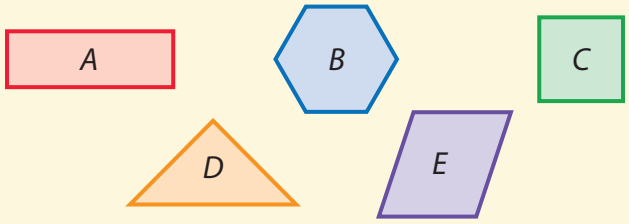
Lesson 32 Introduction

Classify Two-Dimensional Figures

Use What You Know

In Lesson 31, you learned about parallel and perpendicular lines. Now you will use this understanding to classify two-dimensional shapes. Take a look at this problem.

Look at the shapes below. Put a check mark on all the shapes that appear to have at least one pair of parallel sides. Put a star on all the shapes that appear to have at least one pair of perpendicular sides.



a. Which shapes have a pair of sides that are always the same distance apart?

_____

b. Lines, line segments, and rays that are always the same distance apart and never cross are called _____.

c. Which shapes have a pair of sides that form a right angle? _____

d. Lines, line segments, and rays that form a right angle when they meet are called _____.

e. Explain how you could test your choices. _____

_____

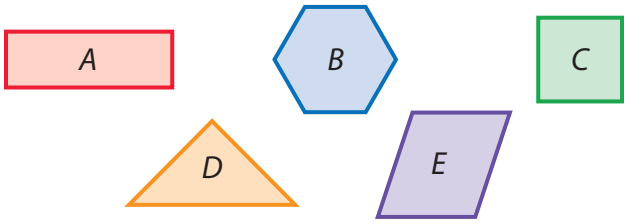
_____

_____

Find Out More

You know that there are many different kinds of shapes with straight sides, such as triangles and quadrilaterals. These shapes are types of **polygons**. There are many ways you can sort these shapes, such as by the number of sides the shape has. You can also sort them by the relationships between the sides.

Take another look at the shapes from the previous page. You can sort them by looking for pairs of parallel and perpendicular sides.



- Shapes with pairs of parallel sides *and* pairs of perpendicular sides: *A* and *C*

You can also sort the shapes by the kinds of angles they have. Here are some ways to sort the shapes by angles.

- Shapes with at least one right angle: *A*, *C*, and *D*
- Shapes with all right angles: *A* and *C*
- Shapes with at least one acute angle: *D* and *E*
- Shapes with at least one obtuse angle: *B* and *E*
- Shapes with all obtuse angles: *B*

Reflect

1 Describe the sides and the angles of shape *C*. _____

_____

_____

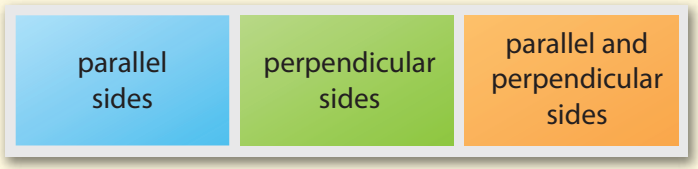
_____

_____

Learn About Sorting Shapes Based on Sides

Read the problem below. Then explore different ways to understand sorting shapes into groups based on parallel and perpendicular sides.

Evan plays a board game. The board is divided into 3 sections.



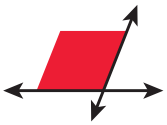
These are Evan's cards. In which sections of the board do the cards belong?

Picture It You can use drawings to help sort shapes.

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

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

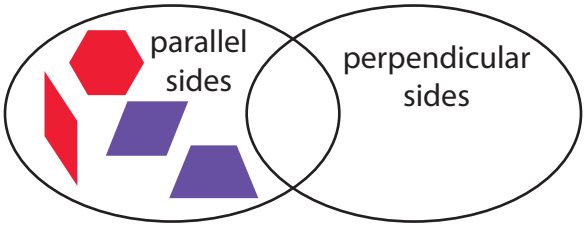
Draw lines along sides of each shape that form angles. Compare these lines to the perpendicular lines you drew.



Model It You can use a model to help sort shapes.

Make a Venn diagram. Put each card's shape where it belongs in the diagram.

Evan's cards belong in the "parallel sides" section of the board.



Connect It

Now you will solve a problem similar to the one from the previous page. Evan gets different cards with a square and a quadrilateral. In which sections of the board do these shapes belong?

2 Look at the sides of the square. In which category does it belong?

square

3 Does the quadrilateral belong to any of the three categories? If not, name a category that can be used to describe this shape.

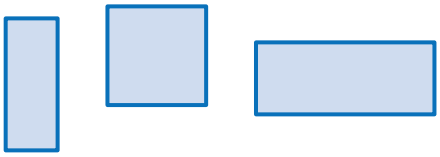
quadrilateral

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

Try It

Answer the following questions using the shapes shown.

5 Describe the group these shapes belong in, based on the kinds of sides they have.

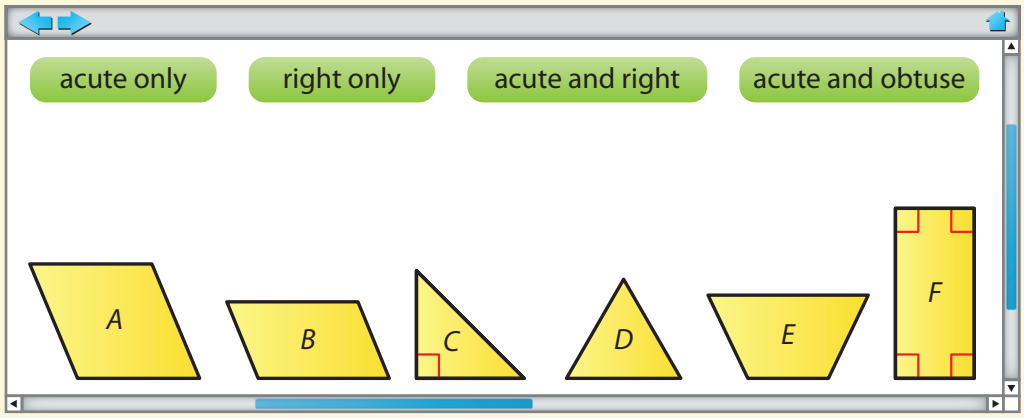


6 Circle the shape that belongs in the group "no parallel sides."

Learn About Sorting Shapes Based on Angles

Read the problem below. Then explore different ways to understand sorting shapes into categories based on angles.

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

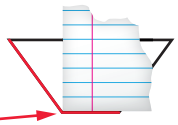


Picture It You can use a model to help sort shapes based on angles.

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**.

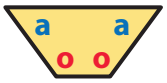


Then you can compare the corner to each of the other 3 angles in the trapezoid.

Model It You can label a picture 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 sort shapes based on angles to solve the problem from the previous page.**

7 Look at parallelograms *A* and *B*. Do they belong to the same group? Explain. Draw arrows to the correct group(s). _____

_____

8 Look at the two triangles. Describe the angles in each one. _____

_____

Draw arrows to match the triangles with their group(s).

9 Look at the trapezoid and rectangle. Which has right angles only? _____
Look at *Picture It*. To which group does the trapezoid belong?
_____ Draw arrows to the group(s).

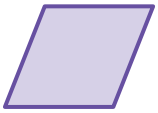
10 Explain how to sort shapes based on whether they have acute, right, or obtuse angles. _____

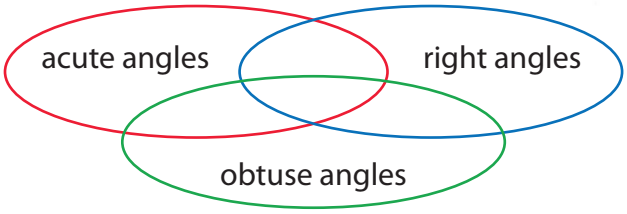
_____

_____

Try It **Use what you just learned to solve these problems.**

11 Where does the rhombus at the right belong in the Venn diagram below? Mark the place with an X.





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

Learn About Sorting Triangles

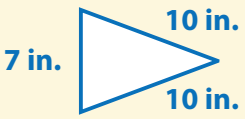
Read the problem below. Then explore different ways to understand sorting triangles into groups based on kinds of angles and lengths of sides.

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? What is the name of this triangle?



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.

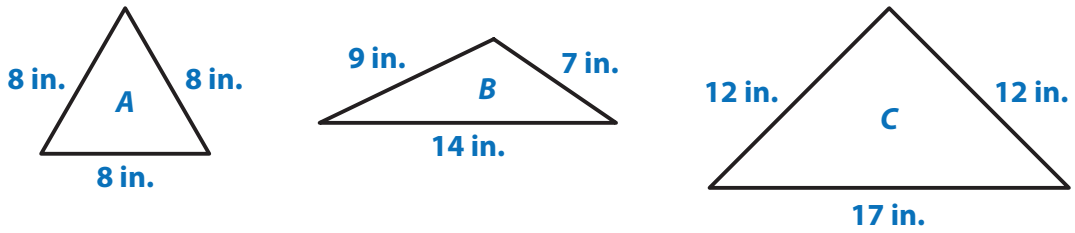
The tables below show triangle names based on the number of sides of equal length and kinds of angles.

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's an isosceles triangle. Since it has 3 acute angles, it is an acute triangle. The triangle is an acute isosceles triangle.

Connect It Now you will explore naming triangles further.



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

What kinds of angles does it have? _____

What are two names for this triangle? _____

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

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

_____

_____

15 What are two names for triangle *C*? Explain.

_____

_____

16 Explain how to give a complete description of a triangle. _____

_____

_____

Try It Use what you just learned to solve these problems.

17 Give a complete description of the triangle below.

_____

18 What do the triangles below have in common? _____

How are they different? _____

_____

Practice Classifying Two-Dimensional Figures

Study the example below. Then solve problems 19–21.

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 Yes; A and D

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

Pair/Share
How could you test for parallel lines?

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19 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 _____

I 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?

20 Compare and contrast the sides and angles of the shapes below.

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?

21 Julio is missing one piece from the middle of the puzzle below. Circle the letter of the correct answer.

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

Which name best describes the missing piece?

A acute isosceles triangle

B acute scalene triangle

C right isosceles triangle

D right scalene triangle

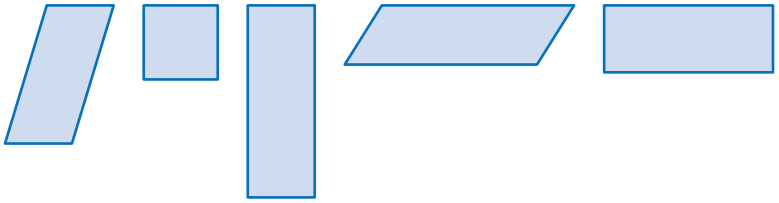
Ricky chose **B** as the correct answer. How did he get that answer?

Pair/Share
Could a triangle ever have 2 right angles?

Practice Classifying Two-Dimensional Figures

Solve the problems.

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



A shapes with acute angles

B shapes with right angles

C shapes with parallel sides

D shapes with perpendicular sides

2 Sort these four shapes. Use the characteristics labeled in the boxes below. Draw each shape in each of the boxes where it belongs. Some shapes may belong in more than one box.

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

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

a. A right scalene triangle can have 3 different kinds of angles. ☐ True ☐ False

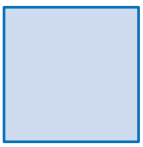
b. A right isosceles triangle has 2 right angles. ☐ True ☐ False

c. An equilateral triangle is also an acute triangle. ☐ True ☐ False

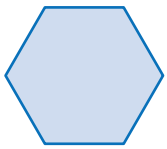
d. A triangle cannot have two perpendicular sides. ☐ True ☐ False

4 Divide the shapes below into 2 groups. Give each group a title that tells what all the shapes in that group have in common. Then draw another shape that belongs to each group.

quadrilateral

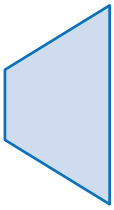


square

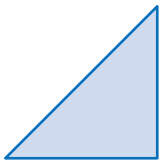


hexagon

parallelogram



trapezoid



triangle

Show your work.

Self Check **Go back and see what you can check off on the Self Check on page 331.**