Title: Raising a Flag for the New Millennium

Brief Overview:

This unit is designed to provide third-grade students with hands-on experience using pattern blocks to create a flag design for their school. This unit integrates literature into the lessons. By the completion of the unit, students will attain the concepts of transformation--specifically slides, flips, and turns -- and will know the properties of polygons. Extension activities and connections to technology are provided to allow for enrichment of geometric concepts.

Links to NCTM 2000 Standards:

- **Standard 3: Geometry and Spatial Sense**
  Mathematics instructional programs should include attention to geometry and spatial sense so that all students analyze characteristics and properties of two- and three-dimensional geometric objects; recognize the usefulness of transformations and symmetry in analyzing mathematical situations; and use visualization and spatial reasoning to solve problems both within and outside of mathematics.

- **Standard 4: Measurement**
  Mathematics instructional programs should include attention to measurement so that all students understand attributes, units, and systems of measurement; and apply a variety of techniques, tools, and formulas for determining measurements.

- **Standard 6: Problem Solving**
  Mathematics instructional programs should focus on solving problems as part of understanding mathematics so that all students build new mathematical knowledge through their work with problems; apply a wide variety of strategies to solve problems and adapt the strategies to new situations; and monitor and reflect on their mathematical thinking in solving problems.

- **Standard 7: Reasoning and Proof**
  Mathematics instructional programs should focus on learning to reason and construct proofs as part of understanding mathematics so that all students recognize reasoning and proof as essential and powerful parts of mathematics.

- **Standard 8: Communication**
  Mathematics instructional programs should use communication to foster an understanding of mathematics so that all students organize and consolidate their mathematical thinking to communicate with others; express mathematical ideas coherently and clearly to peers, teachers, and others; and use the language of mathematics as a precise means of mathematical expression.

- **Standard 9: Connections**
  Mathematics instructional programs should emphasize connections to foster an understanding of mathematics so that all students recognize and use connections among different mathematical ideas; understand how mathematical ideas build on one another to produce a coherent whole; and recognize, use, and learn about mathematics in contexts outside of mathematics.

- **Standard 10: Representation**
  Mathematics instructional programs should emphasize mathematical representations to foster an understanding of mathematics so that all students create and use representations to organize, record, and communicate mathematical ideas; develop a repertoire of mathematical representations that can be used purposefully, flexibly, and appropriately; and use representations to model and interpret physical, social, and mathematical phenomena.

Links to National Science Education Standards:

- **Physical Science**
  Students will investigate the properties of geometric objects and materials. They will manipulate the position of objects to fulfill a purpose.

Grade/Level:

Grade 3

Duration/Length:

5 class periods

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Understanding the attributes of polygons
- Finding area
- Finding perimeter of a figure
- Writing to persuade

Student Outcomes:

Students will:

- construct a flag design using their knowledge of the characteristics of polygons and transformations.
- write to persuade their principal to choose the flag design they created, using mathematical terms to support their stance.

Materials/Resources/Printed Materials:

- *Shapes*, by Shel Silverstein from Light In The Attic
- The Greedy Triangle,by Marilyn Burns
- Pattern blocks
- Overhead Projector
- Construction paper/ glue/ scissors
- Student Resources 1-5
- Teacher Resources 1-4
- Lined writing paper

Development/Procedures:

Day 1: Properties of Polygons

- Share Project Prompt (Teacher Resource #1)
- Read the poem "Shapes" by Shel Silverstein, or any other appropriate text. Ask students to recall the different polygons they heard in the story. Have students suggest the characteristics of polygons.
- Distribute geoboards to students. Play the Mystery Polygon Game. Share clues of different polygon attributes (Teacher Resource #2). Students listen to the attributes and use their geoboards to create the "mystery" polygons, then hold up their geoboard to respond to the clue. Assess the student's ability to create the figure by listening to the clue, then model the correct polygon using an overhead geoboard.
- Have the students work in groups of four to write a description of the characteristics of polygons (Student Resources #1a - 1c) and share their responses with the class.

Day 2: Investigating Transformations

- To review students understanding, use Teacher Resource #3 to create an overhead transparency or chart and complete the whole group. Ask the students to use their characteristics of polygons (Student Resources #1a-1c) to refer to as they compare three types of polygons. As a class, identify the similarities and differences of the polygons and record onto the Venn diagram.
- Read the book, The Greedy Triangle by Marilyn Burns, or any other appropriate text, that refers to shapes.
- Review the shapes and characteristics that were discussed in Day 1.
- Pose a problem- "How many different shapes can you make using only triangles?"
- Distribute triangular pattern blocks to students.
- Have students come up to the overhead projector and show their answers.
- Discuss how to use mathematical terminology to describe how they created the different shapes by using the one triangle. Model each type of geometric transformation using the overhead pattern blocks. (A flip is a reflection or mirror image of a figure over a vertical line of symmetry, across a row, or under a horizontal line of symmetry. A slide is a horizontal or vertical movement of a figure without a change in position. A turn is a rotation of a figure around an endpoint or midpoint.)
- Distribute the other pattern block shapes and have students explore with different shapes. Walk around asking the students to explain the transformations that make up the patterns they created.
- Reread project prompt (Teacher Resource #1). Ask the students to use the pattern blocks to start constructing their flag design.
- Have the students explore their flag pattern and share with their group to get ideas to better develop their own. Have the students sketch their final flag pattern in journal (Student Resource #2) and write the names of the polygons and types of transformations they used.

Day 3: Designing a Flag

- Read aloud/Picture walk Flags, by William Crampton, Eyewitness Books Series or another related book. Discuss the patterns and attributes found in flags. Identify the geometric shapes and the transformations that are commonly used in the design of flags and discuss why these shapes may be prevalent. Develop a list of the features of a well-designed flag, such as colors, shapes, symbols, designs, emblems, etc.

- Reread the flag project prompt (Teacher Resource #1) to review yesterday's objectives and remind them of today's project goal. Model how to use graph paper to draw a flag design and label the transformations.
- Using the journal sketches and pattern blocks of their flag designs, have the students design a flag onto one-inch grid paper (Student Resource #3), then label the transformations they used to create their design. Note that they must have at least four slides, flips, and turns present in their final design.
- Have the students analyze their basic design and plan how the design will be symbolic and representative of their school. Have them complete the planning guide (Student Resource #4) and schedule a conference with the teacher.

Day 4: Constructing a Flag

- Using the rough draft as a template, have the students create a flag by tracing the pattern blocks needed to make the flag onto the correct color of construction paper, cutting them and assembling them to a base for the flag.
- Finally, have the students present their flag to their class, giving a brief explanation of the transformations present in the geometric design, and how the flag symbolizes their school in the new millennium.

Day 5: Performance Task: "Writing to the Principal"

- Distribute and read aloud the vignette found on Student Resource #5. Students will demonstrate their knowledge of the concepts taught in their persuasive letter.
- Score the persuasive letter using the rating scale provided if desired, or the class can create a rubric before beginning the task.

Performance Assessment:

The students will be given a vignette, on Day 5, to assess their knowledge on the unit (Student Resource #5). A rating scale can be used to evaluate student performance (Teacher Resource #4).

Extension/Follow Up:

- The students can use KID PIX to create a color copy of their flag. The class can combine KID PIX designs to create a slideshow presentation for their principal.
- The students can explore the Internet to research vexillology, the study of flagmaking. Try searching http://www.yahooligans.com for flags and flagmaking.
- Students can interpret the designs of flags of the world and analyze them to identify the polygons used and the transformations found in each flag.

Authors:

Jennifer McPherson
District Heights Elementary
Prince George's County, MD

Jennifer Peter
Viers Mill Elementary School
Montgomery County, MD

Maria Nwagbaraocha
Northwood Elementary
Baltimore City, MD

Project Prompt

Many Maryland schools are interested in creating or updating their school flags for the new millennium. Your principal has asked your class to use your knowledge of geometry to create a new design for your school.

A well-designed flag uses geometric shapes, transformations, and colors to create symbolic designs and communicate meaning to others. Your principal is interested in viewing the flags your class makes and learning about the symbolism present in each of the flags. Your principal will eventually choose one of the designs to send to a professional flag maker.

Mystery Polygon Clue Sheet

Triangle
1. polygon
2. closed
3. three sides
4. three angles
5. acute angles
6. one line of symmetry
7. all sides intersect

Square
1. polygon
2. closed
3. four sides
4. four angles
5. all right angles
6. four lines of symmetry
7. all sides equal
8. two sets of parallel lines

Trapezoid
1. polygon
2. closed
3. four sides
4. four angles
5. two acute angles
6. two obtuse angles
7. one line of symmetry
8. parallel sides
9. quadrilateral

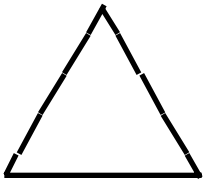
Parallelogram
1. polygon
2. closed
3. four sides (don't have to be equal in length)
4. four angles
5. two obtuse angles
6. two acute angles
7. two sets of parallel lines
8. two lines of symmetry

Rhombus
1. polygon
2. closed
3. four sides (all equal in length)
4. four angles
5. two obtuse angles
6. two acute angles
7. two sets of parallel lines
8. two lines of symmetry

***** These are examples you could use in your game, this resource can also be a method of checking the Characteristics of Polygons (Student Resource #1a, 1b, 1c).

Hexagon
1. polygon
2. closed
3. six sides
4. six angles
5. six obtuse angles
6. six lines of symmetry
7. All sides equal

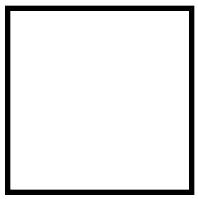
Characteristics of Polygons



Polygon Name:

_____

What I know about this shape:



Polygon Name:

_____

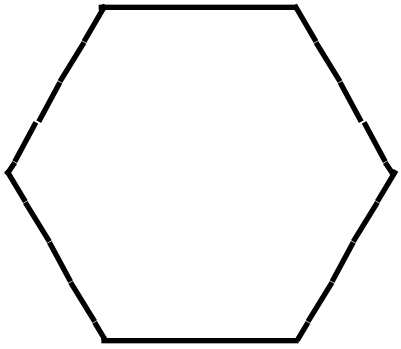
What I know about this shape:

Characteristics of Polygons

Polygon Name:

_____

What I know about this shape:

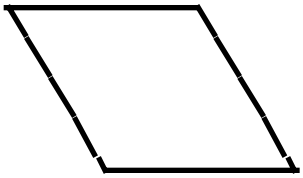


Polygon Name:

_____

What I know about this shape:

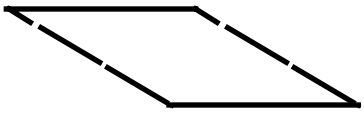
Characteristics of Polygons



Polygon Name:

_____

What I know about this shape:

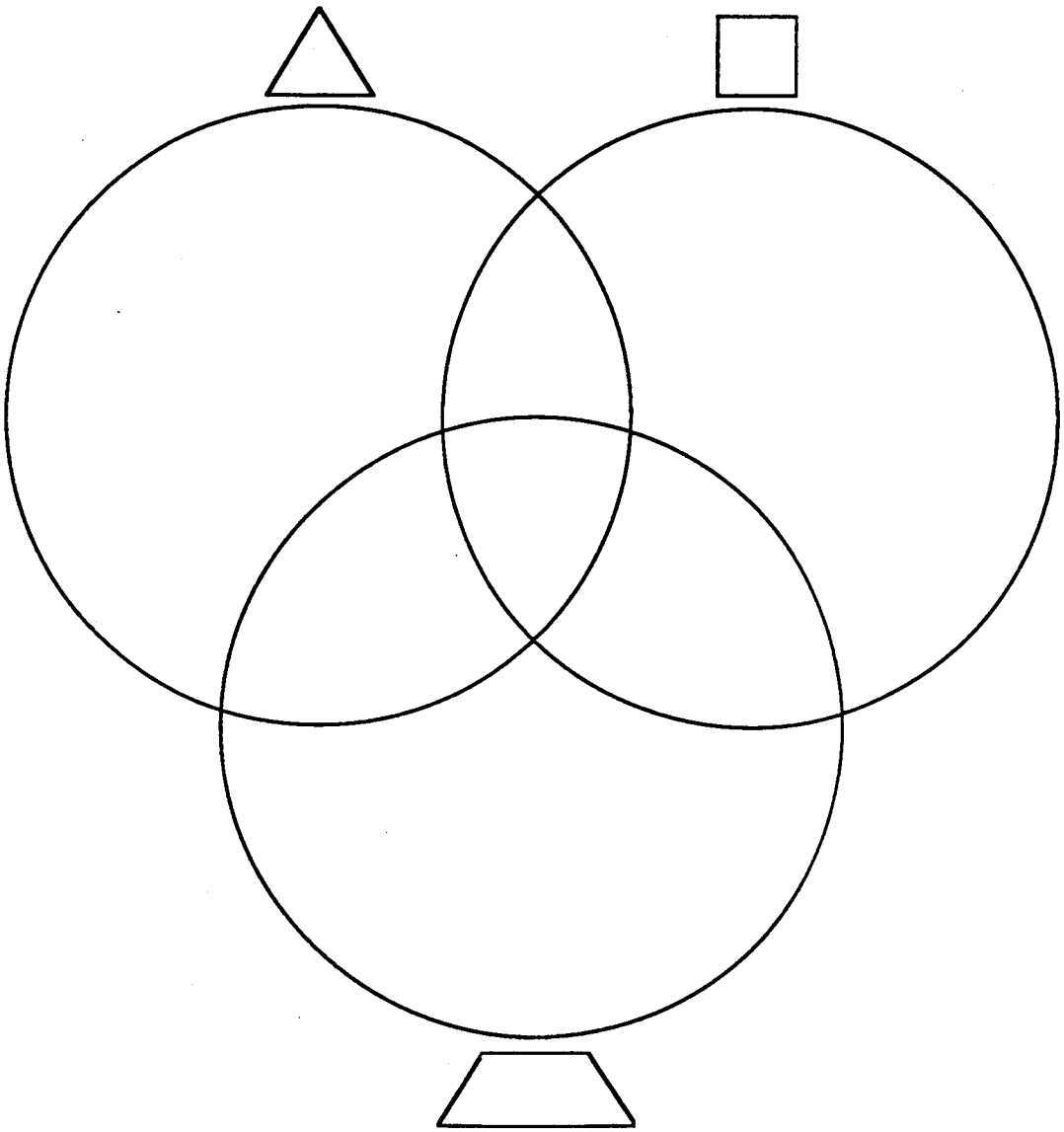


Polygon Name:

_____

What I know about this shape:

Venn Diagram for Comparing Polygons (Overhead Transparency)



Word Box

parallel	straight	equal	angles
congruent	obtuse	four-sided	closed
similar	acute	symmetry	parallel
quadrilateral	right	polygon	

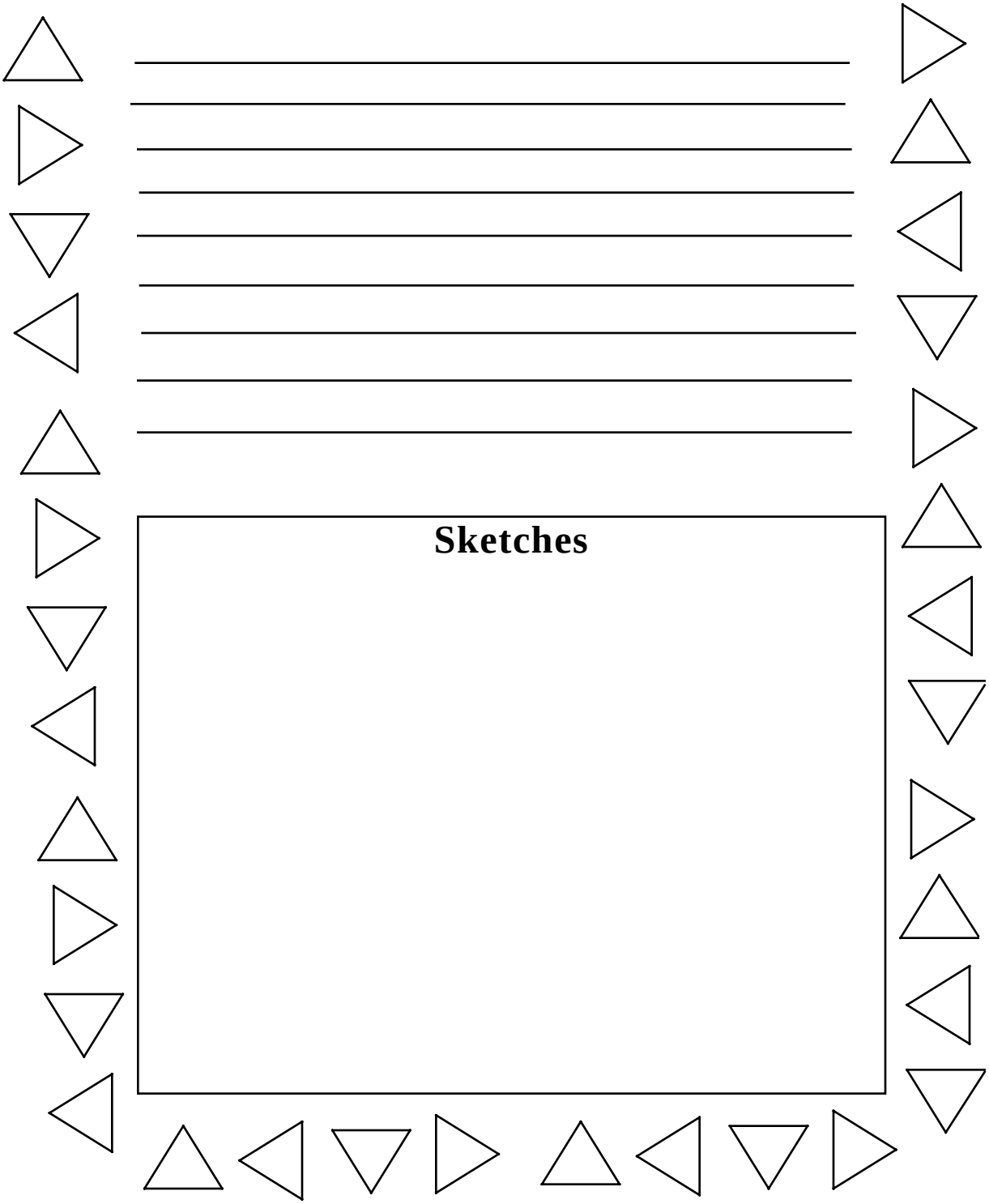
Student Resource #2

Name _____

Date _____

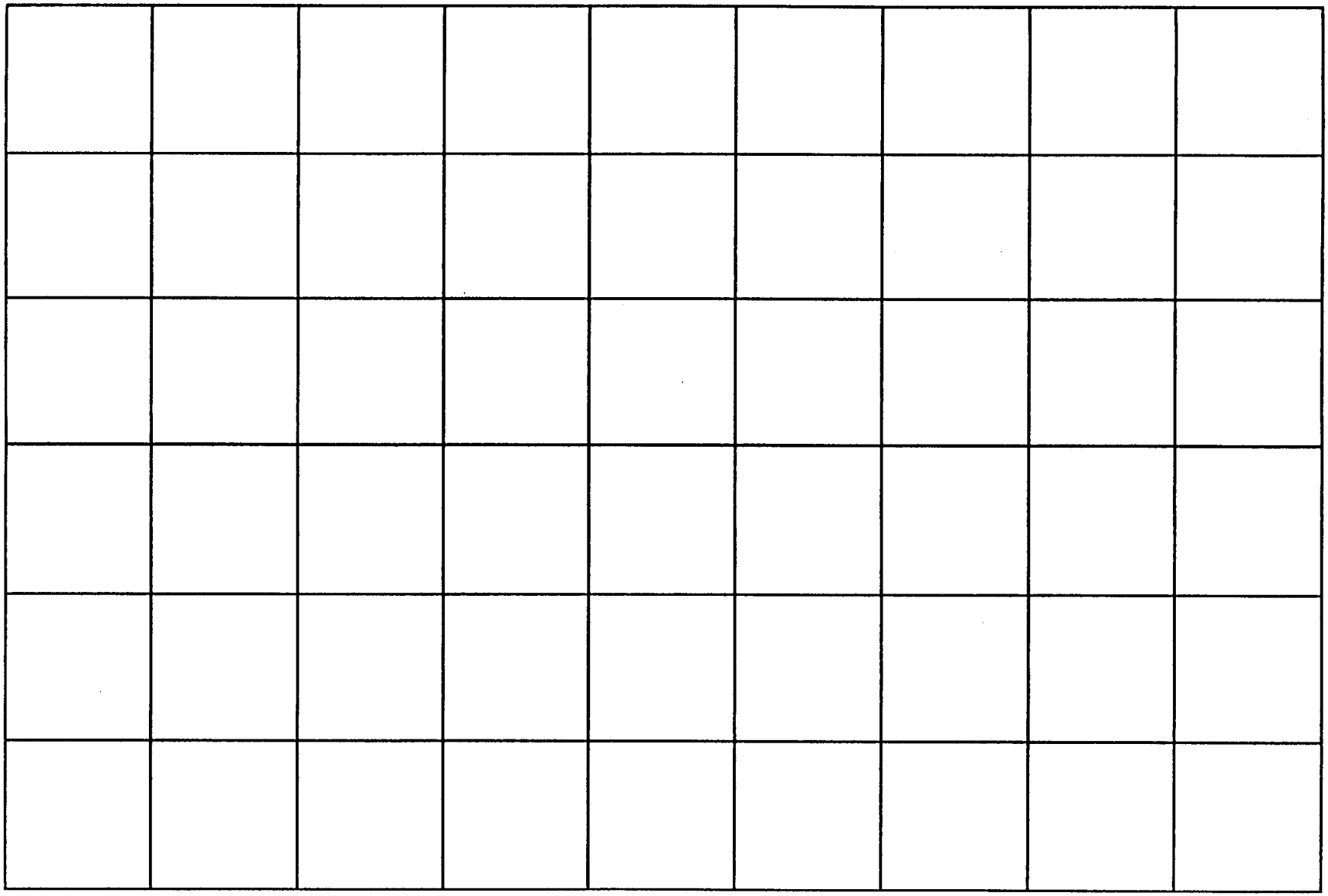
Student Journal

Sketches



Name_____

Use this graph paper to create your flag design. Label the transformations you used in your design. You must have at least four transformations in your design.



Name _____

Flag Design Analysis & Planning Guide

Use the chart below to tally the number of transformations present in your flag design.

	Slides	Flips	Turns
Triangle			
Square			
Hexagon			
Parallelogram			
Trapezoid			
Rhombus			

- **Find the perimeter of your design using one side of the square polygon as a measurement tool. (One side = one unit) Write your answer below.**

  P= _____ units

- **Find the approximate area of your design using one face of the square unit as a measurement tool. Write your answer below.**

  A= _____ square units

Colors of a flag are often symbolic. Choose up to three colors for your design. Identify the color and what it represents below:

Color	Meaning
_____	_____
_____	_____
_____	_____

Student Resource #5

Name _____

Date _____

Vignette: Writing to Persuade

With all the new millennium excitement, your principal wants to create a new school flag. The principal has asked the third grades to create geometric flag designs using their knowledge of transformations, symmetry, and characteristics of polygons.

Write a letter to your principal explaining why your flag design should be selected. You may choose to include the following information about your design:

- Explain how you developed your design.
- Discuss the types and characteristics of the polygons used.
- Explain the types of transformations you used to create your design.
- Describe how the transformations and specific colors create meaning.

Use the space below to create a graphic organizer to help you plan your letter.

Rating Scale For Persuasive Letter

Uses mathematical vocabulary in explanation.

1 2 3 4 5

Uses correct letter format.

1 2 3 4 5

Uses complete sentences to express ideas.

1 2 3 4 5

Uses correct grammar, spelling, and punctuation.

1 2 3 4 5

Scoring Key

5- Excellent
4- Satisfactory level of performance
3- Average
2- Minimal level of performance
1- Unsatisfactory