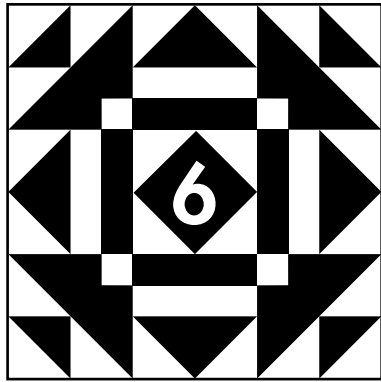


GEOMETRY CONCEPTS



for Middle Schools

Program #6 Geometry Connections

Overview

In program #6, students sort quadrilaterals according to lines of symmetry. They describe the attributes. Students create a Papel Picado (Mexican paper cutting) hanging. This program provides a multicultural insight into this traditional art form of Mexico.

Mathematical Connections

- To examine the concepts of symmetry
- To develop visual skills and reinforce understanding of basic geometric concepts
- To notice the real-world applications of symmetry
- To develop multicultural awareness

NCTM Standards 2000 - Standard 3: Geometry, Grades 6-8

Analyze characteristics and properties of two- (and three-) dimensional geometric objects.

- Create and critique inductive and deductive arguments concerning geometric ideas and relationships
- Recognize and apply geometric ideas and relationships outside the mathematics classroom, in areas such as art, science, and everyday life

Materials

- Scratch paper (8" x 10") or tissue paper (approximately 8" x 10")
- Scissors and staplers
- Tracing paper (optional)
- Student journals

Duplication

- SAS#6.1—one per pair of students
- SAS#6.2—one per pair of students
- SAS#6.3—one per pair of students

Classroom Organization

Sitting in pairs and working in groups of 4.

Telecast Outline

Welcome	Introductions
Focus	Symmetry
Discussion	Where we find symmetry
Activity #1	Quadrilaterals and Symmetry
DLI	Discusses symmetry and introduces the activity
	<i>YOUR TIME</i>
CT	Facilitates activity
S	Sort quadrilaterals by lines of symmetry
	Call-in sort
Activity #2	Quadrilateral Connections
DLI	Introduces the activity
	<i>YOUR TIME</i>
CT	Facilitates activity
S	Begin to look for connections and answer questions on SAS#6.2
DLI	Discusses Papel Picado, an art form from Mexico
Activity #3	Papel Picado
DLI	Introduces the activity
	<i>YOUR TIME</i>
CT	Facilitates activity
S	Create a Papel Picado art
	Video field trip
Journal Writing	Where can we find symmetry in the real world?

DLI = Distance Learning Instructor CT = Classroom Teacher S = Students

Instructions for Activities

Activity # 1: Quadrilaterals and Symmetry

(Activity from NCTM Addenda Series/Grades 5-8 "Geometry in the Middle Grades" page 70.)

Description

Students work with group members to sort quadrilaterals (cut from SAS#6.1) into piles based on the number of lines of symmetry. They look for attributes of these quadrilaterals. Students discuss their decisions.

Materials

- SAS#6.1, one per pair of students
- Scissors

Leading the Activity

Distance Learning Instructor reviews symmetry and demonstrates the activity. Classroom students work in groups to sort the shapes from SAS# 6.1. Classroom Teacher facilitates asking students to justify their sort.

Activity # 2: Quadrilateral Connections

Description

Students look for attributes of the quadrilaterals they sorted in Activity #1. They discuss with their partners and record answers on SAS# 6.2.

Materials

- SAS#6.2, one per pair of students

Leading the Activity

Distance Learning Instructor introduces the activity. Students discuss and complete the questions on SAS# 6.2. Classroom Teacher facilitates the activity by observing students working and asking them to justify their answers.

Activity # 3: Papel Picado

Description

Students follow instructions given by the Distance Learning Instructor to create a Papel Picado hanging

Materials

- Scratch paper
- Tissue paper, approximately 8" x 10"
- Scissors and staplers
- SAS#6.3—one per pair of students

Leading the Activity

Distance Learning Instructor provides step-by-step instructions to create the Papel Picado hanging. There will be several short YOUR TIME segments. Classroom Teacher makes sure students are paying attention to instructions and encourages students to work quickly during the short YOUR TIME segments. Students listen to instructions on-air then work on their hanging during the YOUR TIME segments.

Post-viewing Activities

- **Complete SAS#6.2 (Activity #2)**
 - Students share and discuss attributes quadrilaterals share when lines of symmetry are in common
- **Complete the art in Activity #3**
 - Students create new patterns and share them with us at TEAMS

- **Teachers:**

- Complete the *Geometry Concepts for Middle School* feedback from found at the front of the teacher's guide.
- Visit our website, <http://teams.lacoe.edu>, and join our discussion group.

Assessment or Review

- SAS# 6.5—Polygons and Symmetry

References and Software

- Garza, Carmen Lomas. *Papel Picado Paper Cutout Techniques*. Published by the Xicanindio Arts Coalition, Inc. 1984

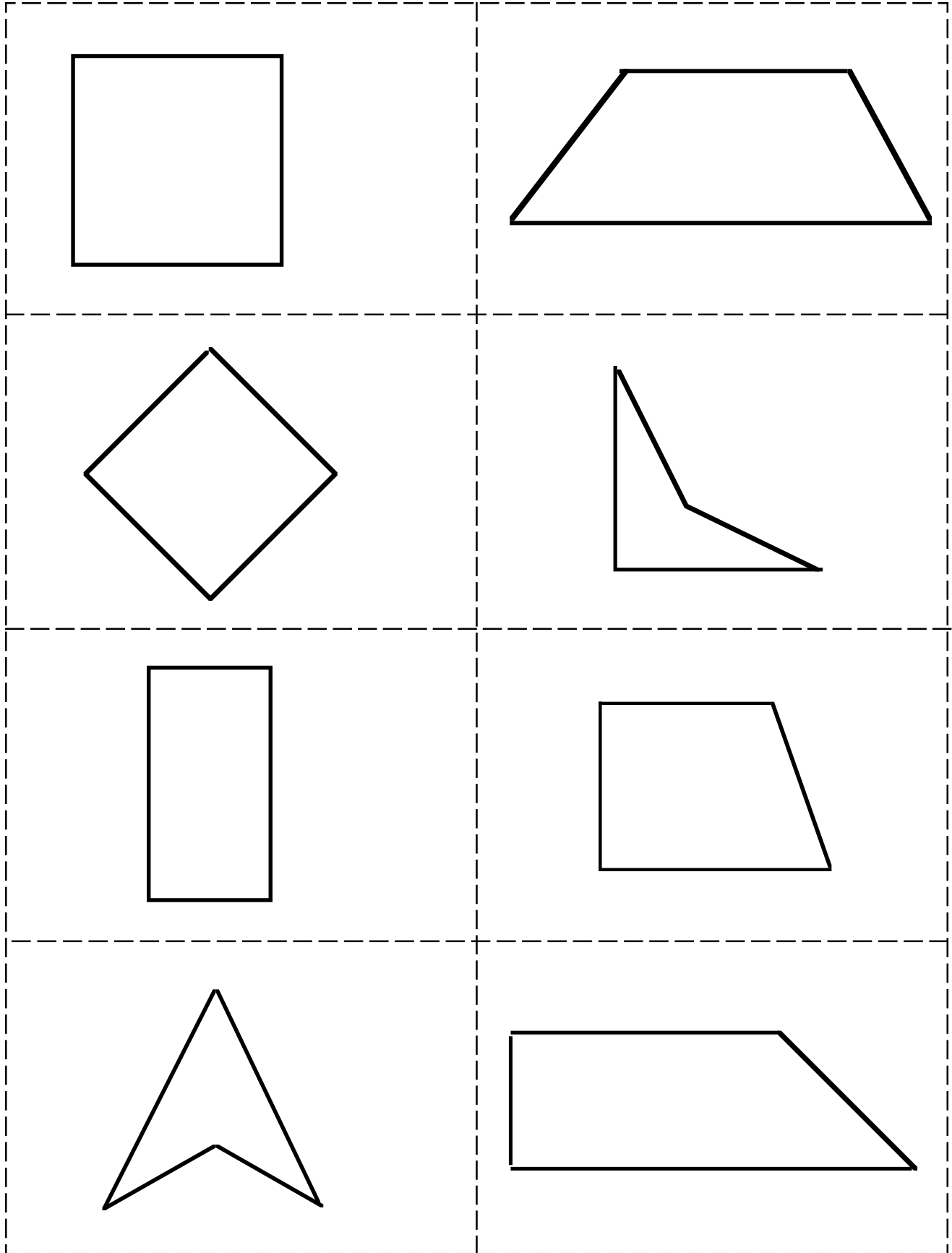
Teacher Background

Papel Picado is an art form from Mexico. Pre-Colombian Mexicans manufactured bark paper from the *amate* trees. During the French invasion of Mexico, 'papel chino', tissue paper was introduced. This tradition continues today. The cutouts are used to adorn homes for holidays and celebrations. A variety of paper sizes and shapes are used.

The mathematics involved in this art form is symmetry. Not all creations of Papel Picado are symmetrical, but the patterns we will use in this activity will be symmetrical in nature. The Japanese call their art of paper cutting "Kirigami". Many other cultures include paper cutting as an art form.

Websites about Papel Picado will be posted in the Middle School Electronic Classroom

SAS# 6.1 Quadrilaterals and Symmetry



Activity from NCTM Addenda Series/Grades 5-8 "Geometry in the Middle Grades" page 70. Used with permission.

SAS#6.2 Quadrilaterals and Symmetry

Student: _____

Date: _____

Student: _____

Date: _____

You and your partner cut out and sort the quadrilaterals on SAS#6.1 into these different piles:

- No lines of symmetry
- Exactly one line of symmetry
- Exactly two lines of symmetry
- Exactly three lines of symmetry
- Exactly four lines of symmetry
- More than four lines of symmetry

After the sort, answer the following questions.

1. Do any piles have no quadrilaterals? If so, can you draw a quadrilateral that would fulfill the attributes? If not, why not?

2. Look at the quadrilaterals with four lines of symmetry. What can you summarize about them? Do they have anything in common? Sketch these shapes below and write your summary below.

3. Look at the quadrilaterals with two lines of symmetry. The lines of symmetry can pass either through vertices, or through edges. What can you say about these two types of quadrilaterals with two lines of symmetry?

4. Look at the quadrilaterals with one line of symmetry. The line of symmetry can pass either through vertices, or through edges. That can you say about these two types of quadrilaterals with one line of symmetry?

Activity from NCTM Addenda Series/Grades 5-8 "Geometry in the Middle Grades" page 70. Used with permission.

SAS#6.3 Papel Picado Template



Place dotted line at fold of paper. Cut out all dark images.



Place dotted line at fold of paper. Cut out all dark images.

SAS#6.4 Cutting Shapes — One Fold

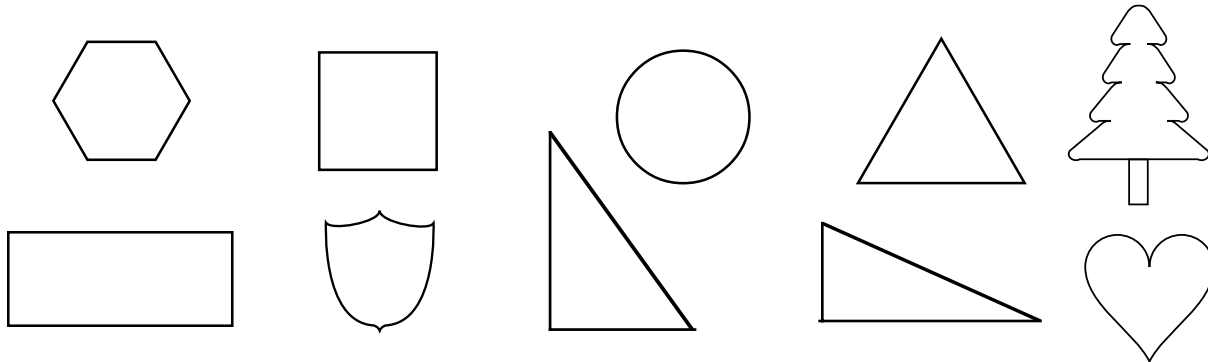
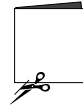
Materials

Scratch paper, scissors, marker

Directions

For each shape below, fold a piece of paper once.

Cut the paper in such a way that, when you unfold it, you have the desired shape.



Which of the shapes could not be made with one fold. Explain why.

Which of the shapes above can be made with two folds? Explain why.

Which of the shapes above cannot be made with two folds? Explain why.

Activity from NCTM Addenda Series/Grades 5-8 "Geometry in the Middle Grades" page 70. Used with permission.

SAS#6.5 Polygons and Symmetry

Student: _____

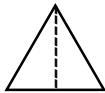
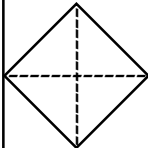
Date: _____

Directions

Try to draw polygons that fit in each space on this grid. Many cannot be done!

1. For a given number of sides, can you always make a polygon with no lines of symmetry? With one? Why?
2. Can you see any patterns what would help you to predict which spaces can be filled in for seven-sided polygons?

Number of Lines of Symmetry

	0	1	2	3	4	5	6
Triangle (3 sides)							
Quadrilateral (4 sides)							
Pentagon (5 sides)							
Hexagon (6 sides)							