Geometry: 3.1-3.3 Notes

NAME______________________

3.1 Identify parallel and perpendicular lines as well pairs of angles formed by transversals. Date:_____

Define Vocabulary:

parallel lines

skew lines

parallel planes

transversal

corresponding angles

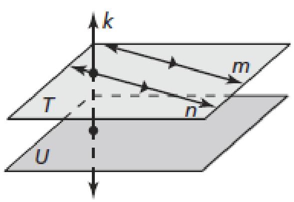
alternate interior angles

alternate exterior angles

consecutive interior angles

Parallel Lines, Skew Lines, and Parallel Planes

Two lines that do not intersect are either *parallel lines* or *skew lines*. Two lines are **parallel lines** when they do not intersect and are coplanar. Two lines are **skew lines** when they do not intersect and are not coplanar. Also, two planes that do not intersect are **parallel planes**.



Lines m and n are parallel lines $(m \parallel n)$.

Lines m and k are skew lines.

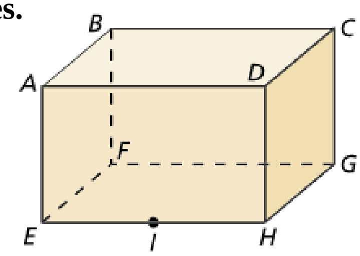
Planes T and U are parallel planes $(T \parallel U)$.

Lines k and n are intersecting lines, and there is a plane (not shown) containing them.

Small directed arrows, as shown on lines m and n above, are used to show that lines are parallel. The symbol $\parallel$ means "is parallel to," as in $m \parallel n$.

Segments and rays are parallel when they lie in parallel lines. A line is parallel to a plane when the line is in a plane parallel to the given plane. In the diagram above, line n is parallel to plane U.

Examples: Identify lines and planes.



WE DO

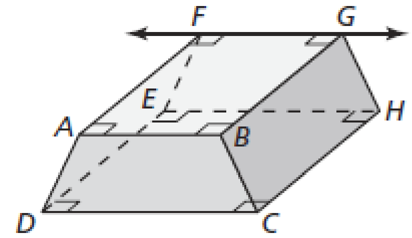
a. line(s) parallel to $\overleftrightarrow{GH}$ and containing point F

b. line(s) skew to $\overleftrightarrow{GH}$ and containing point F

c. line(s) perpendicular to $\overleftrightarrow{GH}$ and containing point F

d. plane(s) parallel to plane GHD and containing point F

YOU DO



1. line(s) skew to $\overleftrightarrow{FG}$.

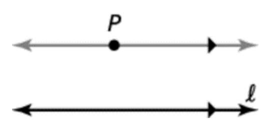
2. line(s) perpendicular to $\overleftrightarrow{FG}$.

3. line(s) parallel to $\overleftrightarrow{FG}$.

4. plane(s) parallel to plane FGH.

Postulate 3.1 Parallel Postulate

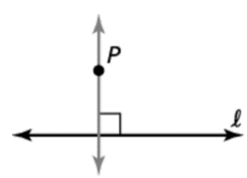
If there is a line and a point not on the line, then there is exactly one line through the point parallel to the given line.



There is exactly one line through P parallel to ℓ.

Postulate 3.2 Perpendicular Postulate

If there is a line and a point not on the line, then there is exactly one line through the point perpendicular to the given line.



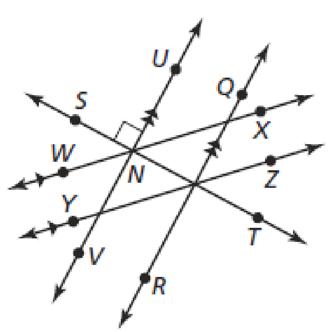
There is exactly one line through P perpendicular to ℓ.

Examples: Identifying parallel and perpendicular lines. Using the diagram.

WE DO

1. Name a pair of perpendicular lines.

2. Is $\overleftrightarrow{WX} \parallel \overleftrightarrow{QR}$? Explain.

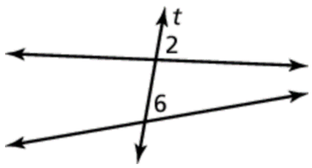


YOU DO

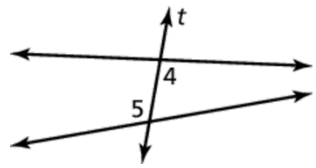
3. Name a pair of parallel lines.

4. Is $\overleftrightarrow{ST} \perp \overleftrightarrow{NV}$? Explain.

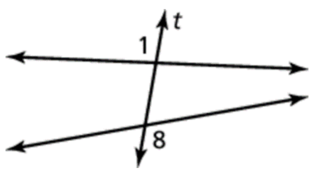
Angles Formed by Transversals



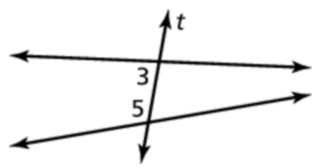
Two angles are **corresponding angles** when they have corresponding positions. For example, $\angle 2$ and $\angle 6$ are above the lines and to the right of the transversal *t*.



Two angles are **alternate interior angles** when they lie between the two lines and on opposite sides of the transversal *t*.



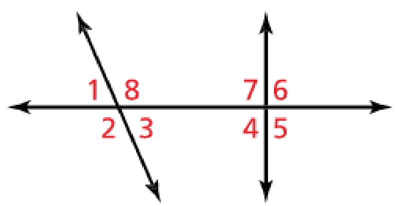
Two angles are **alternate exterior angles** when they lie outside the two lines and on opposite sides of the transversal *t*.



Two angles are **consecutive interior angles** when they lie between the two lines and on the same side of the transversal *t*.

Examples: Identifying pairs of angles.

<u>WE DO</u>



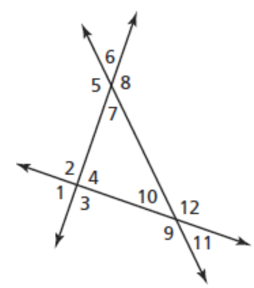
1. Consecutive interior

2. alternate interior

3. corresponding

4. alternate exterior

<u>YOU DO</u>



1. consecutive interior

2. alternate interior

3. corresponding

4. alternate exterior

Assignment	

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 $\angle 2 \cong \angle 7$.

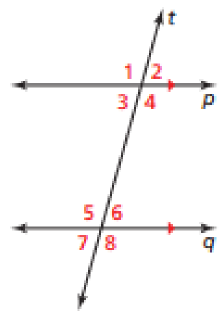
Proof Ex. 15, p. 136

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.

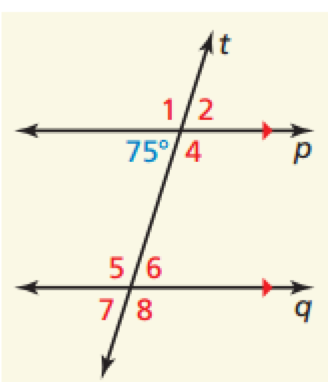
Examples In the diagram at the left, $\angle 3$ and $\angle 5$ are supplementary, and $\angle 4$ and $\angle 6$ are supplementary.

Proof Ex. 16, p. 136



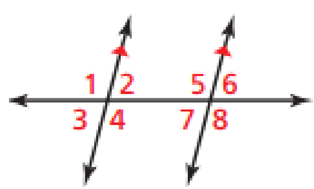
Examples: State the angles who have the same measure as the one given. Explain.

<u>WE DO</u>



<u>YOU DO</u>

$m\angle 1 = 105°$



Examples: Use parallel lines to find the value of the variable.

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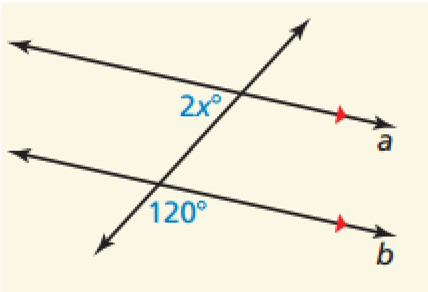
1.



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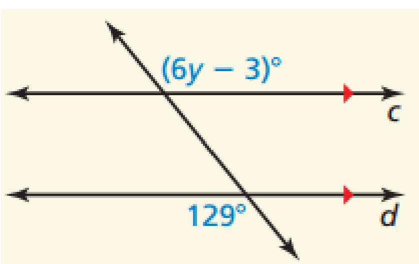

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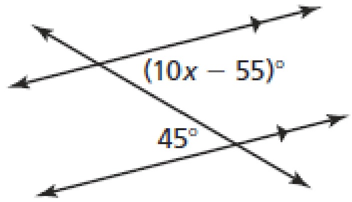

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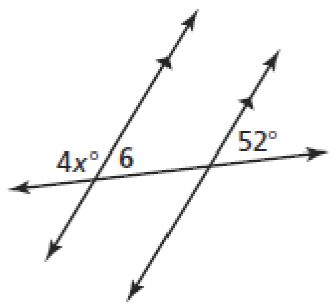


Assignment	

3.3 Prove lines are parallel.______________________________ Date:______________

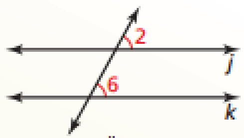
Define Vocabulary:

converse

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.

Proof Ex. 36, p. 180

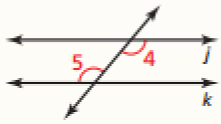


$j \parallel k$

Theorem 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.

Proof Example 2, p. 140

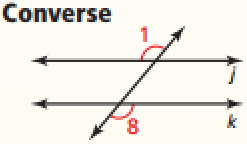


$j \parallel k$

Theorem 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.

Proof Ex. 11, p. 142

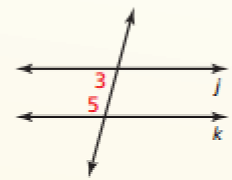


$j \parallel k$

Theorem 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.

Proof Ex. 12, p. 142

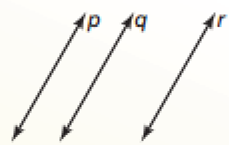


If $\angle 3$ and $\angle 5$ are supplementary, then $j \parallel k$.

Theorem 3.9 Transitive Property of Parallel Lines

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

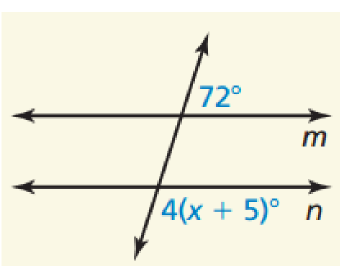
Proof Ex. 39, p. 144; Ex. 48, p. 162



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

Examples: Find the value of x that makes $m \parallel n$ and $v \parallel u$.

<u>WE DO</u>



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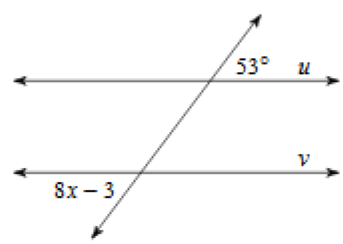
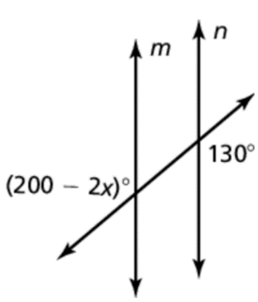
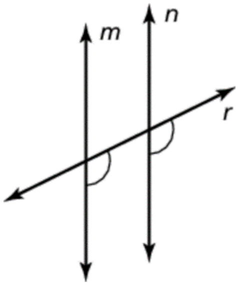


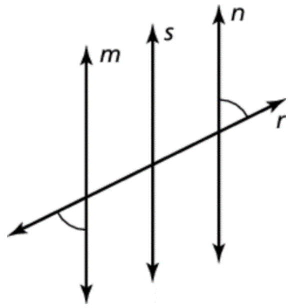


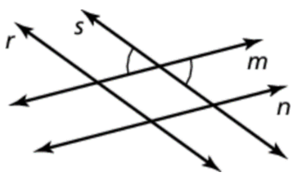
Examples: Decide whether there is enough information to prove $m \parallel n$. If so state the theorem you would use.

WE DO

YOU DO







Assignment	