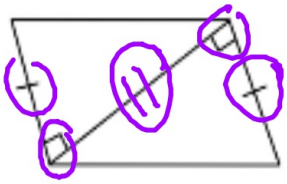
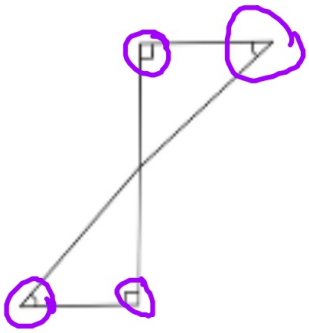
Warm-up

State if the triangles are congruent. If they are, state how you know.

a) yes, by SAS



b) no



Key Concepts, *continued*

- **Vertical angles** are nonadjacent angles formed by two pairs of opposite rays.

Theorem
Vertical Angles Theorem Vertical angles are congruent.

Vertical angles are congruent.

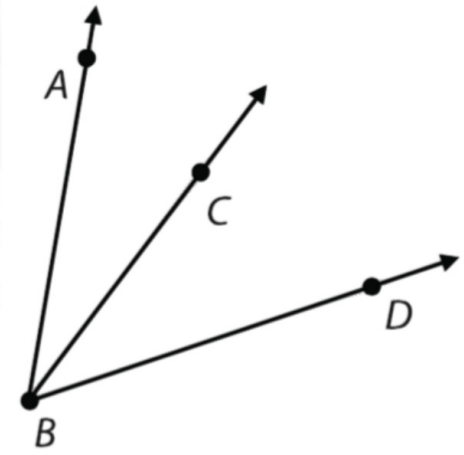
$\angle 1 \cong \angle 3$ and $\angle 2 \cong \angle 4$

Key Concepts, *continued*

Adjacent angles

$\angle ABC$ is adjacent to $\angle CBD$. They share vertex B and $\overrightarrow{BC}$.

$\angle ABC$ and $\angle CBD$ have no common interior points.



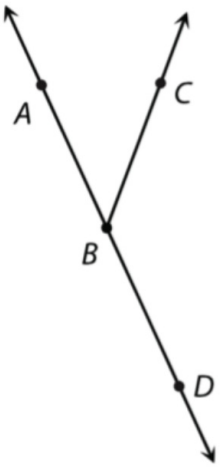
Key Concepts, *continued*

- **Linear pairs** are pairs of adjacent angles whose non-shared sides form a straight angle.

Key Concepts, *continued*

Linear pair

$\angle ABC$ and $\angle CBD$ are a linear pair. They are adjacent angles with non-shared sides, creating a straight angle.



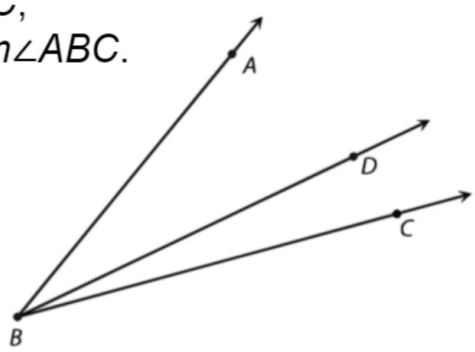
Key Concepts, *continued*

Postulate

Angle Addition Postulate

If D is in the interior of $\angle ABC$, then $m\angle ABD + m\angle DBC = m\angle ABC$.

If $m\angle ABD + m\angle DBC = m\angle ABC$, then D is in the interior of $\angle ABC$.



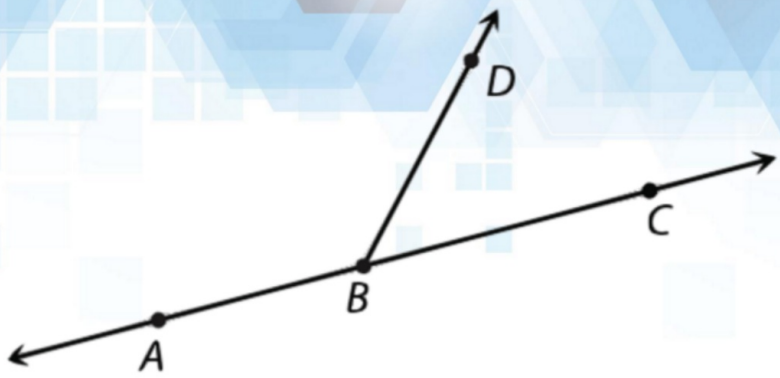
Key Concepts, *continued*

- Informally, the Angle Addition Postulate means that the measure of the larger angle is made up of the sum of the two smaller angles inside it. **Postulates** are true statements that don't need proofs.
- **Supplementary angles** are two angles whose sum is 180°.
- Supplementary angles can form a linear pair or be nonadjacent.

Key Concepts, *continued*

- In the diagram below, the angles form a linear pair.

$m\angle ABD + m\angle DBC = 180$

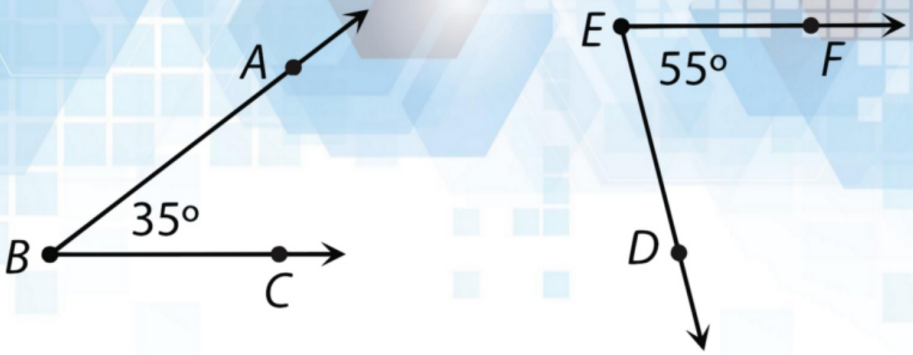


Key Concepts, *continued*

- **Complementary angles** are two angles whose sum is 90°.
- Complementary angles can form a right angle or be nonadjacent.
- The following diagram shows a pair of nonadjacent complementary angles.

Key Concepts, *continued*

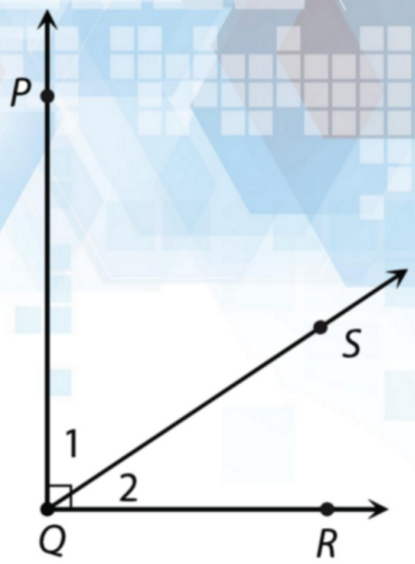
$m\angle B + m\angle E = 90$



Key Concepts, *continued*

- The diagram at right shows a pair of adjacent complementary angles labeled with numbers.

$$m\angle 1 + m\angle 2 = 90$$

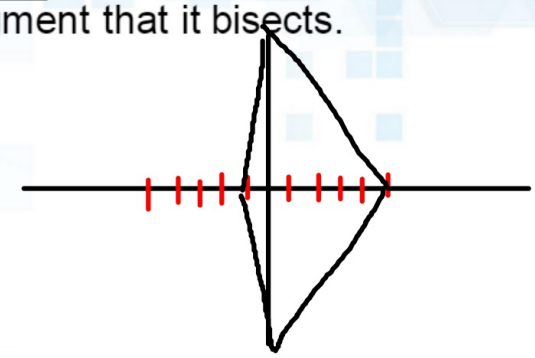


Key Concepts, *continued*

- The symbol for writing perpendicular lines is $\perp$, and is read as "is perpendicular to."
- In the diagram, $\overline{PQ} \perp \overline{QR}$
- Rays and segments can also be perpendicular.
- In a pair of perpendicular lines, rays, or segments, only one right angle box is needed to indicate perpendicular lines.

Key Concepts, *continued*

- **Perpendicular bisectors** are lines that intersect a segment at its midpoint at a right angle; they are perpendicular to the segment.
- Any point along the perpendicular bisector is **equidistant**, or the same distance, from the endpoints of the segment that it bisects.



Key Concepts, *continued*

- Angles have the same congruence properties that segments do.

Theorem
Congruence of angles is reflexive, symmetric, and transitive. • Reflexive Property: $\angle 1 \cong \angle 1$ • Symmetric Property: If $\angle 1 \cong \angle 2$, then $\angle 2 \cong \angle 1$. • Transitive Property: If $\angle 1 \cong \angle 2$ and $\angle 2 \cong \angle 3$, then $\angle 1 \cong \angle 3$.

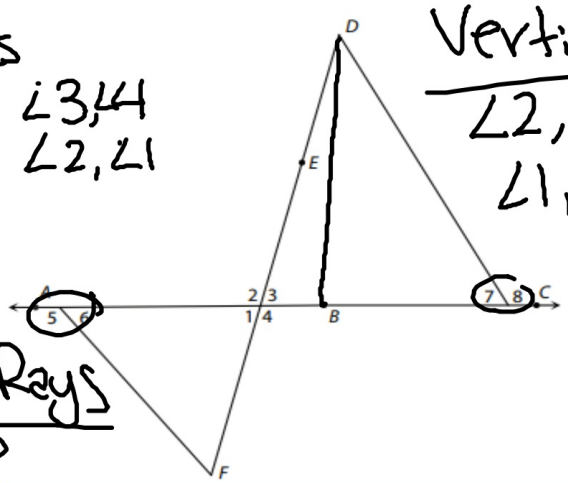
Example 1

Look at the following diagram. List pairs of supplementary angles, pairs of vertical angles, and a pair of opposite rays.

Supp ∠s
∠2, ∠3 ∠3, ∠4
∠1, ∠4 ∠2, ∠1
∠7, ∠8
∠5, ∠6

Vertical ∠'s
∠2, ∠4
∠1, ∠3

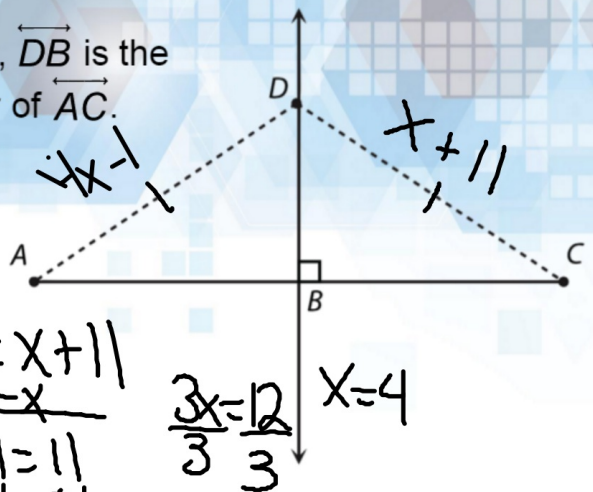
Opposite Rays
$\overrightarrow{BA}$, $\overrightarrow{BC}$



Guided Practice

Example 5

In the diagram at right, $\overleftrightarrow{DB}$ is the perpendicular bisector of $\overleftrightarrow{AC}$. If $AD = 4x - 1$ and $DC = x + 11$, what are the values of AD and DC?



$4x - 1 = x + 11$
$-x \quad -x$
$3x - 1 = 11$
$+1 \quad +1$
$\frac{3x}{3} = \frac{12}{3}$
$x = 4$

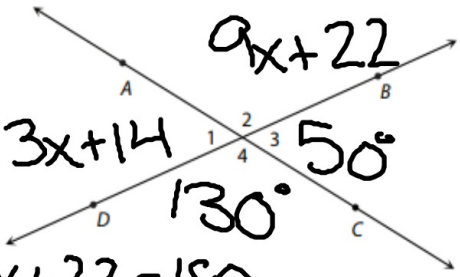
$4 + 11 = 15$

Example 3

In the following diagram, $\overleftrightarrow{AC}$ and $\overleftrightarrow{BD}$ are intersecting lines. If $m\angle 1 = 3x+14$ and $m\angle 2 = 9x+22$, find $m\angle 3$ and $m\angle 4$.

$m\angle 1 = 50°$

$3(12)+14$
$36+14$
50



$3x+14+9x+22=180$
$12x+36=180$
$-36 \quad -36$
$\frac{12x}{12} = \frac{144}{12}$
$x=12$

Example 2

Prove the theorem that angles complementary to congruent angles are congruent using the given information.

In the following figure, prove that $\angle 1$ is congruent to $\angle 4$, given that $\overleftrightarrow{AC}$ is perpendicular to $\overrightarrow{CD}$ and $\angle 2$ is congruent to $\angle 3$.

$\angle 1+\angle 2=\angle 3+\angle 4$
$\angle 1+\angle 2=90°$
$\angle 3+\angle 4=90°$
$\angle 2 \cong \angle 3$
$\angle 1+\angle 2=\angle 2+\angle 4$
$-\angle 2 \quad -\angle 2$
$\therefore$
$\angle 1=\angle 4$