Angles Formed by Parallel Lines and Transversals

Warm Up

Identify each angle pair.

1. ∠1 and ∠3   corr. ∠s

2. ∠3 and ∠6   alt. int. ∠s

3. ∠4 and ∠5   alt. ext. ∠s
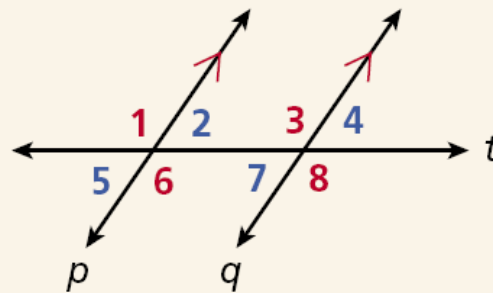
4. ∠6 and ∠7   same-side int ∠s
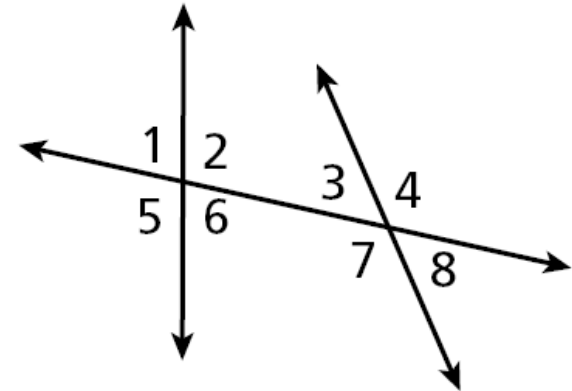
Objective

Prove and use theorems about the angles formed by parallel lines and a transversal.

Postulate 3-2-1 — **Corresponding Angles Postulate**

THEOREM	HYPOTHESIS	CONCLUSION
If two parallel lines are cut by a transversal, then the pairs of corresponding angles are congruent.		$\angle 1 \cong \angle 3$ $\angle 2 \cong \angle 4$ $\angle 5 \cong \angle 7$ $\angle 6 \cong \angle 8$

Example 1: Using the Corresponding Angles Postulate

Find each angle measure.

A. m$\angle ECF$

$x = 70$ *Corr. $\angle$s Post.*

m$\angle ECF = 70°$

B. m$\angle DCE$

$5x = 4x + 22$ *Corr. $\angle$s Post.*

$x = 22$ *Subtract 4x from both sides.*

m$\angle DCE = 5x$

$= 5(22)$ *Substitute 22 for x.*

$= 110°$
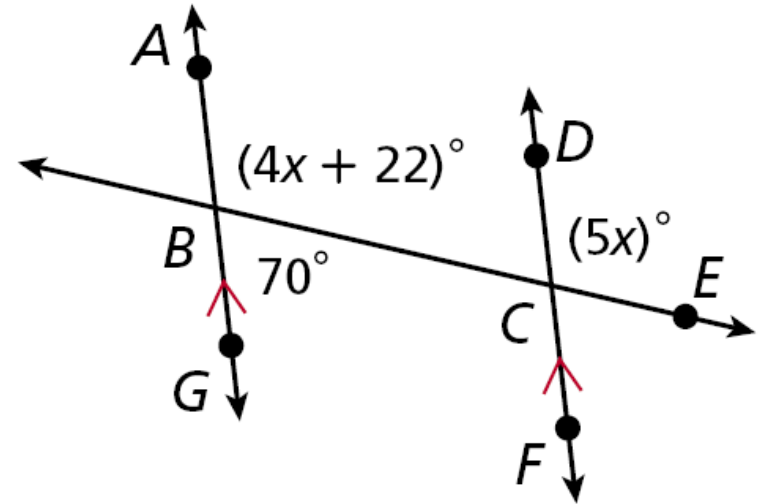
Check It Out! Example 1

Find m∠*QRS*.

$x = 118$ *Corr. ∠s Post.*

m∠*QRS* + x = 180°

m∠QRS = 180° − x

= 180° − 118°

= 62°
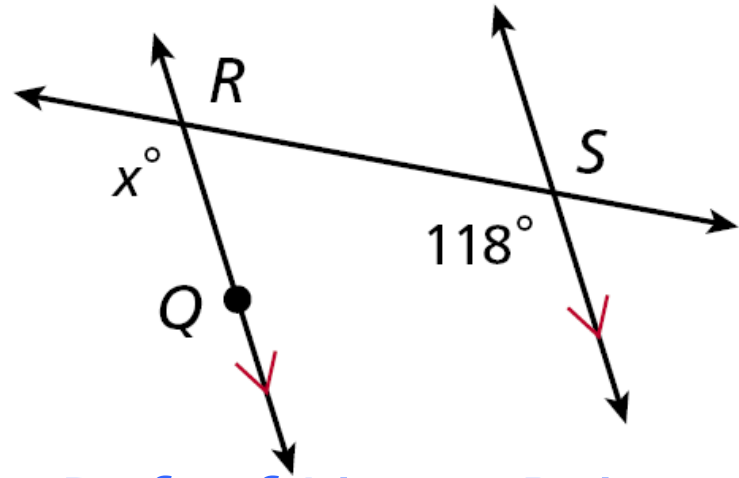
Def. of Linear Pair

Subtract x from both sides.

Substitute 118° for x.

Helpful Hint

If a transversal is perpendicular to two parallel lines, all eight angles are congruent.

Remember that postulates are statements that are accepted without proof.

Since the Corresponding Angles Postulate is given as a postulate, it can be used to prove the next three theorems.

Example 2: Finding Angle Measures
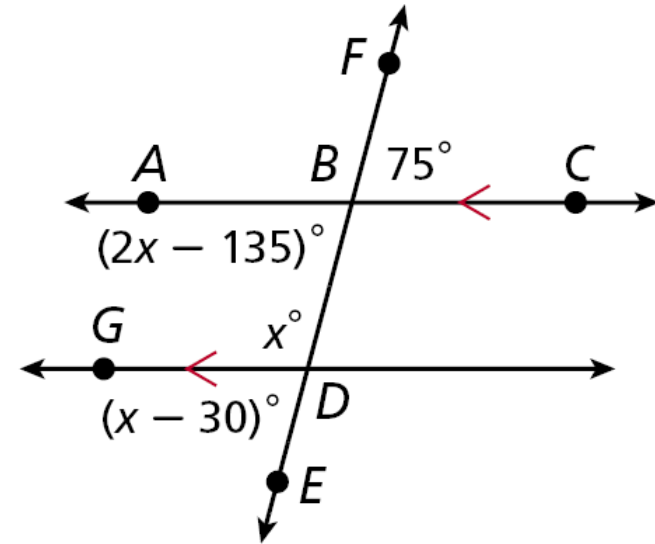
Find each angle measure.

A. m∠EDG

   m∠*EDG* = 75° *Alt. Ext. ∠s Thm.*

B. m∠BDG

   $x - 30° = 75°$ *Alt. Ext. ∠s Thm.*

   $x = 105$ *Add 30 to both sides.*

   m∠*BDG* = 105°

F

A   *B* 75°   *C*

$(2x - 135)°$

G   *x°*

$(x - 30)°$ *D*

E

Check It Out! Example 2

Find m∠ABD.
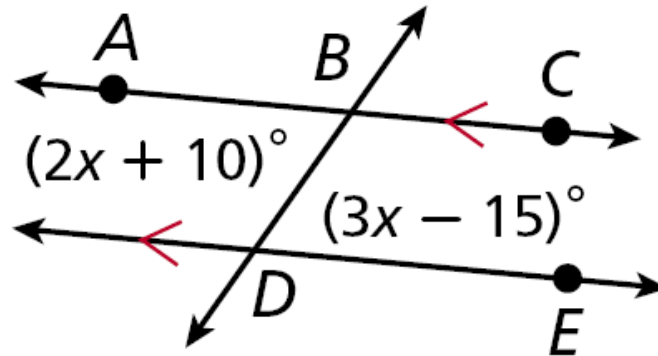
$2x + 10° = 3x − 15°$ *Alt. Int. ∠s Thm.*

$x = 25$ *Subtract 2x and add 15 to both sides.*

m∠*ABD* = 2(25) + 10 = 60°   *Substitute 25 for x.*

Example 3: Music Application

Find *x* and *y* in the diagram.

By the Alternate Interior Angles Theorem, $(5x + 4y)° = 55°$.

By the Corresponding Angles Postulate, $(5x + 5y)° = 60°$.
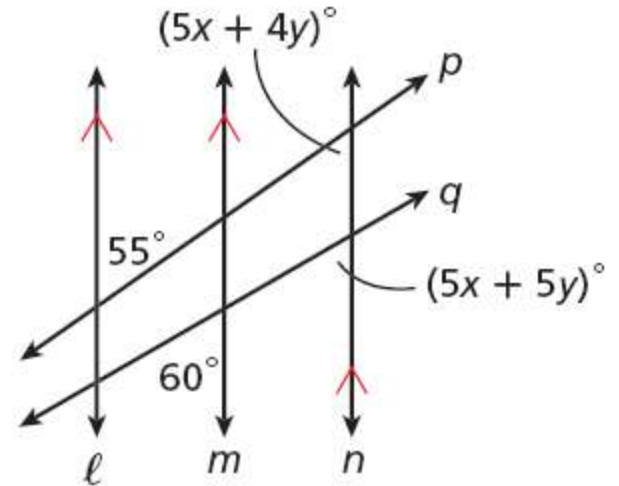
$$5x + 5y = 60$$
$$\underline{-(5x + 4y = 55)}$$
$$y = 5$$

Subtract the first equation from the second equation.
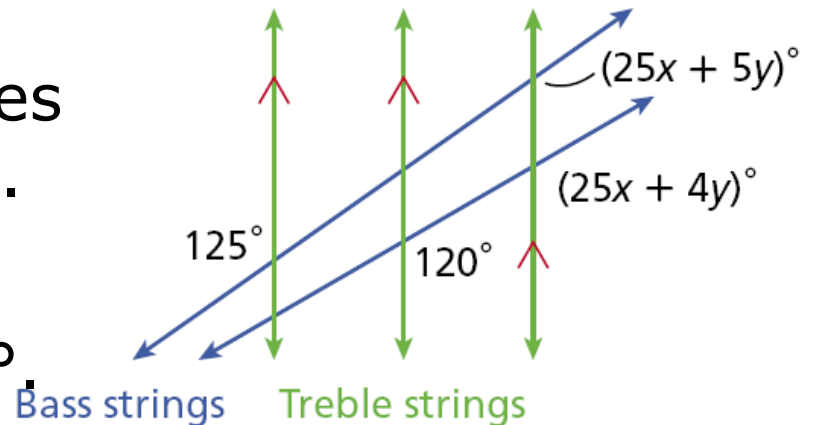
$$5x + 5(5) = 60$$

Substitute 5 for y in 5x + 5y = 60. Simplify and solve for x.

$$x = 7, y = 5$$

Check It Out! Example 3

Find the measures of the acute angles in the diagram.

By the Alternate Exterior Angles Theorem, $(25x + 5y)° = 125°$.

By the Corresponding Angles Postulate, $(25x + 4y)° = 120°$.

$(25x + 5y)°$

$(25x + 4y)°$

$125°$

$120°$

Bass strings   Treble strings

An acute angle will be $180° − 125°$, or $55°$.

The other acute angle will be $180° − 120°$, or $60°$.

Lesson Quiz

State the theorem or postulate that is related to the measures of the angles in each pair. Then find the unknown angle measures.

1. m∠1 = 120°, m∠2 = (60x)°

Alt. Ext. ∠s Thm.; m∠2 = 120°

2. m∠2 = (75x − 30)°,
m∠3 = (30x + 60)°

Corr. ∠s Post.; m∠2 = 120°,
m∠3 = 120°

3. m∠3 = (50x + 20)°, m∠4= (100x − 80)°

Alt. Int. ∠s Thm.; m∠3 = 120°, m∠4 =120°

4. m∠3 = (45x + 30)°, m∠5 = (25x + 10)°

Same-Side Int. ∠s Thm.; m∠3 = 120°, m∠5 =60°