Lines, Rays, and Angles

Essential Question How can you identify and draw points, lines, line segments, rays, and angles?

🔓 UNLOCK the Problem REAL WORLD

Everyday things can model geometric figures. For example, the period at the end of this sentence models a point. A solid painted stripe in the middle of a straight road models a line.
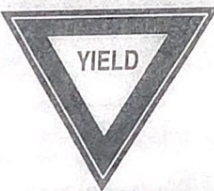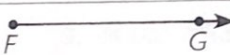
Term and Definition	Draw It	Read It	Write It	Example
A **point** is an exact location in space.	A •	point *A*	point *A*	
A **line** is a straight path of points that continues without end in both directions.	B ← • ——— • → C	line *BC* line *CB*	$\overleftrightarrow{BC}$ $\overleftrightarrow{CB}$	
A **line segment** is part of a line between two endpoints.	D • ——— • E	line segment *DE* line segment *ED*	$\overline{DE}$ $\overline{ED}$	YIELD
A **ray** is a part of a line that has one endpoint and continues without end in one direction.	F • ——— • → G	ray *FG*	$\overrightarrow{FG}$	ONE WAY
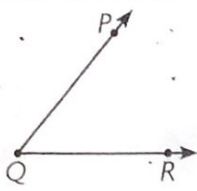
🔑 Activity 1 Draw and label $\overleftrightarrow{JK}$.

_____
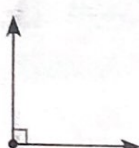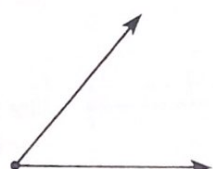
• Is there another way to name $\overleftrightarrow{JK}$? Explain.

_____

_____

Angles

Term and Definition	Draw It	Read It	Write It	Example
An **angle** is formed by two rays or line segments that have the same endpoint. The shared endpoint is called the vertex.	P / Q / R	angle *PQR* angle *RQP* angle *Q*	$\angle PQR$ $\angle RQP$ $\angle Q$	

You can name an angle by the vertex. When you name an angle using 3 points, the vertex is always the point in the middle.

Angles are classified by the size of the opening between the rays.

| A **right angle** forms a square corner.	A **straight angle** forms a line.	An **acute angle** is less than a right angle.	An **obtuse angle** is greater than a right angle and less than a straight angle.

Activity 2 Classify an angle.
Materials ▪ paper

To classify an angle, you can compare it to a right angle.

Make a right angle by using a sheet of paper. Fold the paper twice evenly to model a right angle. Use the right angle to classify the angles below.
Write *acute, obtuse, right,* or *straight.*

a.

b.

c.

d.

Share and Show MATH BOARD
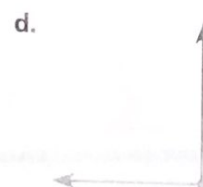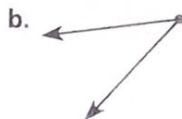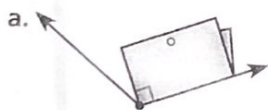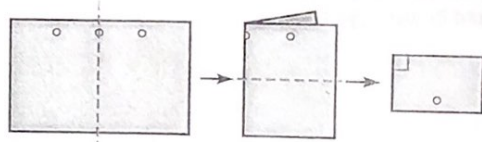
1. Draw and label $\overline{AB}$ in the space at the right.

   $\overline{AB}$ is a _____.

Draw and label an example of the figure.

2. $\overleftrightarrow{XY}$

   ✓ 3. obtuse ∠K

   4. right ∠CDE

Use Figure M for 5 and 6.

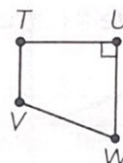5. Name a line segment.

   ✓ 6. Name a right angle.

Figure M

On Your Own

Draw and label an example of the figure.

7. $\overrightarrow{PQ}$

   8. acute ∠RST

   9. straight ∠WXZ

Use Figure F for 10–15.

10. Name a ray.

11. Name an obtuse angle.

12. Name a line.

13. Name a line segment.
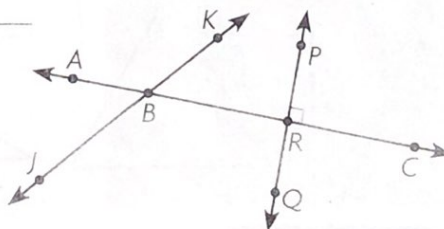
14. Name a right angle.

15. Name an acute angle.

Figure F

Name _____

Share and Show ![MATH BOARD] ·

1. Name the triangle. Tell whether each angle is *acute*, *right*, or *obtuse*.

   A name for the triangle is _____.

   ∠F is _____.

   ∠G is _____.

   ∠H is _____.
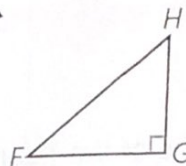
Classify each triangle. Write *acute*, *right*, or *obtuse*.

2.
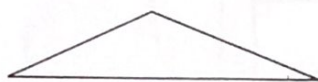
3.

4.

On Your Own ·

Classify each triangle. Write *acute*, *right*, or *obtuse*.

5.

6.

7.

8. **H.O.T.** Cross out the figure that does not belong. **Explain.**

Parallel Lines and Perpendicular Lines
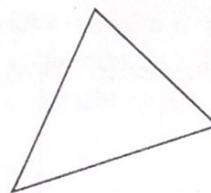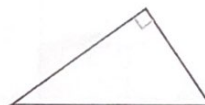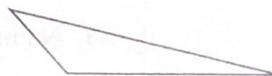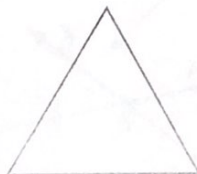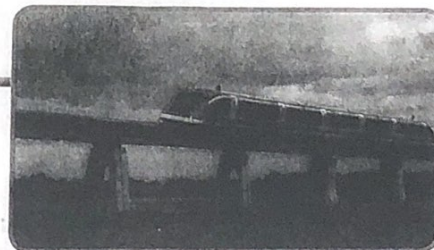
Essential Question How can you identify and draw parallel lines and perpendicular lines?

🔑 UNLOCK the Problem REAL WORLD

You can find models of lines in the world around you. For example, two streets that cross each other model intersecting lines. Metal rails on a train track that never cross model parallel lines.

▲ Maglev trains use magnets to lift them above the tracks while moving.

Term and Definition	Draw It	Read It	Write It
Intersecting lines are lines in a plane that cross at exactly one point. Intersecting lines form four angles.		Line *HI* intersects line *JK* at point *X*.	$\overleftrightarrow{HI}$ and $\overleftrightarrow{JK}$ intersect at point *X*
Parallel lines are lines in a plane that are always the same distance apart. Parallel lines never intersect.		Line *DE* is parallel to line *FG*.	$\overleftrightarrow{DE} \parallel \overleftrightarrow{FG}$ The symbol ‖ means "is parallel to."
Perpendicular lines are lines in a plane that intersect to form four right angles.		Line *LM* is perpendicular to line *NO*.	$\overleftrightarrow{LM} \perp \overleftrightarrow{NO}$ The symbol ⊥ means "is perpendicular to."

Try This! Tell how the streets appear to be related. Write *perpendicular*, *parallel*, or *intersecting*.

- W 36th St and Broadway _____

- W 35th St and 7th Ave _____

- W 37th St and W 36th St _____

Math Talk MATHEMATICAL PRACTICES
Can two rays be parallel? **Explain.**

🔑 Activity Draw and label $\overrightarrow{YX} \perp \overrightarrow{YZ}$ intersecting at point Y.

Materials ▪ straightedge

STEP 1: Draw and label $\overrightarrow{YX}$.

STEP 2: Then draw and label $\overrightarrow{YZ}$.

• How can you check if two rays are perpendicular?

◄- - - - -►

STEP 3: Make sure $\overrightarrow{YX}$ and $\overrightarrow{YZ}$ intersect at point Y.

STEP 4: Make sure the rays are perpendicular.

1. Name the figure you drew.

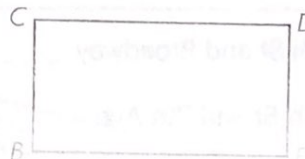2. Can you classify the figure? **Explain.**

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1. Draw and label $\overline{QR} \parallel \overline{ST}$.

Think: Parallel lines never intersect. Parallel line segments are parts of parallel lines.

Use the figure for 2 and 3.

📝 2. Name two sides that appear to be parallel.

✏️ 3. Name two sides that appear to be perpendicular.

C _____ D

B ‾‾‾‾‾

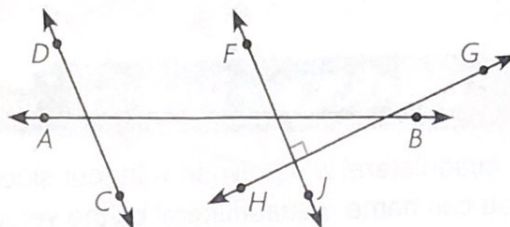**MATHEMATICAL PRACTICES**

Math Talk Explain how the symbols ⊥ and ∥ help you remember which relationships they describe.

On Your Own ·

Use the figure for 4–5.

4. Name a pair of lines that appear to be perpendicular. _____

5. Name a pair of lines that appear to be parallel.

_____

Draw and label the figure described.

6. $\overline{RS} \parallel \overline{TU}$

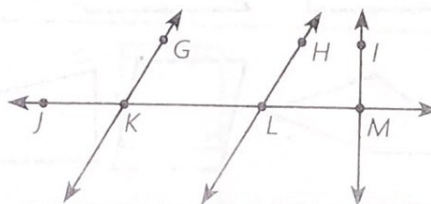7. $\overleftrightarrow{KL}$ and $\overrightarrow{KM}$

8. $\overline{CD} \perp \overline{DE}$

9. $\overleftrightarrow{JK} \perp \overleftrightarrow{LM}$

10. $\overrightarrow{ST}$ intersecting $\overleftrightarrow{UV}$ at point X

11. $\overleftrightarrow{AB} \parallel \overline{FG}$

Use the figure for 12–13.

12. **H.O.T.** **What's the Error?** Dan says that $\overleftrightarrow{HL}$ is parallel to $\overleftrightarrow{IM}$. Is Dan correct? **Explain.**

_____

_____

13. Name two intersecting line segments that are not perpendicular.

_____

_____

Name _____

Classify Quadrilaterals

Essential Question How can you sort and classify quadrilaterals?

UNLOCK the Problem REAL WORLD

A quadrilateral is a polygon with four sides and four angles.
You can name a quadrilateral by the vertices of its angles.

Quadrilateral *ABCD* is a possible name for the figure shown
at the right. Quadrilateral *ACBD* is not a possible name,
since points *A* and *C* are not endpoints of the same side.

Assume that line segments that appear to be parallel are
parallel.
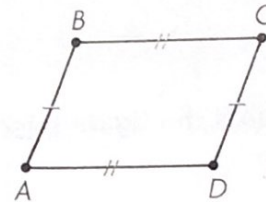
The tick marks on the line segments
show that they have the same length.
Sides *AD* and *BC* have the same length.
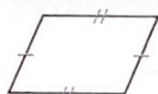Sides *AB* and *CD* have the same length.

Common Quadrilaterals
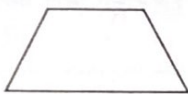
Trapezoid
- 1 pair of parallel sides

Parallelogram
- 2 pairs of parallel sides
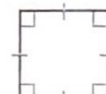- 2 pairs of sides of equal length

Rhombus
- 2 pairs of parallel sides
- 4 sides of equal length

Rectangle
- 2 pairs of parallel sides
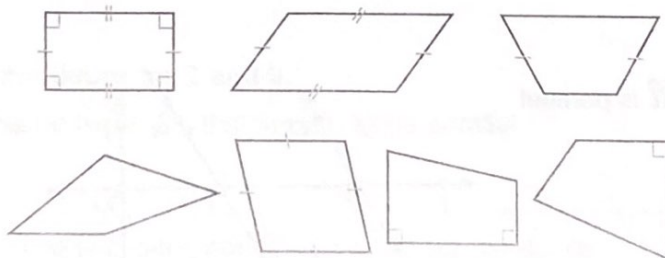- 2 pairs of sides of equal length
- 4 right angles

Square
- 2 pairs of parallel sides
- 4 sides of equal length
- 4 right angles

Activity 1 Identify right angles in quadrilaterals.

Materials ■ color pencils

Use the Quadrilateral Color Guide to color the quadrilaterals.

| Quadrilateral Color Guide	
RED:	exactly 4 right angles
BLUE:	exactly 2 right angles
ORANGE:	exactly 1 right angle

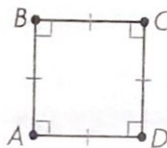**Math Talk** MATHEMATICAL PRACTICES
Can a quadrilateral
have exactly 3 right angles?
Explain

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🔑 Activity 2 Use a Venn diagram to sort quadrilaterals.

Write the names of the quadrilaterals in the Venn diagram.

Quadrilaterals

Exactly 1 Pair of Parallel Sides

_____

_____

_____

No Parallel Sides

_____

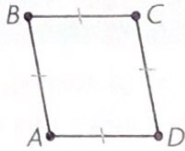_____

_____

2 Pairs of Parallel Sides

_____

_____

_____
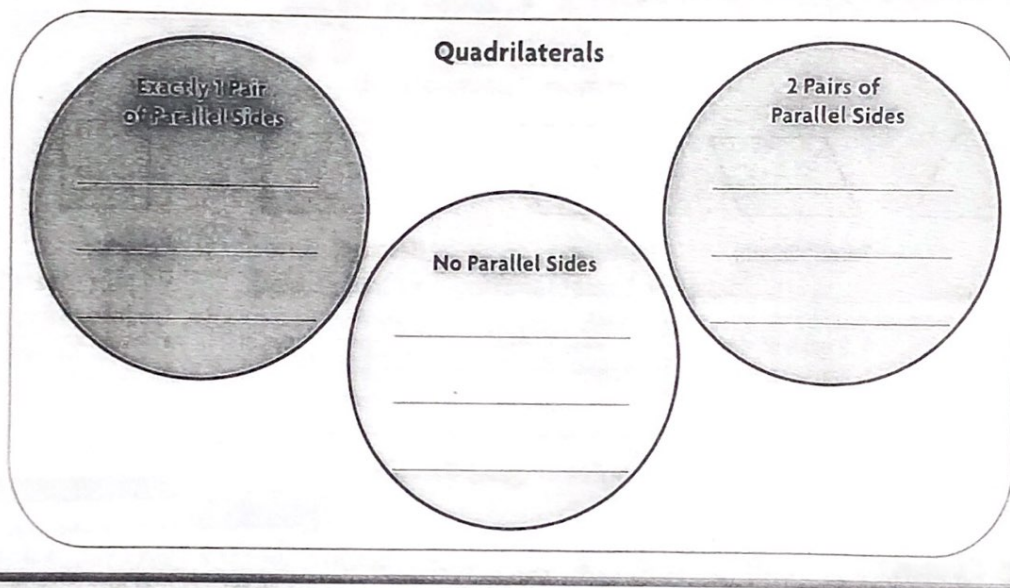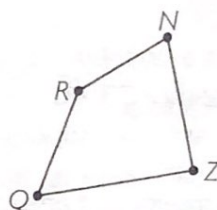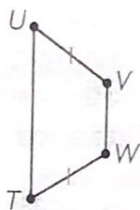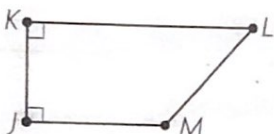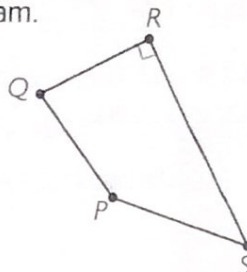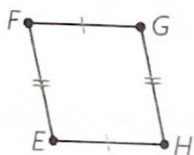
Try This! Classify each figure as many ways as possible. Write *quadrilateral, trapezoid, parallelogram, rhombus, rectangle,* or *square.*

a.

b.

c.

Name _____

Share and Show 🔲 MATH BOARD
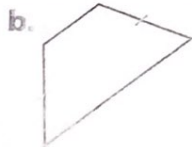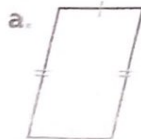
1. Tell whether the quadrilateral is also a trapezoid, parallelogram, rhombus, rectangle, or square.
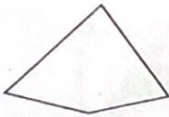
Think: _____ pairs of parallel sides

_____ sides of equal length
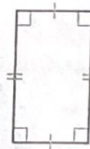
_____ right angles

Quadrilateral *ABCD* is also a _____.

Classify each figure as many ways as possible. Write *quadrilateral, trapezoid, parallelogram, rhombus, rectangle,* **or** *square.*
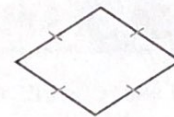
2.

_____

_____

_____

3.

_____

_____

_____

4.

_____

_____

_____

MATHEMATICAL PRACTICES

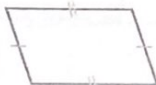**Math Talk** How would you classify a figure with 4 sides, none of which are parallel? Explain.

On Your Own

Classify each figure as many ways as possible.
Write *quadrilateral, trapezoid, parallelogram, rhombus, rectangle,* or *square.*

5.
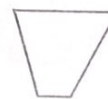
6.

7.

Name _____

✓ Mid-Chapter Checkpoint

▶ Vocabulary

Choose the best term from the box to complete the sentence.

Vocabulary
acute angle
line segment
obtuse angle
ray
right angle
straight angle

1. A _____ is part of a line between two endpoints. (p. 381)

2. A _____ forms a square corner. (p. 382)

3. An _____ is greater than a right angle and less than a straight angle. (p. 382)

4. The two-dimensional figure that has one endpoint is a

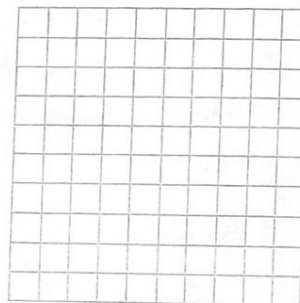_____ . (p. 381)

5. An angle that forms a line is called a _____ . (p. 382)

▶ Concepts and Skills

6. On the grid to the right, draw a polygon that has 2 pairs of parallel sides, 2 pairs of sides equal in length, and 2 acute and 2 obtuse angles. Tell all the possible names for the figure.

_____

Draw the figure.

7. parallel lines

8. obtuse ∠ABC

9. intersecting lines that are not perpendicular

10. acute ∠RST

Fill in the bubble completely to show your answer.

11. Which statement is true?

(A) A right triangle always has two acute angles.

(B) An obtuse triangle always has two obtuse angles.

(C) An acute triangle always has a right angle.
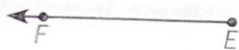
(D) A triangle always has an obtuse angle.

12. Which figure has 2 pairs of sides that appear to be parallel?

(A)

(C)

(B)

(D)
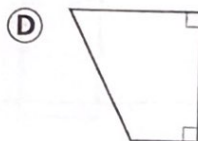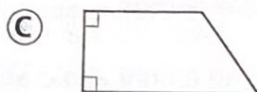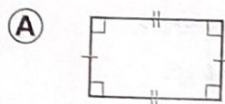
13. Which quadrilateral can have 2 pairs of parallel sides, all sides with equal length, and no right angles?

(A) square

(B) rhombus

(C) rectangle

(D) trapezoid

14. Which names the figure correctly?

F   E

(A) line EF

(B) ray FE

(C) angle FE

(D) ray EF

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