2-D Geometry

Summary

A variety of activities to help students understand geometric terms, angles and shapes.

Main Core Tie

Mathematics Grade 4

Strand: GEOMETRY (4.G.) Standard 4.G.1

Additional Core Ties

Mathematics Grade 4

Strand: GEOMETRY (4.G.) Standard 4.G.2

Materials

Math Journal
3" x 5" cards
pencils
colored pencils
12" ruler
scissors
Power polygons

- *Geometry Concentration Cards*
- *Name That Angle*
- *Classify Shapes*

Additional Resources

Books

- *Twizzlers*
  , by Jerry Polatta ISBN: 0613678605
- *Three Pigs, One Wolf and Seven Magic Shapes*
  by Grace Maccarone & Marilyn Burns ISBN: 0590308572

Background for Teachers

Geometry is more than just naming lines and shapes. Geometry also includes moving, combining, and comparing lines and shapes. Students need to explore kinesthetically in order to better understand different geometric ideas and concepts.

Definitions:

Line -- a straight path continuing without end in both directions.
Point -- an exact location in space represented by a dot.
Line segment -- a part of a line with two endpoints.
Ray -- a part of a line that has one endpoint and goes on forever in one direction.
Horizontal line -- a line that is parallel to the horizon. A horizontal line is straight across.
Vertical lines -- a line that has right angles to the horizon. A vertical line is straight up and down.
Intersecting lines -- lines that meet or cross at one point.
Parallel lines - lines in the same plane that are always the same distance apart - that do not cross.
Angle -- formed by two rays or two line segments with a common end point.
Right angle -- an angle that forms a square corner--measures exactly 90 degrees.

Obtuse angle -- an angle with a measure greater than 90o and less than 180 degrees.
Acute angle -- an angle with a measure less than 90o.
Polygon -- a closed plane figure made by three or more line segments.
Quadrilateral- a four-sided polygon with four sides.
Pentagon -- a polygon with five equal sides
Hexagon -- a polygon with six equal sides
Octagon -- a polygon with eight equal sides
Parallelogram -- a quadrilateral with two pairs of parallel and congruent sides.
Similar -- same shape -- not necessarily the same size
Congruent -- having exactly the same size and shape.

Intended Learning Outcomes

3. Reason mathematically
4. Communicate mathematically
5. Make mathematical connections

Instructional Procedures

Invitation to Learn

Invite students to come to the floor. Demonstrate to the students each vocabulary word with your body and have students mirror the body positions associated with each geometric term.

Line -- a straight path that is endless in both directions (a line must be straight).
Point -- an exact position on a line.
Line segment -- part of a line with two endpoints--line segments have a beginning point and an end point.
Ray -- part of a line that is endless in one direction--has a starting point but no end point.
Horizontal lines -- lines that go left and right. (across the horizon)
Vertical lines -- lines that go up and down.
Intersecting lines -- lines that cross at one point.
Parallel lines - lines that do not cross. (lines are same distance apart)
Angle -- formed by two rays or two line segments with a common end point.
Right angle -- an angle that forms a square corner--measures exactly 90 degrees.

Show students what a "right angle" looks like with both arms (in several different ways--going out to the right and other hand down-- top right, top left, bottom right, bottom left.

Obtuse angle -- an angle with a measure greater than 90 degrees and less than 180 degrees-- greater than a right angle.
Acute angle -- an angle with a measure less than 90 degrees-- smaller than a right angle.

Have the students stand and play *Geometry Says* (Simon Says): with the geometric terms. When a student gets one wrong, they sit down. The last student standing is the winner. You may want to do this in pairs or triads to give students with the most need, practice partners to work through the experience.

An optional way to assess students' knowledge is to place students into small groups and give a point to the first group that has all the students with the correct position. Or the students as a team have to show the geometric term (standing, connecting arms).

Instructional Procedures

After playing *Geometry Says*, have students draw a picture and label each of the geometric terms learned in their math journals. Have the students explain to each other in small groups (think, pair, share) the similarities and differences between the different lines and angles.
Give students each a 3"x 5" card. Students will use it to explore right, acute, and obtuse angles in the classroom. Have students discuss their findings with the class.

Next, have students describe to their neighbor the difference between square and a triangle. They need to be able to describe these shapes using geometric vocabulary.

Teacher demonstrates drawing a shape and describes it with types of lines and angles. For example: Draw a vertical line segment about one inch long. Next, draw a horizontal line segment that is about one half inch long (half the length of the vertical one) starting at the bottom of the vertical line segment and going to the right making a right angle. Last, draw a line segment that connects the top of the vertical line and the far right of the horizontal line creating two acute angles.

Divide the students into pairs. Have each student draw a shape in their math journals using line segments. Then without showing that shape to their partner, describe the shape (using names of lines and angles) they have drawn to see if their partner can produce a shape that is similar.

Explain to students the difference between similar and congruent shapes. Using power polygons have students find similar and congruent shapes.

Pass out a power polygon and have students draw and describe it in their math journals. After discussing it with the class, have the students label it with the geometrical shape name.

Polygon -- a closed figure with three or more sides made up of line segments.

Quadrilateral- a polygon that has four sides.

Pentagon -- a polygon with a five equal sides.

Hexagon -- a polygon with six equal sides.

Octagon -- a polygon with eight equal sides.

Parallelogram -- a quadrilateral with exactly two pairs of parallel and thereby also having two pairs of congruent sides.

Extensions

Curriculum Extensions/Adaptations/ Integration

Line segment star art: You will need white art paper, pencil, ruler, colored pencils, scissors, and contrasting colored paper to mount finished design.

Place two dots three to five inches apart in the center of the paper. Lightly label the endpoints one and two.

Connect the two dots with a ruler to create a horizontal line segment.

Draw about ten dots all over the paper (avoid the horizontal line segment itself and the area if the line segment were extended to the edge of the paper)

Use a ruler to draw a straight line starting at endpoint one, out to a scattered point, and then from the scattered point to endpoint two.

Continue the pattern with other scattered dots around the page.

Design and color each individual section created by intersecting line segments with colored pencils.

Outline star with black, cut out and place on contrasting colored paper.

Have students point out an acute angle, obtuse angle, and see if they have any right angles in their design.

Extend the learning for students with special needs by using students' bodies to demonstrate lines and angles in *Geometry Says*.

This lesson integrates writing and art with geometry.

Family Connections

Have students use the 3" x 5" card to find angles at home. Students can write the type of angles they found and bring them back to share with the class the next day.

Assessment Plan

Using students' math journals teachers can assess what students learned.

Students can demonstrate knowledge of correct geometrical terms by matching pictures to definitions described using *Geometry Concentration* game.
Students can draw and create a picture labeling lines, shapes, and angles.
Watching students play *Geometry Says* to see if they can show different lines and angles.
Other resources: *Name that Angle*

- *Classify Shapes*
  --one sheet per student.

Bibliography

Research Basis

Clements, D. H., & McMillen, S. (1996). Rethinking concrete manipulatives [Electronic Verson]. *Teaching Children Mathematics*, 2(5), 270-279. Retrieved July 5, 2004, from Ebscohost database.
This article discusses what mathematical manipulatives are and how they might be used effectively. It also gives definitions of types of manipulatives and how to select and use them effectively.
Pickreign, J. (2000). Alignment of elementary geometry curriculum with current standards [Electronic version]. *School Science & Mathematics*, 100(1), 243-251. Retreived April 24, 2004, from Ebscohost database.
The subject of geometry in the curriculum is an area of concern among educators. This article identifies models for acquisition of geometry with concrete modeling, pictorial modeling, real-world situation, oral language, and symbolic representations.

Authors

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