesson Six: Congruence, Similarity, and Symmetry

Objective/Goal

The student will be able to identify figures as congruent, similar, and symmetrical.

Materials

Sorting Shapes

Plastic, wooden, or paper sorting blocks

c. Dotted grid paper

Construction paper

e. Tracing paper

Tempera paint of different colors + brushes

Newsprint paper

White liquid glue

Cardboard box

Colored butcher block paper squares

Prior Knowledge for Students

A basic understanding of the meaning of size, shape, and fold.

Key Vocabulary

congruent: figures that are the same shape and size

similar: figures that have the same shape but are different sizes

c. **line of symmetry:** a line that divides a figure into two identical parts that are mirror images of each other. The parts match if folded along the line.

Procedures/Activities

Teacher: Discuss and demonstrate the term similar. Provide shapes that can be sorted by similarity.

Students: Sort the shapes the teacher provides finding the ones that are similar. Describe how they are

similar.

Teacher: Discuss the term congruent. Talk about the difference between similar and congruent.

Students: With the sorting shapes find the ones that are congruent.

Teacher: Using Critical Thinking Activities in Patterns, Imagery, Logic, select from the imagery section different activities to reinforce the concepts of congruence and similarity.

Teacher: Discuss symmetry. Have students give examples of symmetry so they can see where they are located. Provide dotted grid paper to students.

Students: Using your dotted grid paper, create shapes or things that are similar and then create other shapes or things that are congruent.

Teacher: Supply children with paper, paper clips, and other art materials to create shapes which are congruent. "Spy Plane" and "Secret Message" from Paper Tricks lead to using the plane and writing about one of its secret missions. The message is used to write a message to a classmate and "send notes" during math class time.

Students: Create your congruent shape from your art materials. If your teacher has assigned the plane, write a short story about a secret mission. If your teacher has assigned the message, write a short message to a classmate and pass it to him.

Teacher: Provide students with tracing paper, green construction paper, and three other colors of construction paper. Copy Janice Van Cleave's pattern for designing a flower using congruent polygons. (Geometry for Kids, page 54-57).

Parent: Provide your child with a small box for their Chinese Lacquer Ware Project.

Teacher: Chinese Lacquer Ware Project (China Activity Book, p.37), Provide children with paint and glue mixture, brushes, and newsprint to create project. Give children copy of instructions emphasizing cutting out lots of congruent and similar shapes to brush onto their box.

Students: Bring in a small box from home. Cut out lots of congruent and similar shapes. Using the paint and glue mixture, brush cut out shapes on to the box daily for 5-7 days. Overlap your shapes to construct your lacquer ware box.

Teacher: Demonstrate with paper and scissors a symmetrical heart. Ask about what makes the cutting symmetrical when unfolded. Ask if there are other designs or shapes in nature that are symmetrical. Ask the students to fold, cut, and create a symmetrical object: snowflakes in winter, Christmas trees in Dec., Valentine hearts in Feb. Additional sources of ideas can be found in the book, Paper Tricks by Florence Temko.

Students: Using paper, scissors, and paper, fold and cut out a symmetrical design.

Teacher: China Wrapping Paper Project from the China Activity Book, p.38. Provide children with colored butcher block paper squares and colored tissue or construction paper to cut into symmetrical shapes and glue to the square. This is an excellent project combining math, China, Christmas or another gift project.

Students: Follow the teacher's instructions on making your individual Chinese wrapping paper.

Parent: Find things around your home that are similar, congruent, or symmetrical. With your child make a

list to share with the class.

Evaluation/Assessment

Direct the student to fold a sheet of paper into three sections. Label one section similar, one congruent, and one symmetrical. Draw an example of each term in its section of the paper.

G. Lesson Seven: Circles

Objective/Goal

The student will be able to identify the circumference, radius, and diameter of a circle, realizing it is not a true polygon, but a closed figure.

Materials

Compass

Ruler

Circular food items (cookies, crackers, candy, etc.)

String

Clear plastic drinking glasses

8-inch coffee filters

Black water-soluble markers

Prior Knowledge for Students

The student should understand line segments and endpoints.

The student should understand the concept of half and the middle of things.

Key Vocabulary

The **circumference** is the perimeter of a circle; the length of this boundary.

The **chord** is any line segment that begins and ends on the circumference of a circle.

The **diameter** is a chord that passes through the center of a circle.

The **radius** is a line segment from a point on the circumference of a circle to the center of the circle.

Procedures/Activities

Teacher: Draw a circle on an overhead or chalkboard. Label the circumference, radius, and diameter. Define a circle as a line that has no beginning or end; a simple closed curve. Define radius as a line segment from a point on the circumference of a circle to its center. The diameter is a line segment that passes through the center of the circle. Demonstrate how to set the compass to determine the size of the circle. Guide children toward the discovery that the radius of the circle is half as long as the diameter.

Students: Draw three different-sized circles with your compass. Together with a classmate determine the diameter and radius of each of the circles.

Parent: Donate a bag of circular cookies, crackers, rice cakes, or candy to your child's class.

Teacher: Circumference Cookie Activity--Provide children with one Vanilla Wafer (or other circular cookie), round mini pretzel and a large or mini Rice Cake. Review with the children how we determine circumference. With a string and ruler find the circumference for each item. Are they the same measurement for each type of food? Can you determine the radius? Diameter? In The Mailbox issue of Dec./Jan., 1996-97, Peggy Hambright takes this activity further with more food items using both estimation and actual measurements.

Students: Arrange your food items on a paper towel or plate. With your piece of string and ruler measure the diameter of your food. What do you think the radius will be? Measure the radius. Is it half of your diameter measurement? Are your results the same as your classmates? Can you find a relationship between radius, diameter, and circumference?

Teacher: Direct students in following instructions for "Spreaders" activity which produces a curved, multicolored pattern. Use to measure diameter. This can be found in Geometry for Every Kid on pages 78-81.

Students: With a partner carefully follow your teacher's directions to complete "Spreaders." What are your results? Why do you think these things happened?

Teacher: Provide children with colored paper. Instruct them to use their compass to form a circle, cut out. Fold on the diameter. Fold as many times as you want. With your scissors, cut out little designs on your folds. Open up.

Students: Follow your teacher's instructions in folding and cutting your circle to make a symmetrical snowflake.

Evaluation/Assessment

Provide the students with a worksheet of several different sized circles. Have them label and measure the diameter, radius, and circumference.

H. Lesson Eight: Area

1. Objective/Goal

The student will be able to find the area of a figure by counting square centimeters and by multiplying.

Materials

Geoboards + rubber bands

Transparent grid sheets

Plastic or paper pattern blocks

One- inch and centimeter graph paper

Small cardboard box

Geoboard recording paper

Prior Knowledge for Students

The children should know their multiplication facts.

Key Vocabulary

The measure of the number of square units needed to cover the surface of a plane figure is its **area**.

Procedures/Activities

Teacher: Using the geoboard, form two square geoboard regions. Have the students form the same two regions of their geoboard. Guide them in using additional rubber bands to subdivide the large region into squares the size of the small square. Inform the students that the number of squares covering a region is called its area. Form other regions and have students determine the area. Math and the Mind's Eye in Unit V-Activity 2 has some excellent areas to compute with a range from easy to challenging.

Students: Model your geoboard into regions like the teacher's geoboard. Use rubber bands to form smaller squares. Count the squares to determine your area. Continue with other examples. Is there a simpler method other than counting to find the area?

Teacher: Guide students in determining areas of silhouette figures. Provide each student with a transparent grid sheet to place on shaded figure. As a class, determine and discuss the area. Math and the Mind's Eye, Unit V-Activity 3 has some good silhouettes.

Students: Using your transparent grid sheet place on your shaded figure and count the squares to determine the area.

Teacher: Using geoboards, rubber bands, and geoboard recording paper have the students to form squares of different sizes on their boards. Then copy each of their squares in different sections of their recording paper. Guide them toward the discovery of the length of the side relates to area: side x side = area. Continue this activity using rectangular shapes.

Students: Form squares of different sizes on your geoboards. Record each square on your geoboards recording paper. Measure with your metric ruler. Is there an easier way to find the area?

Teacher: Provide the students with pattern blocks and a grid sheet. Shade 2 by 2 units, 3 by 3 units, etc. Tell them to determine the area of each.

Students: Using pattern blocks and your grid sheet, shade 2 by 2 units, 3 by 3 units, etc. Find the area of each. Record your findings.

Parent: Provide your child with a small box, such as raisins, Nerds, etc. for an area activity lesson.

Teacher: Direct students to bring in small boxes. Provide them with a sheet of graph paper to draw the flattened shape of the box to calculate the total surface area of the box. (Depending on the size of the box, you could choose to use 1-inch or 1-cm graph paper.)

Students: Flatten your box and trace it on your graph paper. If the top is rounded, square it off. Find the area of your box.

Parent: With your child measure the area of objects in your home. Record your items and measurements so that your child can share with his/her classmates.

Students: With a partner, use meter sticks, centimeter measuring tape, yardstick, rulers, etc. to find and record the area of objects at school and home. Compare with your classmates.

Evaluation/Assessment

Provide the students with several different sizes of squares and rectangles. Have them measure and record the length of the sides and then calculate the area of each figure.

I. Lesson Nine: Perimeter

Objective/Goal

The student will be able to find the perimeter of a figure by adding the lengths of the sides of a polygon.

Materials

Geoboards + rubber bands

Pretzel sticks

Graph paper

Individually wrapped candy

Prior Knowledge for Students

The students should be proficient in addition with more than 3 addends.

Key Vocabulary

Perimeter is the outer boundary of a plane figure; the length of this boundary.

Procedures/Activities

Teacher: Using a geoboard form two polygons to represent fenced enclosures. Have students determine the inside area. Ask what lengths of fencing we would need to "enclose" the figure. Lead them to the discovery of adding up the length of all the sides. Work through other examples.

Students: Using your geoboard, copy the teacher's two polygons. Determine the area. Count the length of each side. Add all the sides to "enclose" the area. Form other rectangular polygons and with a partner determine the area and the perimeter. Form other closed polygons with more than four sides for a more challenging perimeter problem with your partner. Discuss your conclusions.

Teacher: Provide students with pretzel sticks, or small Tootsie Rolls, Twizzle Sticks, Gummy Worms, etc. Instruct the students to design polygon figures with straight sides. Using their centimeter rulers, measure, and then total the sides to calculate the perimeter. For some students it would be helpful to place their polygons on 1-inch or 1-cm graph paper to calculate and total the perimeter.

Students: Using your pretzel sticks (or other food item) form different straight edge polygon figures. Use your ruler and measure each side's length. Calculate the perimeter of each design.

Evaluation/Assessment

Design several polygons with 4, 5, 6, 7, and 8 sides. Instruct the students to determine the perimeter of each figure.

J. Lesson Ten: Volume

Objective/Goal

The student will be able to find the volume of a rectangular prism.

Materials

Boxes (various sizes)

One inch cubes

c. Sugar cubes

Index cards

Prior Knowledge for Students

Students should be able to multiply three factors.

Key Vocabulary

The **volume** of a figure is how much space it occupies. You measure

space in cubic units.

Procedures/Activities

Teacher: Display different boxes with clearly different capacities. Ask how one could prove that one of the boxes holds more. Discuss the different possibilities.

Teacher: Use 1-inch cubes to demonstrate the volume of various boxes. Let students make predictions on the number of cubes it would take for each. Discuss how volume might be calculated without actually counting the number of cubes that it requires to fill each box.

Teacher: Pass out sugar cubes to pairs of students. Instruct them to make a bottom row of 4 cubes across; put 3 cubes in each row. Count your total cubes. Continue with length of 3 cubes, width of 2, height of 3, etc. How would you go about determining the volume?

Students: With your partner make your model of 4 rows across and 3 cubes in each row. Total your volume. Continue with other measurements given by your teacher. Total the volume of each. Do other combinations of length, width, and height. How high, wide, and long can you go? Have your partner find the volume of your cube design. Take turns challenging each other.

Students: Experiment with the boxes and cubes to see how one might find the volume of a rectangular prism. Tell your teacher what formula you think might work.

Teacher: Prepare index cards with various volumes of rectangular prisms.

Students: Use the volume cards that your teacher has prepared. Pick a card. Construct a rectangular prism with that volume. Have a classmate or adult check your work.

Teacher: Teach the volume formula to the students. Provide practice sheets on volume.

Students: Tell your teacher the formula for finding volume. Practice with the work your teacher has provided.

Evaluation/Assessment

Practice sheets designed by the teacher with drawings of figures in cubic units and a table giving the length, width, and height of other rectangular prisms. Students are to calculate the volume in cubic units.

K. Lesson Eleven: Points on a Grid

Objective/Goal

The student will be able to name the location of points on grids with ordered pairs.

Materials

Transparency grid

Grid sheets

Ordered pair activity sheets

Ruler

Prior Knowledge for Students

Students should have a basic concept of right, up, and over.

Key Vocabulary

Coordinates are number pairs that tell the location of a point on a grid.

Procedures/Activities

Teacher: Inform the students that ordered pairs of numbers can be used to describe the location of a point. Using a transparency grid on the overhead, graph the coordinates. Example (2,5) emphasize over 2 to the right, move up five and mark a dot on the grid. Provide children with a copy of the same grid. As a class activity, give coordinates and check students' work. Give the coordinates (3,5), (4,2), (8,2), (9,5), and (6,4).

Students: On your grid sheet mark the points from each given ordered pair. Have you formed a shape? If so, what is it?

Teacher: Provide different activity sheets of ordered pairs to create secret drawings. From chapter 24 in the book, Geometry for Every Kid, you can learn how to make your coordinated drawings bigger.

Students: On your activity sheet using the given ordered pairs, place dots on the correct coordinates. Connect the dots with a ruler. You must connect them in the order in which you marked them. Determine and color your secret object.

Students: Using dots and a blank grid create your own hidden picture for a classmate. After creating your picture, list the ordered pairs you used. Give the coordinates to a classmate and see if by following the sequence of ordered pairs, they plot the drawing you created.

Evaluation/Assessment

Design a treasure map with a graph. Give coordinates to locate the hidden treasure. Mathematics in Action has a "Problem of the Day" on page 143 B which is an excellent activity for evaluation.

VI. CULMINATING ACTIVITY

Using graph paper, colored pencils, construction paper, rulers, compasses, scissors,

glue, etc. student designs their ideal, dream bedroom, house, or other object. (A lot of children like to invent a homework machine.) Write a short paragraph(s) using descriptive words and geometric terms in your writing. Proofread. Copy and print on the computer or in your best handwriting.

VII. HANDOUTS/STUDENT WORKSHEETS

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