3.2 Use Parallel Lines and Transversals

Before You identified angle pairs formed by a transversal.

Now You will use angles formed by parallel lines and transversals.

Why? So you can understand angles formed by light, as in Example 4.

G.CO.9 Prove theorems about lines and angles.

POSTULATE   *For Your Notebook*
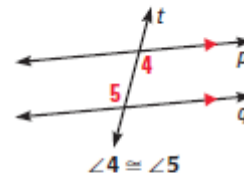
POSTULATE 15 Corresponding Angles Postulate

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

$\angle 2 \cong \angle 6$
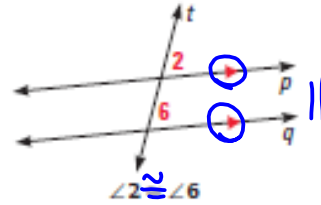
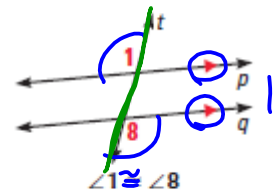## THEOREMS   *For Your Notebook*

THEOREM 3.1 Alternate Interior Angles Theorem

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

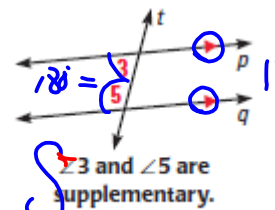$\angle 4 \cong \angle 5$

THEOREM 3.2 Alternate Exterior Angles Theorem

If two parallel lines are cut by a transversal, then the pairs of alternate exterior angles are congruent.
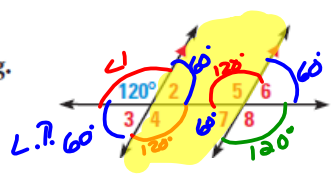
$\angle 1 \cong \angle 8$

THEOREM 3.3 Consecutive Interior Angles Theorem

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

$\angle 3$ and $\angle 5$ are supplementary.

Same Side Int $\angle$s

EXAMPLE 1   Identify congruent angles

The measure of three of the numbered angles is 120°. Identify the angles. Explain your reasoning.
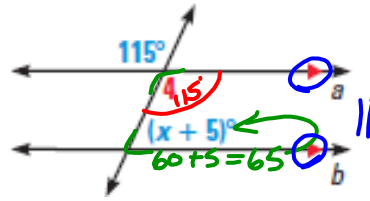
Solution

$m\angle 4 = 120°$ V.A.T.

$m\angle 5 = 120°$ Alt Int $\angle$s ($\angle 4 \wedge \angle 5$)
        Corresp. $\angle$s ($\angle 1 \wedge \angle 5$)

$m\angle 8 = 120°$ Alt Ext $\angle$s ($\angle 1 \wedge \angle 8$)
        Y.A.T ($\angle 5 \wedge \angle 8$)
        Corresp $\angle$s ($\angle 4 \wedge \angle 8$)

EXAMPLE 2 **Use properties of parallel lines**

XY ALGEBRA Find the value of x.

115°

$4\;15$
$(x+5)°$
$60+5=65$
a
b
$\parallel$

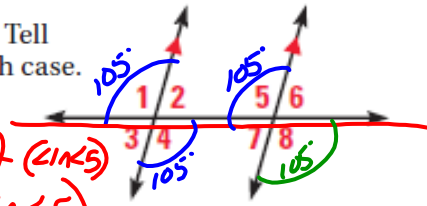**Solution**

$x + 5 + 115 = 180$

$x + 120 = 180$

$x = 60$

Use the diagram at the right.

1. If $m\angle 1 = 105°$, find $m\angle 4$, $m\angle 5$, and $m\angle 8$. Tell which postulate or theorem you use in each case.
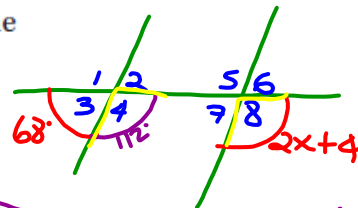
$m\angle 4 = 105°$ V.A.T.

$m\angle 5 = 105°$ Corresp $\angle s$ Post (∠1∧∠5)
Alt Int ∠s (∠4∧∠5)

$m\angle 8 = 105°$ V.A.T (∠5∧∠8)
Alt Ext (∠1∧∠8)
Corresp (∠4∧∠8)

105° 1 2   105° 5 6
3 4   7 8
105°   105°

2. If $m\angle 3 = 68°$ and $m\angle 8 = (2x + 4)°$, what is the value of x? Show your steps.

$2x + 4 + 68 = 180$

$2x + 72 = 180$

$2x = 108$

$x = 54$

1 2   5 6
3 4   7 8
68° 112° 2x+4

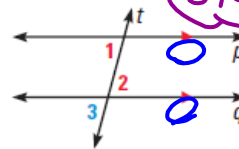$112 = 2x + 4$
$108 = 2x$
$54 = x$

EXAMPLE 3 **Prove the Alternate Interior Angles Theorem**

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

GIVEN ▶ $p \parallel q$
PROVE ▶ $\angle 1 \cong \angle 2$

t
1   p
2
3   q

STATEMENTS	REASONS
1. $p \parallel q$	1. Given
$\angle 2 \cong \angle 3$	V.A.T.
$\angle 3 \cong \angle 1$	Corresp. $\angle s$ Post
$\angle 2 \cong \angle 1$	Trans/Substitution

EXAMPLE 4 **Solve a real-world problem**

SCIENCE When sunlight enters a drop of rain, different colors of light leave the drop at different angles. This process is what makes a rainbow. For violet light, $m\angle 2 = 40°$. What is $m\angle 1$? How do you know?

Alt Int ∠s

2 40°
40° 1