

Find the angle measure.

1.  $(3x + 22)^\circ = (10x - 6)^\circ$  34°

$$\begin{array}{r} 3x + 22 = 10x \\ - 3x \qquad - 3x \\ \hline 22 = 7x - 6 \\ +6 \qquad +6 \\ \hline 28 = 7x \end{array}$$

2.  $(7x - 46)^\circ = (9x - 64)^\circ$

$$\begin{array}{r} 28 = 7x \\ \frac{28}{7} = \frac{7x}{7} \\ \hline x = 4 \end{array}$$

3.  $(15x + 12)^\circ = (19x - 24)^\circ$

$$\begin{array}{r} 15x + 12 = 19x - 24 \\ - 15x \qquad - 15x \\ \hline 12 = 4x - 24 \\ + 24 \qquad + 24 \\ \hline 36 = 4x \end{array}$$

4.  $(15x + 8)^\circ = (21x - 10)^\circ$

$$\begin{array}{r} 36 = 4x \\ \frac{36}{4} = \frac{4x}{4} \\ \hline x = 9 \\ 15 \times 9 \\ 135 + 12 = 147 \end{array}$$

5.  $(16x - 42)^\circ = (9x + 14)^\circ$

$$\begin{array}{r} 19 + 9 \\ 20 + 9 \\ \hline 29 = 180 \\ \hline 151 \\ \hline 151 \end{array}$$

6.  $(11x + 18)^\circ = (14x)^\circ$

**Sketch a diagram of the description.**

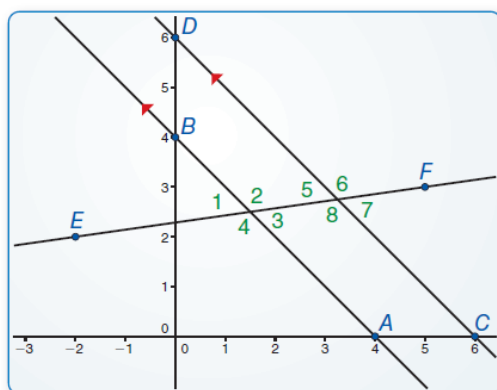
1. plane  $R$  and line  $\ell$  intersecting plane  $R$  at a  $45^\circ$  angle
2.  $\overline{AB}$  in plane  $R$  bisected by point  $C$ , with point  $D$  also on  $\overline{AB}$
3.  $\overline{AB}$  in plane  $R$  with ray  $\overrightarrow{CD}$  such that point  $D$  is on  $\overline{AB}$
4. planes  $R$  and  $S$  with line  $\overline{XY}$  intersecting each plane

## **Essential Question**

When two parallel lines are cut by a transversal, which of the resulting pairs of angles are congruent?

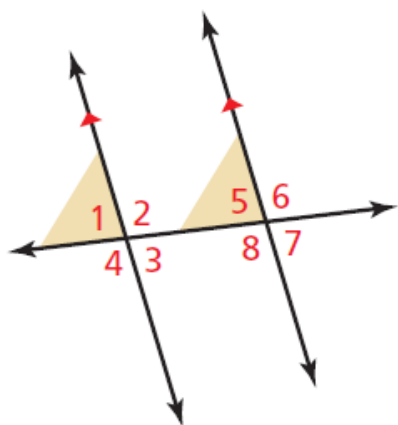
**Work with a partner.**

Use dynamic geometry software to draw two parallel lines. Draw a third line that intersects both parallel lines. Find the measures of the eight angles that are formed. What can you conclude?

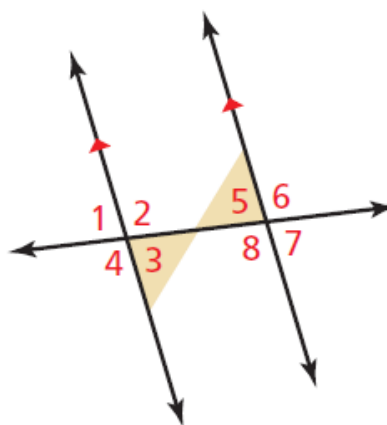


**Work with a partner.** Use the results of Exploration 1 to write conjectures about the following pairs of angles formed by two parallel lines and a transversal.

a. corresponding angles

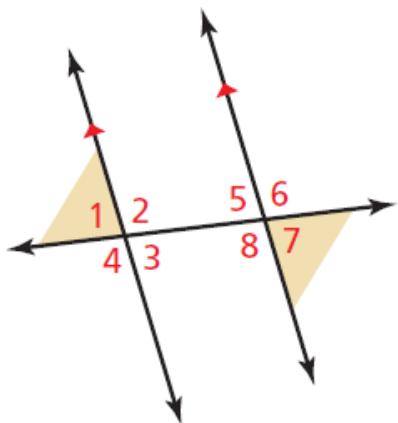


b. alternate interior angles

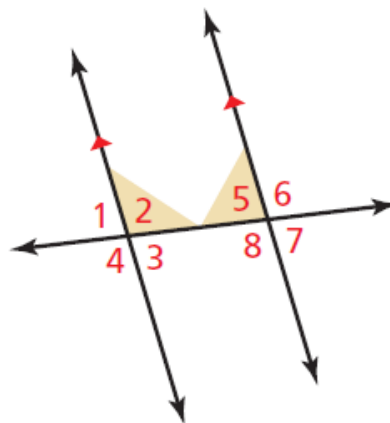


**Work with a partner.** Use the results of Exploration 1 to write conjectures about the following pairs of angles formed by two parallel lines and a transversal.

c. alternate exterior angles



d. consecutive interior angles



## 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

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### 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

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### 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

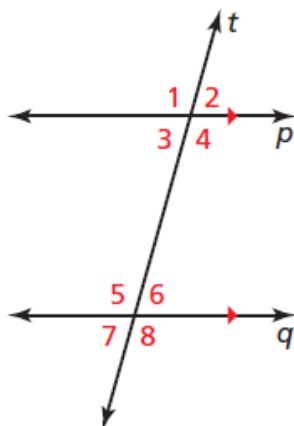
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### Theorem 3.4 Consecutive Interior Angles Theorem

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

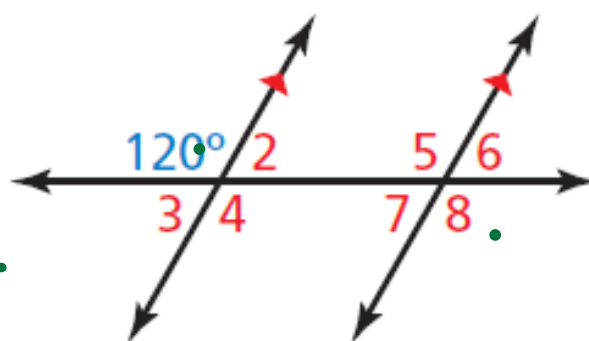


The measures of three of the numbered angles are  $120^\circ$ . Identify the angles.  
Explain your reasoning.

$\angle 4$  : Vertical  $\angle$ 's  
Theorem

$\angle 8$  : Alt Exterior  
 $\angle$ 's Theorem

$\angle 5$  : Corresponding  $\angle$ 's  
Theorem





Find the value of  $x$ .

$$m\angle 4 = 115^\circ$$

- Vertical  $\angle$ 's Thm

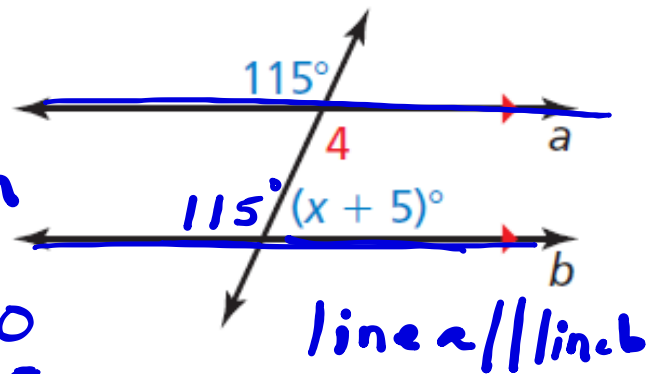
$$115 + (x + 5)^\circ = 180$$

$$- 115 \quad - 115$$

$$(x + 5)^\circ = 65$$

$$x + 5 = 65$$

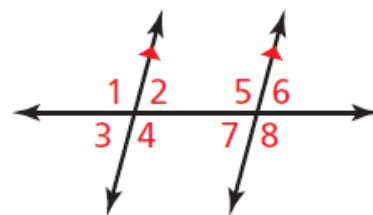
$$\boxed{x = 60}$$





**Use the diagram.**

1. Given  $m\angle 1 = 105^\circ$ , find  $m\angle 4$ ,  $m\angle 5$ , and  $m\angle 8$ . Tell which theorem you use in each case.

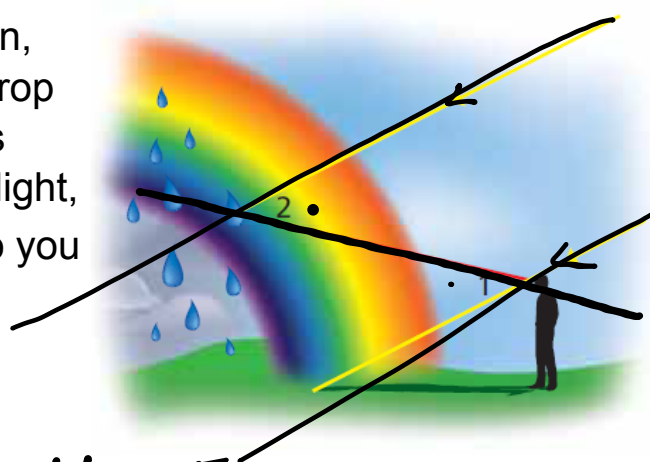


2. Given  $m\angle 3 = 68^\circ$  and  $m\angle 8 = (2x + 4)^\circ$ , what is the value of  $x$ ? Show your steps.

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

**3.** In the proof in Example 4, if you use the third statement before the second statement, could you still prove the theorem? Explain.

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,  $m\angle 2 = 40^\circ$ . What is  $m\angle 1$ ? How do you know?



$$\angle 1 \cong \angle 2$$

Alt Interior  $\angle$ 's Theorem

4. **WHAT IF?** In Example 5, yellow light leaves a drop at an angle of  $m\angle 2 = 41^\circ$ . What is  $m\angle 1$ ? How do you know?

Imagine a friend was absent today. What are the *Big Ideas* of the lesson you would tell your friend?



HW

P 135 # 3-12, 17, 19