Date: 10/19/21

Lesson 3.2/3.4 Parallel, Perpendicular Lines & Transversals

Learning Intent (Target): *Today I will* be able to use properties of parallel & peprendicular lines. Prove theorems about parallel and perpendicular lines.

Success Criteria: *I'll know I'll have it when* I'll be able to use theorems about parallel lines & transversals to determine missing angle measures. Find the distance between lines.

Accountable Team Task: *Therefore, I can* practice from interactive flip charts and apply it to problem solving.

*Color Code Congruent Angles

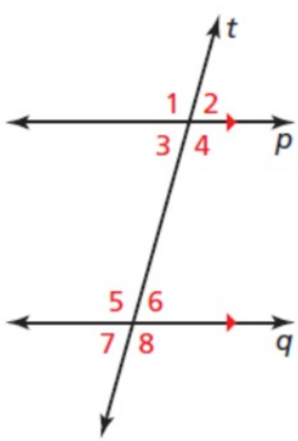
Theorems

Theorem 3.1 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 left, $\angle 2 \cong \angle 6$ and $\angle 3 \cong \angle 7$.

Proof Ex. 36, p. 180



Theorem 3.2 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 left, $\angle 3 \cong \angle 6$ and $\angle 4 \cong \angle 5$.

Proof Example 4, p. 134

Theorem 3.3 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 left, $\angle 1 \cong \angle 8$ and $\angle 2 \cong \angle 7$.

Proof Ex. 15, p. 136

Theorem 3.4 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 left, $\angle 3$ and $\angle 5$ are supplementary, and $\angle 4$ and $\angle 6$ are supplementary.

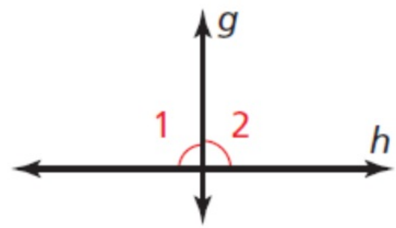
Proof Ex. 16, p. 136

Theorems

Theorem 3.10 Linear Pair Perpendicular Theorem

If two lines intersect to form a linear pair of congruent angles, then the lines are perpendicular.

If $\angle 1 \cong \angle 2$, then $g \perp h$.

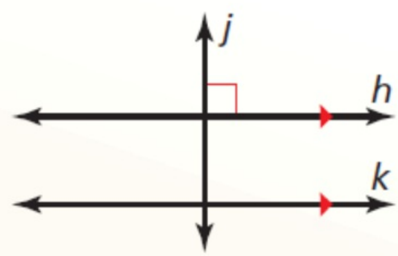


Proof Ex. 13, p. 153

Theorem 3.11 Perpendicular Transversal Theorem

In a plane, if a transversal is perpendicular to one of two parallel lines, then it is perpendicular to the other line.

If $h \parallel k$ and $j \perp h$, then $j \perp k$.

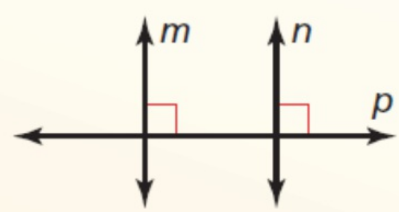


Proof Example 2, p. 150; Question 2, p. 150

Theorem 3.12 Lines Perpendicular to a Transversal Theorem

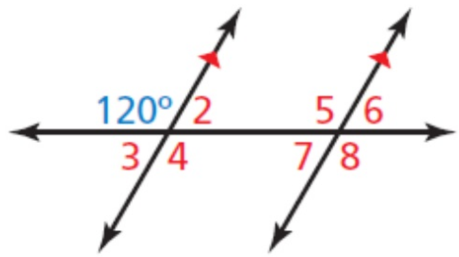
In a plane, if two lines are perpendicular to the same line, then they are parallel to each other.

If $m \perp p$ and $n \perp p$, then $m \parallel n$.



Proof Ex. 14, p. 153; Ex. 47, p. 162

The measures of three of the numbered angles are 120°. Identify the angles. Explain your reasoning.



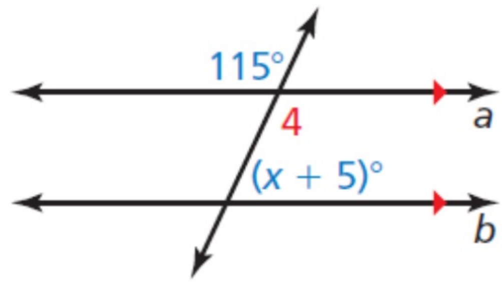
By the Alternate Exterior Angles Theorem, $m\angle 8 = 120^\circ$.

$\angle 5$ and $\angle 8$ are vertical angles. Using the Vertical Angles Congruence Theorem (Theorem 2.6), $m\angle 5 = 120^\circ$.

$\angle 5$ and $\angle 4$ are alternate interior angles. By the Alternate Interior Angles Theorem, $\angle 4 = 120^\circ$.

▶ So, the three angles that each have a measure of 120° are $\angle 4$, $\angle 5$, and $\angle 8$.

Find the value of *x* .



SOLUTION

By the Vertical Angles Congruence Theorem (Theorem 2.6), $m\angle 4 = 115^\circ$. Lines *a* and *b* are parallel, so you can use the theorems about parallel lines.

$m\angle 4 + (x + 5)^\circ = 180^\circ$	Consecutive Interior Angles Theorem
$115^\circ + (x + 5)^\circ = 180^\circ$	Substitute 115° for $m\angle 4$.
$x + 120 = 180$	Combine like terms.
$x = 60$	Subtract 120 from each side.

▶ So, the value of *x* is 60.

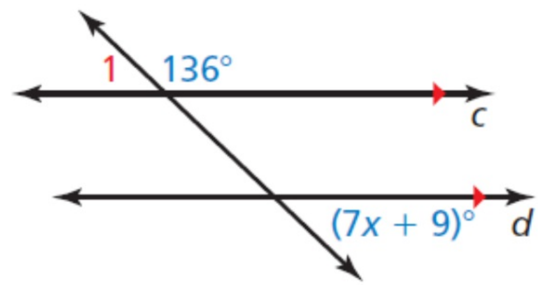
Check

$115^\circ + (x + 5)^\circ = 180^\circ$

$115 + (60 + 5) \stackrel{?}{=} 180$

$180 = 180$ ✓

Find the value of x.



SOLUTION

By the Linear Pair Postulate (Postulate 2.8), $m\angle 1 = 180° - 136° = 44°$. Lines c and d are parallel, so you can use the theorems about parallel lines.

$m\angle 1 = (7x + 9)°$	Alternate Exterior Angles Theorem
$44° = (7x + 9)°$	Substitute 44° for $m\angle 1$.
$35 = 7x$	Subtract 9 from each side.
$5 = x$	Divide each side by 7.

▶ So, the value of x is 5.

Check

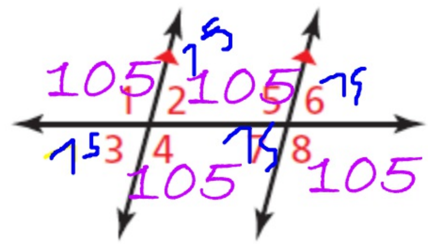
$44° = (7x + 9)°$

$44 \stackrel{?}{=} 7(5) + 9$

$44 = 44$ ✓

Use the diagram.

1. Given $m\angle 1 = 105°$, find $m\angle 4$, $m\angle 5$, and $m\angle 8$. Tell which theorem you use in each case.



1 & 4 are vertical angles

1 & 5 are corresponding

1 & 8 are alternate exterior angles

2. Given $m\angle 3 = 68°$ and $m\angle 8 = (2x + 4)°$, what is the value of x? Show your steps.

$68 + 2x + 4 = 180$ or $180 - 68 = 112$

$72 + 2x = 180$

$-72 \quad -72$

$2x = 108$

$x = 54$

so $2x + 4 = 112$

$-4 \quad -4$

$2x = 108$

$x = 54$