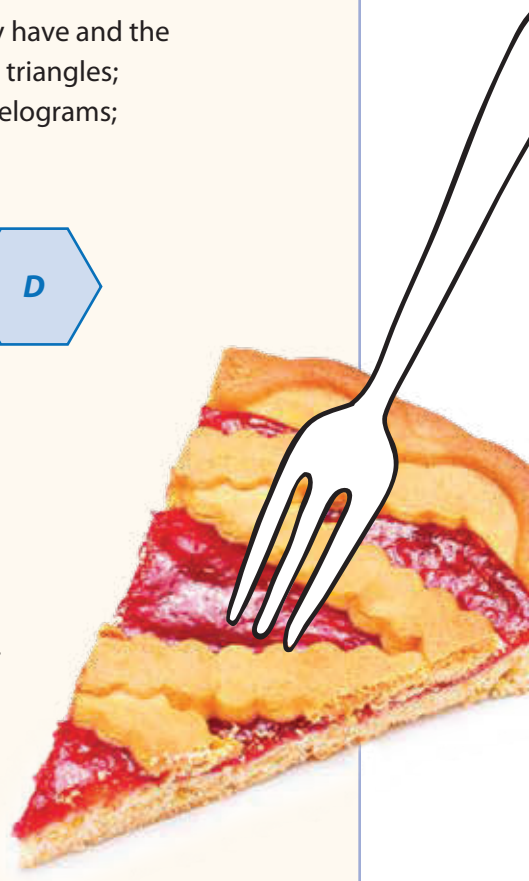
Classify Two-Dimensional Figures

LESSON 33

Dear Family,

This week your child is learning to classify two-dimensional shapes.

Shapes can be sorted into groups based on the kinds of sides they have and the kind of angles they have. Some shapes your child is classifying are triangles; quadrilaterals such as squares, rhombuses, **trapezoids**, and parallelograms; and **hexagons**.



One way to classify shapes is by the kinds of sides they have.

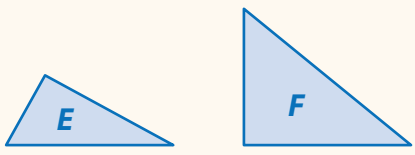
- Shapes *A* and *C* have parallel sides and perpendicular sides.
- Shapes *B* and *D* have parallel sides only.

Another way to classify shapes is by the kinds of angles they have.

- Shapes *A* and *C* have all right angles.
- Shape *B* has some acute angles and some obtuse angles.
- Shape *D* has all obtuse angles.

Triangles can be classified by their sides and angles.

- Triangle *E* is a **scalene triangle**. It has no sides the same length.
- Triangle *F* is a **right triangle**. It has a right angle.

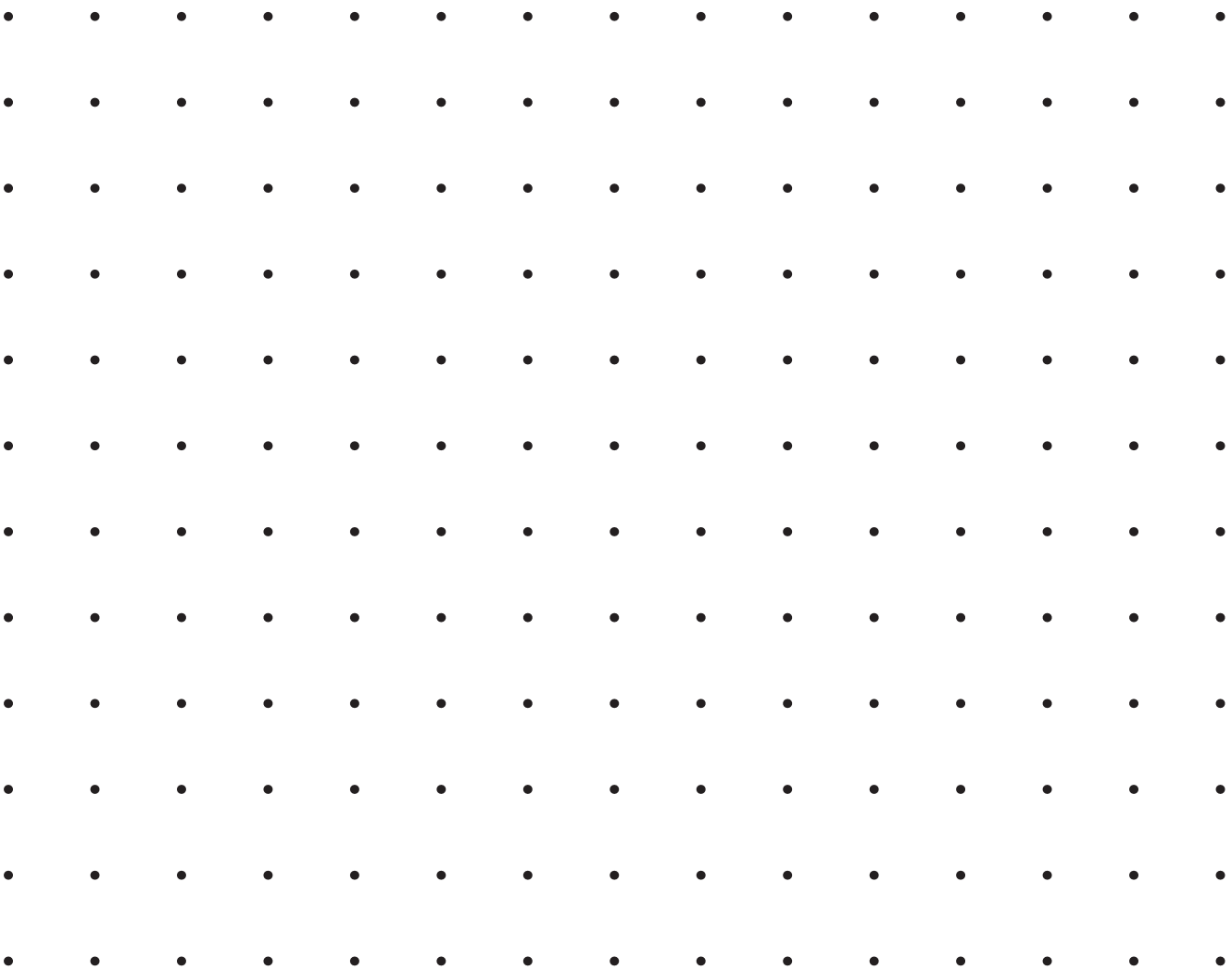


Invite your child to share what he or she knows about classifying two-dimensional figures by doing the following activity together.

ACTIVITY CLASSIFYING TWO-DIMENSIONAL FIGURES

Do this activity with your child to classify two-dimensional figures.

- Use the grid of dots below or make a dot grid on another sheet of paper.
- One person draws a shape. The shape could be a triangle, a quadrilateral, or another kind of shape with straight sides.
- The other person describes the shape. Be sure to talk about any parallel sides and perpendicular sides that the shape has. Describe the angles of the shape, too! Then name the shape.
- Switch roles. Take turns drawing a shape and describing and naming it.



Explore Classifying Two-Dimensional Figures

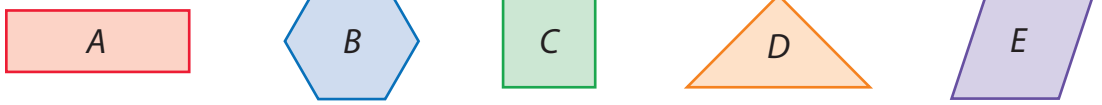
Learning Target

- Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles.

SMP 1, 2, 3, 4, 5, 6, 7, 8

You have learned about parallel and perpendicular lines. Use what you know to try to solve the problem below.

Look at the shapes below. Put a check mark on all the shapes that have at least one pair of parallel sides. Put a star on all the shapes that have at least one pair of perpendicular sides. Explain how you could test your choices.



TRY IT

Math Toolkit

- pattern blocks
- rulers
- index cards
- protractors

DISCUSS IT

Ask your partner: Can you explain that again?

Tell your partner: I knew . . . so I . . .

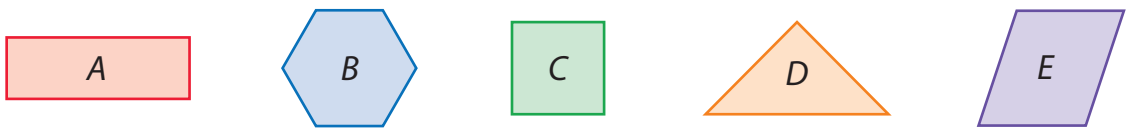
CONNECT IT

1 LOOK BACK

Which shapes have at least one pair of parallel sides and at least one pair of perpendicular sides? Explain.

2 LOOK AHEAD

Shapes with straight sides, such as triangles and quadrilaterals, are types of **polygons**. There are different ways you can sort these shapes, such as by the number of sides the shape has and by the relationships between the sides. You can also sort shapes by the kinds of angles they have.



a. Which shapes have at least one right angle? .....

b. Which shapes have at least one acute angle? .....

c. Which shapes have at least one obtuse angle? .....

3 REFLECT

Describe the sides and angles of shape *C*.

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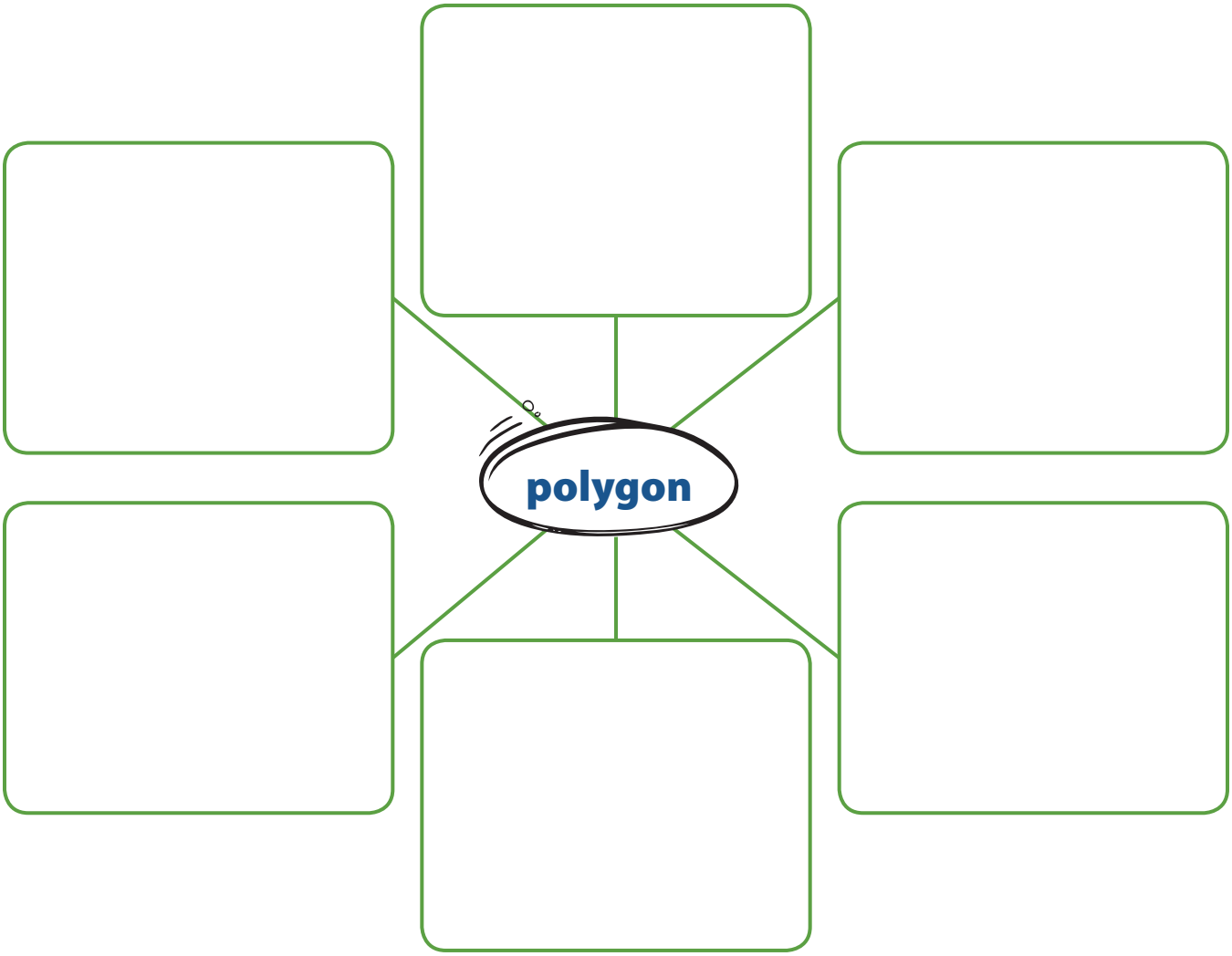
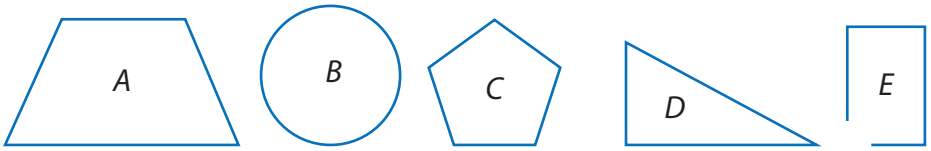
Prepare for Classifying Two-Dimensional Figures

1 Think about what you know about polygons. Fill in each box. Use words, numbers, and pictures. Show as many ideas as you can.

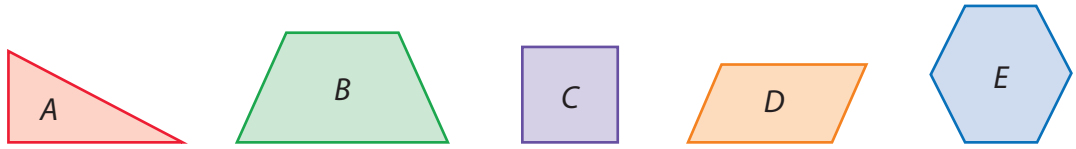


2 Which shapes are polygons?



3 Solve the problem. Show your work.

Look at the shapes below. Put a check mark on all the shapes that have at least one right angle. Put a star on all the shapes that have at least one pair of parallel sides. Explain how you could test your choices.



Solution

4 Check your answer. Show your work.

Develop Sorting Shapes Based on Sides

Read and try to solve the problem below.

Evan plays a board game. The board is divided into three sections.

parallel sides	perpendicular sides	parallel and perpendicular sides

These are Evan's cards. In which sections of the board do the cards belong?


hexagon


rhombus


parallelogram


trapezoid

TRY IT

Math Toolkit

- pattern blocks
- rulers
- index cards
- protractors

DISCUSS IT

Ask your partner: How did you get started?

Tell your partner: I started by . . .

Explore different ways to understand how to sort shapes into groups based on parallel and perpendicular sides.

Evan plays a board game. The board is divided into three sections.

parallel sides	perpendicular sides	parallel and perpendicular sides

These are Evan's cards. In which sections of the board do the cards belong?


hexagon


rhombus


parallelogram

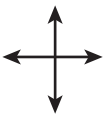

trapezoid

PICTURE IT

You can use drawings to help sort shapes.

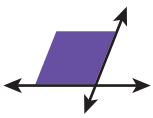
Draw a pair of parallel lines and a pair of perpendicular lines.


parallel lines


perpendicular lines

Draw lines along opposite sides of each shape. Compare these lines to the parallel lines you drew.

Draw lines along sides of each shape that form angles. Compare these lines to the perpendicular lines you drew.



MODEL IT

You can use a table to help sort shapes.

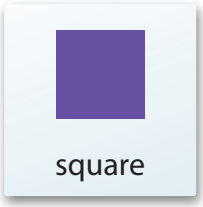
Make a table. Put the shape on each card in the table where the shape belongs.

Parallel Sides	Both Parallel and Perpendicular Sides	Perpendicular Sides
		

Evan's cards belong in the "Parallel Sides" column of the table.

CONNECT IT

Now you will solve a problem similar to the one on the previous page to help you understand how to sort shapes into groups based on parallel and perpendicular sides. Evan gets two more cards. In which sections of the board do the cards with these shapes belong?


square


quadrilateral

1 Evan gets a card with a square. In which section of the board does it belong?

2 Evan gets a card with a quadrilateral. Does the quadrilateral belong to any of the three categories on the board? If not, name a category that can be used to describe this shape.

3 Explain how to sort shapes based on parallel and perpendicular sides.

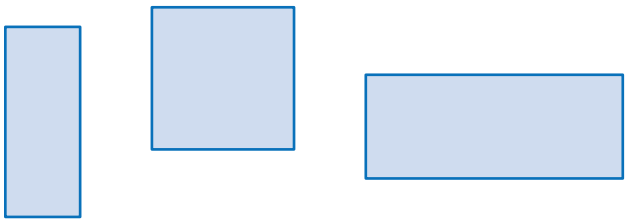
4 REFLECT

Look back at your **Try It**, strategies by classmates, and **Picture It** and **Model It**. Which models or strategies do you like best for sorting shapes into groups based on parallel and perpendicular sides? Explain.

APPLY IT

Use what you just learned to solve these problems.

5 Describe the group that the shapes below belong in based on the kinds of sides they have.



Solution

6 Circle the shape below that belongs in the group: "no parallel sides."

7 Select all the shapes that always have pairs of perpendicular sides.

Ⓐ hexagon

Ⓑ parallelogram

Ⓒ rectangle

Ⓓ rhombus

Ⓔ square

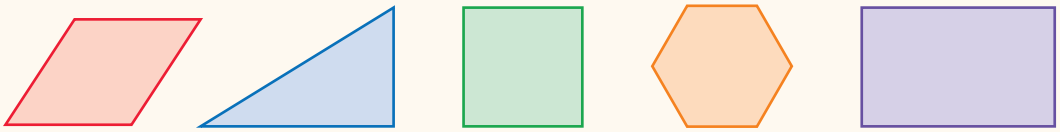
Ⓕ trapezoid

Practice Sorting Shapes Based on Sides

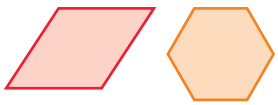
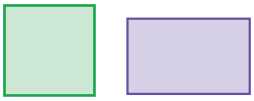
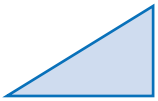
Study the Example showing how to sort shapes into groups based on parallel and perpendicular sides. Then solve problems 1–4.

EXAMPLE

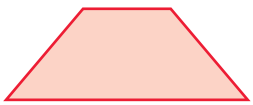
Sort the shapes below based on parallel and perpendicular sides.
Put the shapes in the table below.



rhombus triangle square hexagon rectangle

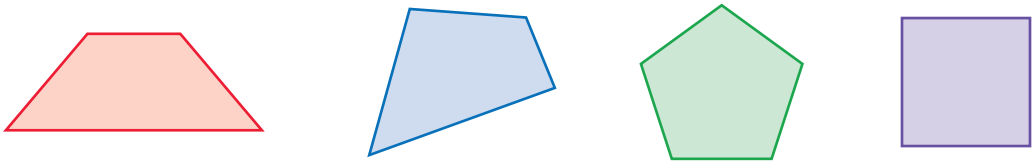
Parallel Sides	Both Parallel and Perpendicular Sides	Perpendicular Sides
		

1 Look at how the shapes in the Example above are sorted into groups. Then look at the shape at the right. Which group does the shape belong in?

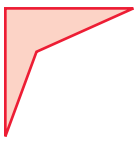
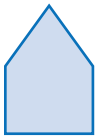
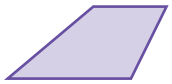


Solution

2 Suppose there is another group for shapes: "no parallel or perpendicular sides." Circle the shapes below that belong in this group.



3 Select the kinds of sides each shape has.

	Parallel Sides	Perpendicular Sides
	Ⓐ	Ⓑ
	Ⓒ	Ⓓ
	Ⓔ	Ⓕ
	Ⓖ	Ⓗ

4 Select all the properties that always belong to each shape.

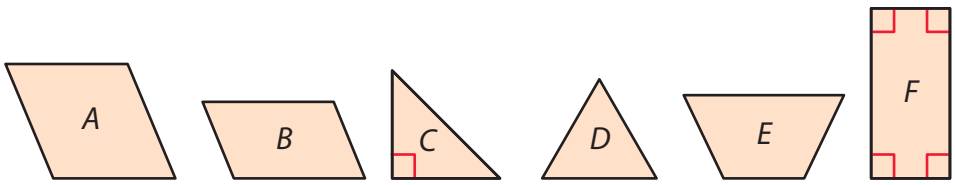
	Parallel Sides	Perpendicular Sides
rectangle	Ⓐ	Ⓑ
rhombus	Ⓒ	Ⓓ
square	Ⓔ	Ⓕ

Develop Sorting Shapes Based on Angles

Read and try to solve the problem below.

A classroom computer game shows a set of categories and a set of shapes. The player puts each shape in the correct category. Draw a line from each shape to the category it belongs in.

acute only | right only | acute and right | acute and obtuse



TRY IT

Math Toolkit

- protractors
- rulers
- index cards

DISCUSS IT

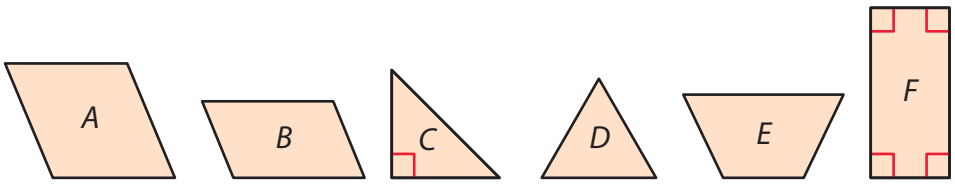
Ask your partner: Do you agree with me? Why or why not?

Tell your partner: I agree with you about . . . because . . .

Explore different ways to understand how to sort shapes into categories based on angles.

A classroom computer game shows a set of categories and a set of shapes. The player puts each shape in the correct category. Draw a line from each shape to the category it belongs in.

acute only | right only | acute and right | acute and obtuse



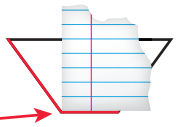
PICTURE IT

You can use a model to help sort shapes based on angles.

Use the corner of a sheet of paper as a model of a right angle. Compare each angle to the paper corner.

For example, hold up the paper corner to the trapezoid.

This angle opens wider than a right angle. The angle is **obtuse**.



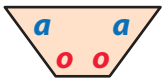
Then you can compare the paper corner to each of the other 3 angles in the trapezoid.

MODEL IT

You can label a drawing to help sort shapes based on angles.

Look at each shape. Mark each angle *a* for acute, *r* for right, or *o* for obtuse.

For example, mark the trapezoid like this:



The trapezoid has 2 acute angles and 2 obtuse angles. It belongs in the group "acute and obtuse."

Remember to look at all of the angles in a shape before you put it in a group.

CONNECT IT

Now you will use the problem from the previous page to help you understand how to sort shapes into categories based on angles.

1. Look at parallelograms *A* and *B*. Check that you have drawn lines to the correct group(s). Do the two parallelograms belong to the same group? Explain.

2. Look at the two triangles. Check that you have drawn lines to match the triangles with their group(s). Describe the angles in each triangle.

3. Look at the trapezoid and rectangle. Which has right angles only? .....
Look at **Picture It**. To which group does the trapezoid belong?

..... Check that you have drawn lines to the correct group(s).

4. Explain how to sort shapes based on whether they have acute, right, or obtuse angles.

5 REFLECT

Look back at your **Try It**, strategies by classmates, and **Picture It** and **Model It**. Which models or strategies do you like best for sorting shapes based on angles? Explain.

.....

.....

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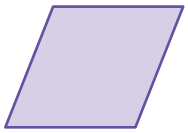
APPLY IT

Use what you just learned to solve these problems.

6 Which of these groups does the rhombus below belong in: "acute angles only," "obtuse angles only," "right angles only," "both acute and obtuse angles," or "both right and obtuse angles"? Explain.

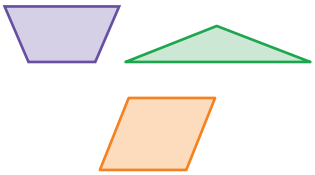


7 Circle the shape that has an acute angle, a right angle, and an obtuse angle.

8 The shapes below have been sorted into two groups based on their angles. Explain how the shapes could have been sorted.

Group 1

Group 2

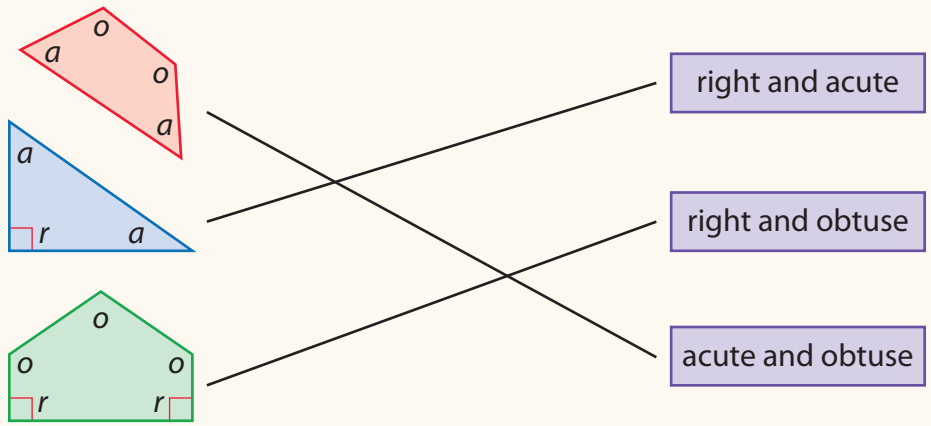


Practice Sorting Shapes Based on Angles

Study the Example showing how to sort shapes into groups based on angles. Then solve problems 1–5.

EXAMPLE

Label each angle in the shapes below with *a* for acute, *r* for right, and *o* for obtuse. Then draw a line from each shape to the group it belongs in.



1 Write the number of acute, right, and obtuse angles for each pentagon shown in the table below.

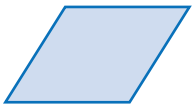
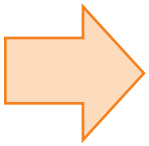
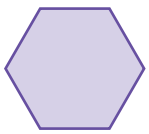
	Acute	Right	Obtuse
X			
Y			

2 Explain how these pentagons are different based on their angles.

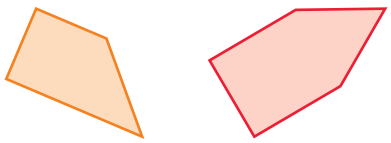
Solution .....

.....

3 Tell whether each shape belongs in the group described.

	Yes	No
 all right angles	Ⓐ	Ⓑ
 right and acute angles	Ⓒ	Ⓓ
 obtuse and acute angles	Ⓔ	Ⓕ
 right and obtuse angles only	Ⓖ	Ⓗ
 all obtuse angles	Ⓘ	Ⓙ

4 Describe a group that the two shapes at the right belong in, based on the kind of angles the shapes have.



Solution

5 Look at the shapes in problem 4. Where do they belong in the table below? Draw each shape in the column in which it belongs. Explain your answer.

Acute and Obtuse Angles	Acute and Right Angles	Obtuse and Right Angles	Acute, Right, and Obtuse Angles

Develop Sorting Triangles

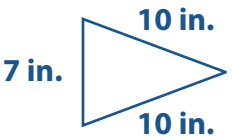
Read and try to solve the problem below.

A website sells 7 kinds of triangular flags based on sides and angles.

Flag	Equal Sides	Angles
1	3	3 acute
2	2	2 acute, 1 right
3	2	2 acute, 1 obtuse
4	2	3 acute

Flag	Equal Sides	Angles
5	0	2 acute, 1 right
6	0	2 acute, 1 obtuse
7	0	3 acute

The triangle at the right is a model for which flag number?



TRY IT

Math Toolkit

- protractors
- rulers
- index cards

DISCUSS IT

Ask your partner: Why did you choose that strategy?

Tell your partner: I do not understand how . . .

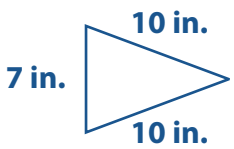
Explore different ways to understand how to sort triangles into groups based on kinds of angles and lengths of sides.

A website sells 7 kinds of triangular flags based on sides and angles.

Flag	Equal Sides	Angles
1	3	3 acute
2	2	2 acute, 1 right
3	2	2 acute, 1 obtuse
4	2	3 acute

Flag	Equal Sides	Angles
5	0	2 acute, 1 right
6	0	2 acute, 1 obtuse
7	0	3 acute

The triangle at the right is a model for which flag number?



PICTURE IT

You can use a picture to help describe the sides and angles of triangles.

Compare the angles of the triangle to a right angle. The triangle has 3 acute angles.

right angle | bottom left angle | top left angle | angle on right

The triangle has 2 sides of equal length (10 in.). Flag 4 has **2 sides of equal length** and **3 acute angles**. The triangle is a model for flag 4.

The tables below show triangle names based on the number of sides of equal length and kinds of angles.

Name	Description of Sides
equilateral	3 equal sides
isosceles	**2 equal sides**
scalene	0 equal sides

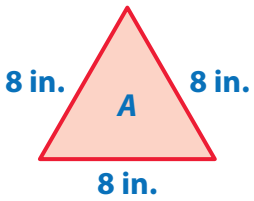
Name	Description of Angles
acute	**3 acute angles**
right	1 right angle
obtuse	1 obtuse angle

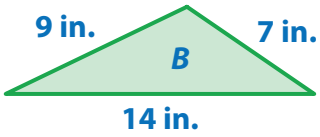
The triangle has 2 equal sides, so it is an **isosceles triangle**. Since it has 3 acute angles, it is an **acute triangle**.

CONNECT IT

Now you will use the problem from the previous page to help you understand how to sort triangles into groups based on kinds of angles and lengths of sides and how to name triangles.

1 Look back at the model for the triangular flag. Fill in the blanks to name this triangle based on its angles and sides: _____ _____ triangle





2 Look at triangle *A* above. How many sides are the same length? _____

What kinds of angles does it have? _____

What are two names for this triangle? _____

3 What are two names for triangle *B*? _____

Can triangle *B* also be called an acute triangle? Why or why not?

4 Explain how to give a complete description of a triangle.

5 REFLECT

Look back at your **Try It**, strategies by classmates, and **Picture It**. Which models or strategies do you like best for sorting triangles into groups based on kinds of angles and lengths of sides and for naming triangles? Explain.

_____

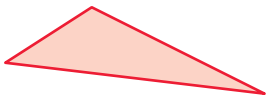
_____

_____

APPLY IT

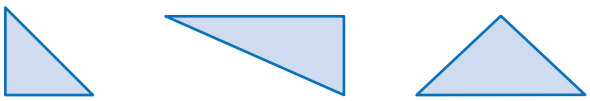
Use what you just learned to solve these problems.

6 Give a complete description of the triangle below. Show your work.



Solution

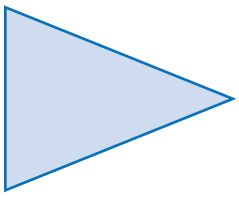
7 What do the triangles below have in common? How are they different?

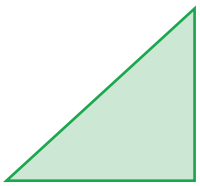


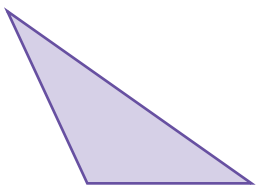
Solution

8 Which figure is an acute isosceles triangle?

Ⓐ 

Ⓑ 

Ⓒ 

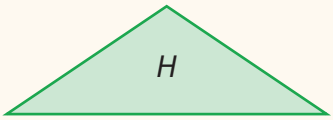
Ⓓ 

Practice Sorting Triangles

Study the Example showing how to sort triangles into groups based on kinds of angles and lengths of sides. Then solve problems 1–4.

EXAMPLE

What is the same about the two triangles shown at the right? What is different?



You can sort triangles into groups based on the kinds of angles they have: acute, right, or obtuse.

You can also sort triangles based on the lengths of their sides.

equilateral: 3 equal sides
isosceles: 2 equal sides
scalene: 0 equal sides

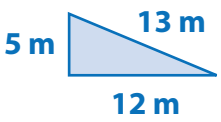
Triangles *B* and *H* are the same because they are both obtuse triangles. They each have 1 obtuse angle.

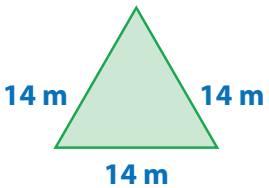
Triangles *B* and *H* are different because triangle *B* is a scalene triangle and triangle *H* is an isosceles triangle.

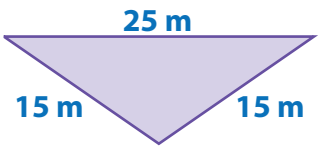
1 Look at the table. Name each triangle below based on the kinds of angles that it has and the lengths of its sides.

Name	Description of Angles
acute	3 acute angles
right	1 right angle
obtuse	1 obtuse angle

Name	Description of Sides
equilateral	3 equal sides
isosceles	2 equal sides
scalene	0 equal sides

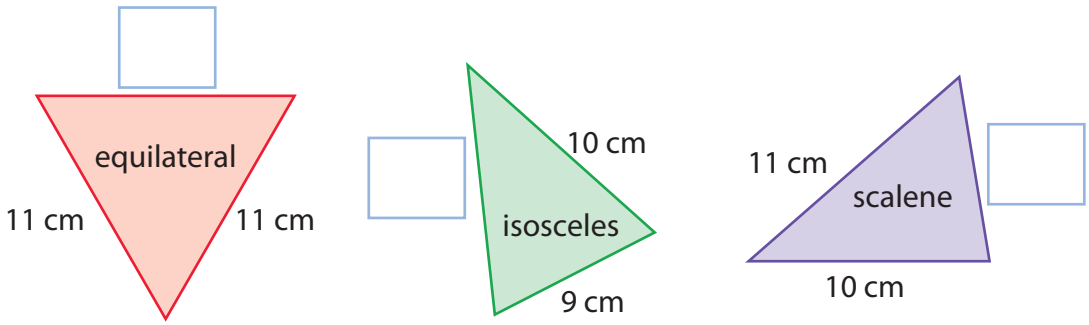




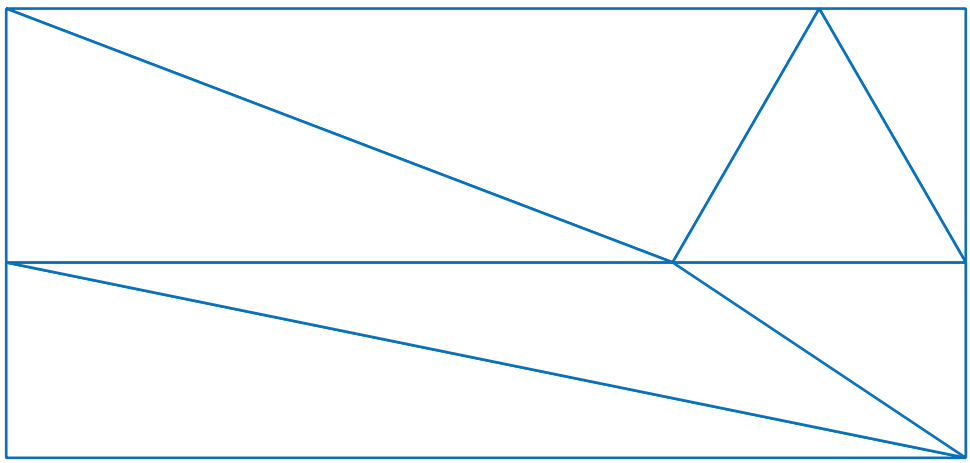


2 Look at the name of each triangle below. Then use the numbers in the boxes to write the missing length for one side of each triangle.

9 cm	10 cm	11 cm



3 Write labels inside each triangle formed by the lines in the drawing below: *a* for acute, *r* for right, *o* for obtuse, *e* for equilateral, *i* for isosceles, *s* for scalene.



4 Which statements below are true?

Ⓐ An obtuse triangle does not have acute angles.

Ⓑ A scalene triangle can be isosceles.

Ⓒ Equilateral triangles are always acute.

Ⓓ Isosceles triangles can be obtuse.

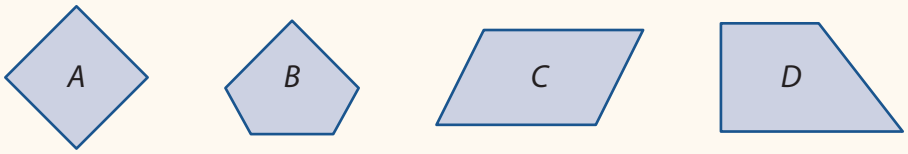
Ⓔ Right triangles are scalene or isosceles.

Refine Classifying Two-Dimensional Figures

Complete the Example below. Then solve problems 1–7.

EXAMPLE

Do any of the shapes below have at least one pair of parallel sides and at least one right angle? If yes, list the shapes. If no, explain.



Look at how you could show your work using a table.

Shape	Parallel Sides	Right Angle
A	X	X
B		X
C	X	
D	X	X

Solution

The student listed each shape in a table and used an X to show that a shape had parallel sides or a right angle.

PAIR/SHARE
How could you test for parallel sides?

APPLY IT

1 Nate and Alicia play Draw My Shape. Nate says: *My shape has 2 pairs of parallel sides, 2 acute angles, and 2 obtuse angles*. Alicia draws the rectangle below. Explain why Alicia's answer is incorrect.

Solution

You can test the angles to see if they are acute, right, or obtuse.

PAIR/SHARE
Can you have a 4-sided shape with 4 right angles and only 1 pair of parallel sides?

2 Tell how the sides and angles of the shapes below are alike and different.

square rhombus

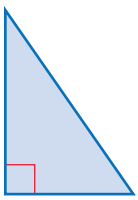
All the square's angles look alike, but the rhombus looks like it has two different kinds of angles.

Solution

PAIR/SHARE

What does a rhombus have in common with a parallelogram?

3 Which is the best name for the triangle shown?



Ⓐ acute isosceles triangle

Ⓑ acute scalene triangle

Ⓒ right isosceles triangle

Ⓓ right scalene triangle

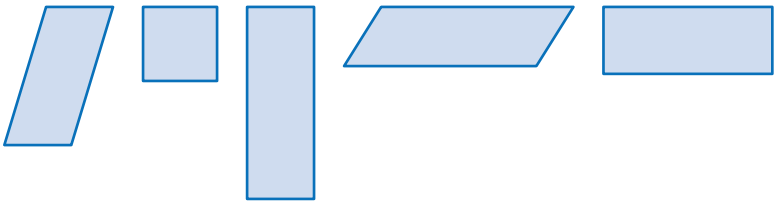
Ricky chose Ⓑ as the correct answer. How did he get that answer?

How many right angles does a triangle have to have to be called a "right triangle"?

PAIR/SHARE

Could a triangle ever have 2 right angles?

4 Which is the best name for the group of shapes below?



Ⓐ shapes with acute angles

Ⓑ shapes with right angles

Ⓒ shapes with parallel sides

Ⓓ shapes with perpendicular sides

5 Sort the four shapes below. Use the characteristics shown in the table. Draw each shape in each column where it belongs. Some shapes may belong in more than one column.

equilateral triangle

parallelogram

square

right trapezoid

Shapes with at Least One Acute Angle	Shapes with at Least One Pair of Perpendicular Sides	Shapes with at Least One Pair of Parallel Sides

6 Tell whether each sentence is *True* or *False*.

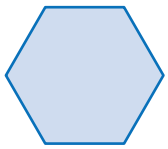
	True	False
A right scalene triangle can have 3 different kinds of angles.	Ⓐ	Ⓑ
A right isosceles triangle has 2 right angles.	Ⓒ	Ⓓ
An equilateral triangle is also an acute triangle.	Ⓔ	Ⓕ
A triangle can have 2 perpendicular sides.	Ⓖ	Ⓗ

7 MATH JOURNAL

Divide the shapes below into two groups. Give each group a title that tells what all the shapes in that group have in common. Then describe another shape that belongs to each group.

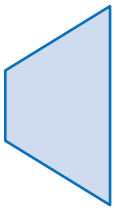
quadrilateral

square

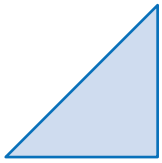


hexagon

parallelogram



trapezoid



triangle

SELF CHECK Go back to the Unit 5 Opener and see what you can check off.