

Lesson 26

USE ANGLE RELATIONSHIPS IN TRIANGLES NY-8.G.5

INTRODUCTION

Real-World Connection

Sheldon is building a triangular ramp for one entrance to his house. He knows that one corner of the ramp will be a right angle and the other corner will be 11° . What is the third angle of the ramp? Let's practice the skills in the **Guided Instruction** and **Independent Practice** and, at the end of the lesson, see what the measure of the angle is!

WORDS TO KNOW

interior angles
exterior angles
supplementary angles
remote interior angles
corresponding angles

What I Am Going to Learn

- The sum of angle measures in a triangle is 180°
- How to use angle measures to find other angle measures
- How to solve problems involving angle measures in triangles

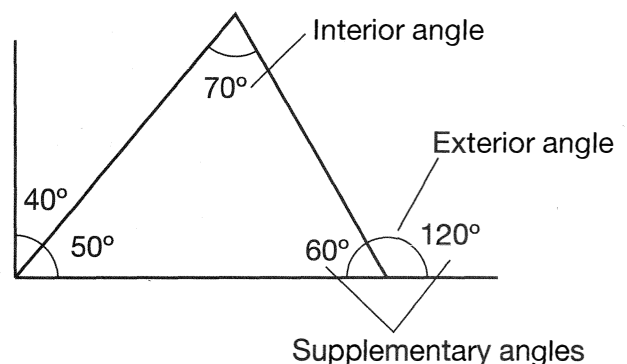
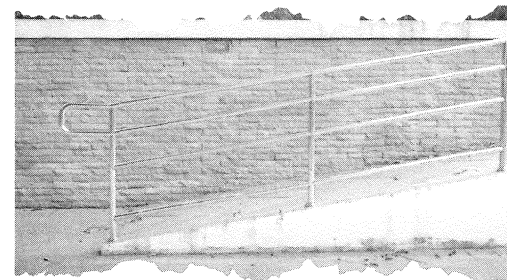
What I May Already Know

- I know how to use supplementary, complementary, adjacent, and vertical angles to solve problems about finding angle measures.
- I can solve equations with a variable.

Vocabulary in Action

A triangle has three sides and three **interior angles**.

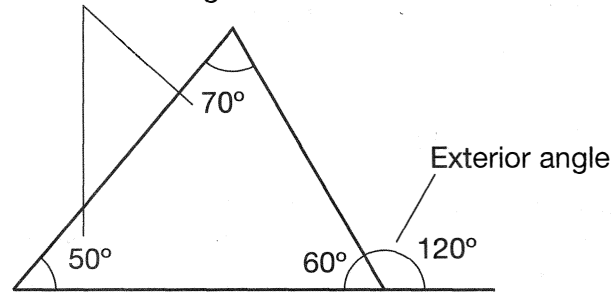
- The sum of the measures of the interior angles in any triangle is 180° .
- If one side of the triangle is extended, an **exterior angle** is formed.





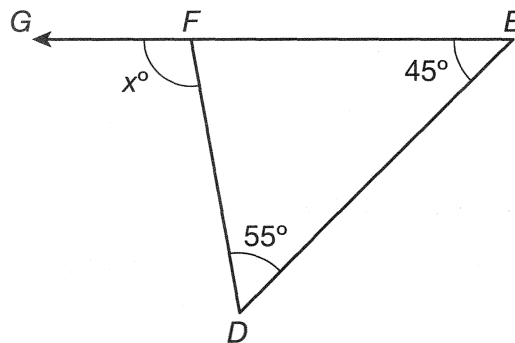
- The interior angle and its exterior angle are **supplementary angles**. The sum of the measures is 180° .
- The measure of an exterior angle is equivalent to the sum of the measures of the two **remote interior angles**.
- When the **corresponding angles** of two triangles are congruent, the triangles are similar.

Remote interior angles



EXAMPLE

Solve for the value of x in two different ways.



Method 1:

Step One The sum of the measures of the two remote interior angles ($FDE + DEF$) equals the measure of the exterior angle (DFG).

$$55^\circ + 45^\circ = x^\circ$$

Step Two Solve for x .

$$100 = x^\circ$$

The value of x is 100.

Method 2:

Step One The sum of the interior angles of any triangle is 180° .

$$(FDE + DEF + EFD = 180^\circ)$$

$$55^\circ + 45^\circ + EFD = 180^\circ$$

Step Two Solve for EFD .

$$100^\circ + EFD = 180^\circ$$

The value of EFD is 80.

Step Three The sum of an interior angle and its exterior angle is 180° .

$$80^\circ + x^\circ = 180^\circ$$

Step Four Solve for x .

$$x^\circ = 100^\circ$$

The value of x is 100.

EXAMPLE

Two of the angle measures in triangle JKL are 72° and 56° .

Two of the angle measures in triangle GHI are 56° and 52° .

Are the two triangles similar?

Find the third angle measure in each triangle by subtracting the known angles from 180° .

$$\triangle JKL: 180^\circ - (72^\circ + 56^\circ) = 52^\circ$$

$$\triangle GHI: 180^\circ - (56^\circ + 52^\circ) = 72^\circ$$

The triangles have corresponding angles that are congruent to each other.

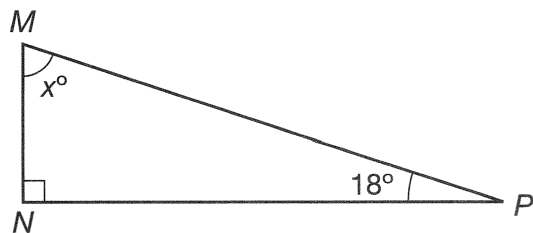
Therefore, the triangles are similar.

TURN AND TALK

Any two equilateral triangles will be similar. Why?

GUIDED INSTRUCTION

1. Find the value of x .



Step One Write an equation.

$$90^\circ + 18^\circ + x^\circ = 180^\circ$$

Step Two Add like terms.

$$108^\circ + x^\circ = 180^\circ$$

Step Three Solve for x .

$$x = 72$$

Angle NMP measures $^\circ$.

THINK ABOUT IT

In a right triangle, the sum of the measures of the two non-right angles is 90° because $90^\circ + 90^\circ = 180^\circ$. The two angles are complementary.

TIPS AND HINTS

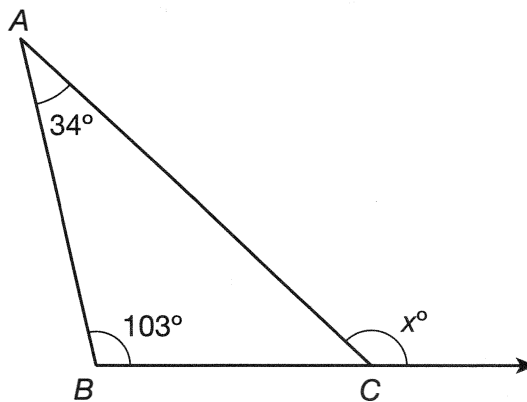
The symbol m means “measure of,” so $m\angle 5$ means “the measure of angle 5.”



SKETCH IT

Draw a triangle with one angle that is as large as possible. Then estimate the measures of the other two angles.

2. Find the value of x .



Step One Write an equation.

Remember, the sum of the measures of the interior angles of any triangle equals 180 degrees.

$$103 + \boxed{} + m\angle BCA = 180$$

Step Two Add like terms and solve to find the measure of unknown interior angle BCA .

$$137 + m\angle BCA = 180$$

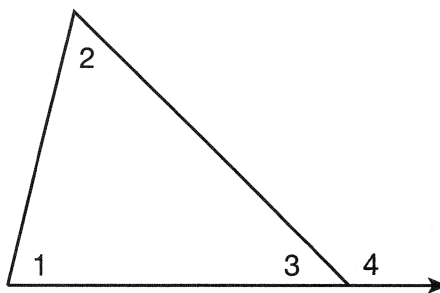
$$m\angle BCA = 43$$

Step Three Solve for x . Subtract the measure of the interior angle from 180.

$$180 - 43 = 137$$

$$x = \boxed{}$$

3. Which equation about the triangle is true?



- (A) $m\angle 1 + m\angle 2 + m\angle 4 = 180^\circ$
 (B) $m\angle 1 + m\angle 2 = m\angle 3$
 (C) $m\angle 1 + m\angle 2 = m\angle 4$
 (D) $m\angle 2 + m\angle 3 + m\angle 4 = 180^\circ$

Learning Together

A scale drawing is similar in shape to the object it represents. Work with a partner to select a geometric object in the classroom and create a scale drawing of it. Explain how the different parts of your scale drawing are proportional.



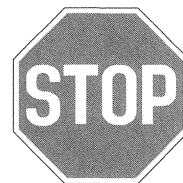
How Am I Doing?

What questions do you have?

How can you find the measure of the third angle in a triangle, if you know the measure of the other two angles?

Can you think of a real-world example where you might see similar triangles? If you take a picture of a triangular object, how would the picture compare to the real thing?

Circle the sign that shows how you are doing with the skill.



I am stuck.



I almost have it.



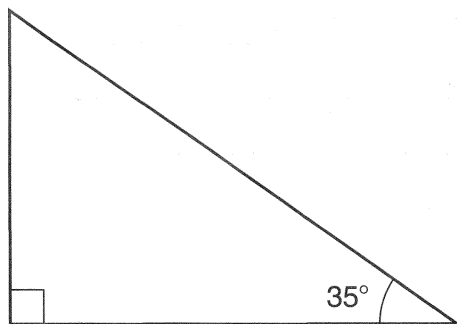
I understand the skill.

INDEPENDENT PRACTICE 1

1 One angle of a triangle measures 47° . Another angle of the triangle measures 94° . What is the measure of the third angle of the triangle?

- A 39°
- B 41°
- C 49°
- D 52°

2 The triangle below has measurements marked for two angles.



Which answer describes a similar triangle?

- A a triangle with an angle measuring 35°
- B an obtuse triangle with two congruent sides
- C a right triangle with an angle measuring 55°
- D an isosceles triangle with two angles measuring 35°

SKETCH IT

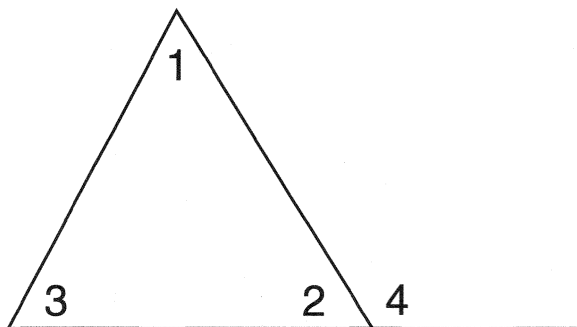
Sketch a triangle and label the given angle measures.

THINK ABOUT IT

Use what you know about the sum of the interior angle measures of triangles to find each angle measure.

3

The figure below has four numbered angles.



What is the measure of angle 4, if the measure of angle 1 is 58° and the measure of angle 3 is 62° ?

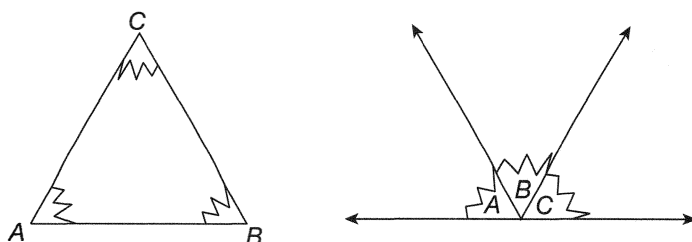
- A 45°
- B 52°
- C 120°
- D 180°

TIPS AND HINTS

Determine the measure of angle 4 before reading the answer choices.

4

The image on the left below shows the corners of a paper triangle that Isabella tore off. The image on the right shows how she aligned the vertices of the three angles.



What can Isabella conclude about the sum of the measures of the interior angles of the triangle?

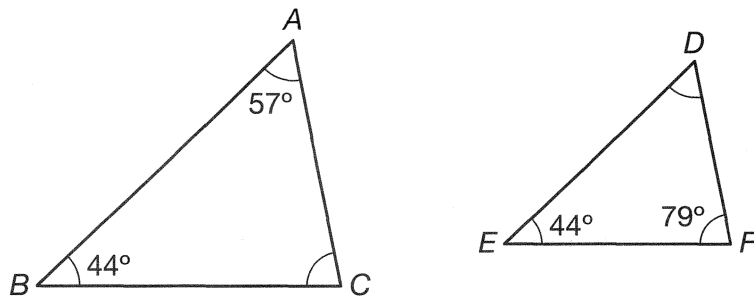
Explain your answer.

TIPS AND HINTS

When explaining an answer, make sure to spell out what the answer is and the reasoning involved.

INDEPENDENT PRACTICE 2

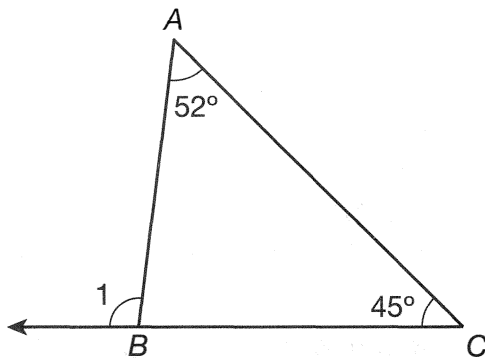
- 1 The two triangles below have some known and unknown angles.



Which choice **best** describes the two triangles?

- A The triangles are similar and appear to be congruent.
- B The triangles are similar but do not appear to be congruent.
- C The triangles appear to be congruent but not similar.
- D The triangles are neither congruent nor similar.

- 2 The triangle below has two unknown angles.



Which equation about the triangle is correct?

- A $m\angle ABC = 97^\circ$
- B $m\angle ABC = 85^\circ$
- C $m\angle 1 = 97^\circ$
- D $m\angle 1 = 135^\circ$

3 The measures of two interior angles of a triangle are 64° and 86° . What is the measure of the unknown interior angle?

A 22°

C 90°

B 30°

D 150°

4 With which of the following would it be possible to draw a triangle, given the interior angle measures?

A $72^\circ, 83^\circ, 35^\circ$

C $36^\circ, 36^\circ, 118^\circ$

B $67^\circ, 54^\circ, 59^\circ$

D $48^\circ, 55^\circ, 80^\circ$

5 A triangle has an interior angle measure of 65° . What is the sum of the other two angles' measures?

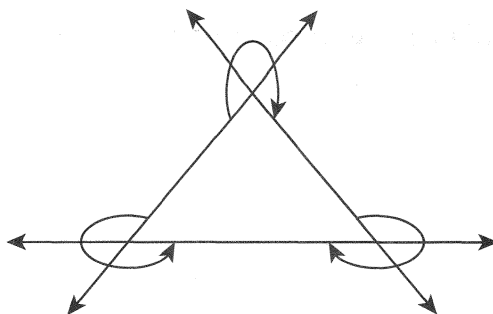
A 25°

C 115°

B 61°

D 245°

6 The triangle below has three groups of marked angles.



What is the sum of the measures of the marked angles?

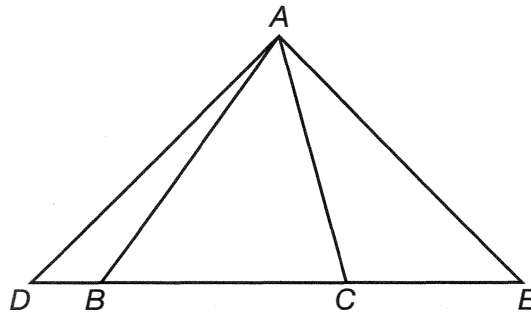
A 720°

C 900°

B 810°

D $1,080^\circ$

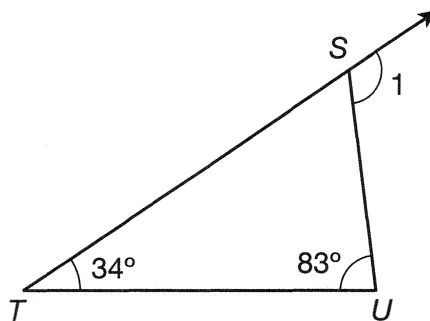
7 The image below shows several triangles.



The measure of $\angle ABD = 120^\circ$. The measure of $\angle ACE = 100^\circ$. What is the measure of $\angle BAC$?

- A 40°
- B 60°
- C 80°
- D 100°

8 The triangle below has an unknown interior angle and an unknown exterior angle.



Find the measure of each unknown angle. Explain how you found the angles.

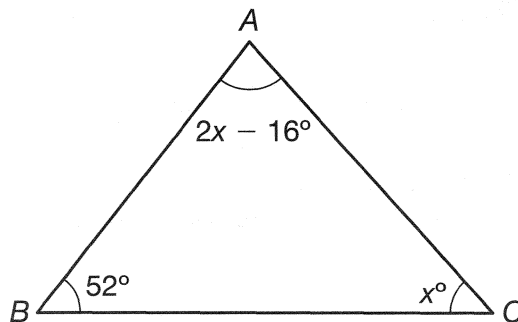
Answer $m\angle UST$ _____

$m\angle 1$ _____

Explain your answer.

9

In the triangle below, two of the angle measurements are unknown.



What are the measurements of the two unknown angles?

Show your work.

Answer $m\angle A$ _____

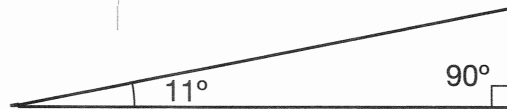
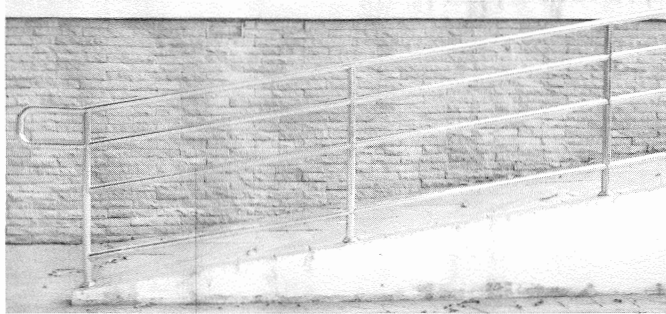
$m\angle C$ _____

EXIT TICKET

NY-8.G.5

Now that you have mastered angle measures in triangles, let's solve the problem in the Real-World Connection.

Sheldon is building a triangular ramp for one entrance to his house. He knows that one corner of the ramp will be a right angle and the other corner will measure 11° . What is the measure of the third angle of the ramp?



Write an equation to find the measure of the missing angle.
