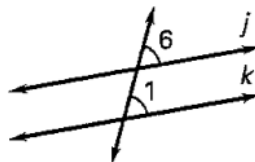# Proving Lines are Parallel

Goals • Prove that two lines are parallel.
• Use properties of parallel lines to solve problems.

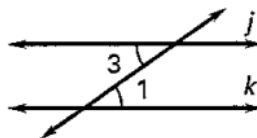### POSTULATE 16: CORRESPONDING ANGLES CONVERSE

If two lines are cut by a transversal so that corresponding angles are *congruent* then the lines are parallel.

If $\angle 1 \cong \angle 6$, then $j \parallel k$.

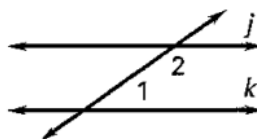### THEOREM 3.8: ALTERNATE INTERIOR ANGLES CONVERSE

If two lines are cut by a transversal so that alternate interior angles are *congruent*, then the lines are parallel.

If $\angle 1 \cong \angle 3$, then $j \parallel k$.

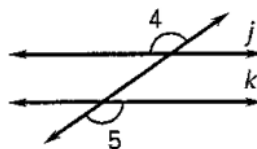### THEOREM 3.9: CONSECUTIVE INTERIOR ANGLES CONVERSE

If two lines are cut by a transversal so that consecutive interior angles are *Supplementary*, then the lines are parallel.

If $m\angle 1 + m\angle 2 = 180°$, then $j \parallel k$.

THEOREM 3.10: ALTERNATE EXTERIOR ANGLES CONVERSE

If two lines are cut by a transversal so that alternate exterior angles are *Congruent* then the lines are parallel.

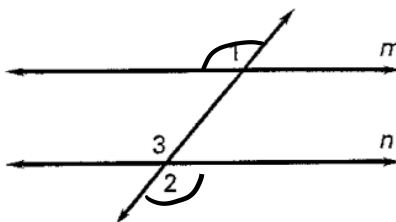If $\angle 4 \cong \angle 5$, then $j \parallel k$.

Example 1   *Proof of the Alternate Exterior Angles Converse*

Prove the Alternate
Exterior Angles Converse.

Solution

Given: $\angle 1 \cong \angle 2$

Prove: $m \parallel n$

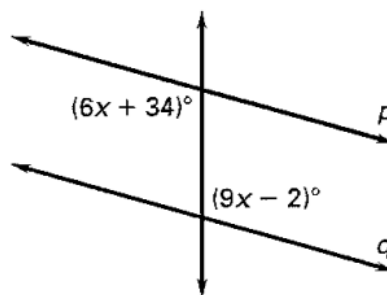| Statements	Reasons
1. $\angle 1 \cong \angle 2$	1. <u>given</u>
2. $\angle 2 \cong \angle 3$	2. <u>VA $\cong$</u>
3. $\angle 1 \cong \angle 3$	3. Transitive Property of Congruence
4. $m \parallel n$	4. <u>corresponding $\angle$s $\cong$</u>

Example 2   *Applying the Alternate Interior Angles Converse*

Find the value of *x* that
makes $p \parallel q$.

Lines *p* and *q* will be parallel
if the marked angles are
<u>congruent</u>

$$6x + 34 = 9x - 2$$
$$6x + 36 = 9x$$
$$36 = 3x$$
$$12 = x$$

(6x + 34)°   p

(9x − 2)°

q

✔ **Checkpoint** Find the value of *x* that makes $p \parallel q$.

1.   alt ext $\angle$s

(3x + 20)°

p

q

(5x)°

$$3x+20 = 5x$$
$$20 = 2x$$
$$x = 10$$

2.   cons. int $\angle$s

(13x + 15)°   (20x)°

p   q

$$13x+15+20x = 180$$
$$15+33x = 180$$
$$33x = 165$$
$$x = 17$$

Example 3 *Identifying Parallel Lines*

Decide which lines are parallel.

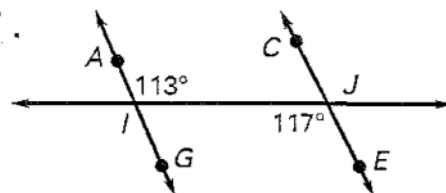a. Is *AG* parallel to *CE* ?

b. Is *BH* parallel to *DF* ?
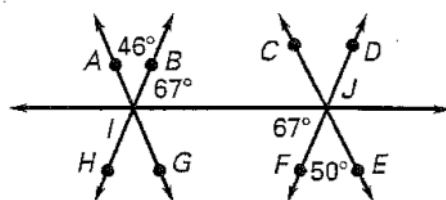
Solution

a. Decide whether *AG* is parallel to *CE* .

$$m\angle AIJ = \underline{46} + \underline{67} = \underline{113}$$
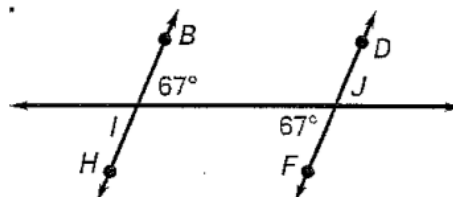$$m\angle EJI = \underline{50} + \underline{67} = \underline{117}$$

Answer ∠AIJ and ∠EJI are <u>alt int ∠s</u> angles that are <u>not congruent</u>. So, *AG* and *CE* are <u>not parallel</u>
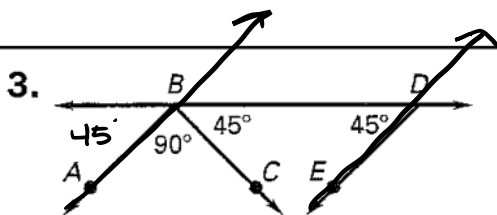
b. Decide whether *BH* is parallel to *DF* .

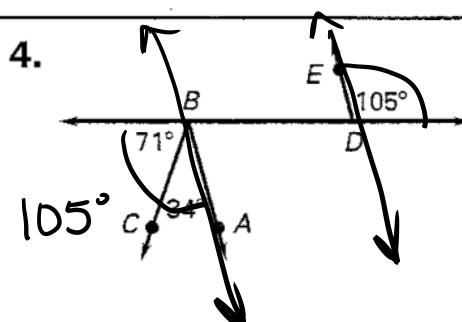$$m\angle BIJ = \underline{67}°$$
$$m\angle FJI = \underline{67}°$$

Answer ∠BIJ and ∠FJI are <u>alt int ∠s</u> angles that are <u>congruent</u>. So, *BH* and *DF* are <u>parallel</u>

Checkpoint Decide whether *BA* is parallel to *DE* . Explain.

3. Corresp ∠s ≅ yes

4. alt ext ∠s yes