

# 3-3

## Proving Lines Parallel

### Content Standard

**Extends G.CO.9** Prove theorems about lines and angles. Theorems include: . . . when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent . . .

**Objective** To determine whether two lines are parallel

**Essential Understanding** You can use certain angle pairs to decide whether two lines are parallel.

Take note

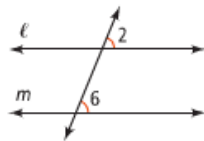
### Theorem 3-4 Converse of the Corresponding Angles Theorem

**Theorem**

If two lines and a transversal form corresponding angles that are congruent, then the lines are parallel.

If . . .

$$\angle 2 \cong \angle 6$$



Then . . .

$$l \parallel m$$

Take note

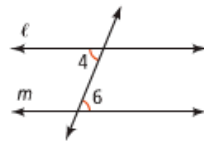
### Theorem 3-5 Converse of the Alternate Interior Angles Theorem

**Theorem**

If two lines and a transversal form alternate interior angles that are congruent, then the two lines are parallel.

If . . .

$$\angle 4 \cong \angle 6$$



Then . . .

$$l \parallel m$$

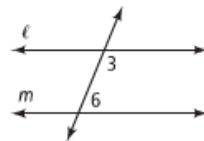
### Theorem 3-6 Converse of the Same-Side Interior Angles Postulate

**Theorem**

If two lines and a transversal form same-side interior angles that are supplementary, then the two lines are parallel.

If . . .

$$m\angle 3 + m\angle 6 = 180$$



Then . . .

$$l \parallel m$$

### Theorem 3-7 Converse of the Alternate Exterior Angles Theorem

**Theorem**

If two lines and a transversal form alternate exterior angles that are congruent, then the two lines are parallel.

If . . .

$$\angle 1 \cong \angle 7$$



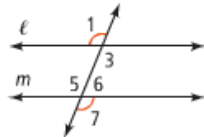
Then . . .

$$l \parallel m$$

You know two forms of proof—paragraph and two-column. In a third form, called **flow proof**, arrows show the logical connections between the statements. Reasons are written below the statements.

**Problem 2 Writing a Flow Proof of Theorem 3-7**

**Given:**  $\angle 1 \cong \angle 7$   
**Prove:**  $\ell \parallel m$



**Know**

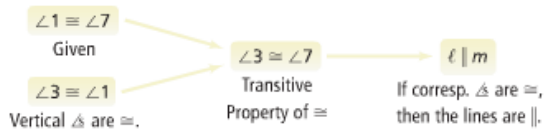
- $\angle 1 \cong \angle 7$
- From the diagram you know
- $\angle 1$  and  $\angle 3$  are vertical
- $\angle 5$  and  $\angle 7$  are vertical
- $\angle 1$  and  $\angle 5$  are corresponding
- $\angle 3$  and  $\angle 7$  are corresponding

**Need**

One pair of corresponding angles congruent to prove  $\ell \parallel m$

**Plan**

Use a pair of congruent vertical angles to relate either  $\angle 1$  or  $\angle 7$  to its corresponding angle.

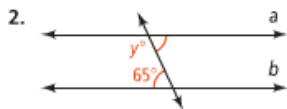
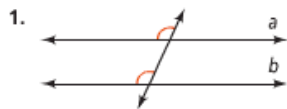




### Lesson Check

#### Do you know HOW?

State the theorem or postulate that proves  $a \parallel b$ .



3. What is the value of  $y$  for which  $a \parallel b$  in Exercise 2?

#### Do you UNDERSTAND?



4. Explain how you know when to use the Alternate Interior Angles Theorem and when to use the Converse of the Alternate Interior Angles Theorem.

5. **Compare and Contrast** How are flow proofs and two-column proofs alike? How are they different?

6. **Error Analysis** A classmate says that  $\overleftrightarrow{AB} \parallel \overleftrightarrow{DC}$  based on the diagram at the right. Explain your classmate's error.

