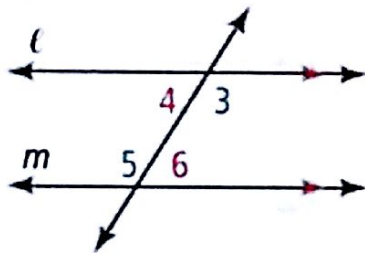


## Section 3-2: Properties of Parallel Lines

**Postulate 3-1:** If a transversal intersects two parallel lines, then same-side interior angles are supplementary

If ...

$$\ell \parallel m$$



Then ...

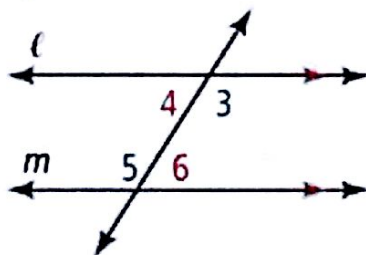
$$m\angle 4 + m\angle 5 = 180$$

$$m\angle 3 + m\angle 6 = 180$$

**Theorem 3-1:** If a transversal intersects two parallel lines, then alternate interior angles are congruent

If ...

$$\ell \parallel m$$



Then ...

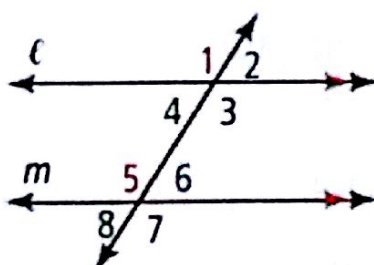
$$\angle 4 \cong \angle 6$$

$$\angle 3 \cong \angle 5$$

**Theorem 3-2:** If a transversal intersects two parallel lines, then corresponding angles are congruent

If ...

$$\ell \parallel m$$



Then ...

$$\angle 1 \cong \angle 5$$

$$\angle 2 \cong \angle 6$$

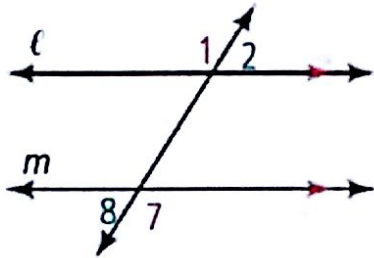
$$\angle 3 \cong \angle 7$$

$$\angle 4 \cong \angle 8$$

**Theorem 3-3:** If a transversal intersects two parallel lines, then alternate exterior angles are congruent

If ...

$$l \parallel m$$



Then ...

$$\angle 1 \cong \angle 7$$

$$\angle 2 \cong \angle 8$$

What about same-side exterior angles?

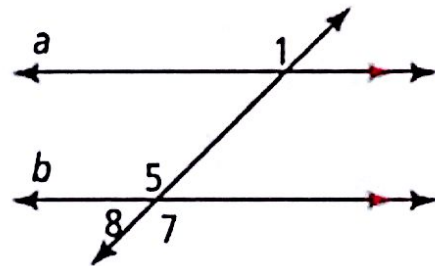
How do you think they are related?

congruent?                      supplementary?

Example 1:

**Given:**  $a \parallel b$

**Prove:**  $\angle 1$  and  $\angle 8$  are supplementary.

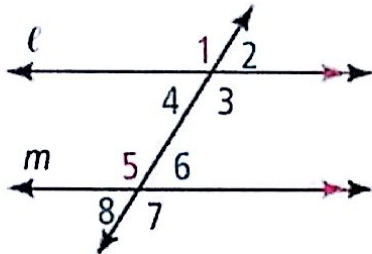


Statements	Reasons
$a \parallel b$	Given
$\angle 1 \cong \angle 5$	If $\neq$ then corr $\angle$ s are $\cong$
$m\angle 1 = m\angle 5$	$\cong \angle$ s have = measures.
$\angle 5$ and $\angle 8$ are supp	$\angle$ s that form a linear pair are supp
$m\angle 5 + m\angle 8 = 180^\circ$	Def of supp $\angle$ s
$m\angle 1 + m\angle 8 = 180^\circ$	Subst.
$\angle 1$ and $\angle 8$ are supp.	Def of supp $\angle$ s

**Theorem 3-X:** If a transversal intersects two parallel lines, then same-side exterior angles are supplementary

If ...

$$\ell \parallel m$$



Then ...

$$m\angle 8 + m\angle 1 = 180^\circ$$

$$m\angle 7 + m\angle 2 = 180^\circ$$

**To summarize:**

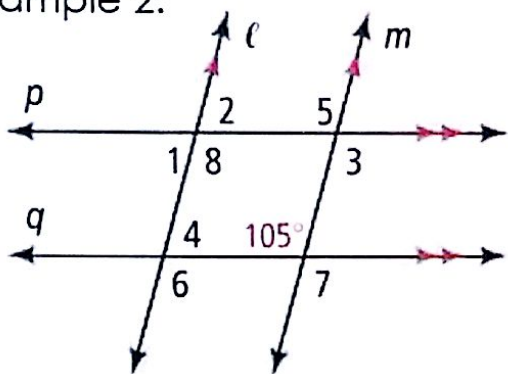
\* ONLY if you have PARALLEL LINES (and a transversal)...

corresponding angles  $\longrightarrow$  Congruent

alternate interior angles  
alternate exterior angles  $\longrightarrow$  Congruent

same-side interior angles  
same-side exterior angles  $\longrightarrow$  Supplementary

Example 2:



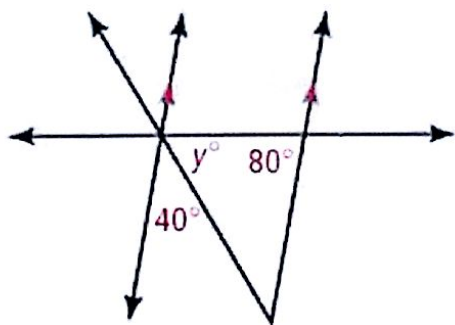
$$m\angle 1 = 75^\circ \quad m\angle 5 = 105^\circ$$

$$m\angle 2 = 75^\circ \quad m\angle 6 = 105^\circ$$

$$m\angle 3 = 105^\circ \quad m\angle 7 = 105^\circ$$

$$m\angle 4 = 75^\circ \quad m\angle 8 = 105^\circ$$

Example 3: Find the value of  $y$ .



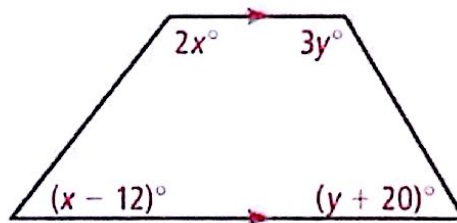
$$(y + 40^\circ) + 80^\circ = 180^\circ$$

AS ONE L

Same-side int

So...  $y + 120^\circ = 180^\circ$   
 $y = 60^\circ$

Example 4: Find the value of  $x$  and  $y$ .



$$2x + (x - 12) = 180$$

$$3x - 12 = 180$$

$$3x = 192$$

$$x = 64$$

$$3y + y + 20 = 180$$

$$4y + 20 = 180$$

$$4y = 160$$

$$y = 40$$