

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

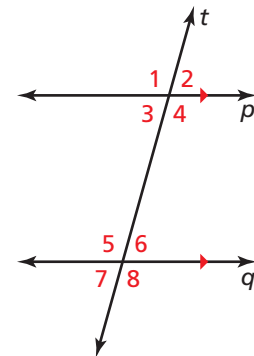
If two parallel lines are cut by a transversal, then the pairs of alternate interior angles are congruent.

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.

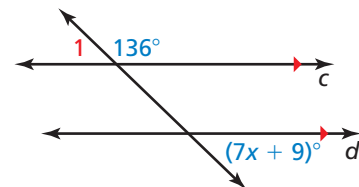
Examples In the diagram at the right, $\angle 3$ and $\angle 5$ are supplementary, and $\angle 4$ and $\angle 6$ are supplementary.

Example 1 Find the value of x .

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

$$\begin{aligned} m\angle 1 &= (7x + 9)^\circ && \text{Alternate Exterior Angles Theorem} \\ 44^\circ &= (7x + 9)^\circ && \text{Substitute } 44^\circ \text{ for } m\angle 1. \\ 35 &= 7x && \text{Subtract 9 from each side.} \\ 5 &= x && \text{Divide each side by 7.} \end{aligned}$$

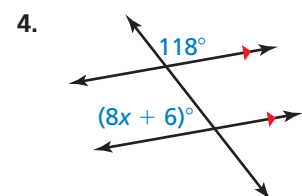
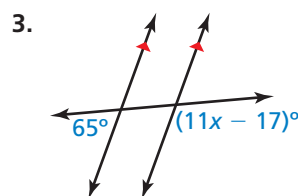
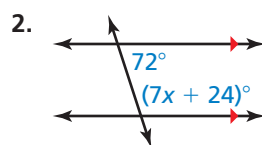
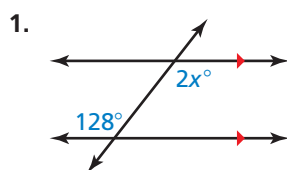
► So, the value of x is 5.



Practice

Check your answers at BigIdeasMath.com.

Find the value of x .



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

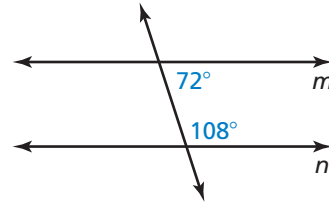
If two lines are cut by a transversal so the alternate exterior angles are congruent, then the lines are parallel.

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.

