

LESSON  
8

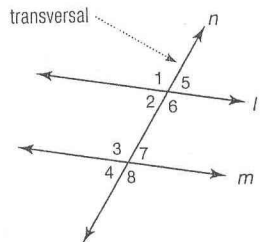
# Properties of Parallel and Perpendicular Lines

## Review It!

When you work with parallel and perpendicular lines cut by a transversal, remember these words:

**transversal** a line that crosses other lines at different points

**parallel lines** lines in the same plane that never meet



**alternate interior angles** two angles on opposite sides of a transversal, both between two lines

pairs of alternate interior angles:  $\angle 2$  and  $\angle 7$ ;  
 $\angle 3$  and  $\angle 6$

**corresponding angles** two nonadjacent angles on the same side of a transversal, one between two lines and one outside the lines

pairs of corresponding angles:  $\angle 1$  and  $\angle 3$ ;  
 $\angle 2$  and  $\angle 4$ ;  $\angle 5$  and  $\angle 7$ ;  $\angle 6$  and  $\angle 8$

**alternate exterior angles** two nonadjacent angles on opposite sides of a transversal, both outside two lines

alternate exterior angles:  $\angle 1$  and  $\angle 8$ ;  $\angle 4$  and  $\angle 5$

When parallel lines are cut by a transversal, pairs of alternate interior angles, corresponding angles, and alternate exterior angles are congruent. Assume lines  $l$  and  $m$  are parallel in the figure above, and  $\angle 1$  in the figure measures  $112^\circ$ . What is the measure of  $\angle 3$ ?

**Step 1** Find the relationship.  $\angle 1$  and  $\angle 3$  are corresponding angles.

**Step 2** Find the measure.

Corresponding angles are congruent, so  $\angle 1 \cong \angle 3$ .

The measures of  $\angle 1$  and  $\angle 3$  are \_\_\_\_\_.

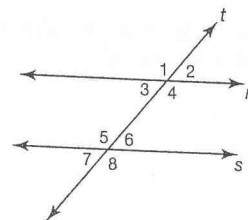
$m\angle 1 = 112^\circ$ , so  $m\angle 3 =$  \_\_\_\_\_ $^\circ$ .

**THINK** Congruent angles have equal measures.

So, the measure of  $\angle 3$  is \_\_\_\_\_ $^\circ$ .

## Try It!

In the figure below, lines  $r$  and  $s$  are parallel. Use the figure for questions 1–9.



Complete the following.

- $\angle 1$  and \_\_\_\_\_ are alternate exterior angles.
- $\angle 1$  and \_\_\_\_\_ are corresponding angles.
- $\angle 3$  and \_\_\_\_\_ are alternate interior angles.

Write *true* or *false* for each.

- $\angle 2$  and  $\angle 6$  are congruent. \_\_\_\_\_
- $\angle 4$  and  $\angle 6$  are congruent. \_\_\_\_\_
- $\angle 4$  and  $\angle 5$  are congruent. \_\_\_\_\_
- $\angle 7$  and  $\angle 1$  are congruent. \_\_\_\_\_

Solve.

- If the measure of  $\angle 2$  is  $59^\circ$ , then what is the measure of  $\angle 7$ ?

\_\_\_\_\_

- If the measure of  $\angle 6$  is  $60^\circ$ , then what is the measure of  $\angle 3$ ?

\_\_\_\_\_

1.

Where are alternate exterior angles? between, or outside the lines?

4.

What type of angle pairs are these? corresponding, or supplementary?

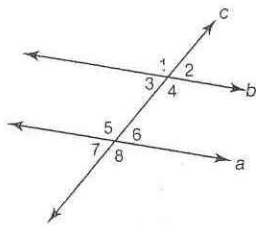
8.

Alternate exterior angles are what? congruent, or supplementary?

**On Your Own!**

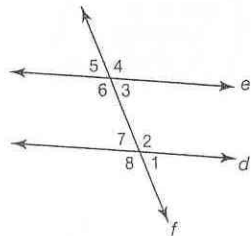
Circle the best answer for each question.

1. Lines  $a$  and  $b$  are parallel. Which is true?



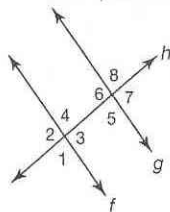
- A.  $\angle 1 \cong \angle 2; \angle 1 \cong \angle 7$
- B.  $\angle 2 \cong \angle 6; \angle 4 \cong \angle 8$
- C.  $\angle 2 \cong \angle 7; \angle 4 \cong \angle 6$
- D.  $\angle 1 \cong \angle 5; \angle 1 \cong \angle 3$

2. Lines  $d$  and  $e$  are parallel. Which is true?



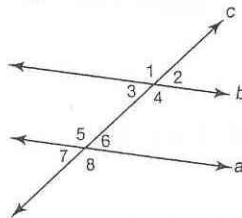
- A.  $\angle 7 \cong \angle 3; \angle 6 \cong \angle 2$
- B.  $\angle 7 \cong \angle 6; \angle 2 \cong \angle 3$
- C.  $\angle 7 \cong \angle 8; \angle 5 \cong \angle 8$
- D.  $\angle 1 \cong \angle 8; \angle 6 \cong \angle 8$

Lines  $f$  and  $g$  are parallel. Use the figure for questions 3–5.



3. Which must be true?
- A.  $\angle 1$  is supplementary to  $\angle 5$ .
  - B.  $\angle 4$  is congruent to  $\angle 5$ .
  - C.  $\angle 4$  is congruent to  $\angle 6$ .
  - D.  $\angle 1$  is supplementary to  $\angle 4$ .
4. If the measure of  $\angle 8$  is  $80^\circ$ , then what is the measure of  $\angle 1$ ?
- A.  $100^\circ$
  - B.  $90^\circ$
  - C.  $80^\circ$
  - D.  $10^\circ$
5. If the measure of  $\angle 3$  is  $110^\circ$ , then what is the measure of  $\angle 7$ ?
- A.  $40^\circ$
  - B.  $70^\circ$
  - C.  $100^\circ$
  - D.  $110^\circ$

6. In this figure, lines  $a$  and  $b$  are parallel, and line  $c$  is a transversal. Suppose the measure of  $\angle 6$  is  $50^\circ$ .



Find the measure of all the other angles.

$m\angle 1 = \underline{\hspace{2cm}}$      $m\angle 2 = \underline{\hspace{2cm}}$      $m\angle 3 = \underline{\hspace{2cm}}$   
 $m\angle 4 = \underline{\hspace{2cm}}$      $m\angle 5 = \underline{\hspace{2cm}}$      $m\angle 7 = \underline{\hspace{2cm}}$   
 $m\angle 8 = \underline{\hspace{2cm}}$

**Math Words**

Fill in the blanks.

7. Two nonadjacent angles on the same side of a transversal, one between two lines and one outside the lines, are \_\_\_\_\_.
8. Two nonadjacent angles on opposite sides of a transversal, both between two lines, are \_\_\_\_\_.
9. Two nonadjacent angles on opposite sides of a transversal, both outside two lines, are \_\_\_\_\_.