English Spanish

5.2 Angles and Sides of Triangles

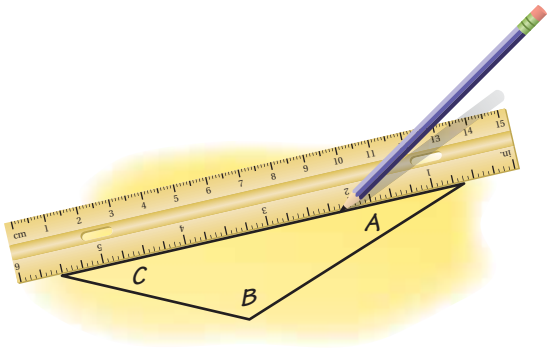
STATE STANDARDS
MA.8.G.2.3

Essential Question How can you classify triangles by their angles?

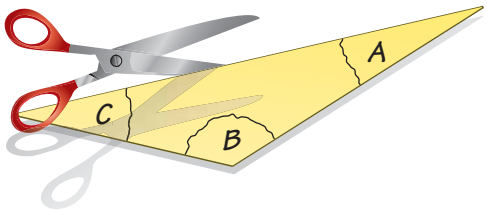
1 ACTIVITY: Exploring the Angles of a Triangle

Work with a partner.

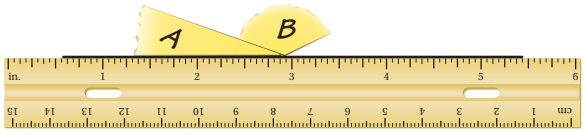
a. Draw a triangle that has an obtuse angle. Label the angles A, B, and C.



b. Carefully cut out the triangle. Tear off the three corners of the triangle.

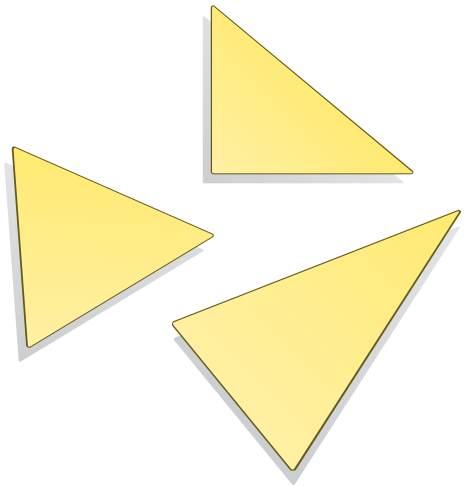


c. Draw a straight line on a piece of paper. Arrange angles A and B as shown.



d. Place the third angle as shown. What does this tell you about the sum of the measures of the angles?

e. Draw three other triangles that have different shapes. Repeat parts (b)–(d) for each one. Do you get the same result as in part (d)? Explain.



f. Write a rule about the sum of the measures of the angles of a triangle. Compare your rule with the rule you wrote in Activity 2 in Section 1.1. Did you get the same result? Explain.

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2 ACTIVITY: Thinking About Vocabulary

Work with a partner. Talk about the meaning of each name. Use reasoning to define each name. Then match each name with a triangle.

Note: Each triangle has at least one name, but some have more than one name.

a. Right triangle

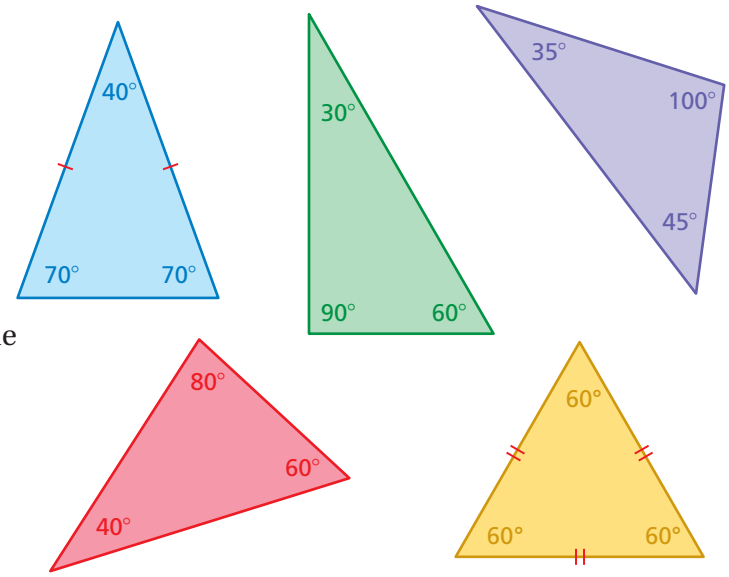
b. Acute triangle

c. Obtuse triangle

d. Equiangular triangle

e. Equilateral triangle

f. Isosceles triangle



3 ACTIVITY: Triangles in Art

Work with a partner.

a. Trace four triangles in the painting. Classify each triangle using the names in Activity 2.

b. Design your own abstract art painting. How many different types of triangles did you use in your painting?

Abstract II by Linda Bahner

What Is Your Answer?

4. **IN YOUR OWN WORDS** How can you classify triangles by their angles?

5. Find examples of real-life triangles in architecture. Name each type of triangle that you find.

Practice Use what you learned about angles of triangles to complete Exercises 3–5 on page 194.

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5.2 Lesson

Check It Out
Lesson Tutorials
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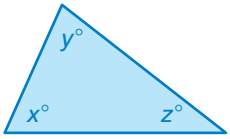
Key Vocabulary
isosceles triangle, *p. 192*
congruent sides, *p. 192*
equilateral triangle, *p. 192*
equiangular triangle, *p. 192*

Key Idea

Angle Measures of a Triangle

Words The sum of the angle measures of a triangle is 180°.

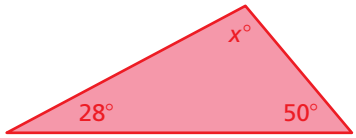
Algebra $x + y + z = 180$



EXAMPLE 1 Finding Angle Measures

Find each value of x. Then classify each triangle.

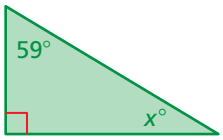
a.



$x + 28 + 50 = 180$
$x + 78 = 180$
$x = 102$

∴ The value of x is 102. The triangle has an obtuse angle. So, it is an obtuse triangle.

b.



$x + 59 + 90 = 180$
$x + 149 = 180$
$x = 31$

∴ The value of x is 31. The triangle has a right angle. So, it is a right triangle.

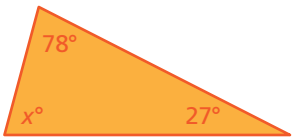
Remember
An *acute triangle* has all acute angles.
A *right triangle* has one right angle.
An *obtuse triangle* has one obtuse angle.

On Your Own

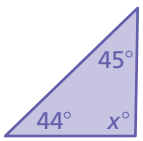
Now You're Ready
Exercises 6–8

Find the value of x. Then classify the triangle.

1.



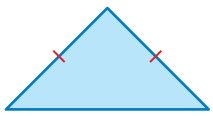
2.



Key Ideas

Isosceles Triangle

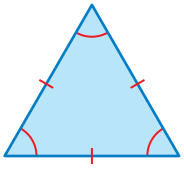
An **isosceles triangle** has at least two sides that are **congruent** (have the same length).



Equilateral Triangle

An **equilateral triangle** has three congruent sides.

An equilateral triangle is also **equiangular** (three congruent angles).



Reading
Small line segments are used to indicate congruent sides.

Multi-Language Glossary at BigIdeasMath.com

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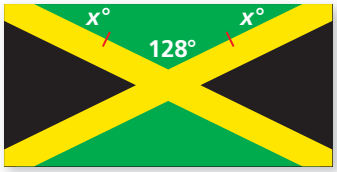
EXAMPLE 2 Finding Angle Measures

Find the value of x. Then classify each triangle.

a. Flag of Jamaica



$$x + x + 128 = 180$$
$$2x + 128 = 180$$
$$2x = 52$$
$$x = 26$$

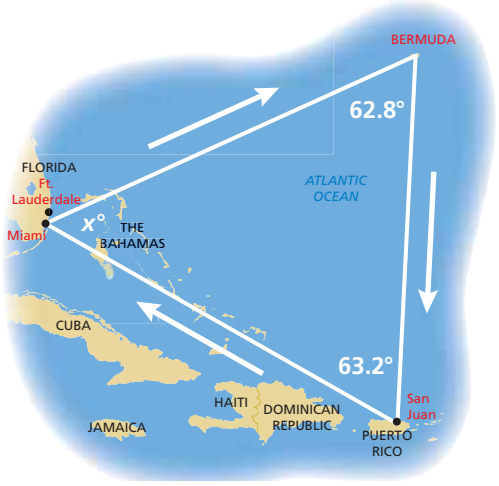
∴ The value of x is 26. Two of the sides are congruent. So, it is an isosceles triangle.

b. Flag of Cuba

$$x + x + 60 = 180$$
$$2x + 60 = 180$$
$$2x = 120$$
$$x = 60$$

∴ The value of x is 60. All three angles are congruent. So, it is an equilateral and equiangular triangle.

EXAMPLE 3 Standardized Test Practice



An airplane leaves from Miami and travels around the Bermuda Triangle. What is the value of x?

Ⓐ 26.8 Ⓑ 27.2 Ⓒ 54 Ⓓ 64

Use what you know about the angle measures of a triangle to write an equation.

$x + 62.8 + 63.2 = 180$ Write equation.

$x + 126 = 180$ Add.

$x = 54$ Subtract 126 from each side.

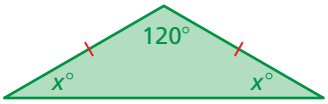
∴ The value of x is 54. The correct answer is Ⓒ.

On Your Own

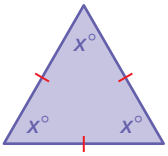
Now You're Ready
Exercises 9–11

Find the value of x. Then classify the triangle in as many ways as possible.

3.



4.



5. In Example 3, the airplane leaves from Fort Lauderdale. The angle measure at Bermuda is 63.9° and the angle measure at San Juan is 61.8°. Find the value of x.

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5.2 Exercises

Check It Out
Help with Homework
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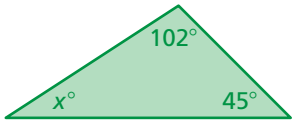
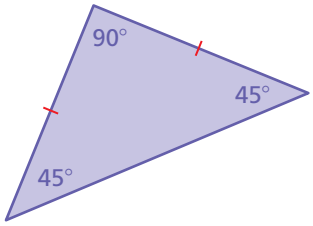
Vocabulary and Concept Check

1. **VOCABULARY** Compare equilateral and isosceles triangles.
2. **REASONING** Describe how to find the missing angle of the triangle.



Practice and Problem Solving

Classify the triangle in as many ways as possible.

3.


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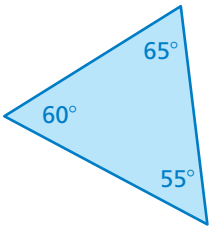

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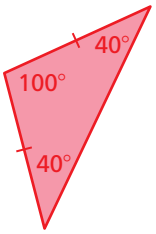
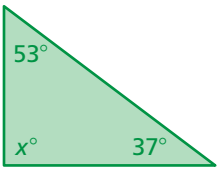


Find the value of x. Then classify the triangle in as many ways as possible.

1

6.


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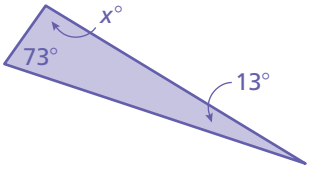

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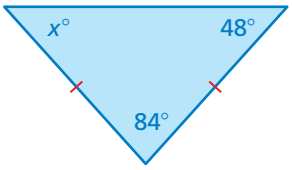

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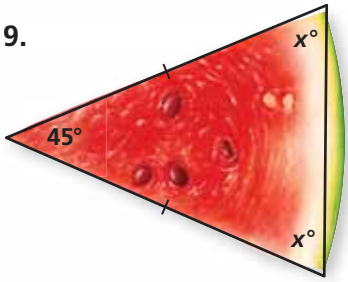
9.


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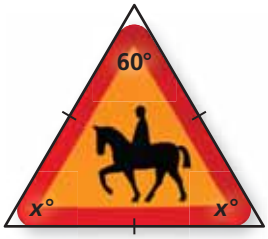
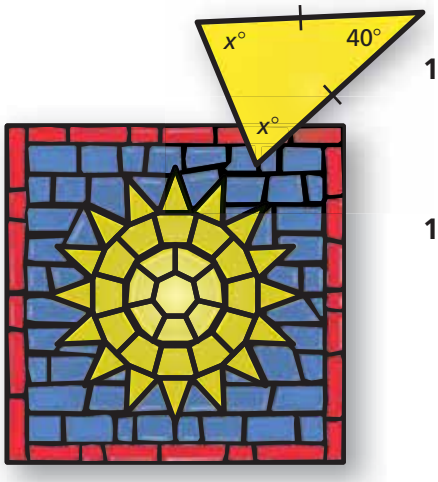
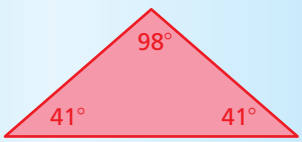


11.

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



The triangle is an acute triangle, because it has acute angles.

13. **MOSAIC TILE** A mosaic is a pattern or picture made of small pieces of colored material.

   a. Find the value of x.

   b. Classify the triangle used in the mosaic in two ways.

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Tell whether a triangle can have the given angle measures. If not, change the first angle measure so that the angle measures form a triangle.

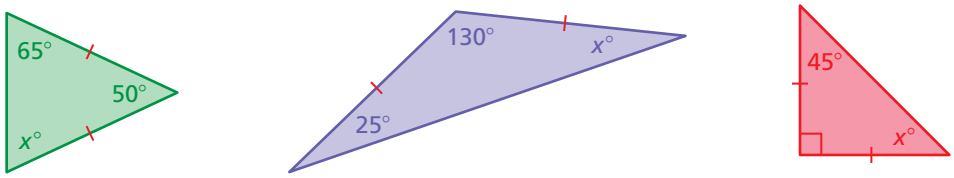
14. $76.2°,\ 81.7°,\ 22.1°$

15. $115.1°,\ 47.5°,\ 93°$

16. $5\frac{2}{3}°,\ 64\frac{1}{3}°,\ 87°$

17. $31\frac{3}{4}°,\ 53\frac{1}{2}°,\ 94\frac{3}{4}°$

18. CRITICAL THINKING Consider the three isosceles triangles.



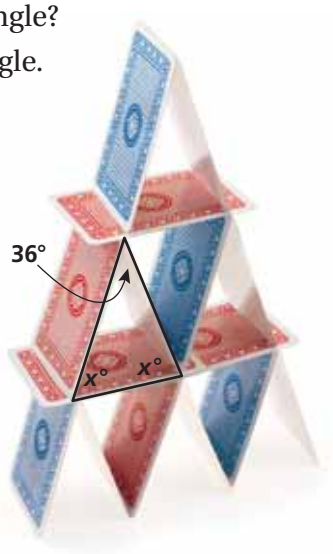
a. Find the value of x for each triangle.

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

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

19. REASONING Explain why all triangles have at least two acute angles.

20. CARDS One method of stacking cards is shown.



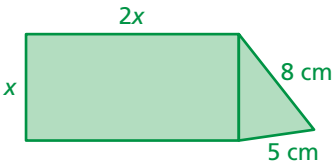
a. Find the value of x.

b. Critical Thinking Describe how to stack the cards with different angles. Is the value of x limited? If so, what are the limitations? Explain your reasoning.

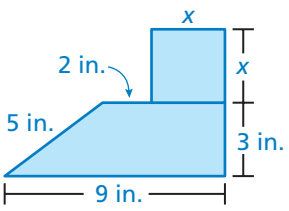
Fair Game Review What you learned in previous grades & lessons

Write and solve an equation to find x. Use 3.14 for π. SKILLS REVIEW HANDBOOK

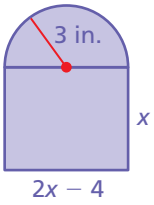
21. $P = 48$ cm



22. $P = 28$ in.



23. $P = 25.42$ m



24. MULTIPLE CHOICE You have \$10 for text messages. Each message costs \$0.25. Which equation represents the amount of money you have after x messages? SECTION 3.1

(A) $y = -0.25x + 10$

(B) $y = 0.25x - 10$

(C) $y = -0.25x - 10$

(D) $y = 0.25x + 10$