3.3 Proofs with Parallel Lines

Recall 3.2 Theorems

THEOREMS

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, $\angle 1 \cong \angle 5$, $\angle 2 \cong \angle 6$, $\angle 3 \cong \angle 7$, and $\angle 4 \cong \angle 8$.

Prove this Theorem Exercise 35, page 174

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 $\angle 4 \cong \angle 5$.

Prove this Theorem Exercise 17, page 131

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 Example 4, page 130

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.

Prove this Theorem Exercise 18, page 131

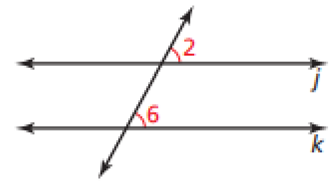
Their converses are also theorems

THEOREM

3.5 Corresponding Angles Converse

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

Prove this Theorem Exercise 35, page 174

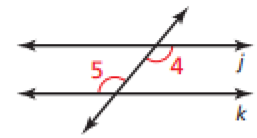


$j \parallel k$

3.6 Alternate Interior Angles Converse

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

Prove this Theorem Example 2, page 136

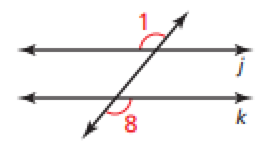


$j \parallel k$

3.7 Alternate Exterior Angles Converse

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

Prove this Theorem Exercise 9, page 138

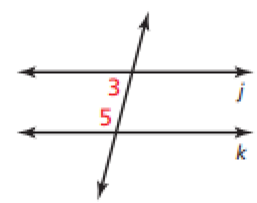


$j \parallel k$

3.8 Consecutive Interior Angles Converse

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

Prove this Theorem Exercise 10, page 138

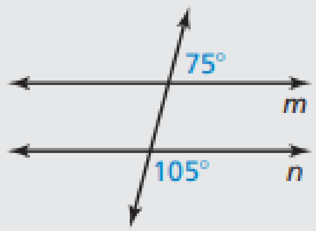


If $\angle 3$ and $\angle 5$ are supplementary, then $j \parallel k$.

We can use these theorems in 3.3 to determine if two lines parallel.

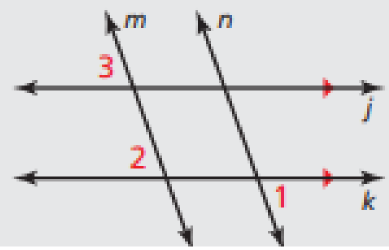
1.

REASONING Is there enough information in the diagram to conclude th $m \parallel n$? Explain.



2.

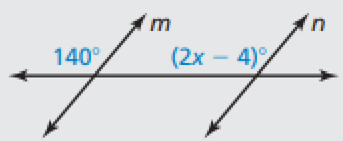
In the diagram, $j \parallel k$ and $\angle 1$ is congruent to $\angle 3$. Prove $m \parallel n$.



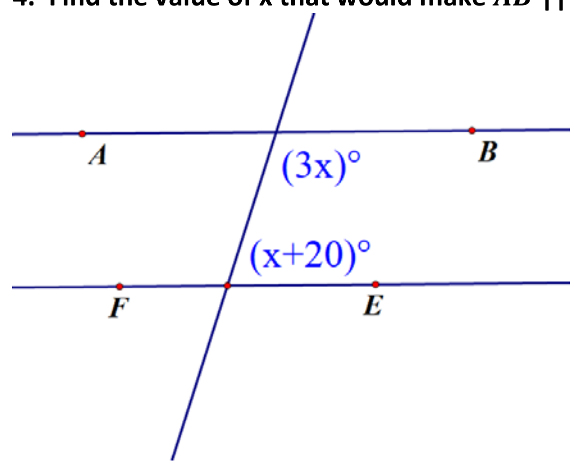
We can also use these theorems in 3.3 to determine values of variables that would make the lines parallel.

3.

Find the value of x that makes $m \parallel n$.



4. Find the value of x that would make $\overleftrightarrow{AB} \parallel \overleftrightarrow{EF}$.



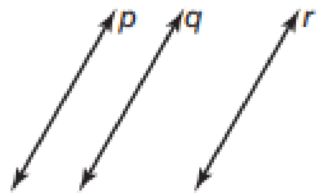
3.3 has one additional theorem

THEOREM

3.9 Transitive Property of Parallel Lines

If two lines are parallel to the same line, then they are parallel to each other.

Prove this Theorem Exercise 38, page 140; Exercise 48, page 156

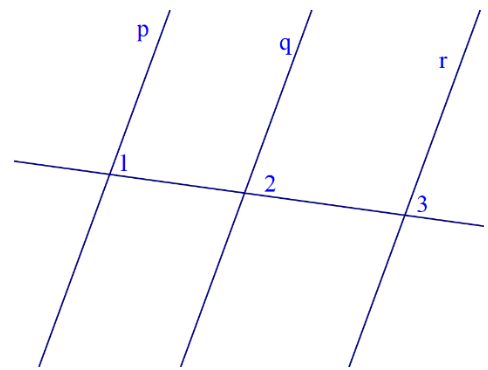


If $p \parallel q$ and $q \parallel r$, then $p \parallel r$.

Proof:

Given: p || q and q || r

Prove: p || r



Statements	Reasons
1. p || q	1. ____________________
2. $\measuredangle 1 \cong \measuredangle 2$	2. ____________________
3. q || r	3.____________________
4. $\measuredangle 2 \cong \measuredangle 3$	4.____________________
5.______________	5. Transitive property of angle congruence
6. ______________	6. Corresponding Angles Converse Theorem