

**Ray**

A set of points that is part of a line. It has one endpoint and extends infinitely in one direction.

**Angle**

A geometric figure made up of two rays with a common endpoint called a vertex

**Vertex**

A point common to both sides of an angle

**Adjacent angle**

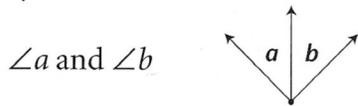
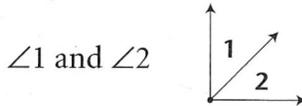
An angle that shares a vertex and a common side with another angle

Geometric figures exist in many shapes and sizes. Two such figures are rays and angles. A **ray** is a set of points that is a part of a line. It has one endpoint and extends infinitely in one direction.

An **angle** is a geometric figure formed by two rays that share a common endpoint called the **vertex**.

The symbol  $\angle$  is used to designate an angle. Any angle can be read or named two ways. The angle at the right can be named  $\angle ABC$  or  $\angle CBA$ . Note that the vertex,  $B$ , is always the middle letter.

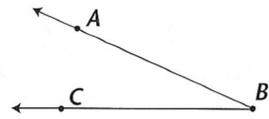
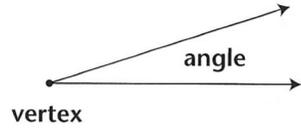
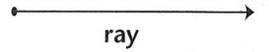
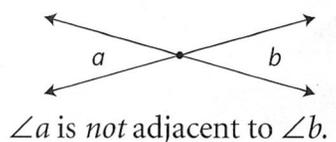
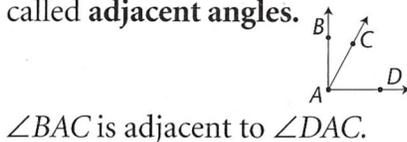
Angles are sometimes named by one letter or number.



The basic unit of angle measure is the degree ( $^\circ$ ).  
The measure of an angle is used to classify angles.

Measure (m) in degrees	Picture	Name of Angle
$0^\circ < m < 90^\circ$		acute
$m = 90^\circ$		right
$90^\circ < m < 180^\circ$		obtuse
$m = 180^\circ$		straight

Angles that share a common vertex and a common side are called **adjacent angles**.



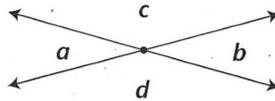
## Vertical angles

Pairs of opposite angles formed by intersecting lines. Vertical angles have the same measure.

## Complementary angles

Two angles whose sum of their measures is  $90^\circ$

**Vertical angles** are opposite pairs of angles formed when two lines intersect.

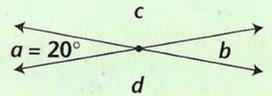


$\angle a$  and  $\angle b$  are vertical angles.  $\angle c$  and  $\angle d$  are vertical angles.

It is possible to compute angle measures.

### EXAMPLE 1

Given  $m\angle a = 20^\circ$ , find the measure (m) of  $\angle b$ ,  $\angle c$ , and  $\angle d$ .



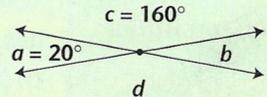
#### Step 1

Find the measure of  $\angle c$ . Recall that the measure of a straight angle is  $180^\circ$ . Since  $\angle a$  and  $\angle c$  are adjacent and form a straight angle,  $m\angle a + m\angle c = 180^\circ$ .

$$20^\circ + m\angle c = 180^\circ$$

$$m\angle c = 180^\circ - 20^\circ$$

$$m\angle c = 160^\circ$$



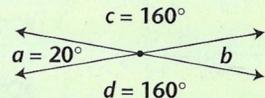
#### Step 2

Find the measure of  $\angle d$ . Since  $\angle a$  and  $\angle d$  are adjacent and form a straight angle,  $m\angle a + m\angle d = 180^\circ$ .

$$20^\circ + m\angle d = 180^\circ$$

$$m\angle d = 180^\circ - 20^\circ$$

$$m\angle d = 160^\circ$$



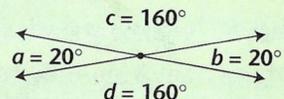
#### Step 3

Find the measure of  $\angle b$ . Since  $\angle d$  and  $\angle b$  are adjacent and form a straight angle,  $m\angle d + m\angle b = 180^\circ$ .

$$160^\circ + m\angle b = 180^\circ$$

$$m\angle b = 180^\circ - 160^\circ$$

$$m\angle b = 20^\circ$$

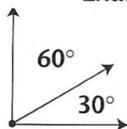


Recall that  $\angle a$  and  $\angle b$  are vertical angles. So are  $\angle c$  and  $\angle d$ . Vertical angles have the same measure.

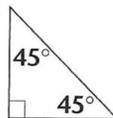
The measure of a circle is  $360^\circ$ .  
The measure of a straight line is  $180^\circ$ .

If the sum of the measures of two angles is  $90^\circ$ , the angles are **complementary angles**. Angles do not have to be adjacent to be complementary.

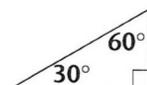
### Examples of Complementary Angles



$$60^\circ + 30^\circ = 90^\circ$$



$$45^\circ + 45^\circ = 90^\circ$$

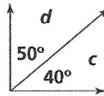
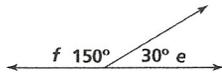


$$30^\circ + 60^\circ = 90^\circ$$

# Angles and Angle Measure

**EXAMPLE**

Identify angle pairs.

 $\angle a$  and  $\angle b$  are vertical angles. $\angle c$  and  $\angle d$  are complementary angles. $\angle e$  and  $\angle f$  are supplementary angles.

**Directions** Describe each pair of angles. Use one of the following words: *vertical, complementary, supplementary.*

Diagram 1

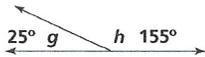
1.  $\angle g, \angle h$  \_\_\_\_\_2.  $\angle p, \angle q$  \_\_\_\_\_

Diagram 2



Diagram 3

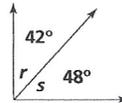
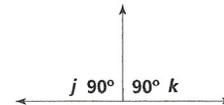
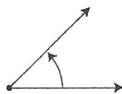
3.  $\angle r, \angle s$  \_\_\_\_\_4.  $\angle j, \angle k$  \_\_\_\_\_

Diagram 4

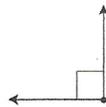
**EXAMPLE**Study these angles. The letter *m* stands for *measure of*.

Acute angle



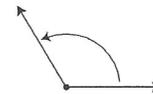
$0^\circ < m < 90^\circ$

Right angle



$m = 90^\circ$

Obtuse angle



$90^\circ < m < 180^\circ$

**Directions** Refer to diagrams 1–4 on this page and answer the questions.

5. Is  $\angle g$  acute? \_\_\_\_\_8. Is  $\angle j$  a right angle? \_\_\_\_\_6. Is  $\angle r$  a right angle? \_\_\_\_\_9. Is  $\angle k$  acute? \_\_\_\_\_7. Is  $\angle h$  obtuse? \_\_\_\_\_10. Is  $\angle s$  acute? \_\_\_\_\_