3.3 Proofs with Parallel Lines

Write the converse of the following theorems: (In your notes from yesterday)

Theorems

(Important!)

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

Converse:

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

Proving the Alternate Interior Angles Converse.

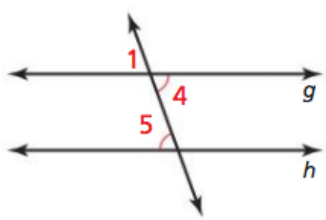
Write a two-column proof:

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

SOLUTION

Given $\angle 4 \cong \angle 5$

Prove $g \parallel h$



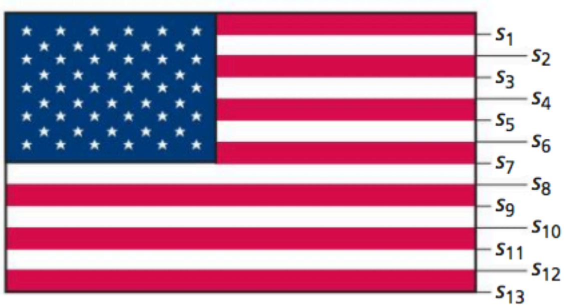
Critical Thinking:

If line L is parallel to line M, and Line M if parallel to line P then…

Why? What is this called?

Real World Example:

The flag of the United States has 13 alternating red and white stripes. Each stripe is parallel to the stripe immediately below it. Explain why the top stripe is parallel to the bottom stripe.

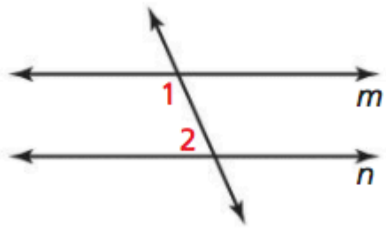


CW/HW

PROOF **In Exercises 33–36, write a proof.**

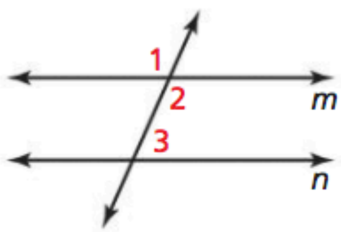
33. **Given** $m\angle 1 = 115°$, $m\angle 2 = 65°$

Prove $m \parallel n$



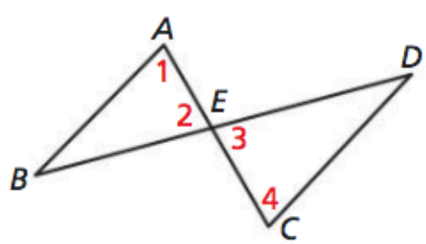
34. **Given** $\angle 1$ and $\angle 3$ are supplementary.

Prove $m \parallel n$



35. **Given** $\angle 1 \cong \angle 2$, $\angle 3 \cong \angle 4$

Prove $\overline{AB} \parallel \overline{CD}$



36. **Given** $a \parallel b$, $\angle 2 \cong \angle 3$

Prove $c \parallel d$