

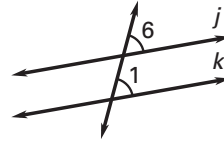
3.4

Proving Lines are Parallel

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

POSTULATE 16: CORRESPONDING ANGLES CONVERSE

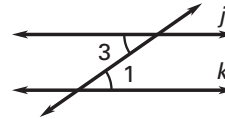
If two lines are cut by a transversal so that corresponding angles are congruent, then the lines are parallel.



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

THEOREM 3.8: ALTERNATE INTERIOR ANGLES CONVERSE

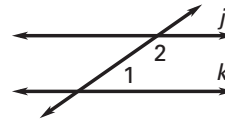
If two lines are cut by a transversal so that alternate interior angles are congruent, then the lines are parallel.



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

THEOREM 3.9: CONSECUTIVE INTERIOR ANGLES CONVERSE

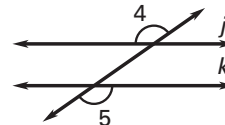
If two lines are cut by a transversal so that consecutive interior angles are supplementary, then the lines are parallel.



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

THEOREM 3.10: ALTERNATE EXTERIOR ANGLES CONVERSE

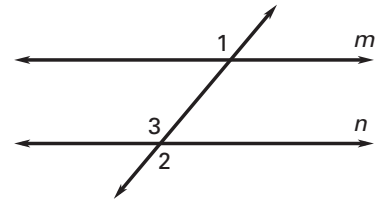
If two lines are cut by a transversal so that alternate exterior angles are congruent, then the lines are parallel.



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: $\angle 1 \cong \angle 2$

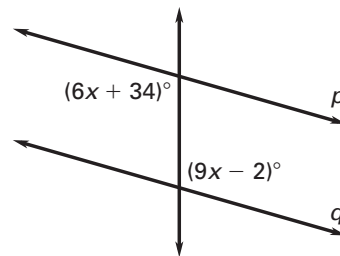
Prove: $m \parallel n$

Statements	Reasons
1. $\angle 1 \cong \angle 2$	1. <u>Given</u>
2. $\angle 2 \cong \angle 3$	2. <u>Vertical Angles Theorem</u>
3. $\angle 1 \cong \angle 3$	3. <u>Transitive Property of Congruence</u>
4. $m \parallel n$	4. <u>Corresponding Angles Converse</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 congruent.



$$\begin{aligned} \underline{6x} + \underline{34} &= \underline{9x} - \underline{2} \\ \underline{6}x + \underline{36} &= \underline{9}x \\ \underline{36} &= \underline{3}x \\ \underline{12} &= x \end{aligned}$$

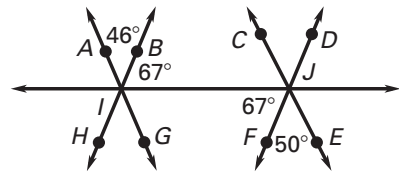
Checkpoint Find the value of x that makes $p \parallel q$.

<p>1.</p> <p style="text-align: center; color: red; font-weight: bold;">10</p>	<p>2.</p> <p style="text-align: center; color: red; font-weight: bold;">5</p>
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Example 3 Identifying Parallel Lines

Decide which lines are parallel.

- a. Is \overleftrightarrow{AG} parallel to \overleftrightarrow{CE} ?
 b. Is \overleftrightarrow{BH} parallel to \overleftrightarrow{DF} ?

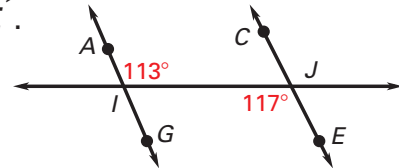


Solution

- a. Decide whether \overleftrightarrow{AG} is parallel to \overleftrightarrow{CE} .

$$m\angle AIJ = 46^\circ + 67^\circ = 113^\circ$$

$$m\angle EJI = 67^\circ + 50^\circ = 117^\circ$$

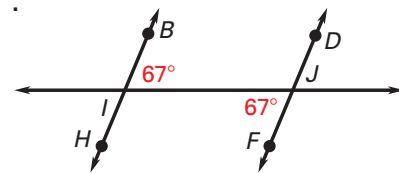


Answer $\angle AIJ$ and $\angle EJI$ are alternate interior angles that are not congruent . So, \overleftrightarrow{AG} and \overleftrightarrow{CE} are not parallel .

- b. Decide whether \overleftrightarrow{BH} is parallel to \overleftrightarrow{DF} .

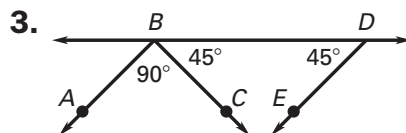
$$m\angle BIJ = 67^\circ$$

$$m\angle FJI = 67^\circ$$

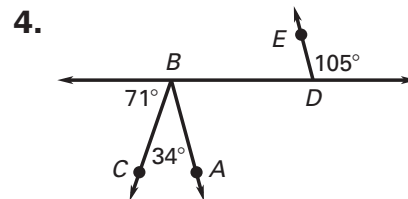


Answer $\angle BIJ$ and $\angle FJI$ are alternate interior angles that are congruent . So, \overleftrightarrow{BH} and \overleftrightarrow{DF} are parallel .

Checkpoint Decide whether \overleftrightarrow{BA} is parallel to \overleftrightarrow{DE} . Explain.



$\overleftrightarrow{BA} \parallel \overleftrightarrow{DE}$; the consecutive interior angles are supplementary.



$\overleftrightarrow{BA} \parallel \overleftrightarrow{DE}$; the alternate exterior angles are congruent.