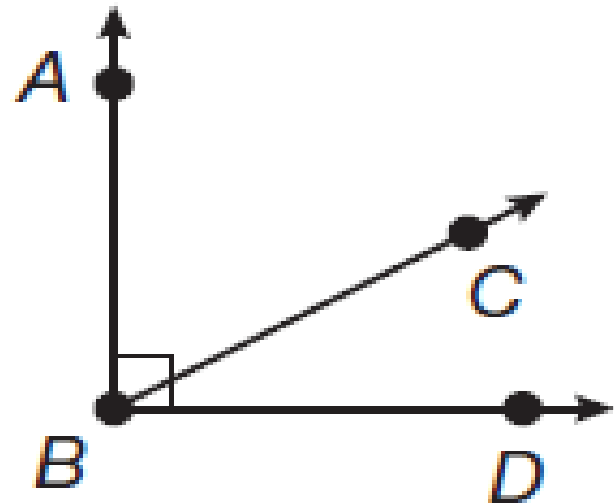# Lesson 6

Identifying Pairs of Angles

A pair of angles can sometimes be classified by their combined measure.

Complementary Angles – Two angles are complementary if the sum of their measures is 90°.

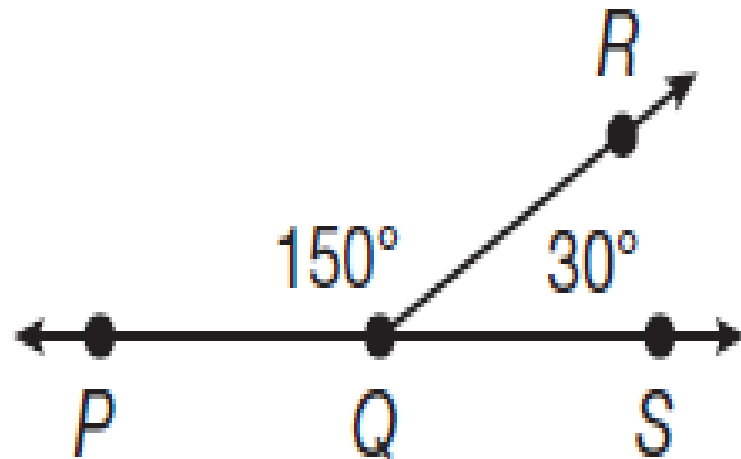$m\angle ABC + m\angle CBD = 90°$, so $\angle ABC$ is complementary to $\angle CBD$.

Supplementary Angles – Two angles are supplementary if the sum of their measures is 180°.

$m\angle PQR + m\angle RQS = 180°$, so $\angle PQR$ is supplementary to $\angle RQS$.

Math Language

The sum of an angle and its **complement** is 90º.
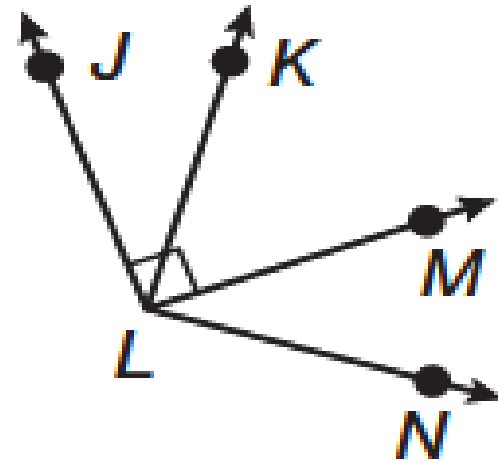The sum of an angle and its **supplement** is 180º.

Example 1. Finding complements and supplements.

a. Find the angles complementary to $\angle KLM$ if $m\angle KLN = 90°$.

Solution

From the diagram, $m\angle JLK + m\angle KLM = 90°$ and $m\angle KLM + m\angle MLN = 90°$. So $\angle JLK$ and $\angle MLN$ are complementary to $\angle KLM$.
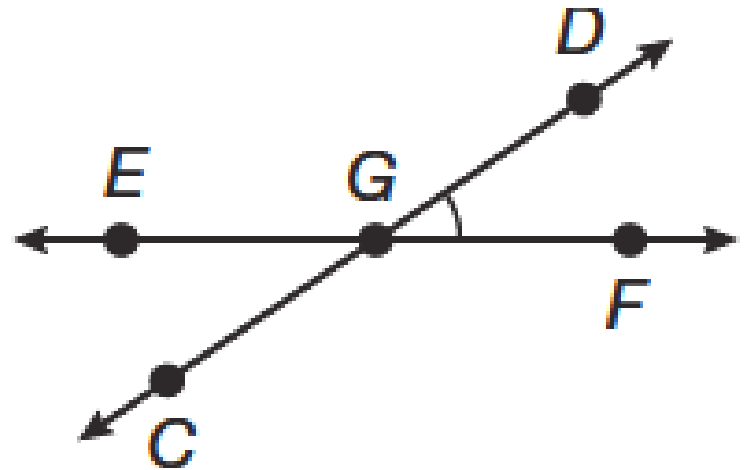
Example 1. Finding complements and supplements.

Find the angles supplementary to $\angle DGF$.

Solution

From the diagram, $m\angle EGD + m\angle DGF = 180°$ and $m\angle DGF + m\angle FGC = 180°$. So $\angle EGD$ and $\angle FGC$ are supplementary to $\angle DGF$.

Theorem 6-1: Congruent Complements Theorem – If two angles are complementary to the same angle or to congruent angles, then they are congruent.

Theorem 6-2: Congruent Supplements Theorem – If two angles are supplementary to the same angle or to congruent angles, then they are congruent.

Example 2. Solving with Complements and Supplements.

Find the measures of the angles labeled x and y.

Solution

To find x, notice that $\angle DBF$ and $\angle FBE$ are complementary.

$m\angle DBF + m\angle FBE = 90°$	Definition of comp. angles.
$55° + x = 90°$	Substitute.
$55° + x - 55° = 90° - 55°$	Subtract 55° from each side.
$x = 35°$	Simplify
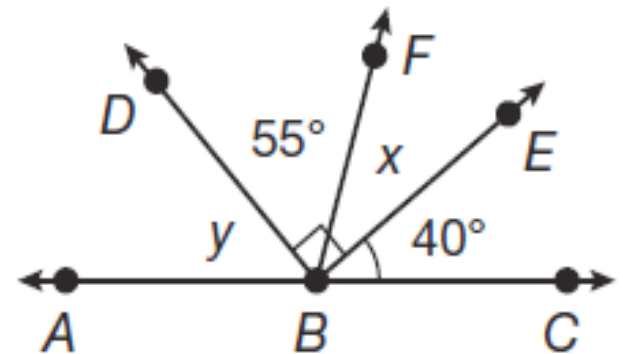
Example 2. Solving with Complements and Supplements.

Find the measures of the angles labeled x and y.

Solution

To find y, notice that $\angle ABD$ and $\angle DBC$ are supplementary.

$m\angle ABD + m\angle DBC = 180°$	Definition of supp. angles.
$y + 55° + 35° + 40° = 180°$	Substitute.
$y + 130° = 180°$	Simplify.
$y + 130° - 130 = 180° - 130°$	Sub. 130° from each side.
$x = 50°$	Simplify
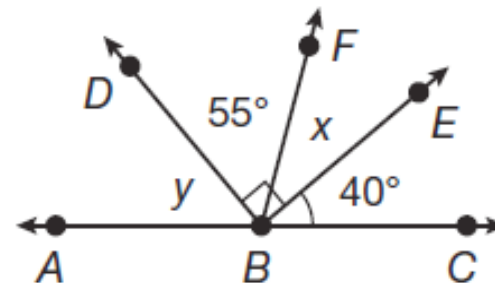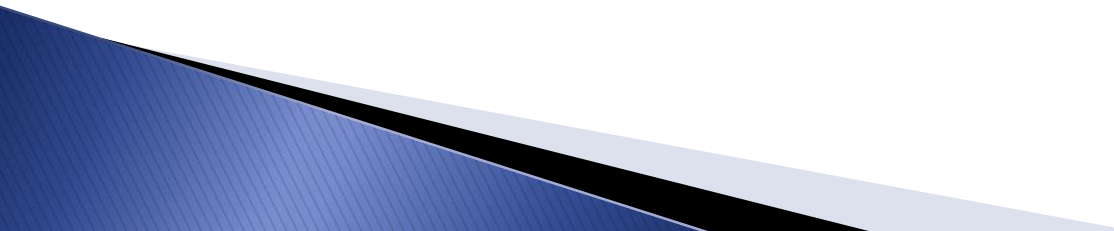
Adjacent Angles – Two angles in the same plane that share a vertex and a side, but share no interior points. In the diagram, $\angle TSL$ is adjacent to $\angle LSM$ and $\angle RST$ is adjacent to $\angle TSL$.

Linear Pair – Adjacent angles whose non-common sides are opposite rays. In the diagram $\angle RST$ and $\angle TSM$ are a linear pair. Linear pairs are also supplementary because their measures add up to 180°.

Theorem 6-3: Linear Pair Theorem – If two angle form a linear pair, then they are supplementary.
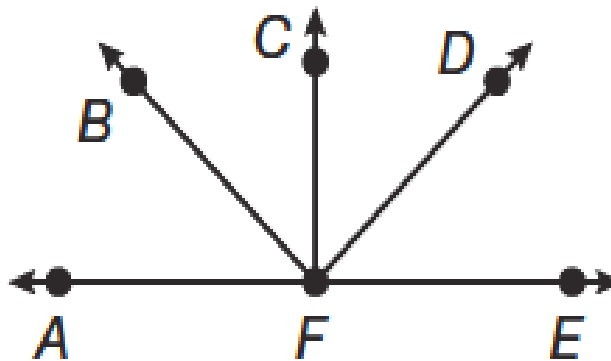
Example 3. Identifying Angle Pairs.

Identify two sets of adjacent angles and one linear pair.

Solution

There are many adjacent angles in the diagram. Two possible sets are $\angle AFB$ and $\angle BFC$, and $\angle AFC$ and $\angle CFE$.

There are also several linear pairs. One is $\angle AFD$ and $\angle DFE$.

Vertical Angles – Nonadjacent angles formed by two intersecting lines.

Theorem 6-4: Vertical Angle Theorem – If two angles are vertical angles, then they are congruent.

Example 4. Solving with Vertical Angles.

Determine the values of x and y.

Solution

Since ∠1 and ∠2 are vertical angles, they are congruent. The same is true of ∠3 and ∠4. Therefore, $m\angle 1 = m\angle 2$ and $m\angle 3 = m\angle 4$.
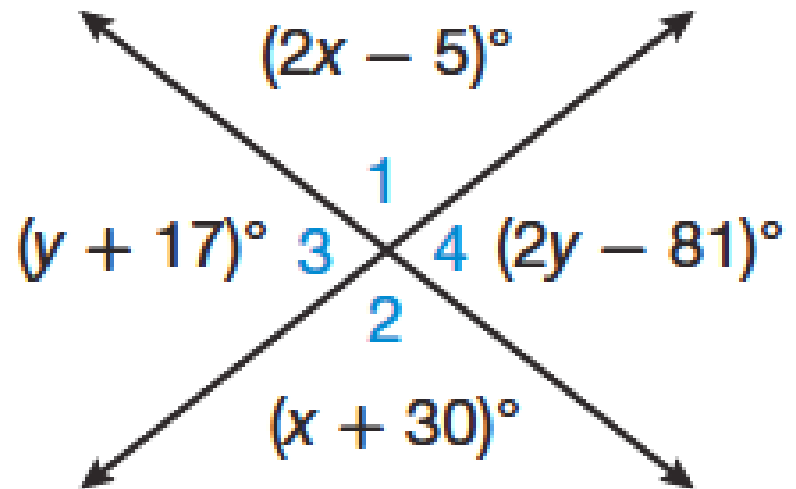
$m\angle 1 = m\angle 2$
$2x - 5 = x + 30$
$2x - 5 + 5 = x + 30 + 5$
$2x - x = x + 35 - x$
$x = 35$

Example 4. Solving with Vertical Angles.

Determine the values of x and y.

Solution

Since ∠1 and ∠2 are vertical angles, they are congruent. The same is true of ∠3 and ∠4. Therefore, $m\angle1 = m\angle2$ and $m\angle3 = m\angle4$.
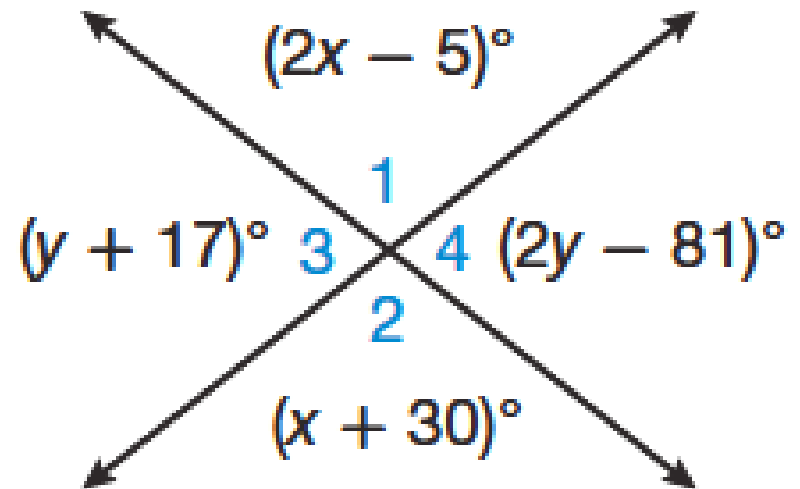
$m\angle3 = m\angle4$

$y + 17 = 2y - 81$

$y + 17 - 17 = 2y - 81 - 17$

$y = 2y - 89$

$y - 2y = 2y - 98 - 2y$

$-y = -98$

$y = 89$

Example 5. Application: Bridge Supports.

The diagram shows the part of a bridge where it contacts a vertical cliff, so that the bridge and the cliff are perpendicular. The angle between the surface of the road and the line extended from the bridge's support measures 50°. It is important that the bridge's support be set at the correct angle to hold the weight of the bridge. What is the angle x that the support makes with the cliff?
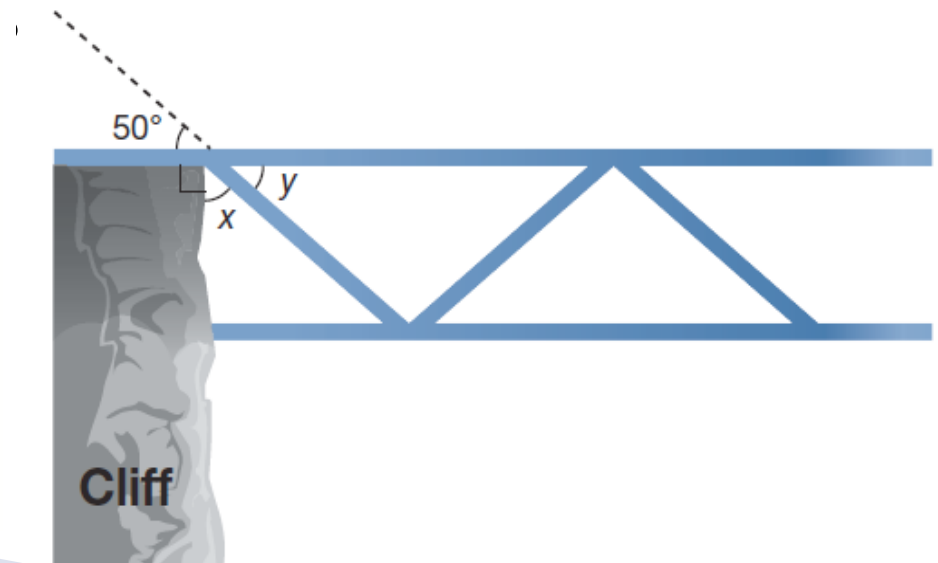
50°

y

x

Cliff
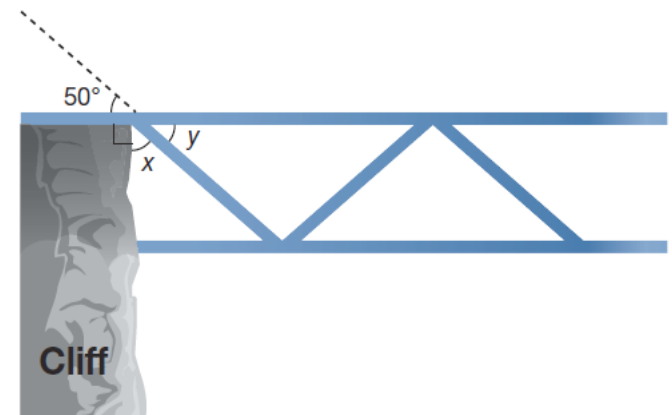
Example 5. Application: Bridge Supports.

Solution

The angle that measures 50° and the angle labeled y are vertical angles. The angles labeled x and y are complementary angles.
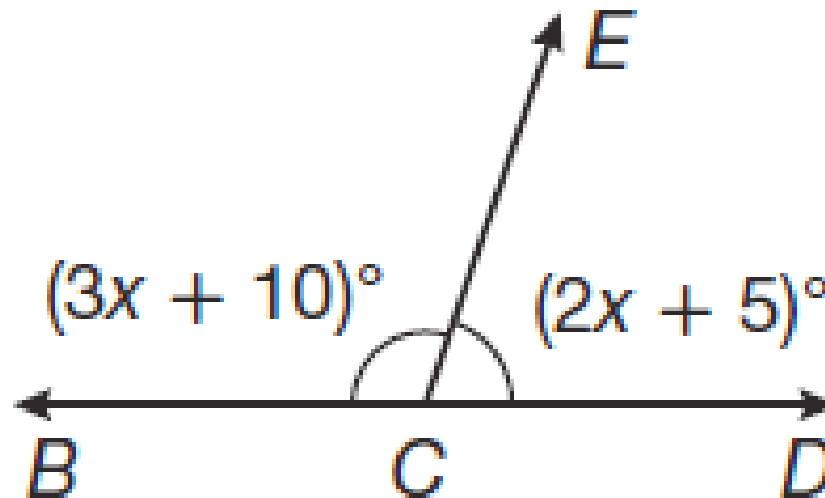
Math Reasoning

Formulate How could you have solved this problem by looking at a linear pair of angles instead of a vertical pair of angles?
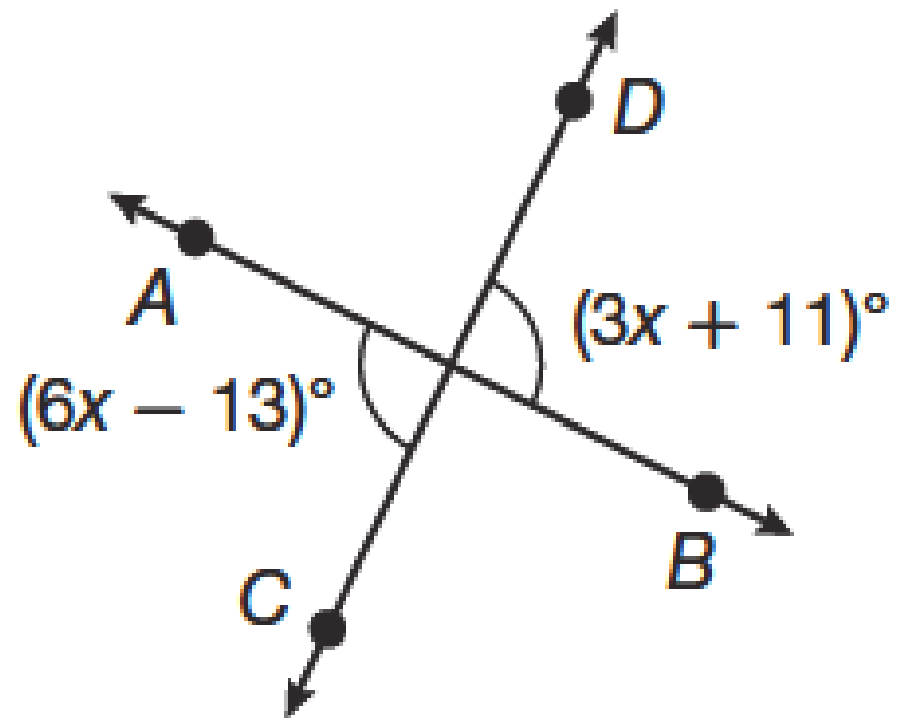

50°

y

x

Cliff

You Try!!!!

Find the value of x.

$$x = 33$$

$(3x + 10)°$ $(2x + 5)°$

E

B   C   D

Determine the value of x.

$$x = 8$$

D

A

$(3x + 11)°$

$(6x - 13)°$

B

C

Assignment

Page 37

     Lesson Practice a–f (Ask Mr. Heintz)

Page 38

     Practice 1–30 (Do the starred ones first)