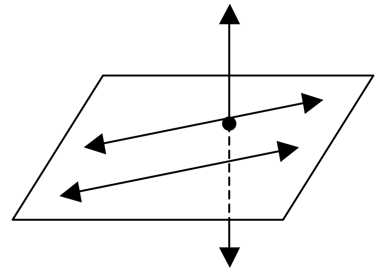
3.1 Lines and Angles

If two lines do not intersect then they must be either parallel lines or skew lines. Parallel lines are coplanar (in the same plane) and skew lines are not coplanar.

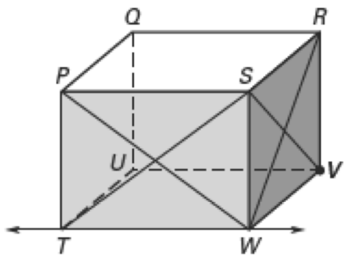
If two planes do not intersect, then they are parallel planes.



Identifying line relationships in 3-dimensional drawings (in space).

Example:

Think of each segment in the diagram as part of a line. Which of the lines appear to fit the description?

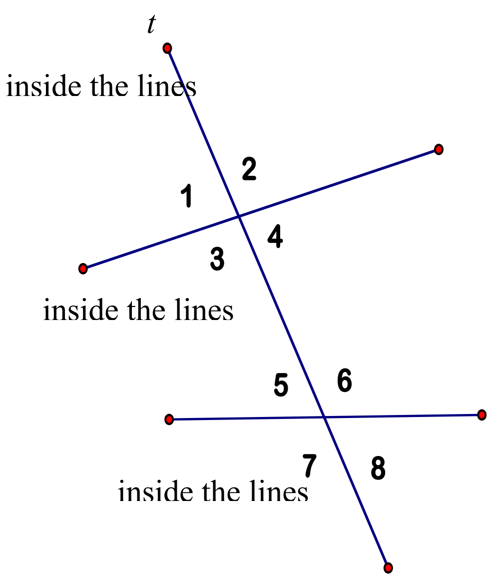


a. parallel to $\overleftrightarrow{TW}$ and contains V

b. perpendicular to $\overleftrightarrow{TW}$ and contains V

c. skew to $\overleftrightarrow{TW}$ and contains V

d. Name the plane(s) that contain V and appear to be parallel to plane TPQ.



Identifying Angles Formed by Transversals:

line *t* is a transversal (travels across) – a line that intersects two or more coplanar lines at different points.

The angle pairs formed are given special names:

corresponding angles have corresponding positions
ex: $\angle 1$ and $\angle 5$ or $\angle 4$ and $\angle 8$

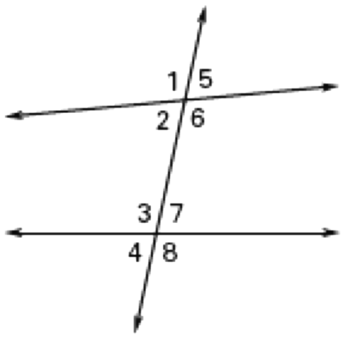
alternate exterior angles are on *different sides* of the transversal and lie *outside* the two lines ex: $\angle 1$ and $\angle 8$, or $\angle 2$ and $\angle 7$

alternate interior angles are on *different sides* of the transversal and lie *inside* the two lines ex: $\angle 3$ and $\angle 6$, or $\angle 4$ and $\angle 5$

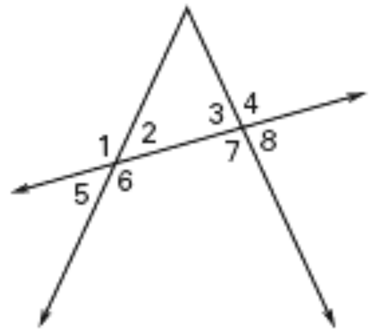
consecutive interior angles or same side interior angles: are on the *same side* of the transversal and lie *inside* the two lines.
ex: $\angle 3$ and $\angle 5$, or $\angle 4$ and $\angle 6$.

Inside the Lines: $\angle 3$, $\angle 4$, $\angle 5$, and $\angle 6$
Outside the Lines: $\angle 1$, $\angle 2$, $\angle 7$, and $\angle 8$
Same side of Transversal: $\angle 1$, $\angle 3$, $\angle 5$, and $\angle 7$ or $\angle 2$, $\angle 4$, $\angle 6$, and $\angle 8$

Example 1:



Example 2:

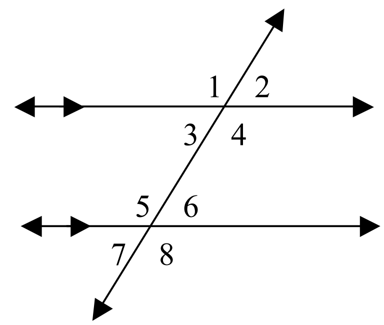
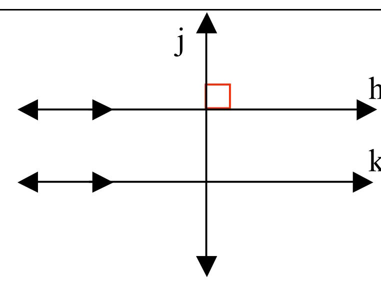


List all pairs of angles that fit the description.

a. corresponding
b. alternate exterior
c. alternate interior
d. consecutive interior

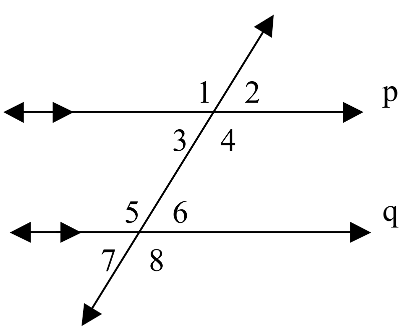
3.3 Parallel Lines and Transversals

Properties of Parallel Lines – Now a transversal crosses two lines that are *parallel*

Theorem/ Postulate	In words	Examples	Picture
Post 15	If two parallel lines are cut by a transversal, then the pairs of corresponding angles are congruent.	$\angle 1 \cong \angle 5$ $\angle 2 \cong \angle 6$ $\angle 3 \cong \angle 7$ $\angle 4 \cong \angle 8$	
Thm 3.4	**Alternate Interior Angles** If two parallel lines are cut by a transversal, pairs of alternate interior angles are congruent.	$\angle 3 \cong \angle 6$ $\angle 4 \cong \angle 5$	
Thm 3.5	**Consecutive Interior Angles** If two parallel lines are cut by a transversal, then pairs of consecutive interior angles are supplementary.	$m\angle 3 + m\angle 5 = 180$ $m\angle 4 + m\angle 6 = 180$	
Thm 3.6	**Alternate Exterior Angles** If two parallel lines are cut by a transversal, then pairs of alternate exterior angles are congruent.	$\angle 1 \cong \angle 8$ $\angle 2 \cong \angle 7$	
Thm 3.7	**Perpendicular Transversal** If a transversal is perpendicular ($\perp$) to one of two parallel lines, then it is $\perp$ to the other.	j $\perp$ k	

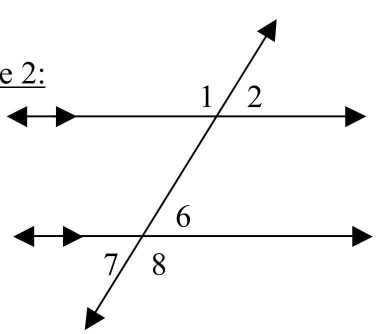
Example 1:

Given: p parallel to q **Prove**: $m\angle 2 + m\angle 8 = 180$



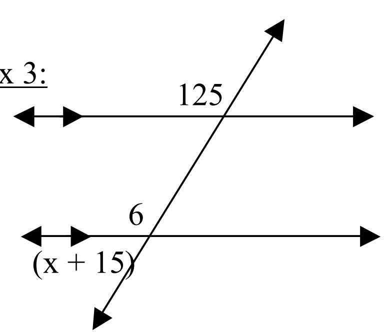
Statements	Reasons
1. p parallel to q	Given
2. $\angle 2 \cong \angle 7$	Alternate Exterior Angles Thm
3. $\angle 7$ *and* $\angle 8$ *are* supplementary	Linear Pair Postulate
4. $\angle 2$ *and* $\angle 8$ *are* supplementary	Congruent Supplements Thm
5. $m\angle 2 + m\angle 8 = 180$	Def of Supplementary

Example 2:



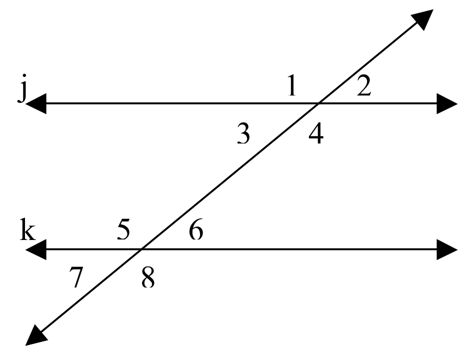
$m\angle 6 = 75$
Find: $m\angle 1,2,7,8$

Ex 3:



3.4 Proving Lines are Parallel

If two lines in a plane are cut by a transversal, then…

#	Words	Examples	Pictures
P16	**Corresponding Angles Converse** If corr.∠s are ≅, then lines are ∥.		
T3.8	**Alternate Interior Angles Converse** If alt. int. ∠s are ≅, then lines are ∥.		
T3.9	**Same Side Interior Angles Converse** If ss int. ∠s are supp., then lines are ∥.		
T3.10	**Alternate Exterior Angles Converse** If alt. ext. ∠s are ≅, then lines are ∥.		

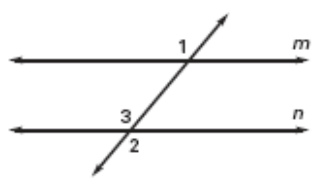
Example 1:

Prove the Alternate Exterior Angles Converse.

Solution

Given: ∠1 ≅ ∠2

Prove: $m \parallel n$

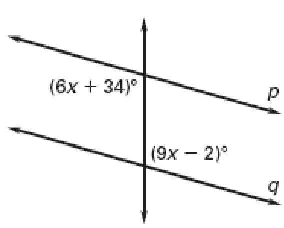


Statements	Reasons

Example 2:

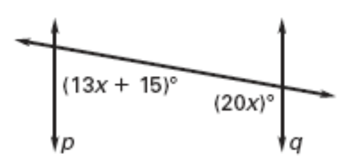
Find the value of x that makes $p \parallel q$.

Lines p and q will be parallel if the marked angles are



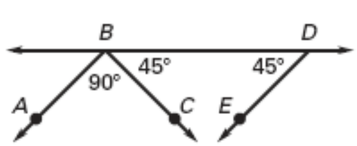
Example 3:

Find the value of x that makes $p \parallel q$.



Decide whether $\overrightarrow{BA}$ is parallel to $\overrightarrow{DE}$. Explain.

Example 4:



Example 5: