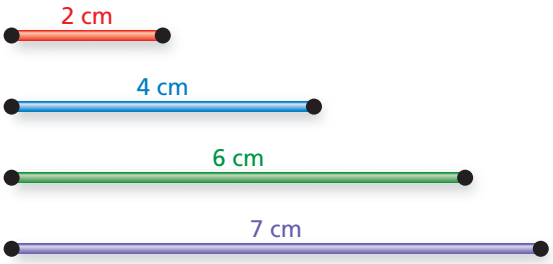
7.3 Triangles

Essential Question How can you construct triangles?

1 ACTIVITY: Constructing Triangles Using Side Lengths

Work with a partner. Cut different-colored straws to the lengths shown. Then construct a triangle with the specified straws if possible. Compare your results with those of others in your class.



a. blue, green, purple

b. red, green, purple

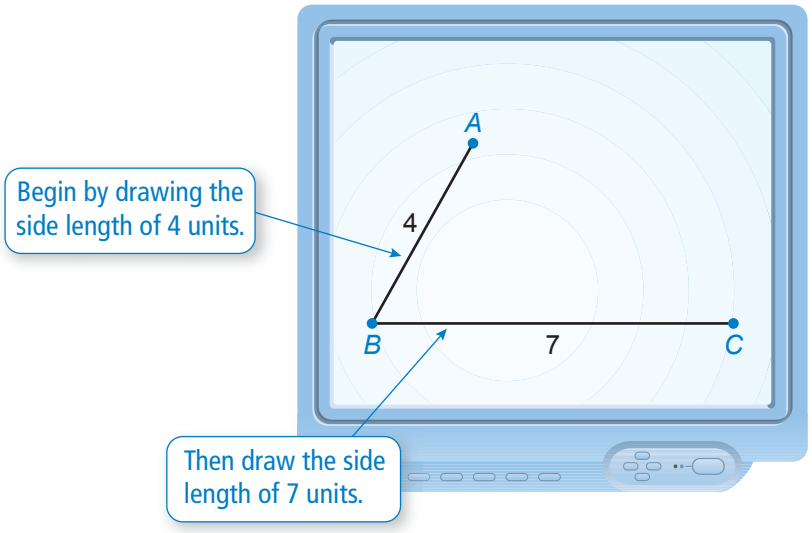
c. red, blue, purple

d. red, blue, green

2 ACTIVITY: Using Technology to Draw Triangles (Side Lengths)

Work with a partner. Use geometry software to draw a triangle with the two given side lengths. What is the length of the third side of your triangle? Compare your results with those of others in your class.

a. 4 units, 7 units



b. 3 units, 5 units

c. 2 units, 8 units

d. 1 unit, 1 unit

Geometry

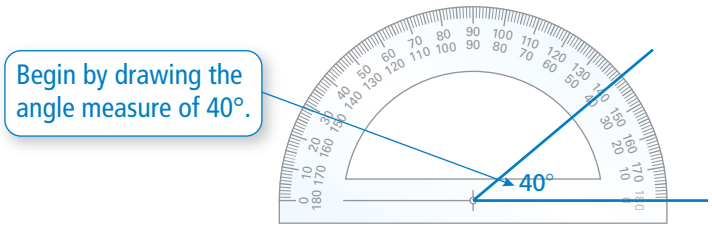
In this lesson, you will

- construct triangles with given angle measures.
- construct triangles with given side lengths.

3 ACTIVITY: Constructing Triangles Using Angle Measures

Work with a partner. Two angle measures of a triangle are given. Draw the triangle. What is the measure of the third angle? Compare your results with those of others in your class.

a. 40°, 70°



b. 60°, 75°

c. 90°, 30°

d. 100°, 40°

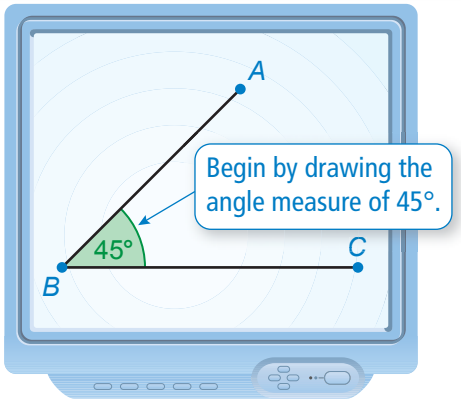
4 ACTIVITY: Using Technology to Draw Triangles (Angle Measures)

Work with a partner. Use geometry software to draw a triangle with the two given angle measures. What is the measure of the third angle? Compare your results with those of others in your class.

a. 45°, 55°

b. 50°, 40°

c. 110°, 35°



Math Practice

Recognize Usefulness of Tools

What are some advantages and disadvantages of using geometry software to draw a triangle?

What Is Your Answer?

5. **IN YOUR OWN WORDS** How can you construct triangles?

6. **REASONING** Complete the table below for each set of side lengths in Activity 2. Write a rule that compares the sum of any two side lengths to the third side length.

Side Length			
Sum of Other Two Side Lengths			

7. **REASONING** Use a table to organize the angle measures of each triangle you formed in Activity 3. Include the sum of the angle measures. Then describe the pattern in the table and write a conclusion based on the pattern.

Practice Use what you learned about constructing triangles to complete Exercises 3–5 on page 286.

7.3 Lesson

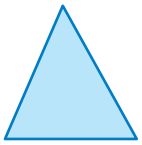
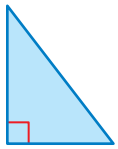
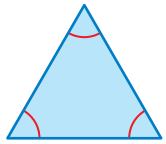
Check It Out
Lesson Tutorials
BigIdeasMath.com

Key Vocabulary
congruent sides, *p. 284*

You can use side lengths and angle measures to classify triangles.

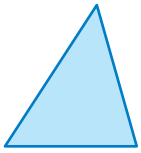
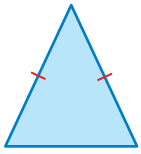
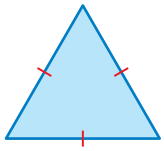
Key Ideas

Classifying Triangles Using Angles

acute triangle	*obtuse* triangle	*right* triangle	*equiangular* triangle
			
all acute angles	1 obtuse angle	1 right angle	3 congruent angles

Classifying Triangles Using Sides

Congruent sides have the same length.

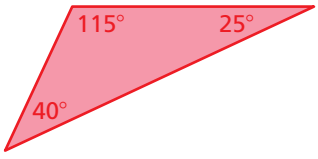
scalene triangle	*isosceles* triangle	*equilateral* triangle
		
no congruent sides	at least 2 congruent sides	3 congruent sides

Reading
Red arcs indicate congruent angles.
Red tick marks indicate congruent sides.

EXAMPLE 1 Classifying Triangles

Classify each triangle.

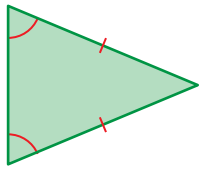
a.



The triangle has one obtuse angle and no congruent sides.

∴ So, the triangle is an obtuse scalene triangle.

b.



The triangle has all acute angles and two congruent sides.

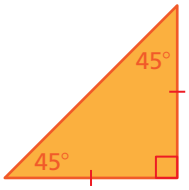
∴ So, the triangle is an acute isosceles triangle.

On Your Own

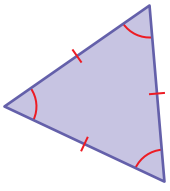
Now You're Ready
Exercises 6–11

Classify the triangle.

1.



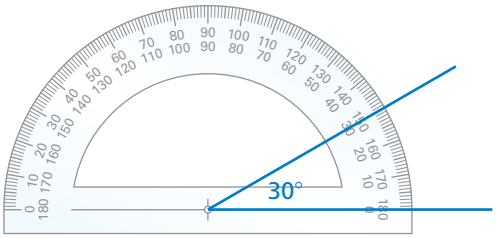
2.



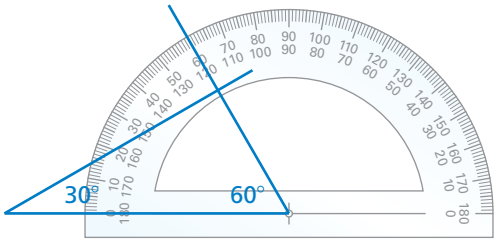
EXAMPLE 2 Constructing a Triangle Using Angle Measures

Draw a triangle with angle measures of 30°, 60°, and 90°. Then classify the triangle.

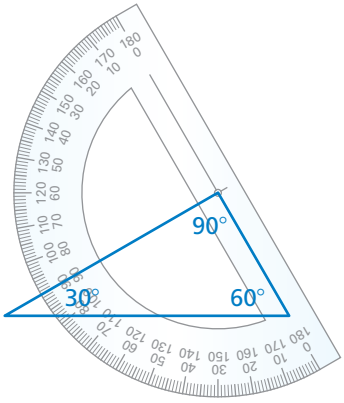
Step 1: Use a protractor to draw the 30° angle.



Step 2: Use a protractor to draw the 60° angle.



Step 3: The protractor shows that the measure of the remaining angle is 90°.



Study Tip

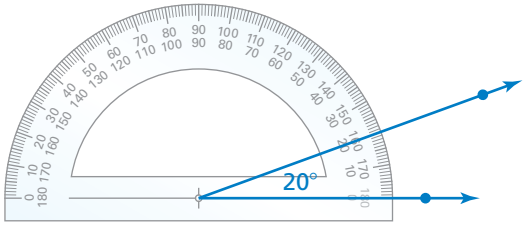
After drawing the first two angles, make sure you check the remaining angle.

∴ The triangle is a right scalene triangle.

EXAMPLE 3 Constructing a Triangle Using Side Lengths

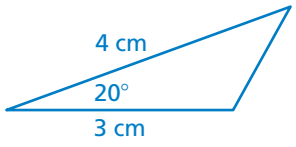
Draw a triangle with a 3-centimeter side and a 4-centimeter side that meet at a 20° angle. Then classify the triangle.

Step 1: Use a protractor to draw a 20° angle.



Step 2: Use a ruler to mark 3 centimeters on one ray and 4 centimeters on the other ray.

Step 3: Draw the third side to form the triangle.



∴ The triangle is an obtuse scalene triangle.

On Your Own

Now You're Ready
Exercises 14–19

3. Draw a triangle with angle measures of 45°, 45°, and 90°. Then classify the triangle.
4. Draw a triangle with a 1-inch side and a 2-inch side that meet at a 60° angle. Then classify the triangle.

7.3 Exercises

Check It Out
Help with Homework
BigIdeasMath.com

Vocabulary and Concept Check

1. **WRITING** How can you classify triangles using angles? using sides?
2. **DIFFERENT WORDS, SAME QUESTION** Which is different? Find "both" answers.

Construct an equilateral triangle.	Construct a triangle with 3 congruent sides.
Construct an equiangular triangle.	Construct a triangle with no congruent sides.

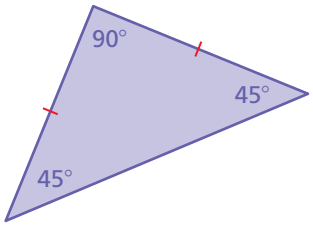
Practice and Problem Solving

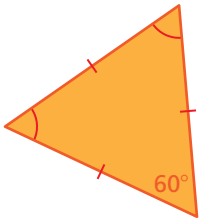
Construct a triangle with the given description.

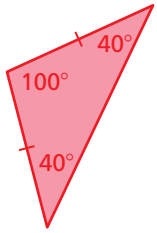
3. side lengths: 4 cm, 6 cm
4. side lengths: 5 cm, 12 cm
5. angles: 65°, 55°

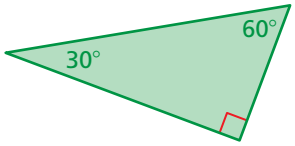
Classify the triangle.

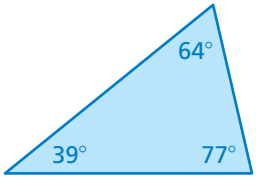
1

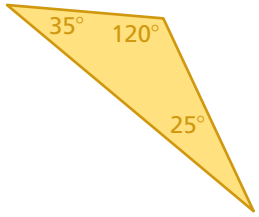
6.


7.


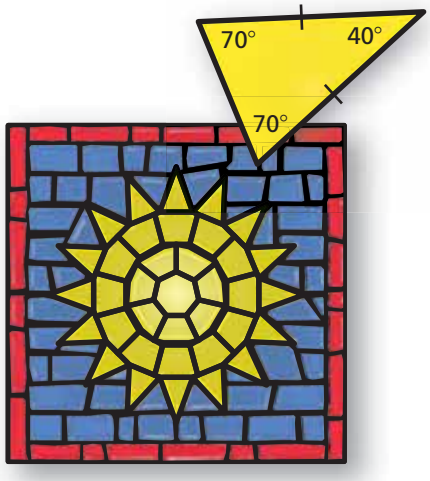
8.


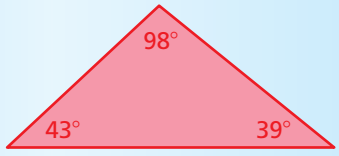
9.


10.


11.


12. **ERROR ANALYSIS** Describe and correct the error in classifying the triangle.





The triangle is acute and scalene because it has two acute angles and no congruent sides.

13. **MOSAIC TILE** A mosaic is a pattern or picture made of small pieces of colored material. Classify the yellow triangle used in the mosaic.

Draw a triangle with the given angle measures. Then classify the triangle.

2 **14.** 15°, 75°, 90° **15.** 20°, 60°, 100° **16.** 30°, 30°, 120°

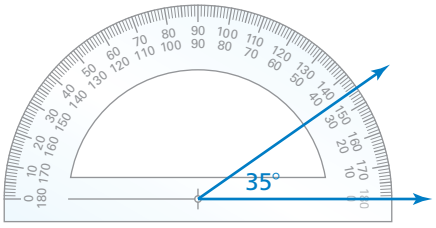
Draw a triangle with the given description.

3 **17.** a triangle with a 2-inch side and a 3-inch side that meet at a 40° angle

18. a triangle with a 45° angle connected to a 60° angle by an 8-centimeter side

19. an acute scalene triangle

20. **LOGIC** You are constructing a triangle. You draw the first angle, as shown. Your friend says that you must be constructing an acute triangle. Is your friend correct? Explain your reasoning.



Determine whether you can construct *many, one,* or *no* triangle(s) with the given description. Explain your reasoning.

21. a triangle with angle measures of 50°, 70°, and 100°

22. a triangle with one angle measure of 60° and one 4-centimeter side

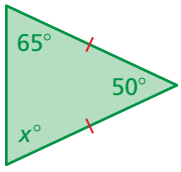
23. a scalene triangle with a 3-centimeter side and a 7-centimeter side

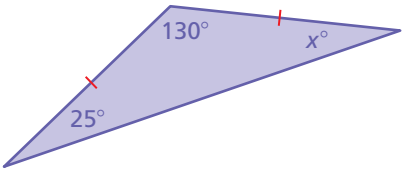
24. an isosceles triangle with two 4-inch sides that meet at an 80° angle

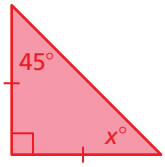
25. an isosceles triangle with two 2-inch sides and one 5-inch side

26. a right triangle with three congruent sides

27. Critical Thinking Consider the three isosceles triangles.







a. Find the value of x for each triangle.

b. What do you notice about the angle measures of each triangle?

c. Write a rule about the angle measures of an isosceles triangle.

Fair Game Review What you learned in previous grades & lessons

Tell whether x and y show direct variation. Explain your reasoning. If so, find the constant of proportionality. *(Section 5.6)*

28. $x = 2y$ **29.** $y - x = 6$ **30.** $xy = 5$

31. **MULTIPLE CHOICE** A savings account earns 6% simple interest per year. The principal is \$800. What is the balance after 18 months? *(Section 6.7)*

(A) \$864 (B) \$872 (C) \$1664 (D) \$7200