

Sorting and Classifying Geometric Shapes



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Program Overview

Students work in cooperative groups to sort cards with shapes as they review the attributes and names of geometric figures. Students practice origami. During the process of folding, students review attributes of geometric shapes and mathematics vocabulary.

Mathematics Instructional Materials

Review Quiz, Page 6

SAS#1.1 Shape Sort (one set per group)

TIS#1.1 (transparency, optional)

TIS#1.2 (transparency, optional)

TIS#1.6 (Journal prompt)

Scratch paper, $8\frac{1}{2}'' \times 8\frac{1}{2}''$

Glue

Scissors

Poster paper or construction paper (12" x 18")

Student journals

NCTM 2000 Standards Addressed

Standard: Geometry

Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships:

Grade 3-5

- identify, compare, and analyze attributes of two- and three-dimensional geometric shapes and develop vocabulary to describe the attributes;
- classify two- and three-dimensional shapes according to their properties and develop definitions of classes of shapes such as triangles and pyramids;
- explore congruence and similarity;
- make and test conjectures about geometric properties and relationships and develop logical arguments to justify conclusions.

Grade 6-8

- precisely describe, classify, and understand relationships among types of two- and three-dimensional objects using their defining properties;

- create and critique inductive and deductive arguments concerning geometric ideas and relationships, such as congruence, similarity, and the Pythagorean relationship.

Instructional programs from prekindergarten through grade 12 should enable all students to:

Standard: Reasoning and Proof

- make and investigate mathematical conjectures.

Standard: Communication

- communicate their mathematical thinking coherently and clearly to peers, teachers, and others;
- use the language of mathematics to express mathematical ideas precisely.

California Standards Addressed

Measurement & Geometry

Grade 5

2.0 Students identify, describe, and classify the properties of, and the relationships between, plane and solid geometric figures:

- 2.2 Know that the sum of the angles of any triangle is 180° and the sum of the angles of any quadrilateral is 360° and use this information to solve problems.

Grade 6

2.0 Students identify and describe the properties of two-dimensional figures:

- 2.1 Identify angles as vertical, adjacent, complementary and/or supplementary, and provide descriptions of these terms.

Mathematical Reasoning

3.0 Students move beyond a particular problem by generalizing to other situations:

Grade 5

- 3.3 Develop generalizations of the results obtained and apply them in other circumstances.

Grade 6

- 3.3 Develop generalizations of the results obtained and the strategies and apply them in new problem situations.

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Program Outline

Pre-Viewing Activities

Arrange students in pairs.
Administer Review Quiz, Page 6

Program Viewing

Welcome	Introductions /Distance Learning Program Format
Focus	Students review two-dimensional geometric shapes and terms.
Activity #1	Shape Sort
DLI	Discusses polygons and introduces the activity <i>YOUR TIME</i>
CT	Facilitates activity
S	Work in groups to sort the designs and justify results
Activity #2	Folding
DLI	Introduces and demonstrates the activity and reviews geometric terms <i>YOUR TIME</i>
CT	Facilitates the activity
S	Follow instructions of the DLI as they proceed with the folding and make a list of geometric terms
Activity #3	Review Geometric Terms
DLI	Correct Pre-Viewing Activity Introduces the activity
CT	Facilitates the activity
S	Put terms in gadget <i>YOUR TIME</i>
DLI	Demonstrates use of gadget <i>YOUR TIME</i>
CT	Facilitates the activity
S	Play review games with partners
Journal Writing	Describe a concave polygon to a 4th grader.

KEY	<i>DLI: Distance Learning Instructor</i>	<i>CT: Classroom Teacher</i>	<i>S: Students</i>
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Instructions for Program Viewing

Activity #1: Geometric Shape Sort

Description

Students work with their group to sort and classify cards with geometric shapes.

Advance Preparation

Duplicate SAS#1.1, one set (two pages) per group.
Cut out each card prior to the program and place in an envelope.

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Materials

Poster paper (12" x 18") or construction paper to record sort
Glue

Lesson Implementation

The Distance Learning Instructor introduces and describes the activity. The Classroom Teacher facilitates by encouraging students to come to a group consensus and justify their sort. Students work in groups. They look at the shape cards, SAS#1.1, and begin to group the cards by attributes. Once they have decided on their sort, they arrange the shape cards on a 12"x18" sheet of paper according to attributes, glue down the shapes, and display their work.

Each group then shares how they decided to sort the shape cards.

Teacher Note

There are a variety of geometric shapes that are included for sorting. Students will find attributes to sort the shapes by (number of sides, degrees of angles, types of polygons, etc). It is important that the teacher not lead students to sort in any predetermined direction. If students need help getting started, suggest a few of the ways mentioned above.

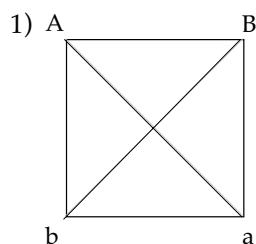
Organizing and displaying their sort can be done in a variety of ways. Some groups will use sections of the paper to group the shapes, some may create a graph, others may use a Venn Diagram. Students should be able to justify their sort. Pages 13-15 have the geometric attributes. These can be enlarged as posters or shown as transparencies to help students see attributes of geometric shapes.

Activity #2: Folding

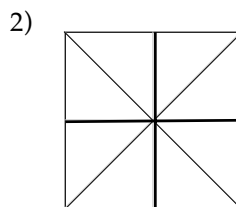
Description

Students use a square sheet of paper ($8\frac{1}{2}'' \times 8\frac{1}{2}''$) to review attributes of shapes and vocabulary as they practice folding. The Distance Learning Instructor demonstrates and instructs the students through each step of the folding. Short *YOUR TIME* segments are provided to complete some folds and to list the geometric shapes and terms they recognize as they fold. All instructions for the folding will be on-air.

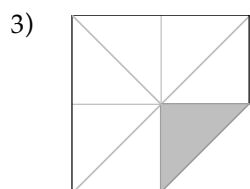
Folding instructions for this Gadget



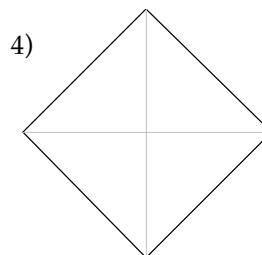
Fold along each diagonal and unfold. (Fourths, angle bisector, square, triangles, right angles, right triangles, acute angles, degree readings, congruent, symmetry, etc).



Fold each side to its opposite side, then unfold.



Fold each corner to the center point of the paper. Students create a quadrilateral, pentagon, and hexagon as they complete these steps.



Flip this shape over and repeat step 3, folding each corner to the center point.

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Materials

- Scissors
- $8\frac{1}{2}$ " x $8\frac{1}{2}$ " paper (scratch)

Lesson Implementation

The Distance Learning Instructor introduces the activity and takes the students through each of the steps. Students use another paper, do the paper folding, and review attributes of shapes. The Classroom Teacher facilitates the activity

Teacher Note

Origami involves precise folding (fine motor skills). Assist students who have difficulty. TIS #1.1 has the basic fold types used in origami.

Origami is a form of art from Japan. The word "ori" is the Japanese verb "to fold" and "gami" is the noun "paper" (TIS#1.2 has the Japanese characters for origami). Origami provides a wonderful opportunity for students to review and create geometric shapes. It also offers an opportunity to review geometric terms, shapes, and angles.

Activity #3: Review Geometric Terms

Description

Students review geometric terms as they put vocabulary words and definitions into their gadget and play review games with their partners.

Advance Preparation

- Duplicate Review Quiz, one per student
- Administer Review Quiz as Pre-Viewing Activity

Materials

- Review Quiz
- Gadget from Activity #2

Lesson Implementation

The Distance Learning Instructor corrects Review Quiz from Pre-Viewing Activity, instructs students to use geometric terms in gadget and demonstrates how to use the gadget to play review games. Two YOUR TIME segments are provided for this activity. During the YOUR TIME segments, students use geometric terms from quiz and Activities #1 and #2 to write terms and definitions in gadget and play review games with their partners. The Classroom Teacher facilitates by checking student understanding for terms and instructions.

Teacher Note: Answers to Review Quiz

- 1) A. acute triangle
- 2) C. quadrilaterals
- 3) B. equilateral triangle
- 4) D. hexagon
- 5) C. isosceles triangle
- 6) D. trapezoid
- 7) D. obtuse triangle
- 8) A. parallelogram B. rectangle
- 9) B. right triangle
- 10) C. scalene triangle

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Post-Viewing Activities

Have students share their list of geometric terms.

Complete Activity #1

- Display student work.
- Have each group share how they decided to sort the shapes.
- Discuss the importance of using attributes to sort, classify, communicate, and learn.

Multicultural Sort – SAS#1.2

- Have students follow the same procedures as those in Hands-On #1
- Display student work.
- Have students share their reasons for their sort.

Optional Post-Viewing Activities

Give students other origami experiences.

- Origami activities and literature, see below.
- Have students investigate the sources of some of the designs on SAS#1.2

Bibliography

Books on origami are also available in public and school libraries.

Origami Instructions and Activities

Aytüra-Scheele, Zülal. *Paperfolding Fun Origami in Color*. New York: Gallery Books, 1986.

Fuse, Tomoko. *Unit Origami: Multidimensional Transformations*. Tokyo & New York: Japan Publications Inc., 1990.

Honda, Isao. *The World of Origami*. San Francisco & Japan: Japan Publications Trading Company, 1965.

Kasahara, Kunihiko. *Origami Made Easy*. Tokyo: Japanese Publications, 1973.

Nakano, Dokuohtei. *Easy Origami*. London, England: Penguin Group, 1985.

Pearl, Barbara. *Math in Motion: Origami in the Classroom*. Newport Beach, CA, 1994.

Sakata, Hideaki. *Origami*. Tokyo: Graph-Sha Ltd, 1990.

Children's Literature that Involve Paper Folding

Bang, Molly. *The Paper Crane*. New York: William Morrow & Company, Inc. 1985.

Coerr, Eleanor. *Sadako and the Thousand Paper Cranes*. New York: G.P. Putnam's Sons, 1978.

Hamanaka, Elaine. *Peace Crane*. New York: Morrow, 1995.

Kroll, Virginia. *Pink Paper Swans*. Michigan: Eerdman, 1994.

Laurin, Anne. *Perfect Crane*. New York: Harper & Row, 1981.

Video Tape

PBS, Reading Rainbow, tape # 409, "The Paper Crane." (Demonstrates origami folds, tells the story, *The Paper Crane*, and ends the program with a taiko drum group performance).

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Name _____

Date _____

Review Quiz

Read each question and circle the correct answer.

1. What is the name of a triangle whose angles are all less than 90° ?
A. acute triangle **B. equilateral triangle**
C. isosceles triangle **D. obtuse triangle**
2. What is the name of all four-sided polygons?
A. parallelograms **B. rectangles**
C. quadrilaterals **D. trapezoids**
3. What is the name of a triangle with three congruent sides?
A. acute triangle **B. equilateral triangle**
C. isosceles triangle **D. obtuse triangle**
4. What is the name for a six-sided polygon?
A. quadrilateral **B. pentagon**
C. rhombus **D. hexagon**
5. What is the name of a triangle with exactly two congruent sides?
A. acute triangle **B. equilateral triangle**
C. isosceles triangle **D. obtuse triangle**
6. Which four-sided polygon has only one pair of parallel sides?
A. parallelogram **B. rectangle**
C. quadrilateral **D. trapezoid**
7. What is the name of a triangle that has one angle which measures greater than 90° ?
A. acute triangle **B. equilateral triangle**
C. isosceles triangle **D. obtuse triangle**
8. Which four-sided polygon has two pairs of congruent, parallel sides?
A. parallelogram **B. rectangle**
C. quadrilateral **D. trapezoid**
9. What is the name of a triangle that contains a 90° angle?
A. acute triangle **B. right triangle**
C. obtuse triangle **D. equilateral triangle**
10. What is the name of a triangle which has no congruent sides?
A. isosceles triangle **B. equilateral triangle**
C. scalene triangle **D. obtuse triangle**

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SAS#1.1

Geometric Shape Sort

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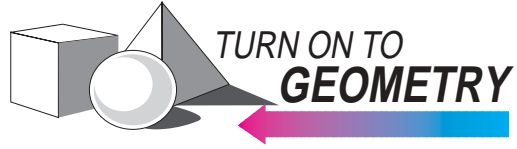


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SAS#1.1

Geometric Shape Sort (cont'd)

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SAS#1.2

Multicultural Design Cards

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SAS#1.2

Multicultural Design Cards (cont'd)

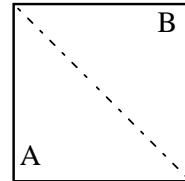
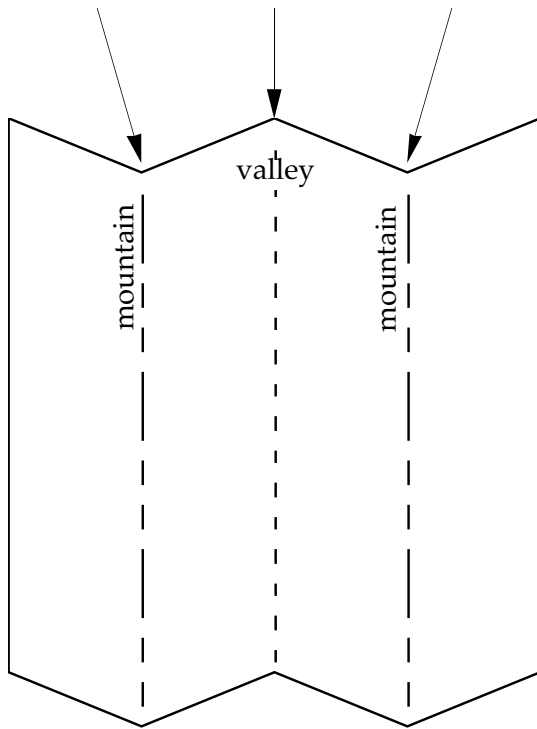
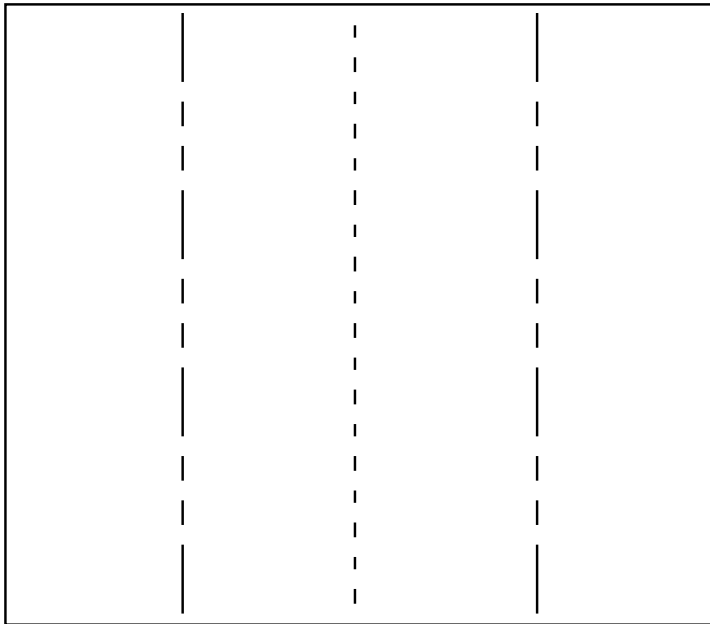
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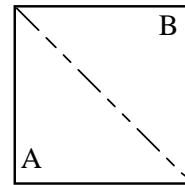
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TIS#1.1

Basic Origami Folds



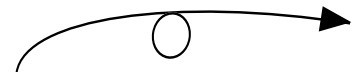
The dotted line indicates a **Valley** fold. Corners A and B come together.



This broken line indicates a **Mountain** fold. Corners A and B come together back-to-back.



Lines with arrows designate the direction the fold should go.



Lines with a loop designate to turn the paper over.



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TIS#1.2

Japanese Characters for Origami

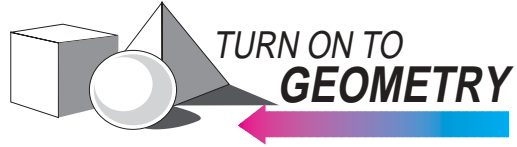
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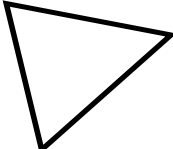

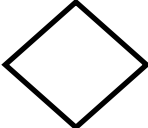
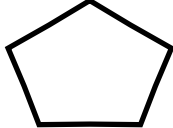



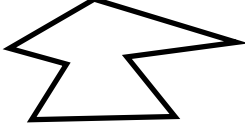
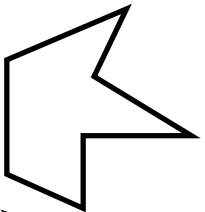
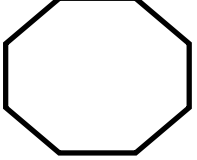
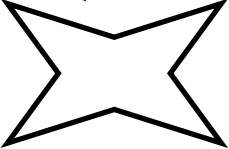
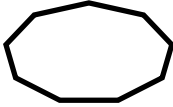
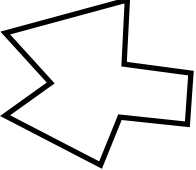
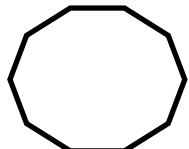
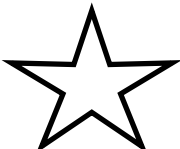
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TIS#1.3

Names of Polygons and their Attributes

Name	# of Sides	Examples	
triangle	3		
quadrilateral	4		
pentagon	5		
hexagon	6		
heptagon	7		
octagon	8		
nonagon	9		
decagon	10		

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TIS#1.4

Names of Polygons and their Attributes

Triangles

acute	All angles are less than 90°
equilateral	All three sides and three angles are congruent
isosceles	Two sides and two angles are congruent
obtuse	One angle is greater than 90°
right	One angle is equal to 90°
scalene	No congruent sides, no equal angles

Quadrilaterals

parallelogram	Two sets of parallel sides, opposite sides are congruent
rectangle	A parallelogram in which angles all equal 90°
square	A rectangle having all four sides are equal
rhombus	Four equal sides, opposite angles are congruent
trapezoid	One set of parallel sides

Note: TIS#1.3 and TIS#1.5 have diagrams to support this page

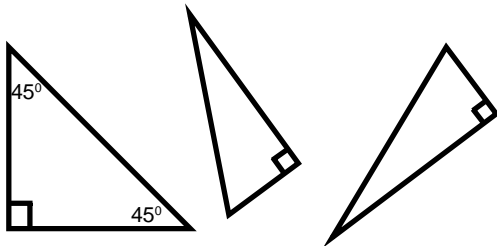
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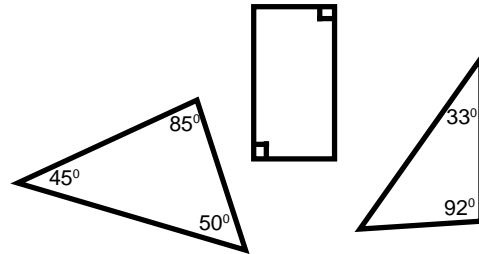
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TIS# 1.5

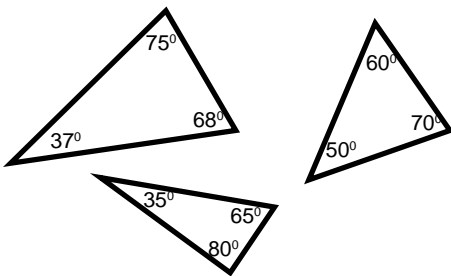
Triangles and Their Attributes



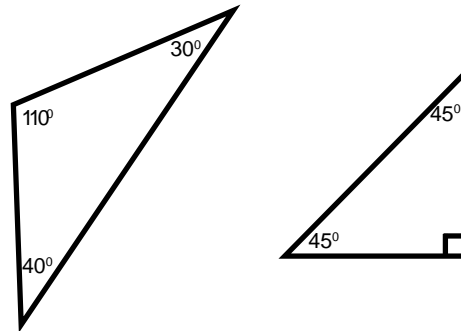
Right Triangles



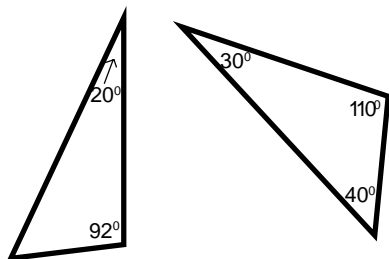
Not right triangles



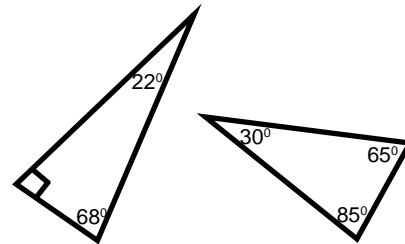
Acute Triangles



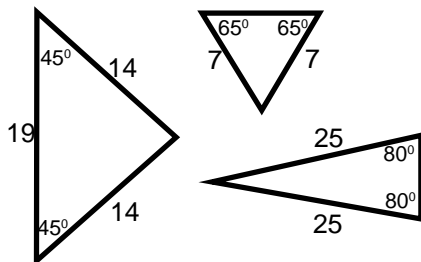
Not acute triangles



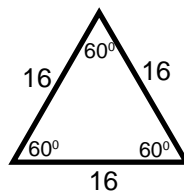
Obtuse Triangles



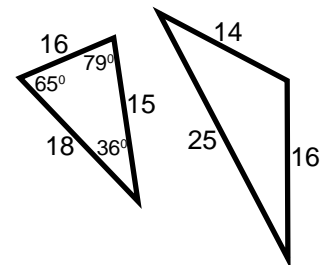
Not obtuse triangles



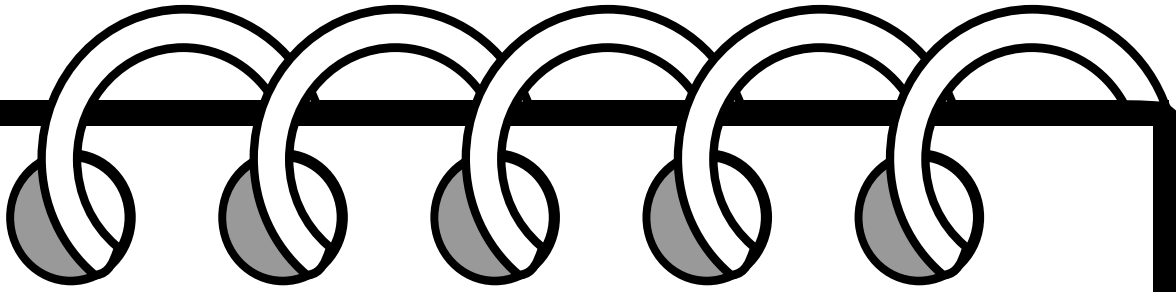
Isosceles Triangles



Equilateral Triangle



Scalene Triangle



Journal Writing

Describe a
concave
polygon
to a
4th grader.

