Purpose: In this session students use what they know about the attributes of two-dimensional shapes to explore ways in which shapes can be grouped based on their attributes. They use tables and Venn diagrams to organize information and show the relationship between two groups of shapes. They learn new vocabulary for describing relationships among groups of geometric shapes.

Start

Connect to Prior Knowledge

Materials: For each student: ruler

Why: Activate prior knowledge of attributes of geometric shapes and prepare students to identify attributes of shapes.

How: Have students draw a shape for each characteristic. Have students compare their shapes to a partner’s shapes to see how they are the same and different. Discuss whether some shapes have more than one of the given characteristics (attributes).

Solution

Draw a shape with 4 sides.
Draw a shape with 2 pairs of parallel sides.
Draw a shape with 4 right angles.

Model It

Read the question at the top of the Student Worktext page. Remind students that two-dimensional figures can be sorted based on characteristics of their sides and angles.

1 – 3: Tell students that they are going to use what they know about the attributes, or characteristics, of rectangles and squares to identify how these categories of shapes are related. Be sure students understand the vocabulary terms attribute and category. Then clarify the task and have students complete the problems.

Common Misconception: If students need additional support with understanding why every square is a rectangle, then connect a visual representation of a square to each of the attributes of a rectangle.

Discuss It

Support Partner Discussion

Encourage students to refer to their drawings of rectangles and squares as they list the attributes of these shapes in the table. Look for understanding of:

• the types of angles in the shape
• relationships between the sides of the shape, such as equal in length or parallel

Support Whole Class Discussion

Prompt students to compare the attributes of a rectangle to the attributes of a square.

Ask: What attributes do both squares and rectangles have?

Listen for: They both have 4 right angles, 2 pairs of parallel sides, opposite sides of equal length, and 4 pairs of perpendicular sides.

Ask: How could you describe a rectangle that is not a square?

Listen for: One pair of opposites sides is longer than the other pair of opposite sides.

Ask: How would you explain why a square is also a rectangle?

Listen for: A square has all the attributes of a rectangle.  

Squares are a subcategory of rectangles.

Every rectangle is a square. Every square is a rectangle.

Possible answer: all four sides of equal length
**Model It**

4 – 5 Tell students that they will now think about showing how groups of shapes are related using a Venn diagram, which is a drawing showing relationships among groups. Clarify the task and have students complete the problems.

**Common Misconception** If students do not recognize that equilateral triangles are a subcategory of isosceles triangles, then review the definitions of isosceles and equilateral. Prompt students to recognize that isosceles triangles can have 2 or 3 sides the same length while equilateral triangles always have 3 sides the same length.

**Discuss It**

**Support Partner Discussion**

Encourage students to refer to the Venn diagrams. Listen for understanding that:

- a square has all the attributes of a rectangle
- an equilateral triangle has all the attributes of an isosceles triangle
- an oval for one shape is placed completely inside the oval for another shape when the first shape has all the attributes of the second shape

**Hands-On Activity**

**Categorize triangles on geoboards.**

If . . . students are unsure about attributes of triangles,

Then . . . use this activity to reinforce understanding of different categories of triangles.

**Materials** For each pair: geoboard, rubber bands, sticky notes

- Tell students to write each category on a sticky note: right triangle, acute triangle, obtuse triangle, scalene triangle, isosceles triangle, and equilateral triangle.
- Have students also write the defining attribute for each category. [1 right angle; 3 acute angles; 1 obtuse angle, no sides the same length; at least 2 sides the same length; all 3 sides the same length]
- Have one student display a triangle on the geoboard. Have the other student choose all sticky notes that describe the triangle.
- Have students switch roles and repeat.

**Support Whole Class Discussion**

Ask a volunteer to restate the definition of hierarchy given on the Student Worktext page. Explain that a hierarchy shows how categories of shapes relate to one another.

**Ask** How does the location of the ovals in the Venn diagrams show the hierarchy of the polygons?

**Listen for** In each diagram, the smaller oval is completely inside the larger oval, so the shape represented by the smaller oval has all the attributes of the shape represented by the larger oval. However, the shape represented by the larger oval only has some of the attributes of the shape represented by the smaller oval.

**Close: Exit Ticket**

6 **Reflect**

Look for understanding that because the oval for equilateral is completely inside the oval for isosceles, equilateral triangles are a subcategory of isosceles triangles.

**Common Misconception** If students have difficulty recognizing which statement is true, then have them draw examples of an equilateral triangle and an isosceles triangle that is not equilateral in the appropriate regions of their Venn diagram.
Support Vocabulary Development

1. Read each of the terms in the Word column of the graphic organizer. Draw a square on the board. Ask: What are some attributes, or characteristics, of this figure? Based on the discussion, guide students to complete the other columns for the word attribute. If students need support to understand the meaning of the word category, provide real-life examples. Say: Apples, bananas, and oranges all belong in the category Fruit. They are subcategories of fruit.

2. Have students read each of the terms, and remind them that the three types of figures are related to each other. Check comprehension by providing sentence frames for students to complete. For example:
   - Rectangles are parallelograms because they have two pairs of _____ sides.
   - Parallelograms are quadrilaterals because they have _____ sides.

Supplemental Math Vocabulary

- angles
- lengths
- parallelogram
- quadrilaterals
- sides

Possible answers:

<table>
<thead>
<tr>
<th>Word</th>
<th>In My Own Words</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>attribute</td>
<td>characteristic or feature of a shape</td>
<td>number of sides length of sides number of angles</td>
</tr>
<tr>
<td>category</td>
<td>a group of shapes that share attributes</td>
<td>Triangles: shapes with 3 sides Quadrilaterals: shapes with 4 sides</td>
</tr>
<tr>
<td>subcategory</td>
<td>a category of shapes within another larger category</td>
<td>Squares are a subcategory of rectangles.</td>
</tr>
<tr>
<td>Venn diagram</td>
<td>a diagram that uses overlapping ovals to show how categories and subcategories are related</td>
<td>Parallelograms Rectangles</td>
</tr>
</tbody>
</table>

Explain the category-subcategory relationships shown in the Venn diagram.

Possible answer: Quadrilaterals are the most general category. Parallelograms are a subcategory of quadrilaterals. Rectangles are a subcategory of parallelograms.
Complete the problems below.

3. Write three attributes shared by all rhombuses and three attributes shared by all squares.
   Possible answers are shown:

<table>
<thead>
<tr>
<th>Rhombuses</th>
<th>Squares</th>
</tr>
</thead>
<tbody>
<tr>
<td>all four sides of equal length</td>
<td>all four sides of equal length</td>
</tr>
<tr>
<td>two pairs of parallel sides</td>
<td>two pairs of parallel sides</td>
</tr>
<tr>
<td>4 angles</td>
<td>4 right angles</td>
</tr>
</tbody>
</table>

4. What attribute do all squares have that not all rhombuses have?
   Possible answer: 4 right angles

5. Circle the true statement below.
   Every rhombus is a square.  Every square is a rhombus.
   The statement “Every square is a rhombus.” should be circled.

6. Are rhombuses a subcategory of squares, or are squares a subcategory of rhombuses?
   Squares are a subcategory of rhombuses.

Prepare for Session 2
Use with Model It.

English Language Learners: Differentiated Instruction

Levels 1–3

Speaking/Writing Use with Model It problem 2. Ask students to look at the table. Say: The category is quadrilaterals. The term quadrilaterals has the root word quad-. Quad- means four. Look at the Venn diagram in problem 1. What two-dimensional figure has two pairs of parallel sides? Display a square and a rectangle. Ask: How many parallel sides does a square have? a rectangle? Do rectangles have four equal sides? What two-dimensional figure has four equal sides? Have students form pairs and discuss how to complete the table. Ask them to write a sentence that describes one of the two-dimensional figures.

Levels 2–4

Speaking/Writing Read Model It problem 2 aloud. Have students form pairs and review the table. Ask: What two-dimensional figure has two pairs of parallel sides? Display a square and a rectangle. Ask: How many parallel sides does a square have? a rectangle? Do rectangles have four equal sides? What two-dimensional figure does? Display the terms square, rectangle, and parallelogram. Have students work with their partners to write sentences that describe each figure. Call on pairs to read their sentences.

Levels 3–5

Speaking/Writing Have students form pairs and read Model It problem 2. Ask students to list different terms or attributes that can be used to describe the quadrilaterals in problem 1. Have students take turns reading their lists to their partner. Have students write sentences that describe the quadrilaterals using the terms and attributes from their lists. Ask students to share their sentences with another set of partners and discuss whether they agree with each others’ descriptions of squares, parallelograms, and rectangles.
LESSON 28
SESSION 2
Develop

Purpose
In this session students use the visual models of a Venn diagram and a tree diagram to show the hierarchy of different subcategories of quadrilaterals. Then they compare the two models and show the hierarchy of other polygons using a model of their choice.

Start

Connect to Prior Knowledge

Why
Support students' facility with using more than one name for a given quadrilateral.

How
Have students identify two names for each of the three quadrilaterals. Students may base their choices on whether sides appear to be parallel, perpendicular or equal in length.

Develop Language

Why
Develop a deeper understanding of the relationship between the terms category and subcategory.

How
Ask students to circle the prefix sub- in the word subcategory. Remind them that sub- means below or under and that it provides a clue to the meaning of the word subcategory. Encourage students to discuss with their partners what are some categories and subcategories of two-dimensional figures.

MODEL IT: VENN DIAGRAMS

1 – 2
Present the problems and have students complete. As students work, have them identify that they are being asked to complete a Venn diagram and a table to help them recognize relationships among categories of quadrilaterals.

Common Misconception
If students are not able to identify all attributes of the given shapes, then have students identify the following attributes for each shape: number of sides, length of sides, types of angles, and types of sides (e.g., number of pairs of parallel sides).

Possible Solutions
Name each shape in two ways.
A: parallelogram, quadrilateral
B: square, rectangle
C: rectangle, quadrilateral

Develop
Categories of Two-Dimensional Figures

MODEL IT: VENN DIAGRAMS

Try these two problems.

1
A hierarchy orders categories from most general to most specific. Ovals A–D in this Venn diagram list attributes of four categories of quadrilaterals. Use the terms below to fill in the names of the subcategories from most general to most specific.

- A. 4 sides
- B. 2 pairs of parallel sides
- C. 4 right angles
- D. 4 sides of equal length

Use the Venn diagram and what you know about quadrilaterals to complete the table. Fill in subcategory names for B–D and attributes for C and D.

<table>
<thead>
<tr>
<th>Category/Subcategory</th>
<th>Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Category: Quadrilaterals</td>
<td>4 sides</td>
</tr>
<tr>
<td>B. Subcategory: Parallelograms</td>
<td>4 sides; 2 pairs of parallel sides</td>
</tr>
<tr>
<td>C. Subcategory: Rectangles</td>
<td>4 sides; 2 pairs of parallel sides; 4 right angles</td>
</tr>
<tr>
<td>D. Subcategory: Squares</td>
<td>4 sides; 2 pairs of parallel sides; 4 right angles; 4 sides of equal length</td>
</tr>
</tbody>
</table>

DISCUSS IT

Support Partner Discussion

Encourage students to find even small differences in their diagrams or tables.

Support as needed with questions such as:

• How did you decide which name to write for each subcategory in problems 1 and 2?
• How did you decide which attributes to write for each subcategory in the table?

Support Whole Class Discussion

For each problem, have several students share their Venn diagrams and tables.

Ask
How do the Venn diagram and table show the relationships of categories and subcategories in different ways?

Listen for
In the Venn diagram, the most general category is the largest oval, and the subcategories are nested within it. The nesting of the ovals helps you see how one subcategory is a subcategory of another. In the table, the most general category is at the top of the table and the subcategories are listed underneath.

Ask
How does the table help you see that a square can be also classified as a rectangle, a parallelogram, and a quadrilateral?

Listen for
You see that a square has the attributes of the other three shapes.
**Model It: Tree Diagrams**

Present the problem, discussing the new vocabulary term tree diagram. As students work, have them identify that they are being asked to complete a tree diagram for categories of quadrilaterals.

**Discuss It**

**Support Partner Discussion**

Encourage partners to relate each category in the tree diagram to the other categories. Support as needed with questions such as:
- How is the position of the boxes important?
- What is the relationship of a category in one box to any category above it?

**Support Whole Class Discussion**

Discuss the tree diagram in problem 3.

Ask: How does the tree diagram order the shapes and show subcategory relationships?

Listen for: Each category is represented by a box, and lines between boxes connect category to subcategory. The shapes are ordered from most general to most specific, so a figure in one category belongs to all the categories above it.

**Hands-On Activity**

Order shapes in a tree diagram.

If ... students are unsure about hierarchies, then ... use this activity to make a tree diagram.

**Materials**

- For each pair: 5 index cards, 5 strips of paper
  - Have partners write each of these categories on an index card: parallelograms, polygons, quadrilaterals, rectangles, squares.
  - Have partners write each attribute on a strip of paper: 2 pairs of parallel sides, 3 or more sides, 4 sides, 4 right angles, 4 equal sides.
  - Have one student order the cards from most general to most specific (top to bottom).
  - Have the other student place the attributes next to each card to check that the first category has only one of the attributes, the second category has the same attribute as the first category plus an additional attribute, and so forth, until students check that the last category has all five attributes.

**Connect It**

Complete the problems below.

4. How are Venn diagrams and tree diagrams alike? How are they different?

   Possible answer: Venn diagrams and tree diagrams are alike because both can be used to show relationships among categories of two-dimensional shapes. They are different because Venn diagrams show relationships among categories of shapes using nested circles or ovals, but tree diagrams show relationships among categories of shapes with lines between separate boxes.

5. Use a Venn diagram or tree diagram to order the categories below from most general to most specific. Then explain why your order makes sense by describing the attributes the figures share.

   Possible student diagram is shown at right.

   Possible explanation: A polygon is a closed two-dimensional figure with at least 3 straight sides and 3 angles. A triangle shares the attributes of a polygon but has exactly 3 sides and 3 angles. A right triangle shares the attributes of a triangle but also has one right angle.

**Close: Exit Ticket**

5. Look for understanding that any model will show polygons as the most general category, triangles as a subcategory of polygons, and right triangles as a subcategory of triangles.

**Common Misconception**

If students show triangles as a subcategory of right triangles, then remind them that the subcategory at the bottom or nested inside all of the other categories has all the attributes of the other category. Ask: Does every triangle have all the attributes of a right triangle? [No, some triangles do not have a right angle.] Does every right triangle have all the attributes of a triangle? [Yes]
Practice with Categories of Two-Dimensional Figures

Study how the Example shows relationships among categories of two-dimensional figures. Then solve problems 1–5.

**EXAMPLE**

Give an example of how the Venn diagram below shows that one category of figures is a subcategory of another.

The Venn diagram shows that the region for parallelograms completely overlaps the region for quadrilaterals, so parallelograms are a subcategory of quadrilaterals. A parallelogram has all the attributes of a quadrilateral. A quadrilateral has 4 sides, and so does a parallelogram.

1. Complete each sentence using all or some to make each statement true.
   a. Squares have all of the attributes of rhombuses.
   b. Rhombuses have all of the attributes of parallelograms.
   c. Parallelograms have some of the attributes of rhombuses.

2. Name two attributes that squares and rhombuses always share. Name an attribute they only sometimes share.
   Possible answer: Both rhombuses and squares always have 4 sides of equal length and 2 pairs of parallel sides. Squares always have 4 right angles. Some rhombuses do not have 4 right angles.

**Assign Categories of Two-Dimensional Figures**

In this activity students use tree diagrams and Venn diagrams to categorize polygons. Students develop their analytical skills by grouping polygons based on qualities such as number of sides, number of angles, types of angles, and so on. The activity cultivates students' abilities at describing and categorizing shapes using precise geometric terms.

**Fluency and Skills Practice**

1. Draw a tree diagram to show the hierarchy of the terms below.
   Parallelograms, Polygons, Quadrilaterals, Squares
   Write All, Some, or No to make each statement true.
   parallelograms have 2 pairs of parallel sides.
   quadrilaterals have 2 pairs of parallel sides.

2. Draw a Venn diagram to show the hierarchy of the terms below.
   Parallelograms, Polygons, Rectangles, Squares
   Write All, Some, or No to make each statement true.
   parallelograms have 4 sides of equal length.
   rectangles have 4 right angles.

3. Complete the Venn diagram to show the hierarchy of the terms below.
   Polygons, Quadrilaterals, Rectangles, Right Triangles, Triangles
   Write All, Some, or No to make each statement true.
   polygons have 4 sides.
   quadrilaterals have 3 sides.
   right triangles have 3 sides.

4. How does drawing a Venn diagram help you understand relationships among figures?
Lesson 28  Understand Categories of Two-Dimensional Figures

Levels 1–3

**Speaking/Writing** Pair students. Read Apply It problem 2 aloud. Say: *Circle the term tree diagram. Discuss with your partner what the tree diagram shows.* Provide the sentence frames below to guide students’ conversations:

- The lines in the tree diagram show _______.
- The box at the top of the tree diagram shows _______.

Ask students to work with their partners to review the information in the diagrams. Provide the following sentence frames for students to complete in writing:

- An equilateral triangle is an _______.
- An isosceles triangle cannot be a _______ triangle.

**Prepare for Session 3** Use with Apply It.

Levels 2–4

**Speaking/Writing** Pair students. Read Apply It problem 2 aloud. Have students look at both diagrams and describe how the diagrams are alike. Provide the following sentence starters for students to complete individually:

- An equilateral triangle _______.
- An isosceles triangle _______.

Have students take turns reading the sentences to their partners. Ask them to discuss their reasoning for their answers and then call on pairs to share their explanations.

Levels 3–5

**Speaking/Writing** Have students form pairs and read Apply It problem 2. Ask students to discuss how the categories of triangles are related. Then ask them to think about the similarities and differences between the diagrams. Have students write sentences to describe what each diagram shows and to explain how the diagrams are similar and different. Encourage students to use the terms *category* and *subcategory* in their sentences. Call on students to read their sentences.

**English Language Learners:**

**Differentiated Instruction**

**ELL**

**Speaking/Writing** Have students form pairs and read Apply It problem 2. Ask students to discuss how the categories of triangles are related. Then ask them to think about the similarities and differences between the diagrams. Have students write sentences to describe what each diagram shows and to explain how the diagrams are similar and different. Encourage students to use the terms *category* and *subcategory* in their sentences. Call on students to read their sentences.

**Prepare for Session 3** Use with Apply It.

**Levels 1–3**

- a. Isosceles triangles have some of the attributes of equilateral triangles.
- b. Equilateral triangles have all of the attributes of isosceles triangles.
- c. Triangles have some of the attributes of isosceles triangles.

**Medium**

**Levels 2–4**

- a. Isosceles triangles have _______ of the attributes of equilateral triangles.
- b. Equilateral triangles have _______ of the attributes of isosceles triangles.
- c. Triangles have _______ of the attributes of isosceles triangles.

- A; The shape has 4 sides, so it is a quadrilateral. The shape has 2 pairs of opposite sides parallel, so it is also a parallelogram. The shape has 4 right angles, so it is also a rectangle. The correct ordering from most general to most specific is quadrilateral, parallelogram, rectangle.

**Medium**

**Levels 3–5**

- a. Isosceles triangles have _______ of the attributes of equilateral triangles.
- b. Equilateral triangles have _______ of the attributes of isosceles triangles.
- c. Triangles have _______ of the attributes of isosceles triangles.

**Possible answer:** Isosceles and equilateral triangles always have at least 2 sides of equal length. Equilateral triangles always have 3 sides of equal length. Only some isosceles triangles have 3 sides of equal length.

**Medium**

**Levels 2–4**

- a. Isosceles triangles have _______ of the attributes of equilateral triangles.
- b. Equilateral triangles have _______ of the attributes of isosceles triangles.
- c. Triangles have _______ of the attributes of isosceles triangles.

- A; The shape has 4 sides, so it is a quadrilateral. The shape has 2 pairs of opposite sides parallel, so it is also a parallelogram. The shape has 4 right angles, so it is also a rectangle. The correct ordering from most general to most specific is quadrilateral, parallelogram, rectangle.

**Medium**

**Levels 3–5**

**Possible answer:** Isosceles and equilateral triangles always have at least 2 sides of equal length. Equilateral triangles always have 3 sides of equal length. Only some isosceles triangles have 3 sides of equal length.

**Medium**

**Levels 2–4**

- a. Isosceles triangles have _______ of the attributes of equilateral triangles.
- b. Equilateral triangles have _______ of the attributes of isosceles triangles.
- c. Triangles have _______ of the attributes of isosceles triangles.

**Possible answer:** Isosceles and equilateral triangles always have at least 2 sides of equal length. Equilateral triangles always have 3 sides of equal length. Only some isosceles triangles have 3 sides of equal length.

**Medium**

**Levels 3–5**

**Possible answer:** Isosceles and equilateral triangles always have at least 2 sides of equal length. Equilateral triangles always have 3 sides of equal length. Only some isosceles triangles have 3 sides of equal length.

**Medium**
LESSON 28
SESSION 3 Refine

Purpose In this session students demonstrate their understanding of the relationships among categories of polygons as they talk through three problems. Then they identify a mistake in a tree diagram showing relationships among categories of polygons and draw either a tree diagram or a Venn diagram to show the correct hierarchy.

Start

Connect to Prior Knowledge

Why Support students’ facility with ordering polygons to show category/subcategory relationships.

How Have students draw a tree diagram to show how acute triangles, triangles, and polygons are related.

Solution

Check that students’ tree diagrams show a hierarchy from top to bottom: polygons, triangles, and then acute triangles.

APPLY IT

Have students work independently or with a partner.

1 EXPLAIN

Ask a volunteer to restate the definition of regular polygon given on the Student Worktext page. Look for understanding that if a shape is a subcategory of regular polygons, it has all the attributes of a regular polygon.

Prompt discussion with questions such as:

• Can you draw a [square, pentagon, equilateral triangle, hexagon] that does not have all sides of equal length?
• Can you draw a [square, pentagon, equilateral triangle, hexagon] that does not have all angles of equal measure?

2 ANALYZE

A tree diagram can use two lines to show subcategories that do not overlap. Jose drew these two diagrams to show how categories of triangles are related. Are his diagrams correct? Explain.

Yes; Possible explanation: Equilateral triangles are a subcategory of isosceles triangles because they have at least 2 equal sides. Scalene triangles have all sides of different lengths, so they cannot be isosceles or equilateral. Both diagrams show these relationships.

3 CREATE

Describe the attributes of a shape that is both a rectangle and a rhombus. Name the shape and use the grid to draw an example.

a parallelogram with 4 sides of equal length and 4 right angles; a square

PAIR/SHARE

Discuss your solutions for these three problems with a partner.

Common Misconception If students name a broader category that includes both rectangles and rhombuses rather than a subcategory, then ask students to put the name of this category (e.g., parallelogram or quadrilateral) in the following sentence frames to see if both statements are true:

Every ___ is a rectangle.

Every ___ is a rhombus.
4. **Before students begin**, read through problem 4 as a class. Make sure students understand their task is to find the mistake in the tree diagram and then draw a correct diagram.

**As students work on their own**, walk around to assess their progress and understanding, to answer their questions, and to give additional support, if needed.

**Have students share** their model with a partner and then compare their models.

### Scoring Rubric

#### Part A

<table>
<thead>
<tr>
<th>Points</th>
<th>Expectations</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>The response demonstrates that students understand why the hierarchy shown in the tree diagram is not correct and how to change the tree diagram so that it shows the correct hierarchy.</td>
</tr>
<tr>
<td>1</td>
<td>An effort was made to accomplish the task. The response demonstrates some understanding of the error in the tree diagram or how to correct the tree diagram, but some part of the explanation is incorrect or missing.</td>
</tr>
<tr>
<td>0</td>
<td>There is no response or the response shows no evidence of understanding the relationships shown in the tree diagram.</td>
</tr>
</tbody>
</table>

#### Part B

<table>
<thead>
<tr>
<th>Points</th>
<th>Expectations</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>The tree diagram or Venn diagram indicates a student’s understanding of the relationships among the five categories. The diagram correctly connects the five categories.</td>
</tr>
<tr>
<td>1</td>
<td>An effort was made to accomplish the task. The tree diagram or Venn diagram demonstrates some understanding of the relationships among the five categories, but the student’s diagram is missing categories, misplaces categories, or incorrectly connects categories.</td>
</tr>
<tr>
<td>0</td>
<td>There is no tree diagram or Venn diagram, or the diagram shows little or no understanding of the relationships among the five categories.</td>
</tr>
</tbody>
</table>

**MATH JOURNAL**

Are rhombuses a subcategory of parallelograms or are parallelograms a subcategory of rhombuses? Explain.

Rhombuses are a subcategory of parallelograms. Possible explanation: A rhombus is a quadrilateral with 2 pairs of parallel sides like a parallelogram. A rhombus also has 4 sides of equal length. Not all parallelograms have this attribute.

#### Close: Exit Ticket

**MATH JOURNAL**

Students use their understanding of the attributes of parallelograms and rhombuses to determine how the two categories of shapes are related. Students’ responses should indicate that both a rhombus and a parallelogram have two pairs of parallel sides, but a rhombus also has four sides of equal length.

**Error Alert** If students do not identify the attributes of the shapes in their response, then have them make flash cards for each shape by drawing a picture of the shape on one side of an index card and a list of the attributes of the shape on the back.
**Tested Skills**

**Assesses** 5.G.B.3, 5.G.B.4

Problems on this assessment form require students to be able to categorize and subcategorize two-dimensional figures based on attributes, and order and connect these categories using a Venn diagram or tree diagram. Students will also need to be familiar with the attributes of polygons, such as side lengths and angle types, as well as the presence or absence of parallel sides.

Alternately, teachers may assign the **Digital Comprehension Check** online to assess student understanding of this material.

**Error Alert** Students may:
- not recognize that a figure has a given attribute.
- not realize that at least one also includes more than one.
- reverse the “direction” of a category-subcategory relationship.
- not recognize how the categories and subcategories in a tree diagram or Venn diagram are related.
- believe that the most specific subcategory a shape fits into is the only way to classify the shape.

**Solutions**

1. **A, C;** Students could solve the problem by recognizing that squares and rectangles have at least 2 sides of equal length, at least 1 right angle, and 2 pairs of parallel sides.
   - **B** is not correct because right triangles do not always have 2 sides of equal length, and they do not have 2 pairs of parallel sides.
   - **D** is not correct because isosceles triangles do not always have 1 right angle, and they do not have 2 pairs of parallel sides.
   - **E** is not correct because rhombuses do not always have right angles.
   - **F** is not correct because parallelograms do not always include right angles.

   2 points 5.G.B.3, DOK 1

2. **The table shows some attributes of shapes.**

   Which shapes always have all of the attributes shown in the table? Choose all the correct answers. (2 points)

   - [ ] squares
   - [ ] right triangles
   - [ ] rectangles
   - [ ] isosceles triangles
   - [ ] rhombuses
   - [ ] parallelograms

3. **Attributes of Shapes**

   - At least 2 sides of equal length
   - At least 1 right angle
   - 2 pairs of parallel sides

   **2 Decide if each statement correctly describes a relationship between the categories. Choose Yes or No for each statement. (2 points)**

<table>
<thead>
<tr>
<th>Statement</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equilateral triangles are a subcategory of isosceles triangles.</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Right triangles are a subcategory of polygons.</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Polygons are a subcategory of parallelograms.</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Rectangles are a subcategory of parallelograms.</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

3. **Name one attribute that rhombuses and parallelograms always share.**
   - Possible answer: Both rhombuses and parallelograms always have 2 pairs of parallel sides. Rhombuses always have 4 sides of equal length.
   - Some parallelograms do not have 4 sides of equal length.

**Multiple Select Scoring Rubric**

<table>
<thead>
<tr>
<th>2 points</th>
<th>1 point</th>
<th>0 points</th>
</tr>
</thead>
<tbody>
<tr>
<td>All answers are correct</td>
<td>1 incorrect answer</td>
<td>2 or more incorrect answers</td>
</tr>
</tbody>
</table>

**Short Response Scoring Rubric**

<table>
<thead>
<tr>
<th>Points</th>
<th>Expectations</th>
</tr>
</thead>
</table>
| 2      | - Correct solutions, and/or reasoning. (1 point)
         | - Well-organized, clear, and concise work that demonstrates thorough understanding of math concepts. (1 point) |
| 1      | - Mostly correct solution(s). |
         | - Shows partial or good understanding of math concepts. |
| 0      | - Incorrect solution or no attempt to find a solution. |
2 A (Yes);  
C (Yes);  
F (No);  
G (Yes)  
2 points  
5.G.B.3, DOK 2

3 See possible answer on the student page.  
2 points  
5.G.B.3, DOK 2

4 See possible diagrams on the student page.  
2 points  
5.G.B.4, DOK 2

5 B; Students could solve the problem by correctly identifying that squares are a subcategory of rectangles, so “Squares” should be inside “Rectangles” in the diagram.  
A is not correct because squares are a subcategory of rectangles, rectangles are not a subcategory of squares.  
C is not correct because although squares and rectangles have all the attributes of parallelograms parallelograms, the shapes share other attributes, such as having 4 right angles.  
D is not correct because although squares and rectangles have all the attributes of parallelograms and both have 4 right angles, squares are a subcategory of rectangles.  
1 point  
5.G.B.4, DOK 2

5.5.G.B.3, DOK 2

5.G.B.3, DOK 2

5.G.B.4, DOK 2

Differentiated Instruction  
Teacher Toolbox

RETEACH

Tools for Instruction  
Students who require additional support for prerequisite or on-level skills  
Will benefit from activities that provide targeted skills instruction

REINFORCE

Math Center Activities  
Students who require additional practice to reinforce concepts and skills and deepen understanding  
Will benefit from small group collaborative games and activities (available in three versions—on-level, below-level, and above-level)

EXTEND

Enrichment Activities  
Students who have achieved proficiency with concepts and skills and are ready for additional challenges  
Will benefit from group collaborative games and activities that extend understanding