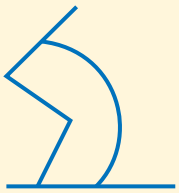
# Points, Lines, Rays, and Angles



## Use What You Know

**In the past, you have learned about shapes like squares, rectangles, and triangles. Now you will learn more about the parts that make up these shapes. Take a look at this problem.**

Traci tries to teach her younger sister how to draw a rectangle. Traci tells her, "Draw a shape with four straight sides." Traci's sister draws the shape at the right.



The shape includes 4 straight sides. Why is Traci's sister's drawing not a rectangle?

**a.** What is the total number of sides in a rectangle? _____

**b.** Are the sides of a rectangle straight, curved, or some of each? _____

**c.** How many corners does a rectangle have? _____

**d.** Are the corners of a rectangle like the corner of a sheet of paper, or are they narrower or wider? _____

**e.** Do some or all of the sides of a rectangle go on forever or do they all stop at a certain point? _____

**f.** Are all the sides of a rectangle the same length or can some be different lengths?

_____

_____

**g.** Explain how Traci could make her directions more clear. _____

_____

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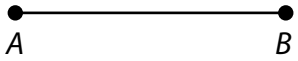
## Find Out More

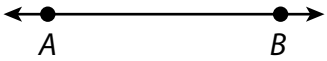
Traci's directions are not clear and complete. In geometry, certain words are used to describe shapes in detail. Below are some of these words.

**Point**—A point is a single location in space. You can draw a dot to show a point. Name points with a capital letter: point *A*.

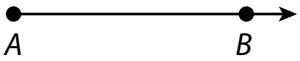

**Line Segment**—A line segment is a straight row of points that starts at one point and ends at another point. You can write "line segment *AB*" as $\overline{AB}$.



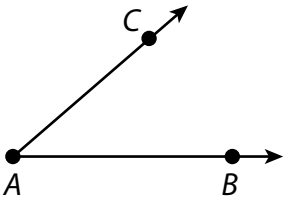

**Line**—A line is a straight row of points that goes on forever in both directions. You can write "line *AB*" as $\overleftrightarrow{AB}$. The arrows show that the line goes on forever in both directions.




**Ray**—A ray is a straight row of points that starts at one point and goes on forever in one direction. You can write "ray *AB*" as $\overrightarrow{AB}$. When you name a ray, you always start with the endpoint.




**Angle**—If rays, lines, or line segments meet at a common point, they form an angle. You can write "angle *A*" as $\angle A$. Notice that $\angle A$ is made up of $\overrightarrow{AB}$ and $\overrightarrow{AC}$ meeting at point *A*. You can also name this angle using three points: $\angle CAB$ or $\angle BAC$. The vertex is always the middle letter.



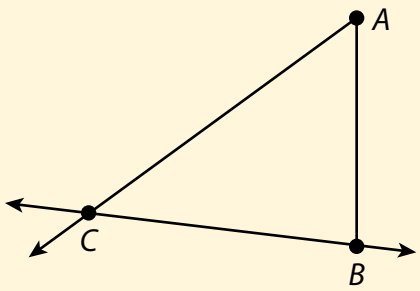

## Reflect

**1** Use geometry words and symbols to describe the rectangle below.

# Learn About Points, Lines, Line Segments, and Rays

**Read the problem below. Then explore different ways to understand points, lines, line segments, and rays.**

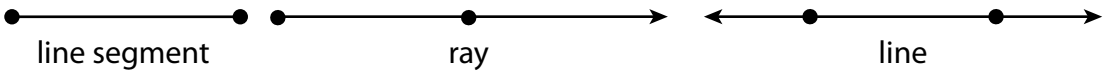
Kent draws a shape with three sides. Use geometry words to describe each side of the shape.




## Picture It

**You can make some drawings to help describe the sides of the shape.**

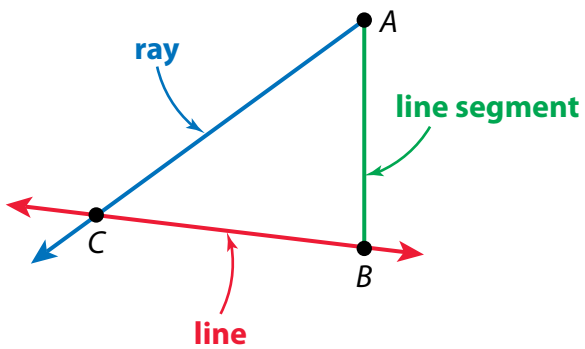
Each side is straight. Draw the different kinds of straight rows of points that you know.




## Model It

**You can also use words to help describe the sides of the shape.**

Label the line segment, ray, and line that are drawn as the sides of Kent's shape. Look for endpoints and arrowheads.



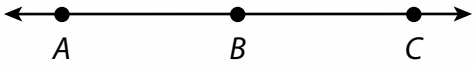
## Connect It Now you will explore real-world examples of geometry words and solve a problem similar to the one on the previous page.

**2** Name a real-world example of a line segment. _____

**3** When two line segments, lines, or rays meet at a point, they form an angle. Name a real-world example of an angle. _____

**4** Name a real-world example of a ray. _____

**5** Explain how the drawing below represents one line, three line segments, four rays, and one angle.

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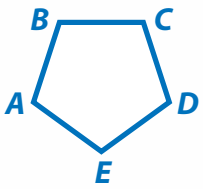
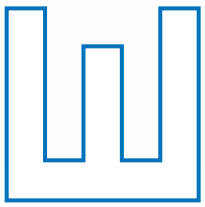
## Try It Use what you just learned to solve these problems.

**6** How many lines are in this shape? _____ How many rays? _____



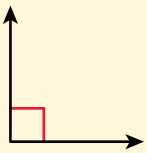

**7** How many line segments are in this shape? _____



# Learn About Identifying Angles

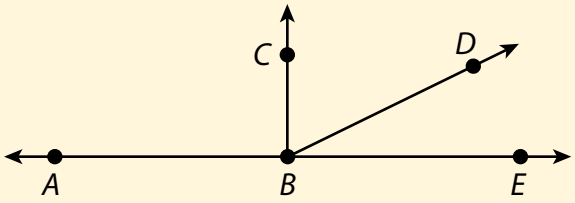
**Read the problem below. Then explore different ways to understand angles.**

The angle shown at the right is a **right angle**. A right angle looks like a square corner and measures 90°.



Look at the figure below. Name the rays that make up each of the angles listed.

1. A right angle
2. An angle that has a smaller opening than a right angle
3. An angle that has a wider opening than a right angle, but does not open as wide as a straight line

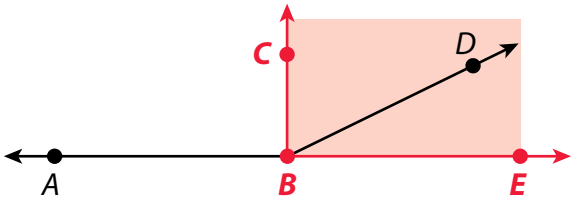



## Picture It

**You can make a drawing to help identify different types of angles.**

Use shading to find the rays that make each angle.

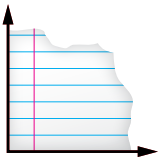
A right angle is shaded. Look at the rays along the edges of the shaded area.




## Model It

**You can also use a model to help identify different types of angles.**

Compare the opening of an angle to a right angle by holding the corner of a sheet of paper next to the angle. The angle below opens as wide as a right angle.



## Connect It **Now you will extend your understanding of angles to identify them in the figure on the previous page.**

**8** *Model It* shows a right angle. Draw a right angle. Then use 3 points to name a right angle in the figure on the previous page. _____

**9** An angle that has a smaller opening than a right angle is called an **acute angle**. Name an acute angle in the figure on the previous page. _____ Draw an acute angle.

**10** An angle that has a wider opening than a right angle, but does not open as wide as a straight line, is called an **obtuse angle**. Name an obtuse angle in the figure on the previous page. _____ Draw an obtuse angle.

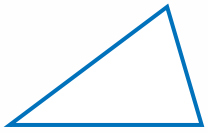
**11** Explain how you could decide whether any angle is acute, right, or obtuse.

_____

_____

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

**12** How many acute angles are in the shape below? _____

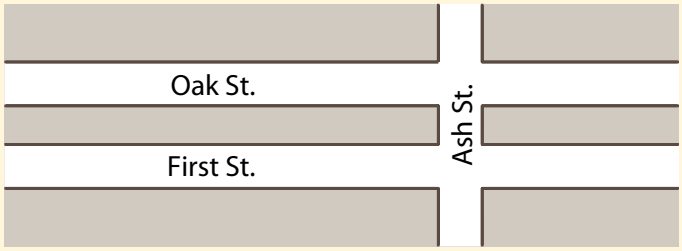


**13** How many obtuse angles are in the shape below? _____

# Learn About Parallel and Perpendicular Lines

**Read the problem below. Then explore different ways to understand parallel and perpendicular lines and line segments.**

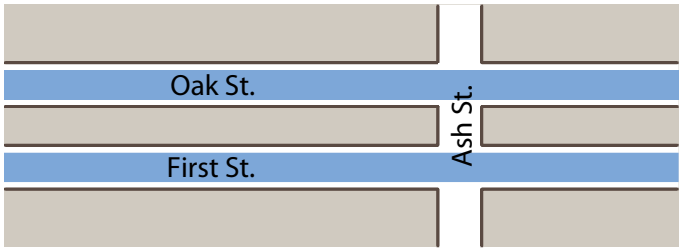
Jordan looks at the street map below.




Describe the relationship between Oak Street and First Street. Then describe the relationship between Oak Street and Ash Street. How are they different?

## Picture It You can use a sketch to help understand the problem.

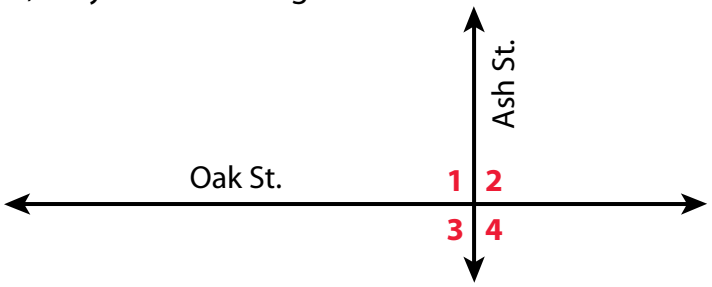
Sketch a picture of Oak Street and First Street. Shade the streets.




Notice that the streets do not cross.

## Model It You can also use a model to help understand the problem.

Look at Oak Street and Ash Street. Think of each street as a line. When the two lines cross, they form four angles.



## Connect It **Now you will use understanding of parallel and perpendicular lines to identify them in the map from the previous page.**

**14** Lines that are always the same distance apart and never cross are called **parallel lines.** Name a real-world example of parallel lines.

**15** Suppose each street keeps going in a straight line. If Jordan travels on Oak Street and makes no turns, can he ever get to First Street? Explain.

**16** Describe the angles that Oak Street and Ash Street make when they cross.

**17** Lines that cross and form a right angle are called **perpendicular lines.** Name a real-world example of perpendicular lines.

**18** Explain why 3 separate lines can all be parallel to each other, but 3 separate lines cannot all be perpendicular to each other. Use a drawing to show your answer.

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

**19** How many pairs of parallel sides does the shape below appear to have? _____

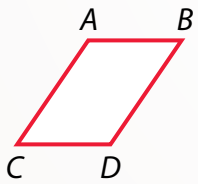
**20** A rectangle is a parallelogram with _____ pairs of parallel sides.

# Practice Identifying Points, Lines, Rays, and Angles

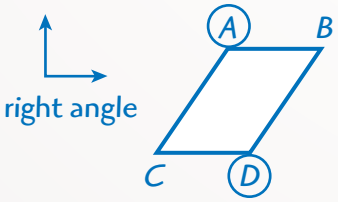
**Study the example below. Then solve problems 21–23.**

## Example

In the shape below, list each pair of parallel sides and circle the letter marking each obtuse angle.




**Look at how you could show your work.**




***Solution*** $\overline{AB}$ and $\overline{CD}$ are parallel. $\overline{AC}$ and $\overline{BD}$ are parallel.

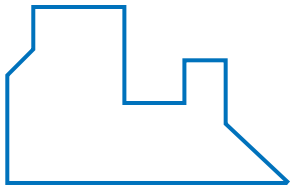
$\angle A$ and $\angle D$ open wider than a right angle, so they are obtuse.

Even if the sides of the shape went on forever, the opposite sides would never cross each other.

**Pair/Share**

What kind of angles are $\angle B$ and $\angle C$? How do you know?

**21** Put an X where each pair of perpendicular line segments meet in the shape below.

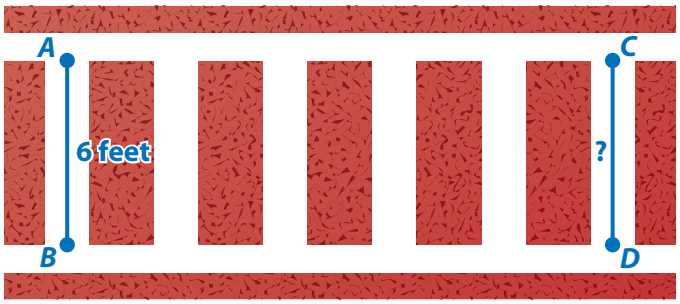


Perpendicular line segments meet to form right angles.

**Pair/Share**

Describe the angles that are NOT marked with an X.

**22** A crosswalk is marked with a pair of parallel line segments. The distance straight across from point *A* to point *B* is 6 feet. What is the distance straight across from point *C* to point *D*?

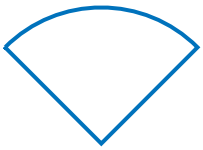



What facts do I know about parallel lines?

**Pair/Share**
Can the lines still be parallel if the distance from *C* to *D* is 3 feet?

***Solution*** _____

**23** Toshi cuts one fourth of a circle out of paper. How many angles does this shape have? Circle the letter of the correct answer.



I know that it takes two rays to make an angle.

**A** 0

**B** 1

**C** 2

**D** 3

Esme chose **D** as the correct answer. How did she get that answer?

_____

_____

_____

_____

**Pair/Share**
Does Esme's answer make sense?

# Practice Identifying Points, Lines, Rays, and Angles

**Solve the problems.**

**1** Think about a real-world example of where a wall meets the floor and where the same wall meets the ceiling. Which term describes the edge of the floor and the edge of the ceiling?

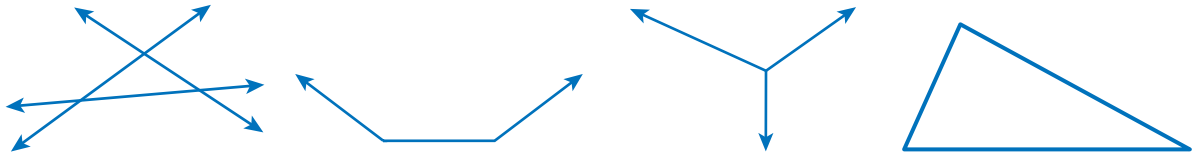
**A** parallel line segments

**B** perpendicular line segments

**C** right angle

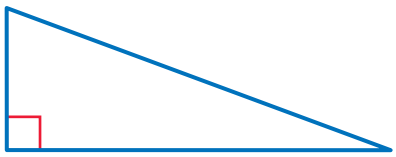
**D** acute angle

**2** Which drawing shows 3 lines?



**A** **B** **C** **D**

**3** Choose either *Yes* or *No* to tell whether there is an example of the given term in the diagram below.



| | | |
|---|---|---|
| **a.** parallel line segments | ☐ Yes | ☐ No |
| **b.** perpendicular line segments | ☐ Yes | ☐ No |
| **c.** right angle | ☐ Yes | ☐ No |
| **d.** acute angle | ☐ Yes | ☐ No |
| **e.** obtuse angle | ☐ Yes | ☐ No |

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

**a.** A ray goes on forever in two directions. ☐ True ☐ False

**b.** A line segment has exactly two endpoints. ☐ True ☐ False

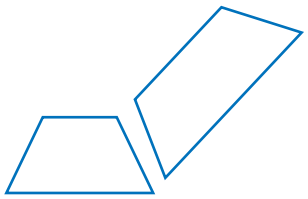
**c.** An obtuse angle has a wider opening than a right angle. ☐ True ☐ False

**d.** Parallel lines meet to form an acute angle. ☐ True ☐ False

**5** A triangle can have one pair of perpendicular sides. Can a triangle have one pair of parallel sides? Use drawings and words to explain your answer.

**Show your work.**

**6** Liz draws two shapes. Use words you have learned in this lesson to describe what the shapes have in common. How are they different?



**Self Check** **Go back and see what you can check off on the Self Check on page 335.**