



CLASSIFYING GEOMETRIC SHAPES

5.G.4

CONTENTS

The types of documents contained in the unit are listed below. Throughout the unit, the documents are arranged by lesson.

LEARNING MAP INFORMATION	An overview of the standards, the learning map section, and the nodes addressed in this unit
TEACHER NOTES	A brief discussion describing the progression depicted in the learning map section with research-based recommendations for focusing instruction to foster student learning and an introduction to the unit's lessons
OVERVIEW OF INSTRUCTIONAL ACTIVITIES	A table highlighting the lesson goals and nodes addressed in each lesson of this unit
INSTRUCTIONAL ACTIVITY	A detailed walkthrough of the unit
INSTRUCTIONAL ACTIVITY STUDENT HANDOUT	A handout for the guided activity, intended to be paired with the Instructional Activity
INSTRUCTIONAL ACTIVITY SUPPLEMENT	A collection of materials or activities related to the Instructional Activity
STUDENT ACTIVITY	A work-alone activity for students
STUDENT ACTIVITY SOLUTION GUIDE	A solution guide for the work-alone activity with example errors, misconceptions, and links to the learning map section

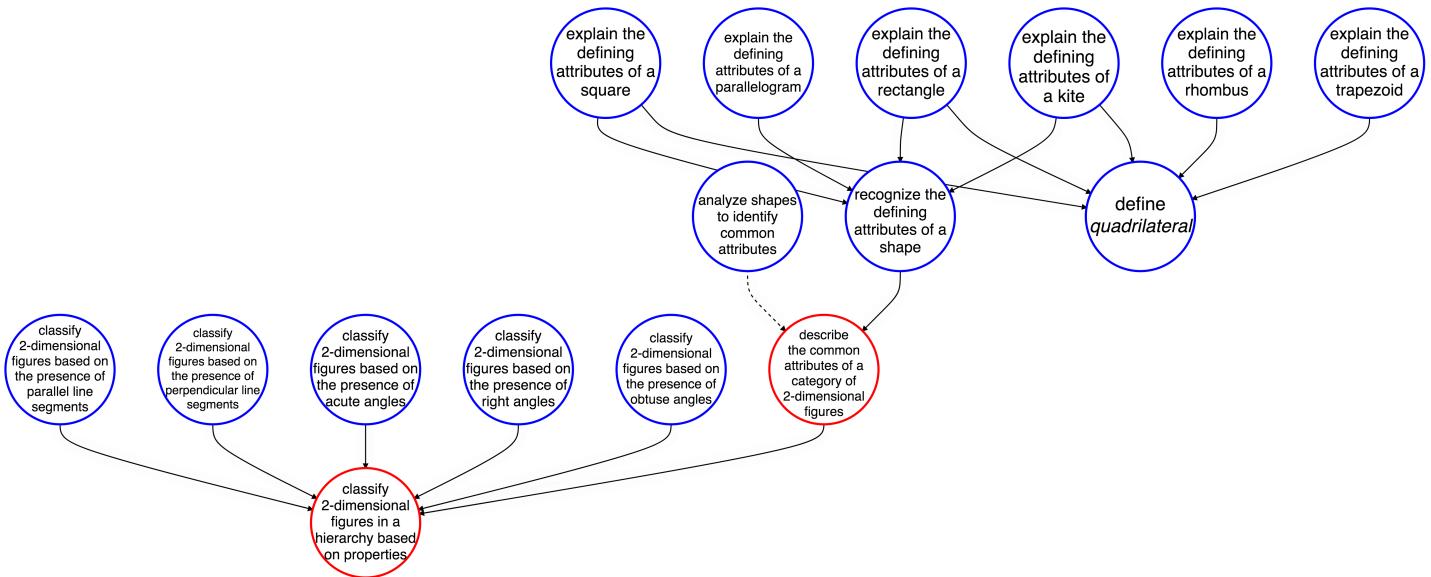
CLASSIFYING QUADRILATERALS BASED ON PROPERTIES

LEARNING MAP INFORMATION

STANDARDS

5.G.4 Classify two-dimensional figures in a hierarchy based on properties.

NOTE: Triangles are not addressed in this unit.



*Learning map model of 5.G.4

Node Name	Node Description
ANALYZE SHAPES TO IDENTIFY COMMON ATTRIBUTES	Analyze and compare shapes using informal language to describe their similarities, differences, parts, and other attributes.
CLASSIFY 2-DIMENSIONAL FIGURES BASED ON THE PRESENCE OF PARALLEL LINE SEGMENTS	Group two-dimensional figures based on the number of pairs of parallel line segments.
CLASSIFY 2-DIMENSIONAL FIGURES BASED ON THE PRESENCE OF PERPENDICULAR LINE SEGMENTS	Group two-dimensional figures based on the number of pairs of perpendicular line segments.
CLASSIFY 2-DIMENSIONAL FIGURES BASED ON THE PRESENCE OF ACUTE ANGLES	Group two-dimensional figures based on the number of acute angles.
CLASSIFY 2-DIMENSIONAL FIGURES BASED ON THE PRESENCE OF OBTUSE ANGLES	Group two-dimensional figures based on the number of obtuse angles.
CLASSIFY 2-DIMENSIONAL FIGURES BASED ON THE PRESENCE OF RIGHT ANGLES	Group two-dimensional figures based on the number of right angles.
CLASSIFY 2-DIMENSIONAL FIGURES IN A HIERARCHY BASED ON PROPERTIES	Classify two-dimensional figures in a hierarchy based on the shapes' properties. For example, a hierarchy would be polygons, rectangles, and squares.
COMPARE AND CONTRAST THE PROPERTIES OF 2 OR MORE SHAPES	Compare two or more shapes by describing their shared and different geometric properties (e.g., rectangles and rhombuses both have four congruent sides, but their angles' properties are different).
DEFINE QUADRILATERAL	Define a quadrilateral as a four-sided figure.
DESCRIBE THE ATTRIBUTES OF SHAPES	Describe different attribute values of shapes. For instance, how many sides does a shape have?
DESCRIBE THE COMMON ATTRIBUTES OF A CATEGORY OF 2-DIMENSIONAL FIGURES	Make known your understanding of the common attributes belonging to a category of two-dimensional figures.
EXPLAIN THE DEFINING ATTRIBUTES OF A KITE	Make known your understanding that a kite is a quadrilateral with exactly two nonoverlapping pairs of adjacent congruent sides and one pair of opposite congruent angles.
EXPLAIN THE DEFINING ATTRIBUTES OF A PARALLELOGRAM	Make known your understanding that a parallelogram is a quadrilateral with two pairs of parallel sides.
EXPLAIN THE DEFINING ATTRIBUTES OF A RECTANGLE	Make known your understanding that a rectangle is a quadrilateral with two pairs of parallel sides and four right angles.
EXPLAIN THE DEFINING ATTRIBUTES OF A RHOMBUS	Make known your understanding that a rhombus is a quadrilateral with congruent sides.
EXPLAIN THE DEFINING ATTRIBUTES OF A SQUARE	Make known your understanding that a square is a quadrilateral with four congruent sides, two pairs of parallel sides, and four right angles.
EXPLAIN THE DEFINING ATTRIBUTES OF A TRAPEZOID	Make known your understanding that a trapezoid is a quadrilateral with at least one pair of parallel sides.
EXPLAIN THE DEFINING ATTRIBUTES OF SHAPES	Make known your understanding that shapes have defining attributes (e.g., triangles are closed and three-sided).
RECOGNIZE ACUTE ANGLES IN A 2-DIMENSIONAL FIGURE	Identify or name acute angles in a two-dimensional figure.
RECOGNIZE OBTUSE ANGLES IN A 2-DIMENSIONAL FIGURE	Identify or name obtuse angles in a two-dimensional figure.

RECOGNIZE PARALLEL LINE SEGMENTS IN A 2-DIMENSIONAL FIGURE	Identify or name parallel line segments in a two-dimensional figure.
RECOGNIZE PERPENDICULAR LINE SEGMENTS IN A 2-DIMENSIONAL FIGURE	Identify or name perpendicular line segments in a two-dimensional figure.
RECOGNIZE RIGHT ANGLES IN A 2-DIMENSIONAL FIGURE	Identify or name right angles in a two-dimensional figure.
RECOGNIZE THE DEFINING ATTRIBUTES OF A SHAPE	When presented with a shape, correctly communicate its defining attributes.

ADDITIONAL NODES RELATED TO THIS UNIT OF INSTRUCTION

Node Name	Node Description	Related Node
EXPLAIN ACUTE ANGLE	Make known your understanding that an acute angle is an angle whose measurement is less than 90 degrees.	Connected to RECOGNIZE ACUTE ANGLES IN A 2-DIMENSIONAL FIGURE
EXPLAIN OBTUSE ANGLE	Make known your understanding that an obtuse angle is an angle whose measurement is more than 90 degrees and less than 180 degrees.	Connected to RECOGNIZE OBTUSE ANGLES IN A 2-DIMENSIONAL FIGURE
EXPLAIN PARALLEL LINES/SEGMENTS	Make known your understanding that parallel lines/segments are lines/segments that are a constant distance apart and will never touch or cross.	Connected to RECOGNIZE PARALLEL LINE SEGMENTS IN A 2-DIMENSIONAL FIGURE
EXPLAIN PERPENDICULAR LINES/SEGMENTS	Make known your understanding that perpendicular lines/segments are two lines/segments that meet at a 90 degree angle.	Connected to RECOGNIZE PERPENDICULAR LINE SEGMENTS IN A 2-DIMENSIONAL FIGURE
RECOGNIZE KITE	When presented a set of different shapes, select the kite.	Prerequisite of DESCRIBE THE ATTRIBUTES OF SHAPES and EXPLAIN THE DEFINING ATTRIBUTES OF A KITE
RECOGNIZE PARALLELOGRAM	When presented a set of different shapes, select the parallelogram.	Prerequisite of DESCRIBE THE ATTRIBUTES OF SHAPES and EXPLAIN THE DEFINING ATTRIBUTES OF A PARALLELOGRAM
RECOGNIZE RECTANGLE	When presented a set of different shapes, select the rectangle.	Prerequisite of DESCRIBE THE ATTRIBUTES OF SHAPES and EXPLAIN THE DEFINING ATTRIBUTES OF A RECTANGLE
RECOGNIZE RHOMBUS	When presented a set of different shapes, select the rhombus.	Prerequisite of DESCRIBE THE ATTRIBUTES OF SHAPES and EXPLAIN THE DEFINING ATTRIBUTES OF A RHOMBUS
RECOGNIZE SQUARE	When presented a set of different shapes, select the square.	Prerequisite of DESCRIBE THE ATTRIBUTES OF SHAPES and EXPLAIN THE DEFINING ATTRIBUTES OF A SQUARE
RECOGNIZE TRAPEZOID	When presented a set of different shapes, select the trapezoid.	Prerequisite of DESCRIBE THE ATTRIBUTES OF SHAPES and EXPLAIN THE DEFINING ATTRIBUTES OF A TRAPEZOID

CLASSIFYING GEOMETRIC SHAPES

TEACHER NOTES

This unit includes the following documents:

- ▶ Learning Map Information
- ▶ Instructional Activity (four lessons)
- ▶ Instructional Activity Student Handout (Lesson 3)
- ▶ Instructional Activity Supplements (Lessons 2 and 4)
- ▶ Student Activity
- ▶ Student Activity Solution Guide

In this unit, students learn to recognize and accurately describe the attributes of two-dimensional geometric shapes. Students will recognize different representations of the attributes and classify shapes according to one or more common attributes.

RESEARCH

As students proceed through the activities, we expect their understanding of shapes to move from the ability to recognize shapes solely based on their appearance to the ability to name and classify shapes based on the attributes that define different quadrilaterals (squares, rectangles, rhombuses, kites, parallelograms, and trapezoids). The activities require students to compare shapes by identifying their similarities and differences and then to classify shapes into categories defined by one or more characteristics. Instruction that focuses on similarities and differences provides opportunities for students to form cognitive connections and effectively strengthens conceptual understanding (Marzano, Pickering, & Pollock, 2001).

LEARNING MAP INFORMATION

The learning map section for this sequence of activities reflects that students will proceed through three levels of geometric thinking (van Hiele, 1986). Students operating at the first level of geometric thinking can visually recognize particular shapes. This level is represented in the learning map section by the nodes [RECOGNIZE SQUARE](#), [RECOGNIZE RECTANGLE](#), [RECOGNIZE RHOMBUS](#), [RECOGNIZE KITE](#), [RECOGNIZE PARALLELOGRAM](#), and [RECOGNIZE TRAPEZOID](#). Too often, students have limited experiences and primarily engage with prototype shapes. This focus has the unintended consequence of narrowing students' perceptions of each shape. For example, students whose primary experiences are restricted to equilateral or isosceles triangles with horizontal bases may not recognize a scalene triangle as a triangle. Through more varied experiences and instruction, however, students can proceed to the second level of geometric thinking, where they can analyze shapes and use their properties to classify them. This level is represented in the learning map section by the nodes [RECOGNIZE RIGHT/ACUTE/OBTUSE ANGLES](#), [RECOGNIZE PARALLEL/PERPENDICULAR LINES/SEGMENTS](#), and [RECOGNIZE \[EACH OF THESE PROPERTIES\] IN A 2-DIMENSIONAL FIGURE](#). After students can identify properties

such as parallel sides or right angles in single figures, they can proceed to the third level of geometric thinking, where they consider figures simultaneously, compare their properties, and identify shapes with one or more common attributes. This level is represented in the learning map section by [DESCRIBE THE COMMON ATTRIBUTES BELONGING TO A CATEGORY OF 2-DIMENSIONAL FIGURES](#). Students operating at this level are prepared to explain why a rhombus is also a parallelogram and how a rhombus is like and unlike a square ([CLASSIFY 2-DIMENSIONAL FIGURES IN A HIERARCHY BASED ON PROPERTIES](#)).

INSTRUCTIONAL ACTIVITIES

The activities in this unit are designed to introduce students to classifying shapes through concrete and pictorial representations. Students will first construct a library of images of the properties that define different shapes. Then students will work with collections of cutout shapes to identify which shapes have each of the properties in students' libraries. At this point, it is more important for students to match the property names to their appearance in the different shapes than it is for students to name the shapes.

After students practice classifying shapes according to single properties (e.g., all the shapes with one or more right angle, or all the shapes with parallel sides), they should group shapes according to multiple common properties but not necessarily only the combinations that define particular shapes. For example, one category might include shapes with only one right angle and one pair of parallel sides; this grouping results in a subset of trapezoids rather than all trapezoids. This activity may include categories that define particular shapes, which should prompt students to recognize that some shapes belong to multiple categories. For example, a category could include all shapes with two pairs of parallel sides and four right angles. Students should place some squares and some rectangles in this category; an appropriate follow-up activity can have students compare this group of shapes to the requirements for squares (two pairs of parallel sides, four right angles, and four sides of equal length). This is the best time to introduce the names of the shape categories and associate those names with their defining attributes.

Common differentiation strategies include covering part of a shape in order to isolate specific attributes or properties of the shape, practicing vocabulary by drawing examples of specific attributes or properties, and referring back to the library of photo examples created in [LESSON 1](#).

It may be helpful to make a class set of polygons on cardstock for future use and have students help cut them out. These polygons can be stored in envelopes to use in future years.

REFERENCES

- Marzano, R. J., Pickering, D. J., & Pollock, J. E. (2001). *Classroom instruction that works: Research-based strategies for increasing student achievement*. Alexandria, VA: Association for Supervision and Curriculum Development.
- van Hiele, P. M. (1986). *Structure and insight: A theory of mathematics education*. Orlando, FL: Academic Press.

CLASSIFYING GEOMETRIC SHAPES

OVERVIEW OF INSTRUCTIONAL ACTIVITIES

Lesson	Learning Goal	Nodes Addressed
Lesson 1	Students will learn the names of the attributes that are used to define quadrilaterals. The critical outcome of this activity is for students to construct an accurate image of each attribute and to label each image correctly.	<ul style="list-style-type: none"> ▶ EXPLAIN ACUTE ANGLE ▶ EXPLAIN OBTUSE ANGLE ▶ EXPLAIN PARALLEL LINES/SEGMENTS ▶ EXPLAIN PERPENDICULAR LINES/SEGMENTS
Lesson 2	Students will classify shapes according to single attributes.	<ul style="list-style-type: none"> ▶ DESCRIBE THE ATTRIBUTES OF SHAPES ▶ ANALYZE SHAPES TO IDENTIFY COMMON ATTRIBUTES
Lesson 3	Students will describe multiple attributes of shapes.	<ul style="list-style-type: none"> ▶ DESCRIBE THE ATTRIBUTES OF SHAPES ▶ ANALYZE SHAPES TO IDENTIFY COMMON ATTRIBUTES ▶ EXPLAIN THE DEFINING PROPERTIES OF [EACH SHAPE] ▶ RECOGNIZE [THE PRESENCE OF EACH PROPERTY] IN [THESE SHAPES]
Lesson 4	Students will classify shapes according to the defining attributes of quadrilaterals (squares, rectangles, rhombuses, parallelograms, kites, and trapezoids). Students will recognize hierarchical membership defined by common attributes of shapes (e.g., squares are also rectangles).	<ul style="list-style-type: none"> ▶ CLASSIFY 2-DIMENSIONAL FIGURES IN A HIERARCHY BASED ON PROPERTIES

CLASSIFYING GEOMETRIC SHAPES

INSTRUCTIONAL ACTIVITY

Lesson 1

LEARNING GOAL

Students will learn the names of the attributes that are used to define quadrilaterals. The critical outcome of this activity is for students to construct an accurate image of each attribute and to label each image correctly.

PRIMARY ACTIVITY

Students will create and label examples of these attributes:

- ▶ Line segment
 - ▶ Acute angle
 - ▶ Right angle
 - ▶ Obtuse angle
 - ▶ Parallel line segments
 - ▶ Perpendicular line segments
-

OTHER VOCABULARY

Students will need to know the meaning of

- ▶ Side (of a shape)
 - ▶ Opposite (sides)
 - ▶ Adjacent (sides)
-

MATERIALS

- ▶ Small, straight objects such as toothpicks, cocktail straws, or wooden skewers
 - ▶ Construction or plain paper
 - ▶ Glue (optional)
 - ▶ Digital camera (optional)
-

IMPLEMENTATION

There are different ways to build these representations. Have students construct examples of each attribute using their straight objects. Students can glue their examples to construction paper and label them, or if the technology is available, students can construct and label examples and then take digital photos of them using devices such as phones or tablets.

EXAMPLE IMAGES



GUIDING QUESTIONS

Determine if the student can [EXPLAIN ACUTE ANGLE](#):

- ▶ How is an acute angle different from a right angle?

Determine if the student can [EXPLAIN OBTUSE ANGLE](#):

- ▶ How is an obtuse angle different from a right angle?

Determine if the student can [EXPLAIN PARALLEL LINES/SEGMENTS](#):

- ▶ Can two line segments that meet at a point be parallel? Why or why not?

Determine if the student can [EXPLAIN PERPENDICULAR LINES/SEGMENTS](#):

- ▶ Can two line segments that meet at a point be perpendicular? Why or why not?
- ▶ Do lines need to intersect to be considered perpendicular?
- ▶ Are all intersecting lines perpendicular?
- ▶ Are all perpendicular lines intersecting?

Ask students to have their examples on their desks.

Show examples of each attribute without any labels, and ask students to identify each attribute with its proper name.

NOTE: If students have prior knowledge of the names and types of angles this activity can be adapted to be an exploration of angle measures using protractors.

A follow-up activity would be for students to identify examples of the attributes in the school building or at home. If students have access to digital cameras, they could take photos of the examples to show their peers.

CLASSIFYING GEOMETRIC SHAPES

INSTRUCTIONAL ACTIVITY

Lesson 2

LEARNING GOAL

Students will classify shapes according to single attributes.

PRIMARY ACTIVITY

Students will create groups of shapes that have one attribute in common.

MATERIALS

- ▶ Cutout shapes from the [INSTRUCTIONAL ACTIVITY SUPPLEMENT A](#), ideally on different colors of paper (10 of each shape for each student). Colors are suggested in the list below and are referred to in subsequent parts of the instructional activities.

NOTE: To extend this group of activities, include nonquadrilaterals, such as triangles, hexagons, circles, or ellipses, and their defining attributes.

- ▶ Square (red)
 - ▶ Rectangle (pink)
 - ▶ Rhombus (yellow)
 - ▶ Parallelogram (orange)
 - ▶ Kite (light green)
 - ▶ Right trapezoid (dark green)
 - ▶ Isosceles trapezoid (light blue)
 - ▶ Nonright, nonisosceles trapezoid (dark blue)
 - ▶ General quadrilateral with one right angle (purple)
 - ▶ Concave quadrilateral (gray)
 - ▶ Convex quadrilateral with no right angles (white)
- ▶ [INSTRUCTIONAL ACTIVITY SUPPLEMENT B](#) (Shapes available in color for color printing.)
 - ▶ Construction paper mats labeled at the bottom or top with one attribute name from the [INSTRUCTIONAL ACTIVITY SUPPLEMENT](#).

NOTE: Read each property precisely; that is, “one acute angle” means “exactly one acute angle.”

IMPLEMENTATION

In this activity students will create groups of paper shapes that share one common property.

Ask groups of students to arrange the paper property mats so none are on top of each other. Then ask the students to collect all of their pink shapes.

Ask students to place one pink shape on each mat representing an attribute that matches the pink shape. (The students should place pink shapes on the mats labeled *four right angles*, *two pairs of perpendicular sides*, *two pairs of parallel sides*, and *two pairs of opposite sides that are the same length*.)

Proceed through all the different shapes until each shape is placed on every mat where it belongs.

GUIDING QUESTIONS

Determine if the student can **DESCRIBE THE ATTRIBUTES OF SHAPES**:

- ▶ [Show a rectangle.] Find all of these shapes on your property mats. What are the properties that belong to this shape? Point to the parts of the shape that show each property.
- ▶ [Show a parallelogram.] Find all of these shapes on your property mats. What are the properties that belong to this shape? Point to the parts of the shape that show each property.

Determine if the student can **ANALYZE SHAPES TO IDENTIFY COMMON ATTRIBUTES**:

- ▶ [Show two different shapes.] Do these two shapes share any properties? What properties do they **not** share?
- ▶ Find two different shapes that share one or more property. Look for the same pair of shapes sitting together on one or more of your property mats.

Show one colored shape and ask students which properties from their mats belong to the shape. This will prepare students to examine shapes for multiple properties, which they will practice during the next activity by developing lists of properties for different shapes.

Some students may struggle to examine properties and prefer to name the shapes instead. For such a student, ask the student to return to their library of photos or examples of each property from [LESSON 1](#). Then pick a shape and cover up part of the shape to allow the student to focus on one aspect of the shape, for example, one angle. Point to the angle and ask “What kind of angle is this? What can you say about the lengths of the two opposite sides?” This scaffolding should help students begin to analyze shapes and [RECOGNIZE \[THE PRESENCE OF EACH PROPERTY\] IN \[THESE SHAPES\]](#).

CLASSIFYING GEOMETRIC SHAPES
INSTRUCTIONAL ACTIVITY SUPPLEMENT A

[Lesson 2](#)

SINGLE-PROPERTY CATEGORY LABELS

One acute angle

Two acute angles

Three acute angles

One right angle

Two right angles

Four right angles

One obtuse angle

Two obtuse angles

One pair of perpendicular sides

Two pairs of perpendicular sides

One pair of parallel sides

Two pairs of parallel sides

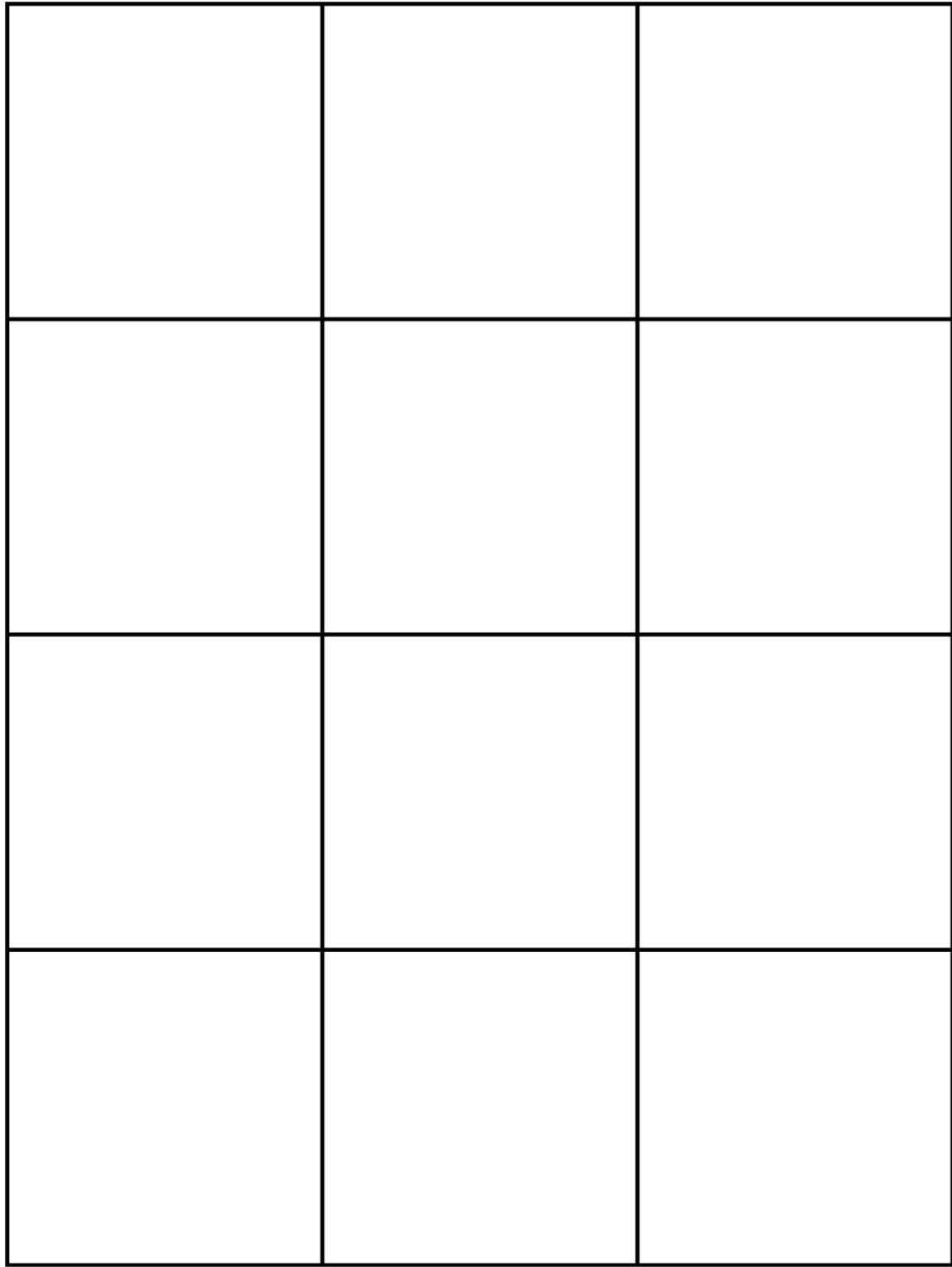
One pair of opposite sides that are the same length

Two pairs of opposite sides that are the same length

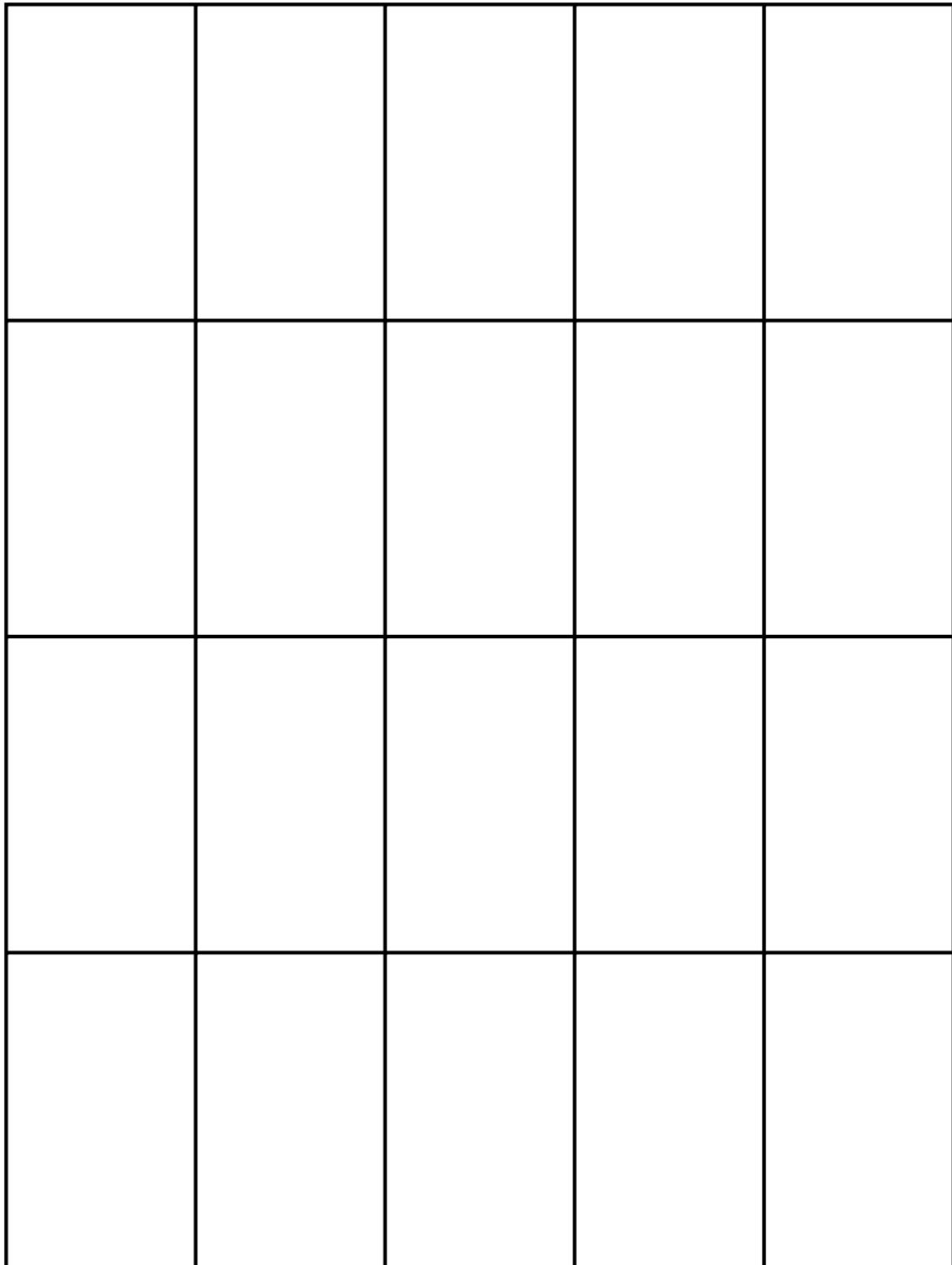
Four sides are the same length

One pair of adjacent sides that are the same length

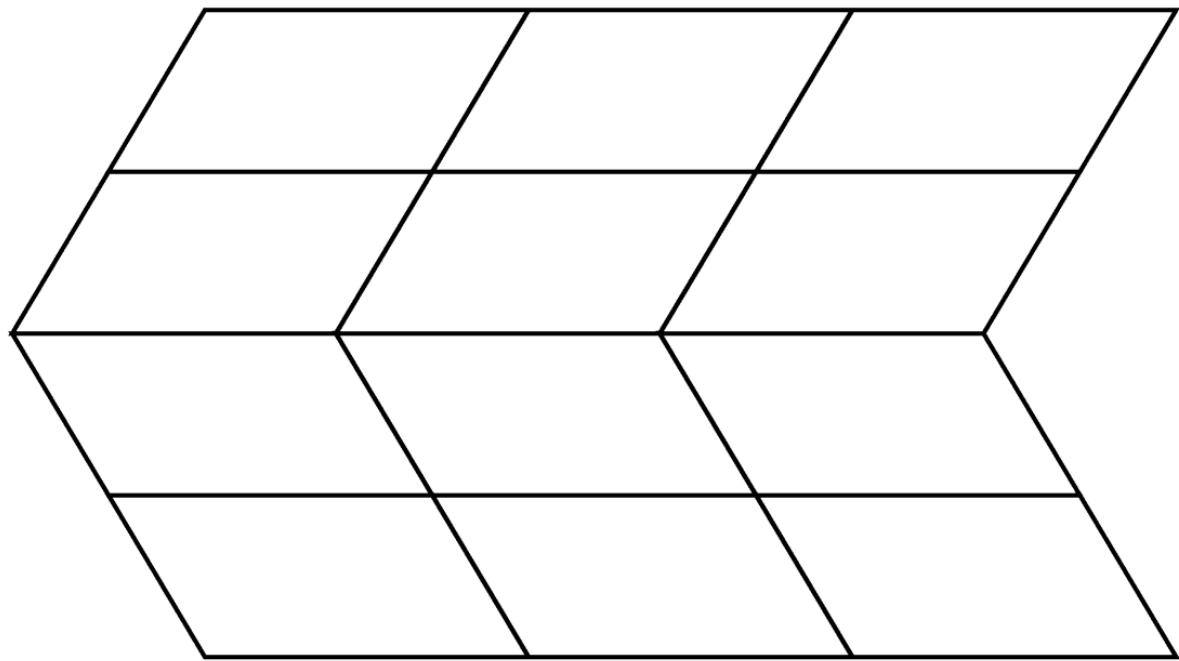
Square



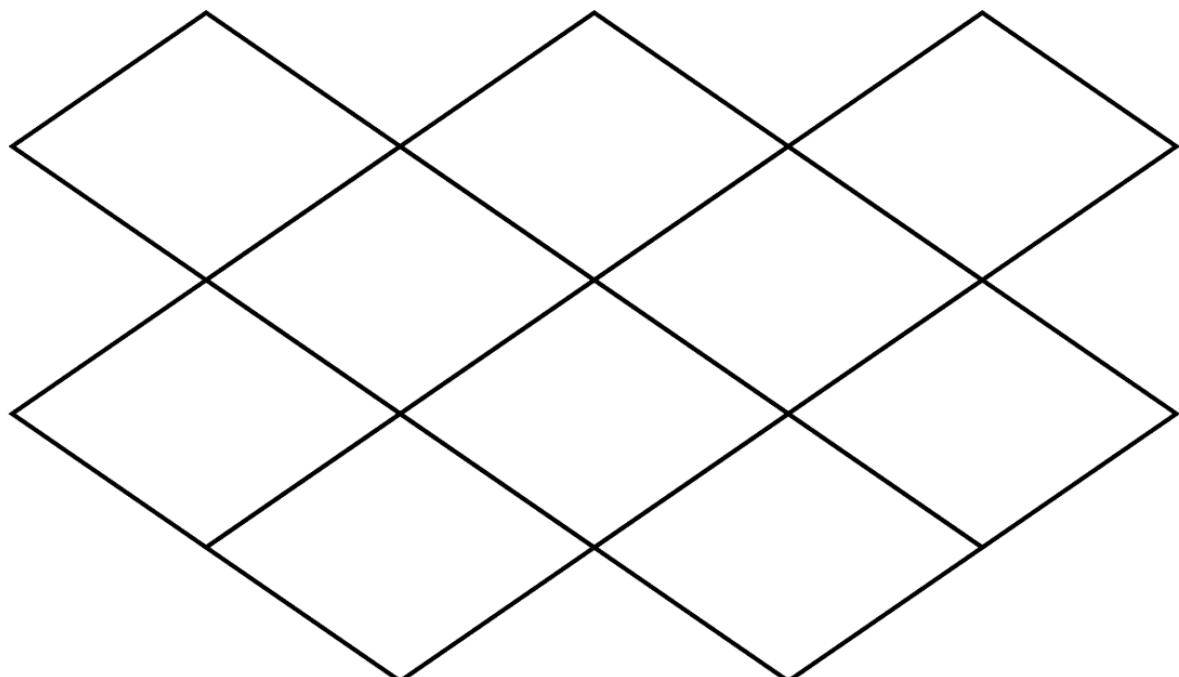
Rectangle



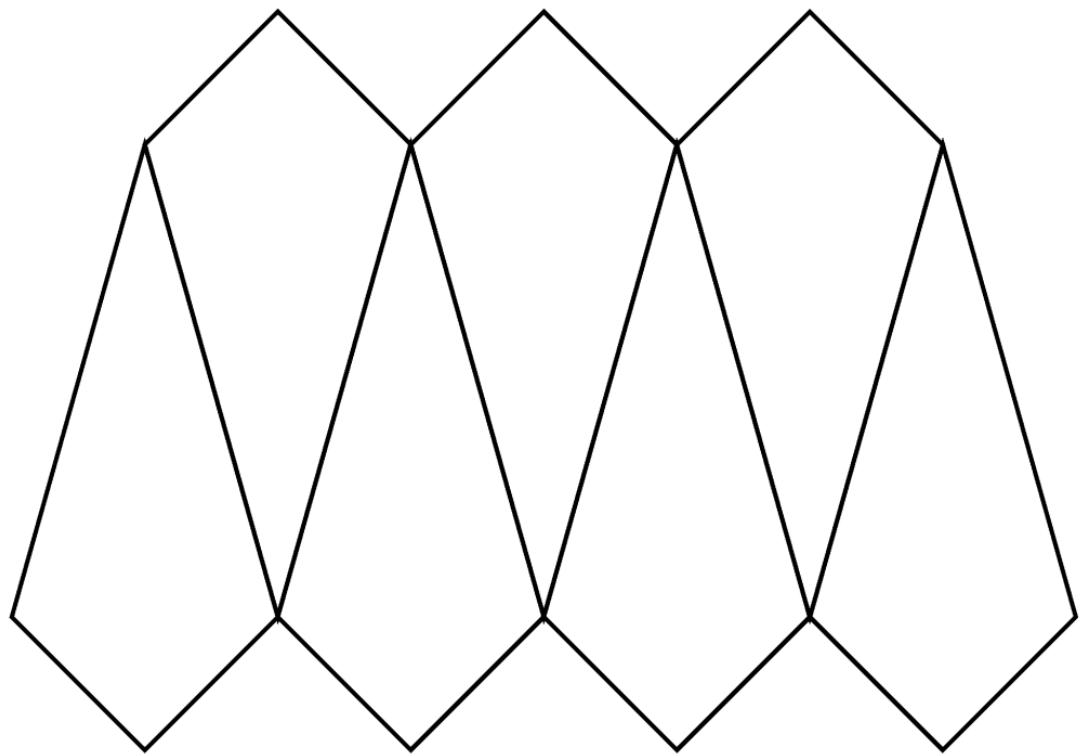
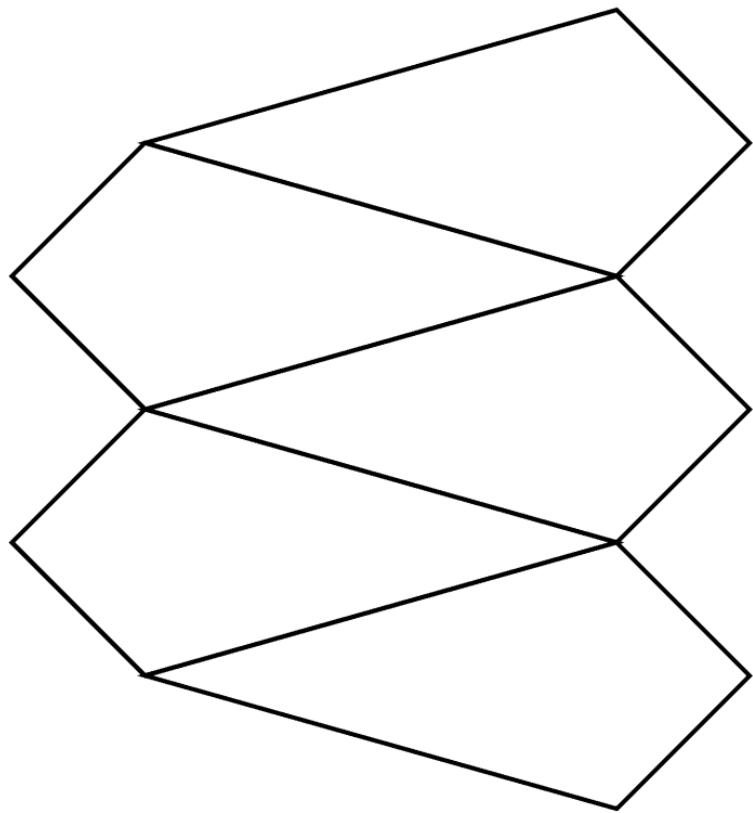
Parallelogram



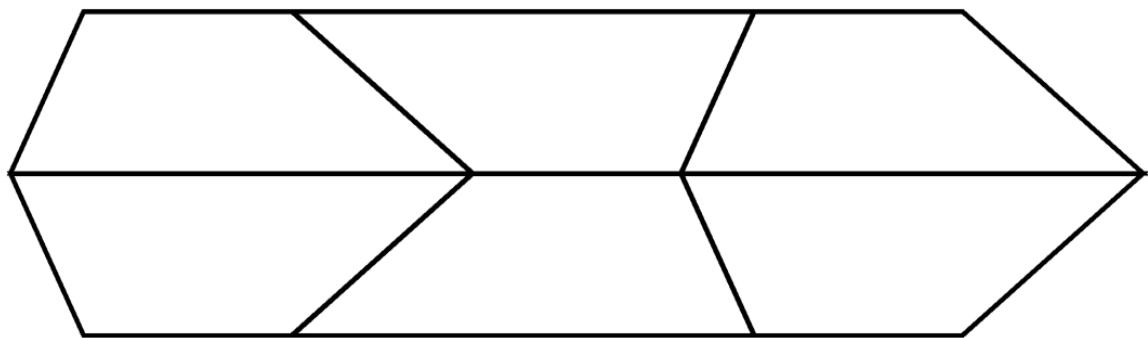
Rhombus



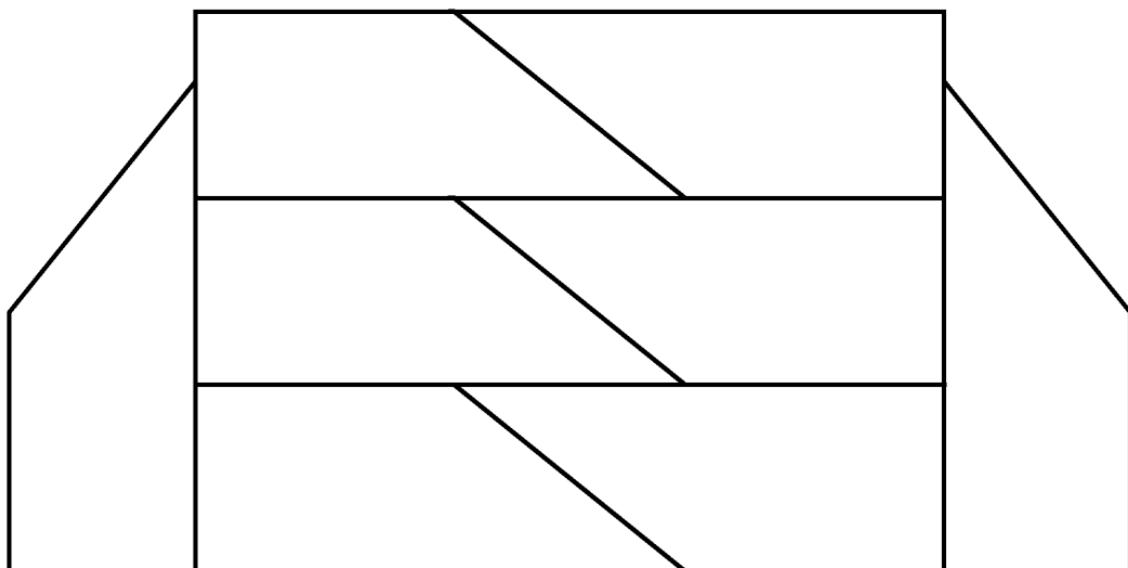
Kite



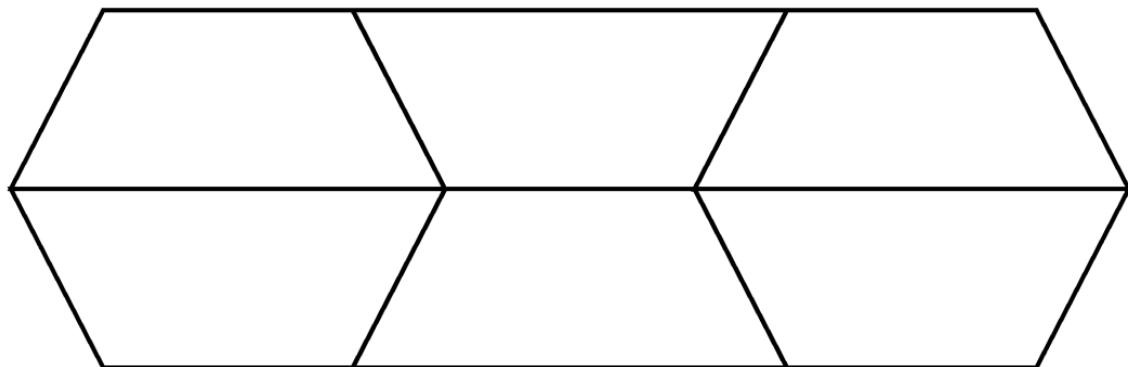
Non-right, non-isosceles trapezoid



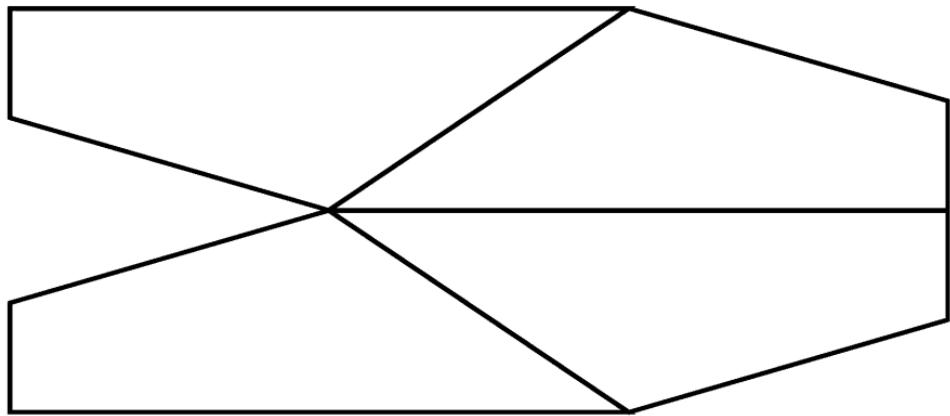
Right trapezoid



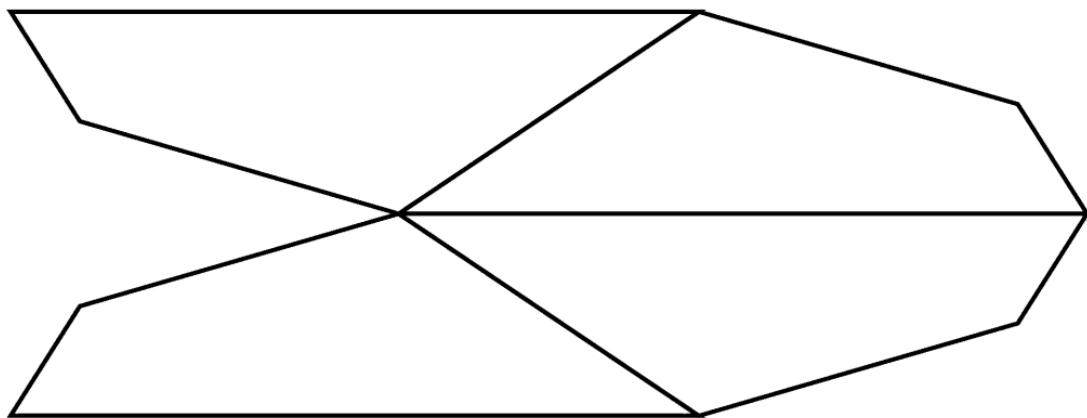
Isosceles trapezoid



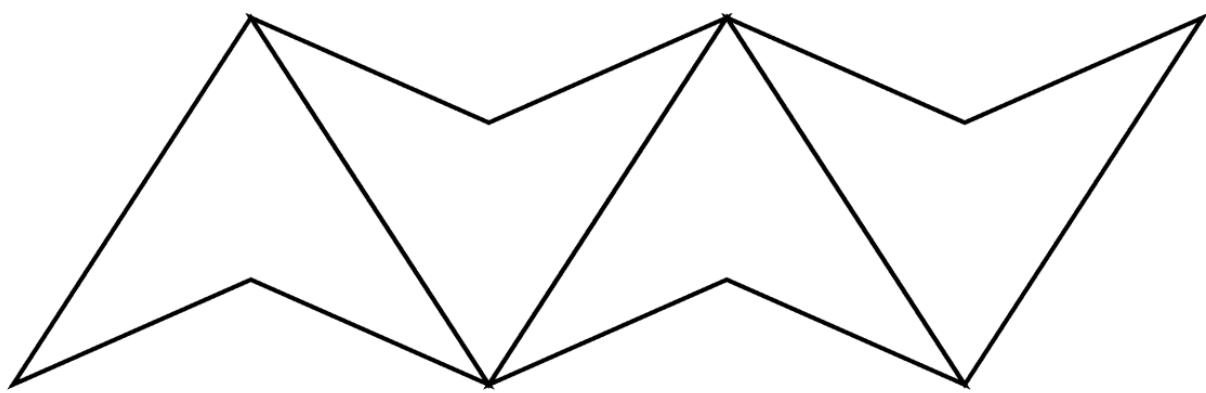
General quadrilateral with one right angle



Convex quadrilateral with no right angles



Concave quadrilateral



CLASSIFYING GEOMETRIC SHAPES
INSTRUCTIONAL ACTIVITY SUPPLEMENT B

Lesson 2

SINGLE-PROPERTY CATEGORY LABELS

One acute angle

Two acute angles

Three acute angles

One right angle

Two right angles

Four right angles

One obtuse angle

Two obtuse angles

One pair of perpendicular sides

Two pairs of perpendicular sides

One pair of parallel sides

Two pairs of parallel sides

One pair of opposite sides that are the same length

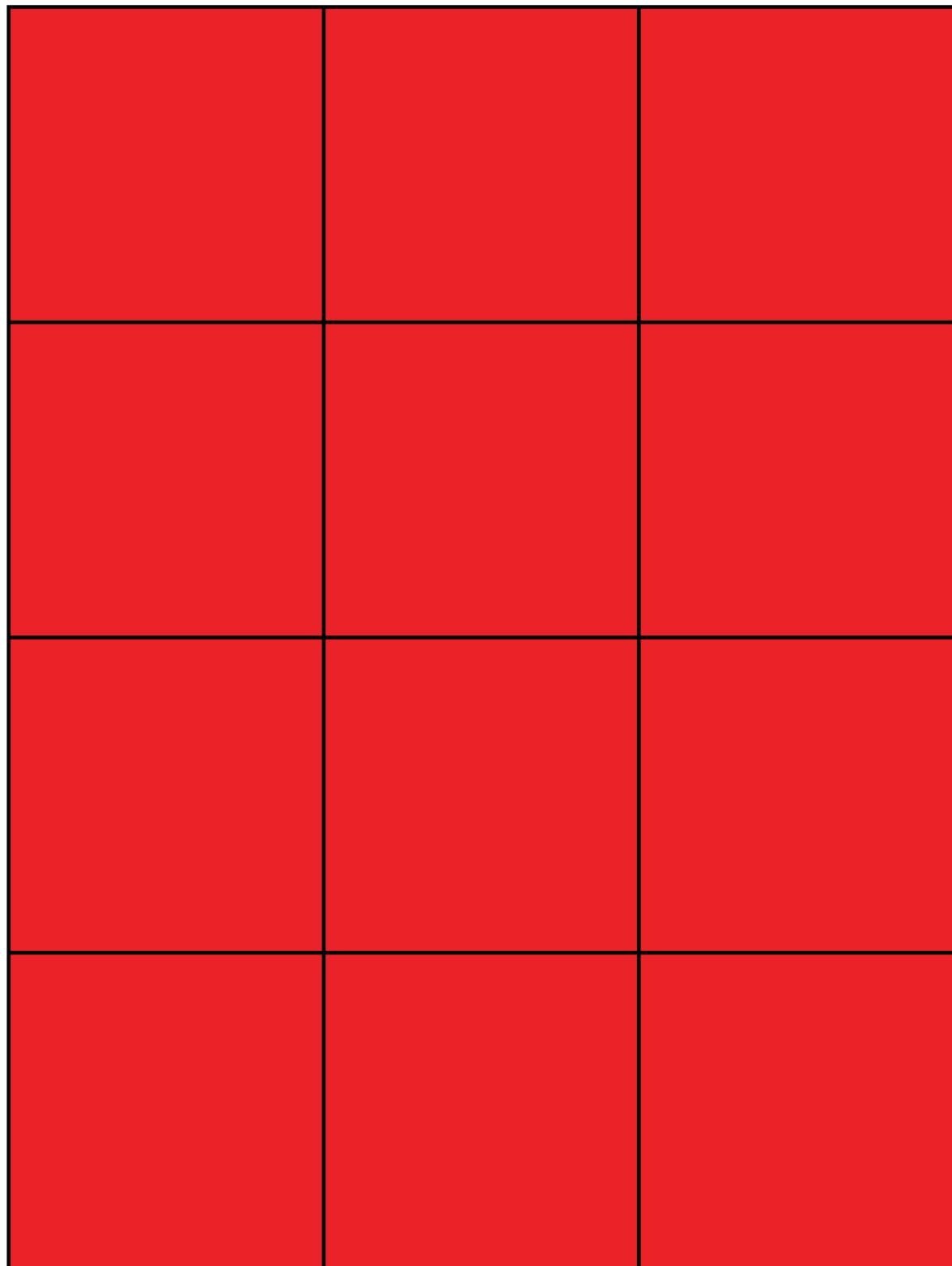
Two pairs of opposite sides that are the same length

Four sides are the same length

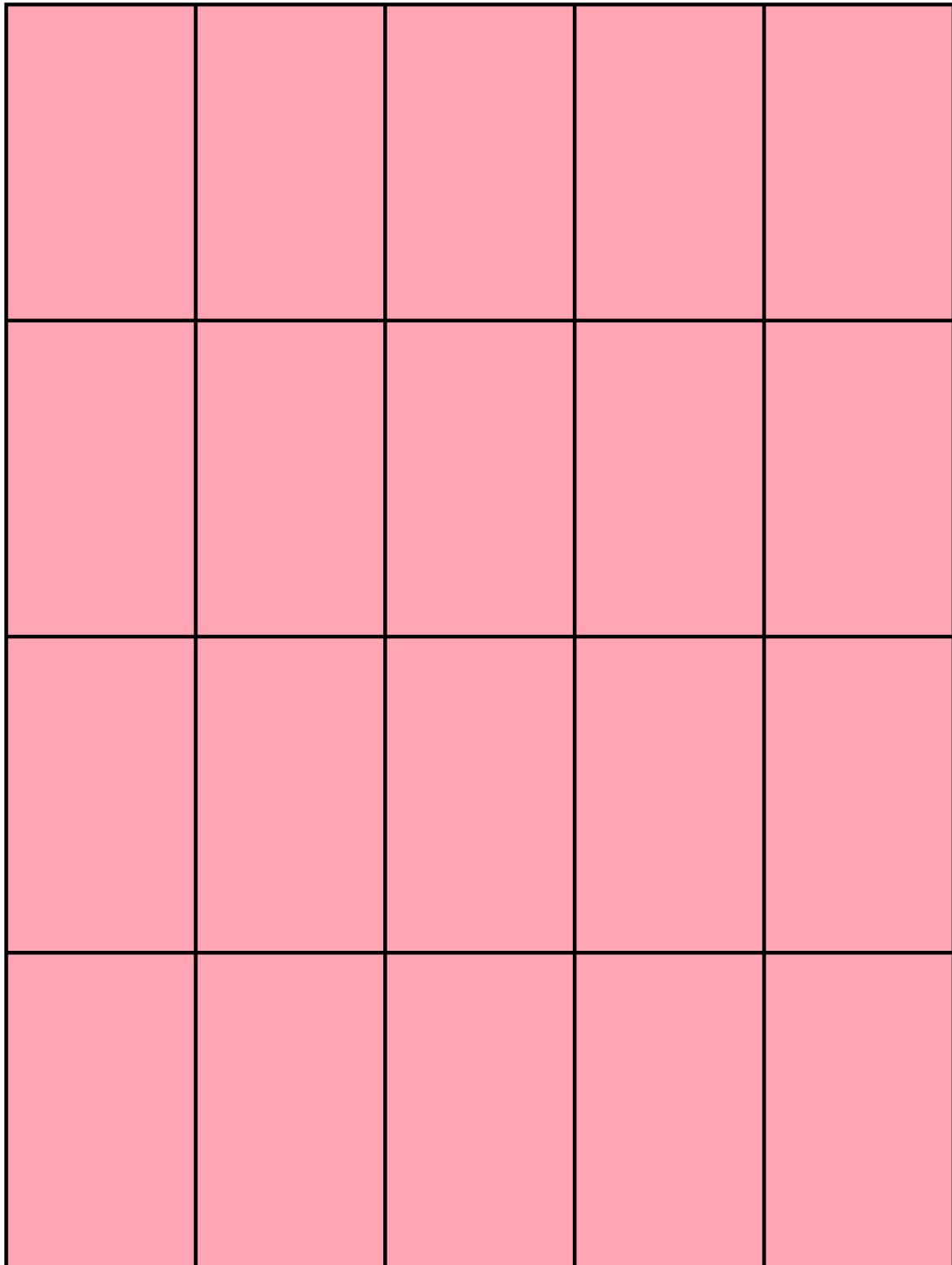
One pair of adjacent sides that are the same length

Two pairs of adjacent sides that are the same length

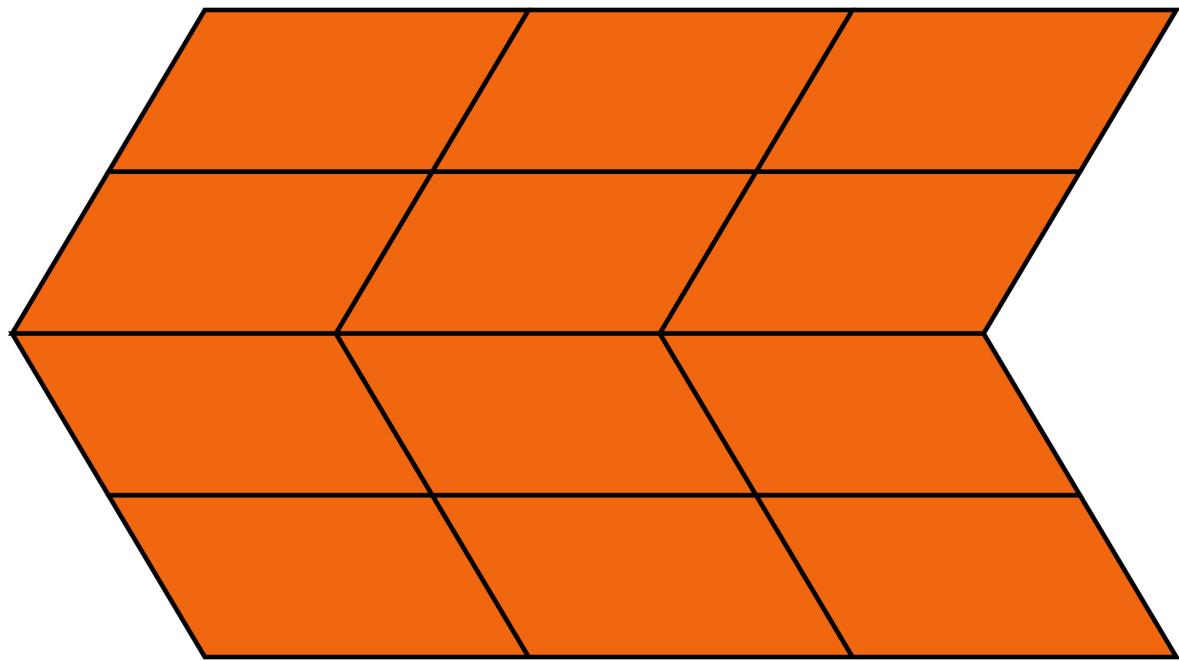
Square



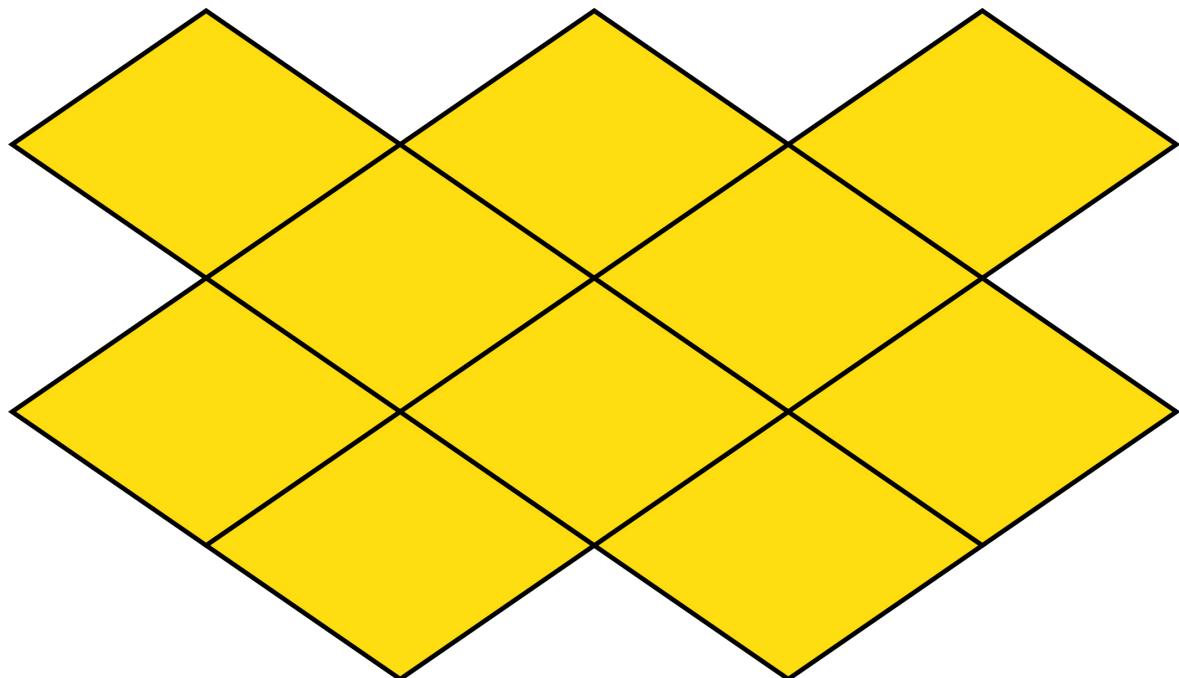
Rectangle



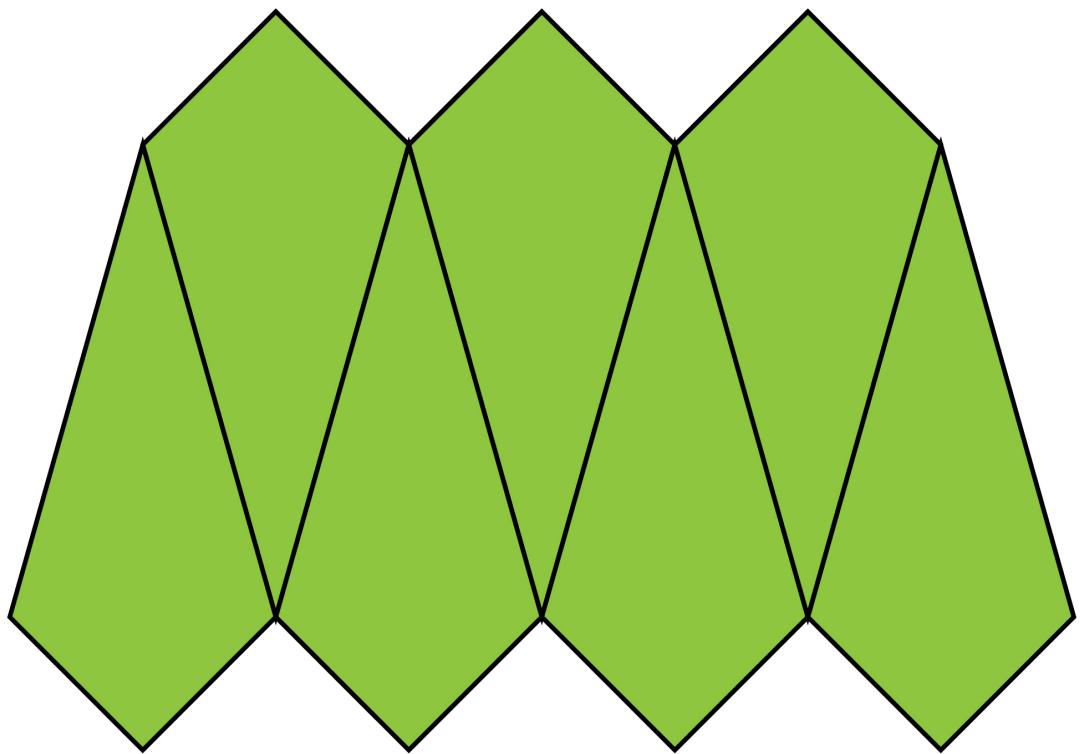
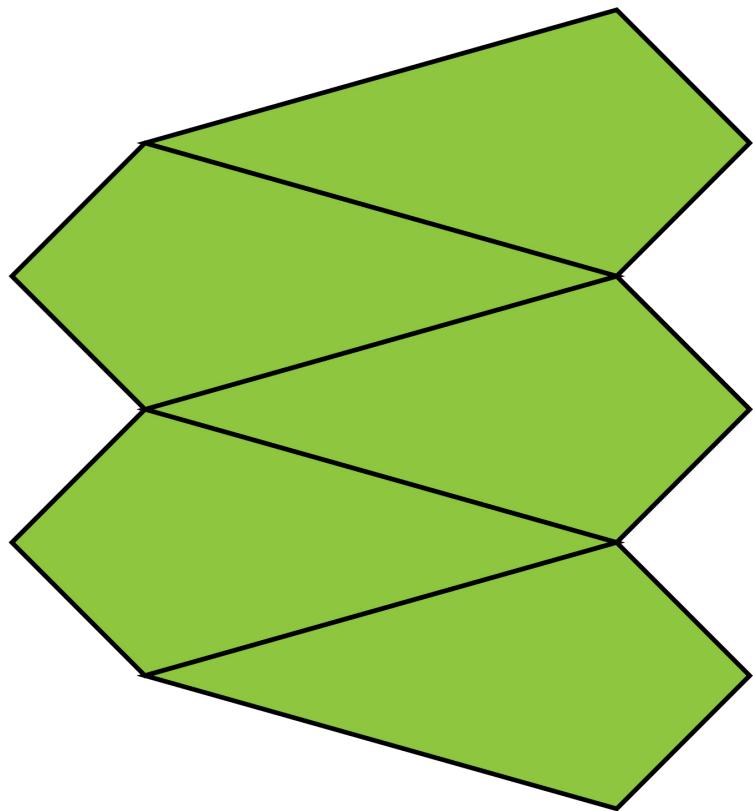
Parallelogram



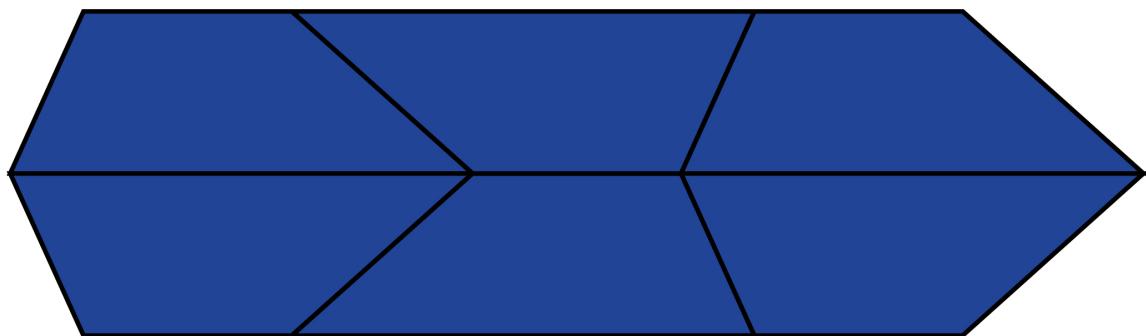
Rhombus



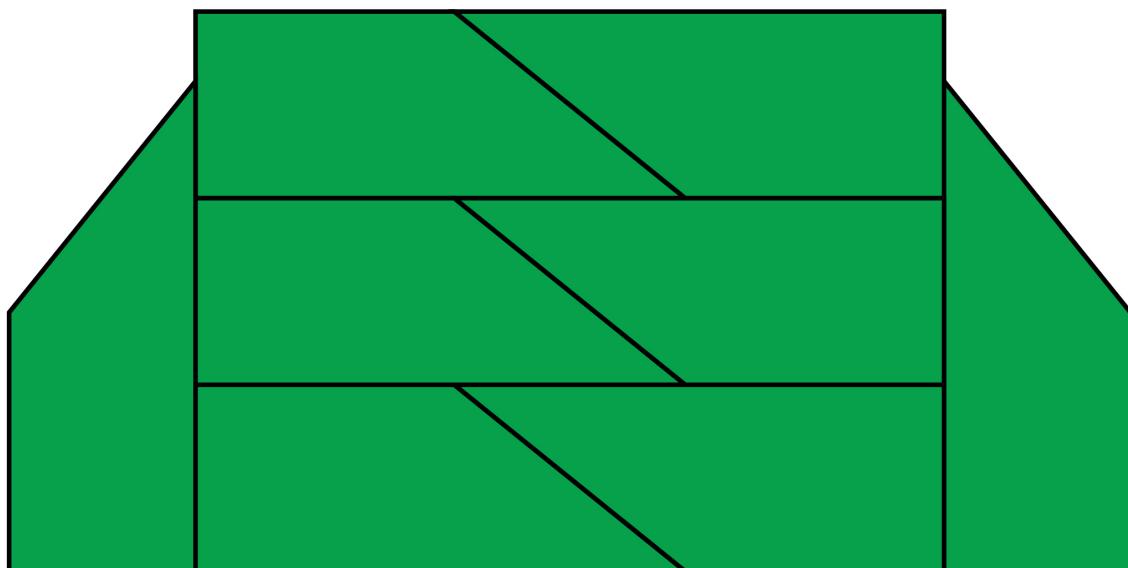
Kite



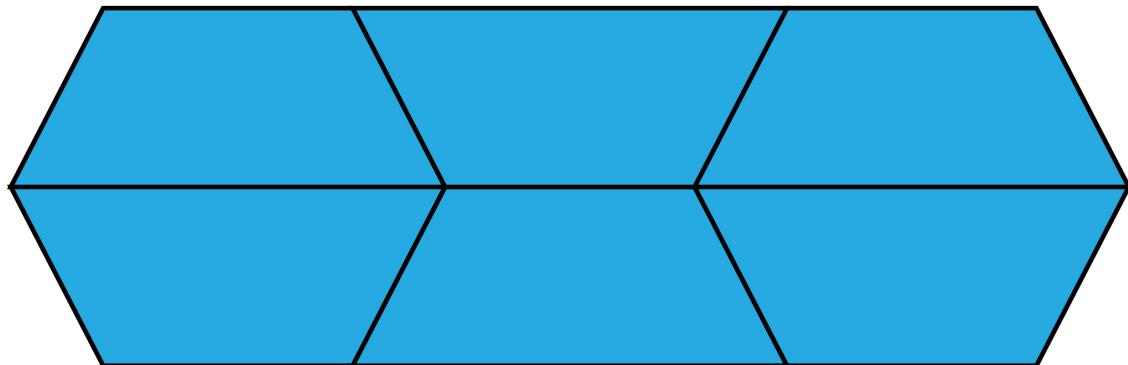
Non-right, non-isosceles trapezoid



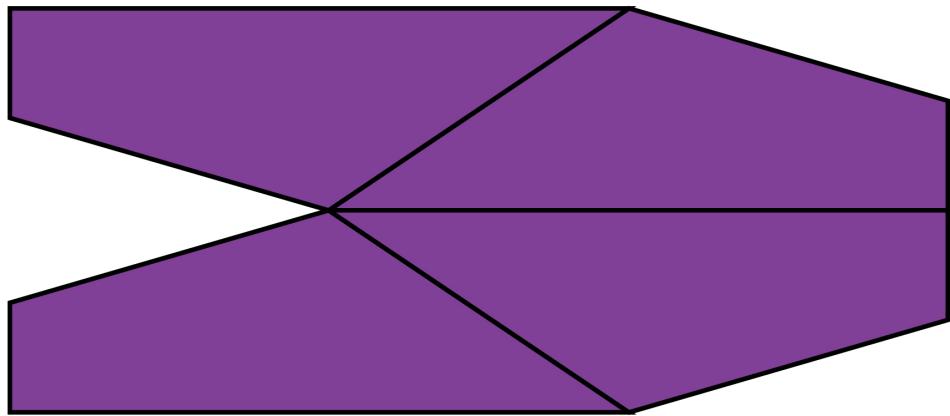
Right trapezoid



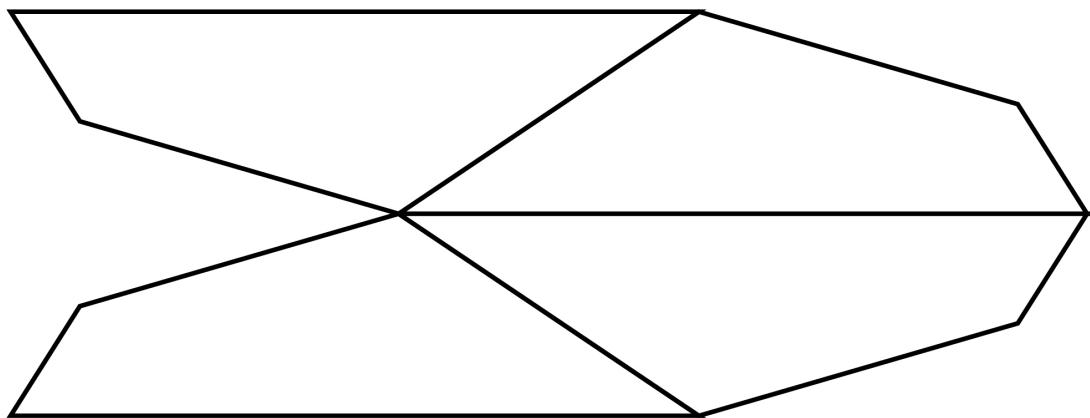
Isosceles trapezoid



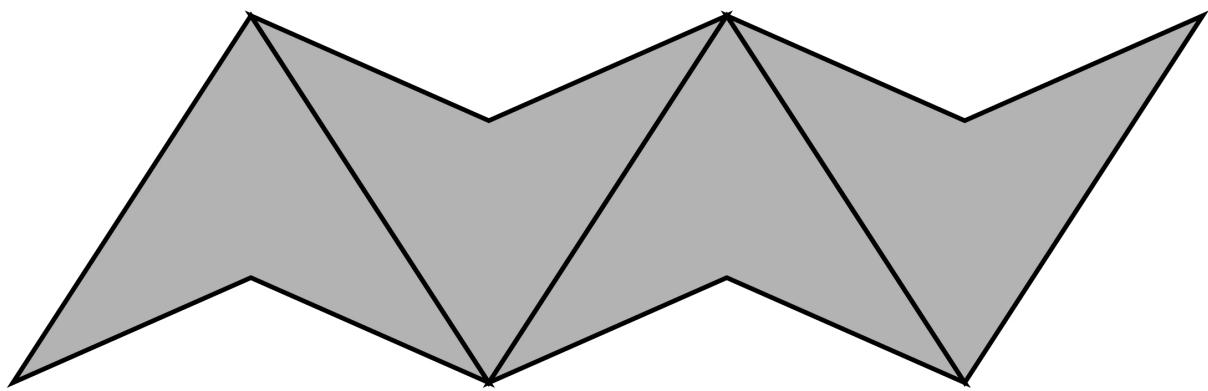
General quadrilateral with one right angle



Convex quadrilateral with no right angles



Concave quadrilateral



CLASSIFYING GEOMETRIC SHAPES

INSTRUCTIONAL ACTIVITY

Lesson 3

LEARNING GOAL

Students will describe multiple attributes of shapes.

PRIMARY ACTIVITY

Students will examine one shape at a time and identify that shape's properties, given a set of property labels.

MATERIALS

- ▶ Shapes from the [LESSON 2 INSTRUCTIONAL ACTIVITY SUPPLEMENT A](#) or [B](#)
-

IMPLEMENTATION

In this activity students will describe multiple properties of shapes.

Ask groups of students to select one shape and identify all the properties of the shape. For example, the students should identify these properties for the parallelogram:

- ▶ Two pairs of opposite sides that are the same length
- ▶ Two pairs of parallel sides
- ▶ Two obtuse angles
- ▶ Two acute angles

Emphasize that students should identify the most specific properties relevant to each shape. Thus, a parallelogram has *two pairs of parallel sides*, which is more specific (and more appropriate) than *one pair of parallel sides*.

Students should record their findings either using photos assembled into an album or using the [STUDENT HANDOUT](#).

Proceed through all the different shapes to identify all of each shape's properties. As students work, **walk** around the room and look at the lists of properties students assemble for each shape.

GUIDING QUESTIONS

Elicit student thinking:

- ▶ Describe everything you notice about this shape.

Determine if the student can **DESCRIBE THE ATTRIBUTES OF SHAPES**:

- ▶ Did students identify properties that describe the angles of each shape?
- ▶ Did students identify properties that describe the sides of each shape?
- ▶ Did students identify the most specific properties for each shape?

Determine if the student can **ANALYZE SHAPES TO IDENTIFY COMMON ATTRIBUTES**:

- ▶ Find two property lists. What is different about these two shapes? What is the same about these two shapes?
- ▶ What properties are the same for these two shapes?
- ▶ What properties are different for these two shapes?

Some students may continue to struggle with the vocabulary needed for precise descriptions, as described by the nodes **EXPLAIN THE DEFINING PROPERTIES OF [EACH SHAPE]**. To address this void in their knowledge, **ask** students to show an example of a particular property and to compare it to other examples.

GUIDING QUESTIONS

- ▶ Can you find an example of an obtuse angle? [Student picks an acute angle instead.]
- ▶ [Pick up a shape with a right angle.] Is your angle bigger or smaller than my angle?
- ▶ What kind of angle do I have? [right]
- ▶ How do you know? (If needed remind the student that obtuse angles are larger than right angles.)
- ▶ Do you still think your angle is obtuse? Find an example of an obtuse angle.

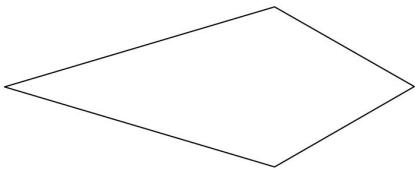
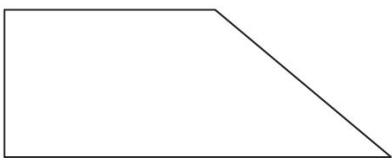
Some students may struggle to examine properties and prefer to name the shapes instead. For such a student, **ask** the student to return to their library of photos or examples of each property from [LESSON 1](#). Then **pick** a shape and **cover up** part of the shape to allow the student to focus on one aspect of the shape such as, for example, one angle.

GUIDING QUESTIONS

- ▶ What type of angle is this?
- ▶ What can you say about the lengths of the two opposite sides [point to them]? (This scaffolding should help students begin to analyze shapes and [RECOGNIZE \[THE PRESENCE OF EACH PROPERTY\] IN \[THESE SHAPES\]](#)).

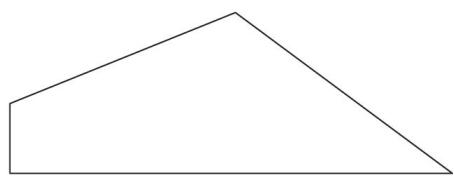
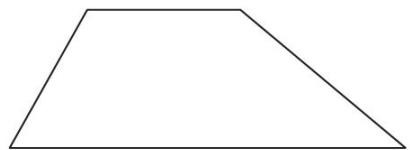
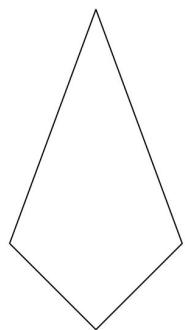
CLASSIFYING GEOMETRIC SHAPES

Lesson 3

Shape	Properties
 A trapezoid is a quadrilateral with one pair of parallel opposite sides.	
 A kite is a quadrilateral with two pairs of adjacent sides of equal length.	
 A right trapezoid is a trapezoid with one right angle.	

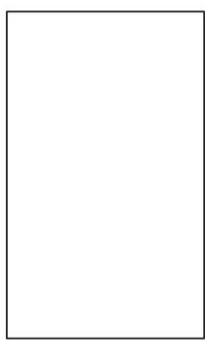
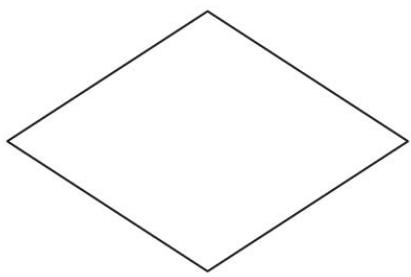
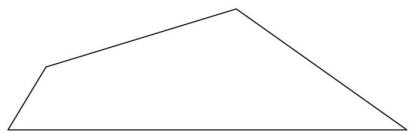
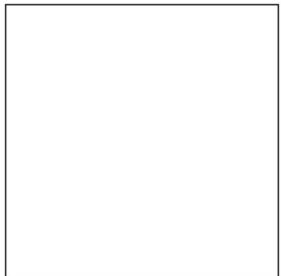
Shape

Properties



Shape

Properties



CLASSIFYING GEOMETRIC SHAPES

INSTRUCTIONAL ACTIVITY

Lesson 4

LEARNING GOAL

Students will classify shapes according to the defining attributes of quadrilaterals (squares, rectangles, rhombuses, parallelograms, kites, and trapezoids). Students will recognize hierarchical membership defined by common attributes of shapes (e.g., squares are also rectangles).

PRIMARY ACTIVITY

Students will create groups of each type of quadrilateral by examining the shapes' attributes and comparing the attributes to those that define each type of quadrilateral.

MATERIALS

- ▶ Shapes from the [LESSON 2 INSTRUCTIONAL ACTIVITY SUPPLEMENT A or B](#)
 - ▶ Construction paper mats labeled at the bottom or top with one attribute name from the [INSTRUCTIONAL ACTIVITY SUPPLEMENT](#).
-

IMPLEMENTATION

In this activity, students will create groups of paper shapes that share multiple common properties.

Ask groups of students to arrange the paper property mats so none are on top of each other. Then ask the students to collect all of their shapes and place one of each shape on every mat with properties that match the shape.

Emphasize that the shape must illustrate **all** the properties on each mat.

Proceed through all the different shapes to place the same color shape on every mat where it belongs.

Ask students to examine the shapes on each mat to determine whether all of the shapes on a mat could be described by one shape name: square, rectangle, rhombus, parallelogram, kite, trapezoid, or general quadrilateral.

GUIDING QUESTIONS

Determine if the student can **CLASSIFY 2-DIMENSIONAL FIGURES IN A HIERARCHY BASED ON PROPERTIES** with this progression of questions:

- ▶ Show me the shapes on the mat with the label *four right angles and all sides are the same length?* (There should be only squares here.)
- ▶ [Hold up a square.] What is special about these shapes?
- ▶ What are the properties listed on the mat?
- ▶ Do you know the name of this shape? (square)
- ▶ Where else do you see squares on your mats?
- ▶ Do squares belong to other categories also?

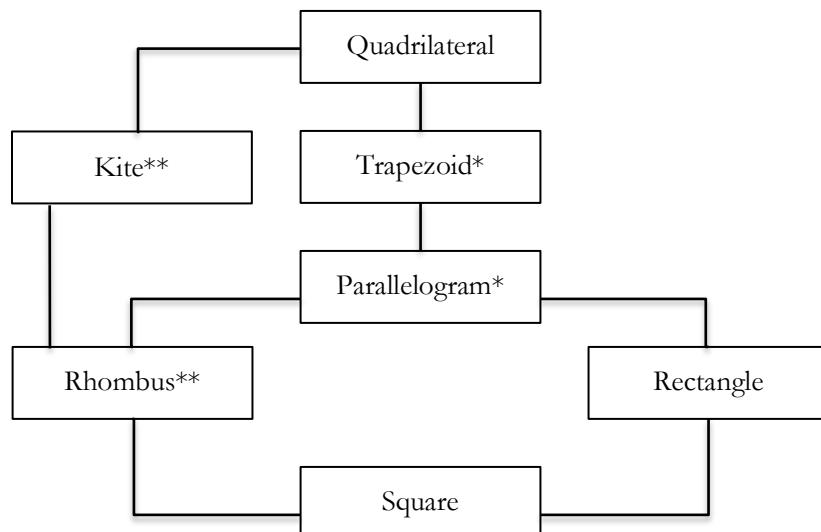
Determine if a student can **CLASSIFY 2-DIMENSIONAL FIGURES IN A HIERARCHY BASED ON PROPERTIES** with this progression of questions:

- ▶ Show me the shapes on the mat with the label *four right angles?* (There should be rectangles and squares here.)
- ▶ Why are some of these shapes **not** squares? (They don't have four sides that are the same length.)

- ▶ [Hold up a rectangle.] Do you know the name of this shape?
- ▶ What makes this category the same as the mat with only the squares?
- ▶ What makes this category different from the mat with only the squares? (One mat requires that all four sides are the same length, the other does not.)
- ▶ Do the squares still belong on the mat only requiring four right angles?
- ▶ What is the relationship between squares and rectangles?

Lead this dialogue for each of the mats defining a part of the hierarchy of quadrilaterals. Once most students recognize the relationships among the shapes, the class can consider the hierarchy of shapes as shown in the diagram below.

HIERARCHY OF QUADRILATERALS



*When we define a trapezoid to have **at least** one pair of parallel sides, then a parallelogram is also a trapezoid.

When we define a kite to have **at least one pair of opposite congruent angles, then a rhombus is also a kite.

CLASSIFYING GEOMETRIC SHAPES

INSTRUCTIONAL ACTIVITY SUPPLEMENT

Lesson 4

MULTIPLE-PROPERTY CATEGORY LABELS

Four sides

One or more pairs of parallel sides

Two pairs of parallel sides

Four sides are the same length

Two pairs of adjacent sides that are the same length

Four right angles

Four right angles and all sides are the same length

CLASSIFYING GEOMETRIC SHAPES

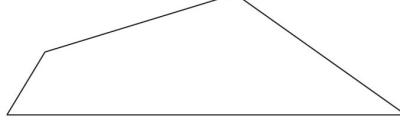
STUDENT ACTIVITY

2. Pairs of geometric shapes are shown below. Name each shape and use the list of Geometric Properties to describe the properties for each shape. Then list the properties that are common to each pair of shapes.

GEOMETRIC PROPERTIES

number of acute angles
number of obtuse angles
number of pairs of parallel sides
number of sides of equal length

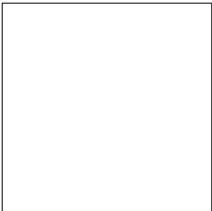
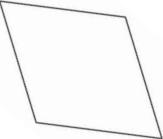
number of right angles
number of sides
number of pairs of perpendicular sides
number of opposite sides of equal length

Name of Shape:	Name of Shape:
	
Properties	
<p>Common Properties What properties are the same for these two shapes?</p>	

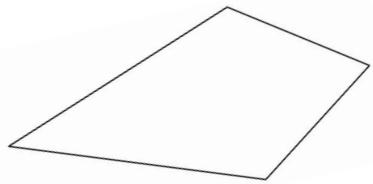
Name _____

Name of Shape:	Name of Shape:
	
Properties	
<p>Common Properties What properties are the same for these two shapes?</p>	

Name _____

Name of Shape:	Name of Shape:
	
Properties	
<p>Common Properties What properties are the same for these two shapes?</p>	

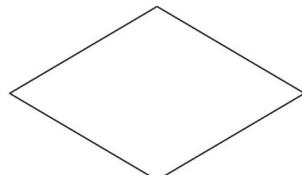
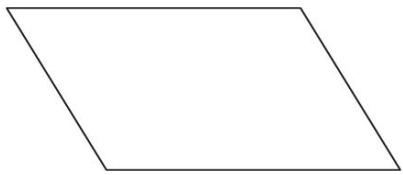
2. Consider the kite pictured below.



2.a. List the properties of a kite.

2.b. What properties does a kite share with a quadrilateral?

3. Consider the parallelogram and rhombus pictured below.



3.a. What are the common properties of a parallelogram and a rhombus?

3.b. What properties are different for a parallelogram and a rhombus?

4. John thinks that any rectangle is also a parallelogram. Do you think John is correct? Explain your thinking using the properties of rectangles and parallelograms.
5. What is the relationship between a square and a rectangle? Is any square also a rectangle, or is any rectangle also a square? Explain your thinking using the properties of rectangles and squares.

CLASSIFYING GEOMETRIC SHAPES

STUDENT ACTIVITY SOLUTION GUIDE

1. Pairs of geometric shapes are shown below. Name each shape and use the list of Geometric Properties to describe the properties for each shape. Then list the properties that are common to each pair of shapes.

CORRECT ANSWER

Name of Shape: Quadrilateral	Name of Shape: Parallelogram
	
Properties four sides	Properties four sides one pair of parallel sides two sides of equal length
Common Properties What properties are the same for these two shapes? four sides	

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
The student lists parallel sides as an attribute of the quadrilateral.	may confuse “opposite” with “parallel,” or the student does not understand what parallel line segments look like in figures	RECOGNIZE PARALLEL LINE SEGMENTS IN A 2-DIMENSIONAL FIGURE
The student lists two pairs of parallel sides for the trapezoid.	does not distinguish between parallel and nonparallel	RECOGNIZE PARALLEL LINE SEGMENTS IN A 2-DIMENSIONAL FIGURE

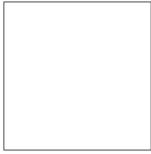
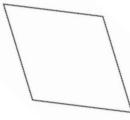
CORRECT ANSWER

Name of Shape: Parallelogram	Name of Shape: Rectangle
	
Properties four sides two pairs of parallel sides two pairs of sides of equal length	Properties four sides two pairs of parallel sides four right angles two pairs of sides of equal length
Common Properties What properties are the same for these two shapes? four sides two pairs of parallel sides two pairs of sides of equal length	

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
The student calls the rectangle a square.	does not recognize that squares are special rectangles with four congruent sides	EXPLAIN THE DEFINING ATTRIBUTES OF RECTANGLES
The student lists four sides of equal length for the parallelogram.	cannot discern the relative sizes of the sides	RECOGNIZE THE DEFINING ATTRIBUTES OF A SHAPE

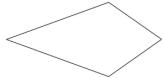
CORRECT ANSWER

Name of Shape: Square	Name of Shape: Rhombus
	
Properties	
four sides four sides of equal length four right angles	four sides four sides of equal length
Common Properties What properties are the same for these two shapes?	
four sides four sides of equal length	

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
The student does not identify the four right angles for the square.	does not recognize that squares not only have four congruent sides, but also have four right angles	EXPLAIN THE DEFINING ATTRIBUTES OF SQUARES
The student identifies the rhombus as a parallelogram.	may not be able to discern the relative sizes of the sides	RECOGNIZE THE DEFINING ATTRIBUTES OF A SHAPE
<i>Note:</i> Although this response is not necessarily wrong, it may expose a misconception.		

2. Consider the kite pictured below.



- 2.a. List the properties of a kite.

CORRECT ANSWER

four sides
two pairs of sides of equal length

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
The student does not identify two nonoverlapping pairs of sides of equal length.	does not recognize the defining attributes of a kite	RECOGNIZE THE DEFINING ATTRIBUTES OF A SHAPE
The student lists four sides of equal length.	cannot discern the relative sizes of the sides	RECOGNIZE THE DEFINING ATTRIBUTES OF A SHAPE
The student lists two pairs of parallel sides.	does not distinguish between parallel and nonparallel sides of a figure	RECOGNIZE PARALLEL LINE SEGMENTS IN A 2-DIMENSIONAL FIGURE
The student lists one right angle.	does not recognize the difference between a defining property of a kite and a nondefining property of a kite	RECOGNIZE THE DEFINING ATTRIBUTES OF A SHAPE
The student does not list four sides.	does not recognize that having four sides distinguishes a kite from an isosceles triangle	DEFINE QUADRILATERAL

2.b. What properties does a kite share with a quadrilateral?

CORRECT ANSWER

four sides

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
The student lists both properties of the kite.	does not understand common properties to be those that are the same for two or more shapes	DESCRIBE THE COMMON ATTRIBUTES BELONGING TO A CATEGORY OF 2-DIMENSIONAL SHAPES
The student identifies additional properties as shared properties.	does not know the definition of a quadrilateral	DEFINE QUADRILATERAL
The student does not identify four sides as a shared property.	cannot compare properties of two different figures	ANALYZE SHAPES TO IDENTIFY COMMON ATTRIBUTES

3. Consider the parallelogram and the rhombus pictured below.



- 3.a. What are the common properties of a parallelogram and a rhombus?

CORRECT ANSWER

four sides

two pairs of parallel sides

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
The student identifies incorrect properties that do not belong to a parallelogram.	does not know the properties of parallelograms	EXPLAIN THE DEFINING ATTRIBUTES OF PARALLELOGRAMS
The student lists four sides of equal length as a common property.	does not understand common properties to be those that are the same for two or more shapes	DESCRIBE THE COMMON ATTRIBUTES BELONGING TO A CATEGORY OF 2-DIMENSIONAL SHAPES
The student does not list two pairs of parallel sides as a common property.	does not recognize parallel sides in one or both of these shapes	RECOGNIZE PARALLEL LINE SEGMENTS IN A 2-DIMENSIONAL FIGURE

3.b. What properties are different for a parallelogram and a rhombus?

CORRECT ANSWER

Parallelograms have two pairs of sides of equal length, while rhombuses have all four sides of equal length.

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
The student does not identify that the rhombus has four sides of equal length.	does not understand the defining properties of a rhombus	EXPLAIN THE DEFINING ATTRIBUTES OF RHOMBUSES
The student reports that the properties of a rhombus and parallelogram are the same.	does not understand how a rhombus and parallelogram are different	RECOGNIZE THE DEFINING ATTRIBUTES OF A SHAPE

4. John thinks that any rectangle is also a parallelogram. Do you think John is correct? Explain your thinking using the properties of rectangles and parallelograms.

CORRECT ANSWER

John is correct. Parallelograms must have four sides, two pairs of parallel sides, and two pairs of sides of equal length. These are all also properties of rectangles, though rectangles have one additional property (four right angles).

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
The student cannot explain their answer using properties of parallelograms.	does not know the defining attributes of parallelograms	EXPLAIN THE DEFINING ATTRIBUTES OF PARALLELOGRAMS
The student cannot explain their answer using properties of rectangles.	does not know the defining attributes of rectangles	EXPLAIN THE DEFINING ATTRIBUTES OF RECTANGLES

Example Error	Misconception	Missing Knowledge
The student states that rectangles are not also parallelograms.	cannot compare properties of parallelograms and rectangles	ANALYZE SHAPES TO IDENTIFY COMMON ATTRIBUTES

5. What is the relationship between a square and a rectangle? Is any square also a rectangle, or is any rectangle also a square? Explain your thinking using the properties of rectangles and squares.

CORRECT ANSWER

Squares can always be classified as rectangles. Squares have all the same properties as rectangles (four sides, two pairs of parallel sides, two pairs of sides of equal length). However, squares are more specific because all four sides of a square have equal length. Therefore, rectangles cannot be classified as squares unless they have four congruent sides.

ERRORS, MISCONCEPTIONS, AND MISSING KNOWLEDGE

Example Error	Misconception	Missing Knowledge
The student does not use the properties of squares in their response.	does not know the defining attributes of squares	EXPLAIN THE DEFINING ATTRIBUTES OF SQUARES
The student does not use the properties of rectangles in their response.	does not know the defining attributes of rectangles	EXPLAIN THE DEFINING ATTRIBUTES OF RECTANGLES
The student states that squares are not always rectangles.	cannot compare properties of squares and rectangles	ANALYZE SHAPES TO IDENTIFY COMMON ATTRIBUTES