Parallel Lines and Transversals

Using Properties of Parallel Lines

Corresponding Angles Theorem

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

Examples In the diagram at the right, $\angle 2 \cong \angle 6$ and $\angle 3 \cong \angle 7$.
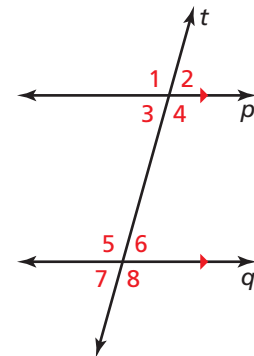
Alternate Interior Angles Theorem

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

Examples In the diagram at the right, $\angle 3 \cong \angle 6$ and $\angle 4 \cong \angle 5$.

Alternate Exterior Angles Theorem

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

Examples In the diagram at the right, $\angle 1 \cong \angle 8$ and $\angle 2 \cong \angle 7$.

Consecutive Interior Angles Theorem

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

Examples In the diagram at the right, $\angle 3$ and $\angle 5$ are supplementary, and $\angle 4$ and $\angle 6$ are supplementary.

Example 1 **Find the value of x.**

By the Linear Pair Postulate, $m\angle 1 = 180° - 136° = 44°$. Lines c and d are parallel, so you can use the theorems about parallel lines.

$\quad m\angle 1 = (7x + 9)°$ Alternate Exterior Angles Theorem

$\quad\quad 44° = (7x + 9)°$ Substitute 44° for $m\angle 1$.
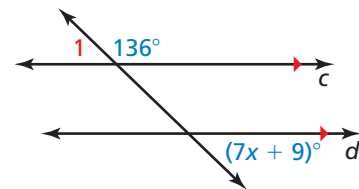
$\quad\quad 35 = 7x$ Subtract 9 from each side.

$\quad\quad\ 5 = x$ Divide each side by 7.

▶ So, the value of x is 5.

Practice

Check your answers at BigIdeasMath.com.

Find the value of x.

1. $2x°$ $128°$

$x = 64$

2. $72°$ $(7x + 24)°$

$x = 12$

3. $65°$ $(11x - 17)°$

$x = 12$

4. $118°$ $(8x + 6)°$

$x = 7$

Topic 10.11
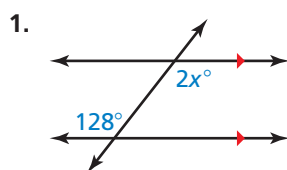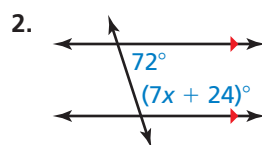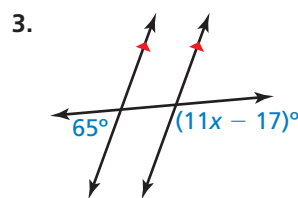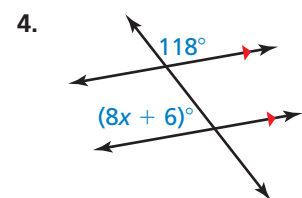
Parallel Lines and Transversals

Determining Whether Lines are Parallel

The theorems about angles formed when parallel lines are cut by a transversal have true converses.

Corresponding Angles Converse

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

Alternate Interior Angles Converse

If two lines are cut by a transversal so the alternate interior angles are congruent, then the lines are parallel.
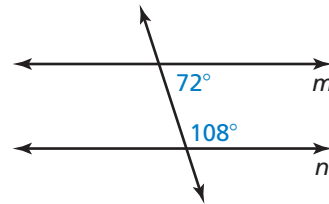
Alternate Exterior Angles Converse

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

Consecutive Interior Angles Converse

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

Example 1 **Decide whether there is enough information to prove that $m \parallel n$. If so, state the theorem you would use.**
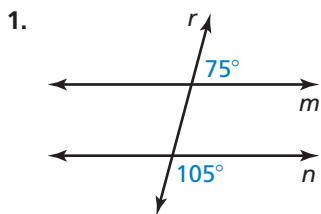
The sum of the marked consecutive interior angles is 180°. Lines m and n are parallel when the consecutive interior angles are supplementary. So, by the Consecutive Interior Angles Converse, $m \parallel n$.
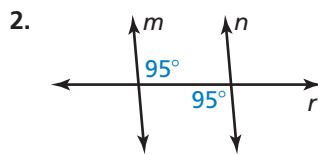

Practice
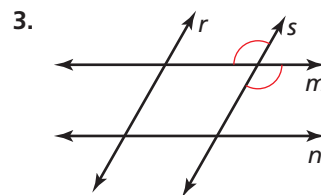
Check your answers at BigIdeasMath.com.

Decide whether there is enough information to prove that $m \parallel n$. If so, state the theorem you would use.

1.

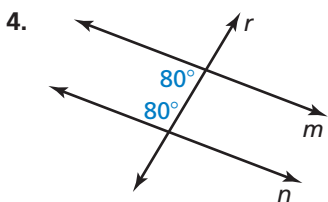

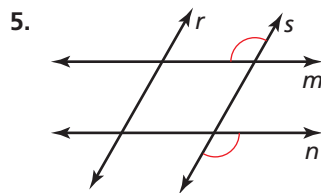yes; *Sample answer:* Corresponding Angles Converse

2.

yes; *Sample answer:* Alternate Interior Angles Converse

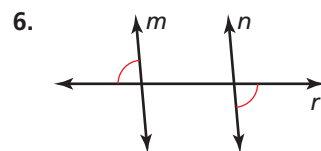**3.**

no

4.

no

5.

yes; *Sample answer:* Alternate Exterior Angles Converse

6.

yes; *Sample answer:* Alternate Exterior Angles Converse