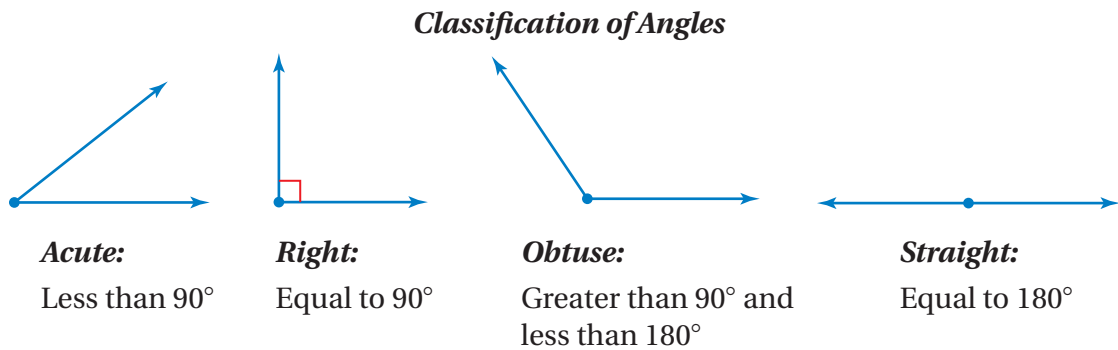


# 5.1 Classifying Angles

**Essential Question** How can you classify two angles as complementary or supplementary?

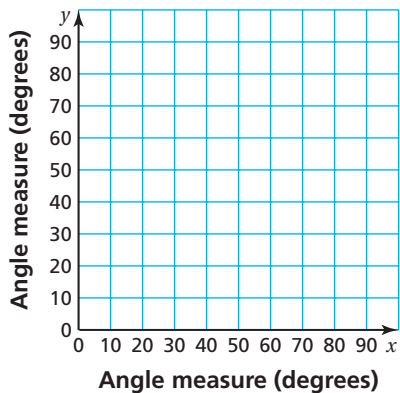


## 1 ACTIVITY: Complementary and Supplementary Angles

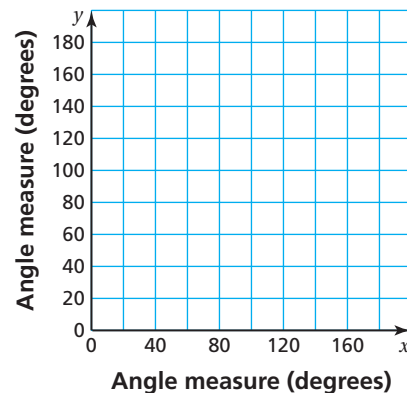
Work with a partner.

- Copy and complete each table.
  - Graph each function. Is the function linear?
  - Write an equation for  $y$  as a function of  $x$ .
  - Describe the domain of each function.
- a. Two angles are **complementary** if the sum of their measures is  $90^\circ$ . In the table,  $x$  and  $y$  are complementary.
- b. Two angles are **supplementary** if the sum of their measures is  $180^\circ$ . In the table,  $x$  and  $y$  are supplementary.

<b>x</b>	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$
<b>y</b>					



<b>x</b>	$30^\circ$	$60^\circ$	$90^\circ$	$120^\circ$	$150^\circ$
<b>y</b>					



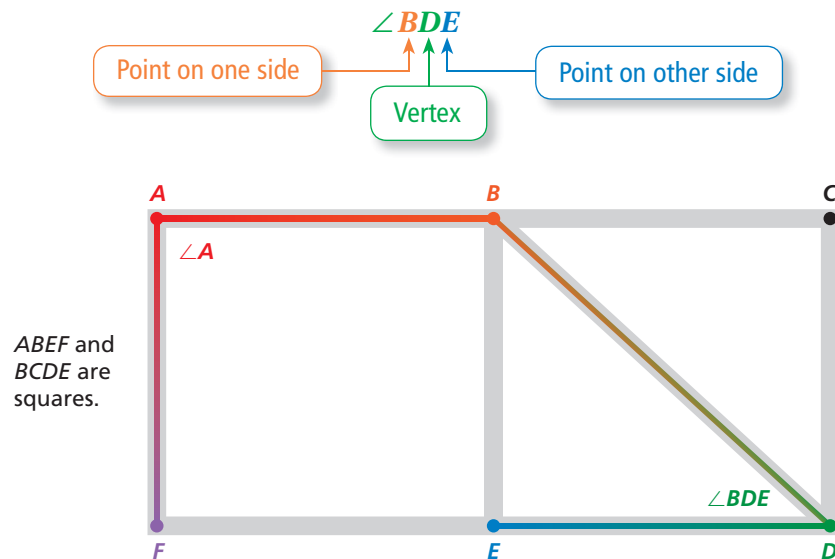
## 2 ACTIVITY: Exploring Rules About Angles

Work with a partner. Copy and complete each sentence with *always*, *sometimes*, or *never*.

- If  $x$  and  $y$  are complementary angles, then both  $x$  and  $y$  are \_\_\_\_\_ acute.
- If  $x$  and  $y$  are supplementary angles, then  $x$  is \_\_\_\_\_ acute.
- If  $x$  is a right angle, then  $x$  is \_\_\_\_\_ acute.

## 3 ACTIVITY: Naming Angles

Some angles, such as  $\angle A$ , can be named by a single letter. When this does not clearly identify an angle, you should use three letters, as follows.



Work with a partner.

- Name all pairs of complementary angles in the diagram above.
- Name all pairs of supplementary angles in the diagram above.

## What Is Your Answer?

- IN YOUR OWN WORDS** How can you classify two angles as complementary or supplementary? Give examples of each type.
- Find examples of real-life objects that use complementary and supplementary angles. Make a drawing of each object and approximate the degree measure of each angle.

### Practice

Use what you learned about classifying angles to complete Exercises 3–5 on page 188.

### Key Vocabulary

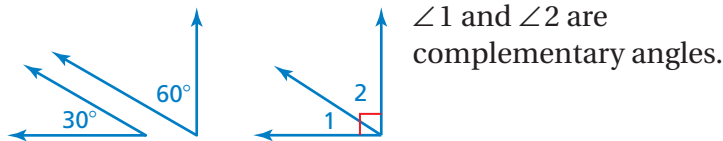
complementary angles, p. 186  
supplementary angles, p. 186  
congruent angles, p. 187  
vertical angles, p. 187

## Key Ideas

### Complementary Angles

**Words** Two angles are **complementary angles** if the sum of their measures is  $90^\circ$ .

#### Examples



### Supplementary Angles

**Words** Two angles are **supplementary angles** if the sum of their measures is  $180^\circ$ .

#### Examples



## EXAMPLE 1 Classifying Pairs of Angles

Tell whether the angles are *complementary*, *supplementary*, or *neither*.

a.  $70^\circ + 110^\circ = 180^\circ$

∴ So, the angles are supplementary.

b.  $41^\circ + 49^\circ = 90^\circ$

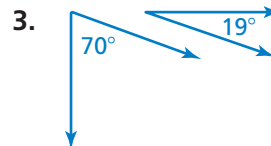
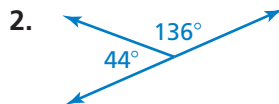
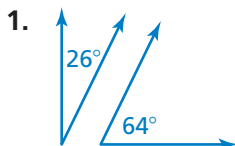
∴ So, the angles are complementary.

c.  $128^\circ + 62^\circ = 190^\circ$

∴ So, the angles are *neither* complementary nor supplementary.

## On Your Own

Tell whether the angles are *complementary*, *supplementary*, or *neither*.



Now You're Ready  
Exercises 6–11

## Key Ideas

### Reading

Arcs are used to indicate congruent angles.

### Congruent Angles

**Words** Two angles are **congruent** if they have the same measure.

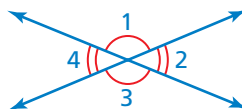
### Examples



### Vertical Angles

**Words** Two angles are **vertical angles** if they are opposite angles formed by the intersection of two lines. Vertical angles are congruent.

### Examples

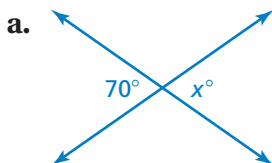


$\angle 1$  and  $\angle 3$  are vertical angles.

$\angle 2$  and  $\angle 4$  are vertical angles.

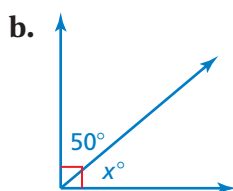
## EXAMPLE 2 Finding Angle Measures

Find the value of  $x$ .



The angles are vertical angles. Because vertical angles are congruent, the angles have the same measure.

So,  $x$  is 70.



The angles are complementary. So, the sum of their measures is  $90^\circ$ .

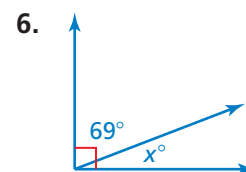
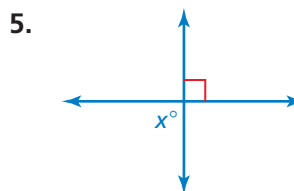
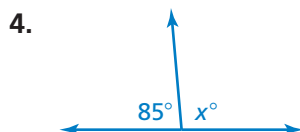
$$x + 50 = 90$$

$$x = 40$$

So,  $x$  is 40.

### On Your Own

Find the value of  $x$ .



Now You're Ready  
Exercises 12–14

## Vocabulary and Concept Check

- VOCABULARY** Explain the difference between complementary angles and supplementary angles.
- WRITING** When two lines intersect, how many pairs of vertical angles are formed? Explain.

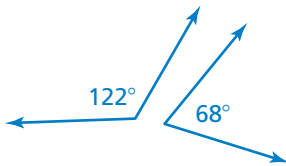
## Practice and Problem Solving

Tell whether the statement is *always*, *sometimes*, or *never* true. Explain.

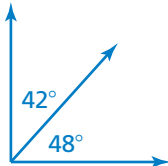
- If  $x$  and  $y$  are supplementary angles, then  $x$  is obtuse.
- If  $x$  and  $y$  are right angles, then  $x$  and  $y$  are supplementary angles.
- If  $x$  and  $y$  are complementary angles, then  $y$  is a right angle.

Tell whether the angles are *complementary*, *supplementary*, or *neither*.

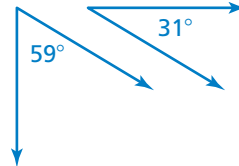
1 6.



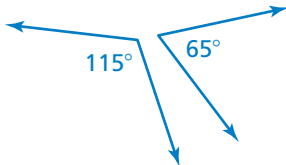
7.



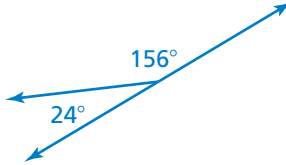
8.



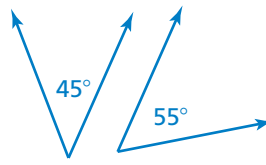
9.



10.

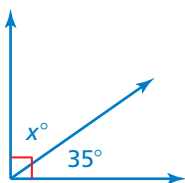


11.

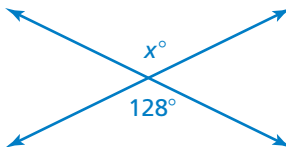


Find the value of  $x$ .

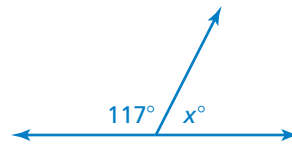
2 12.



13.



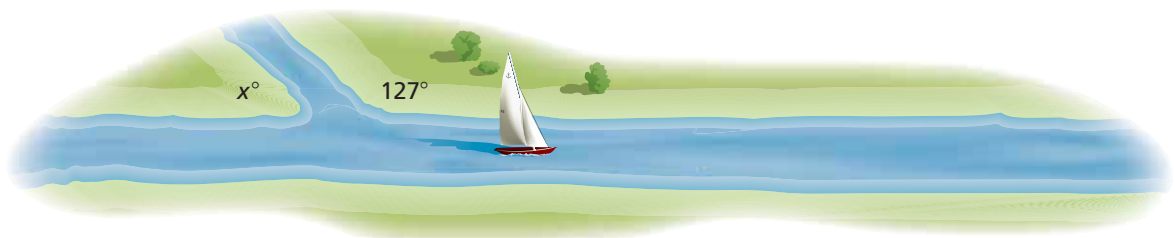
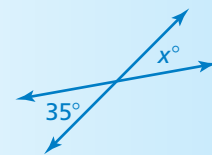
14.



- ERROR ANALYSIS** Describe and correct the error in finding the value of  $x$ .
- TRIBUTARY** A tributary joins a river at an angle. Find the value of  $x$ .

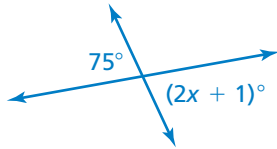


The value of  $x$  is 55 because vertical angles are complementary.

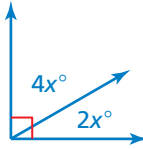


Find the value of  $x$ .

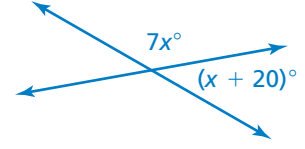
17.



18.



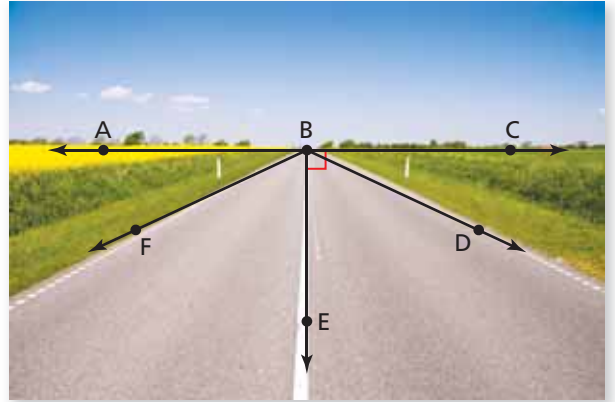
19.



20. **OPEN-ENDED** Give an example of an angle that can be a supplementary angle but cannot be a complementary angle. Explain.

21. **VANISHING POINT** The vanishing point of the picture is represented by point  $B$ .

- Name two pairs of complementary angles.
- Name three pairs of supplementary angles.

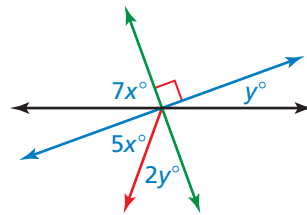


22. **INTERSECTION** What are the measures of the other three angles formed by the intersection?

23. **RATIO** The measures of two complementary angles have a ratio of  $3 : 2$ . What is the measure of the larger angle?

24. **REASONING** Two angles are vertical angles. What are their measures if they are also complementary angles? supplementary angles?

25. **Critical Thinking** Write and solve a system of equations to find the values of  $x$  and  $y$ .



## Fair Game Review what you learned in previous grades & lessons

Solve the equation. Check your solution. (Section 1.1 and Section 1.2)

26.  $x + 60 + 45 = 180$

27.  $x + 58.5 + 92.2 = 180$

28.  $x + x + 110 = 180$

29. **MULTIPLE CHOICE** The graph of which equation has a slope of  $-\frac{1}{2}$  and passes through the point  $(6, 4)$ . (Section 3.2)

(A)  $y = x + 3$

(B)  $y = -\frac{1}{2}x + 7$

(C)  $y = -\frac{1}{2} + 1$

(D)  $y = \frac{1}{2}x - 3$