Classifying Triangles

Lesson 1

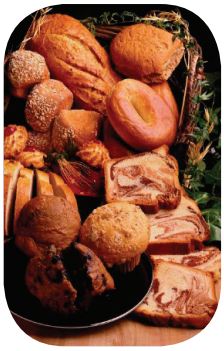
VOCABULARY

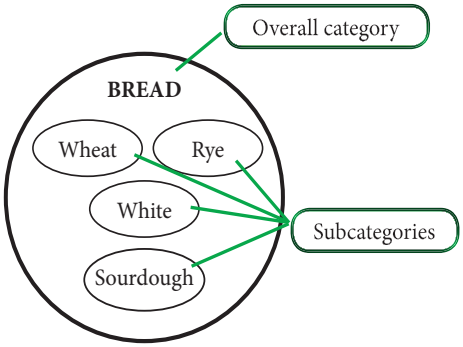
acute angle
right angle
obtuse angle
congruent
isosceles
scalene
equilateral
Venn diagram

TARGET

I can classify triangles.

You classify many things around you. For example, you might choose to make a sandwich and you have to pick a type of bread. Your choices might be wheat, white, sourdough or rye. These types each have the properties of bread, but have different flavors. The connection between them can be shown in a Venn diagram. A **Venn diagram** shows relationships between things.





C3 Lesson 1 Classifying Triangles 1

Materials

None

Pre-Requisite Skills

- Estimate angle measures as acute, right or obtuse. (B3 Lesson 2)
- Understand what a degree measure means in an angle. (B3 Lesson 3)
- Informally use attributes to describe triangles. (B3 Lesson 6)

Common Core State Standards

5.G.3 Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category.

5.G.4 Classify two-dimensional figures in a hierarchy based on properties.

*This lesson addresses the standards using triangles.

Learning Progression

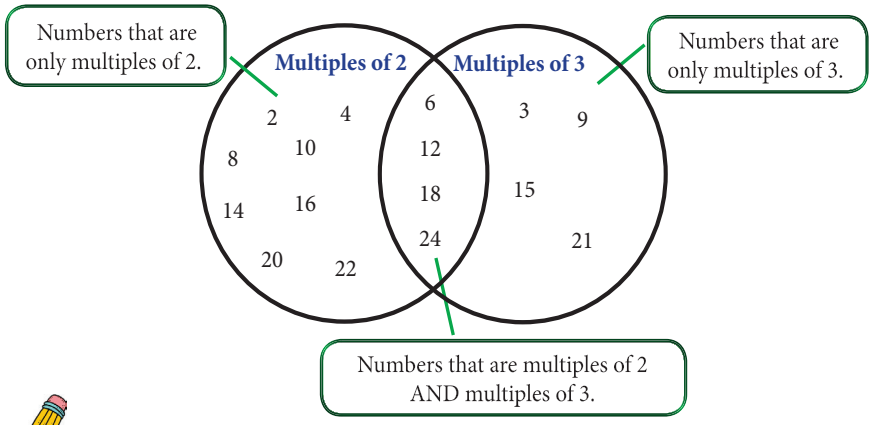
In earlier grades, students have…

- understood that shapes within a category share attributes (emphasis on quadrilaterals). (3.G.1)
- drawn and identified points, lines, line segments, rays, angles and perpendicular and parallel lines. (4.G.1)
- classified two-dimensional figures based on lines or angles and identified right triangles. (4.G.2)

In future grades, students will…

- find the area of triangles, quadrilaterals and polygons. (6.G.1)
- represent three-dimensional figures using nets and use the nets to find surface area. (6.G.4)
- draw geometric shapes with given conditions. (7.G.2)
- describe two-dimensional figures resulting from slicing three-dimensional figures. (7.G.3)

Sometimes the relationships shown on a Venn diagram do not all fit into one category like bread. Suppose a Venn diagram is used to show multiples of 2 and multiples of 3 within the numbers 1–25. A Venn diagram like the one below might be used.



Why do the two circles in the Venn diagram overlap?

The overlap shows numbers that are multiples of 2 and 3.

If the Venn Diagram showed multiples of 2 and multiples of 3 within the numbers 1–36, what other numbers would be in the overlap of the two circles?

30 and 36

In this lesson you will use attributes of two-dimensional shapes to classify triangles. One way to show the relationships between types of triangles will be with a Venn diagram.

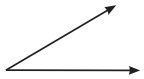
A triangle is a polygon with three sides. There are many types of triangles. Each triangle can be classified by its angle types and its number of sides with equal lengths. Angles in a triangle can be acute, right or obtuse. When the sides of a triangle are equal in length, they are **congruent**. Congruent figures are the exact same size and shape.

Incorporating the Mathematical Practices

MP 1 Encourage the use of the Venn diagrams to help students make sense of the similarities and differences between the different types of triangles. Some students may prefer a chart and others word descriptions or a Frayer model to show examples and non-examples. All of these strategies will support student understanding of how triangles are classified. Have students regularly explain their reasoning.

MP 3 Many problems in this lesson lend themselves to student justification and/or an opportunity for students to critique the reasoning of others. Remind students they can draw pictures to justify their reasoning if it is appropriate. Consider using Practice Problems #5, 8 and 11 to develop this habit of mind. Students who struggle writing may need to orally explain their thinking.

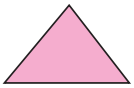
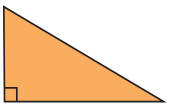
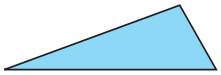
MP 6 Throughout the lesson, emphasize correct vocabulary use in speaking and writing. You may want to begin a word wall to help students access the vocabulary words and see examples of each one. Have students generate the words and examples placed on the word wall.

Acute Angle	Right Angle	Obtuse Angle
		
An **acute angle** measures between 0° and 90°. It is smaller than a right angle.	A **right angle** measures 90°.	An **obtuse angle** measures between 90° and 180°. It is larger than a right angle.

The charts below show how to classify a triangle by its angles and sides.

The short lines on the sides of a triangle show that these sides are congruent (equal in length).

Classify Triangles Using Sides		
		
Scalene Triangle: no congruent sides	**Isosceles Triangle:** at least 2 congruent sides	**Equilateral Triangle:** 3 congruent sides

Classify Triangles Using Angles		
		
Acute Triangle: 3 acute angles	**Right Triangle:** 1 right angle	**Obtuse Triangle:** 1 obtuse angle

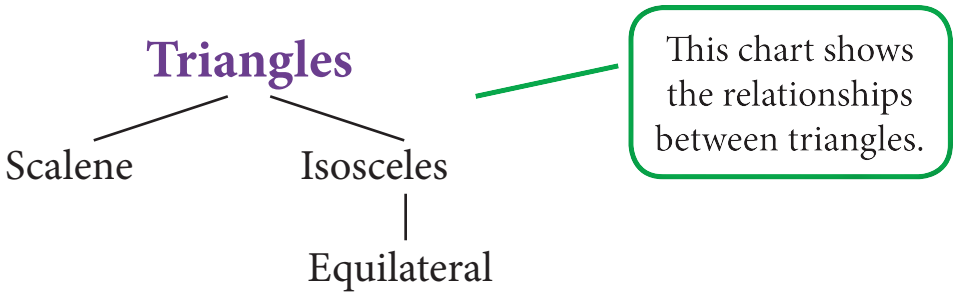
Communication Prompt

Can you draw an obtuse right triangle? Explain your reasoning.

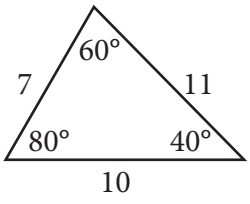
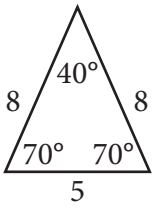
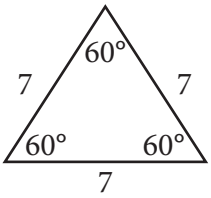
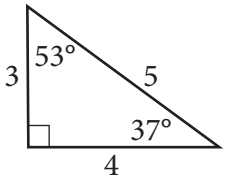
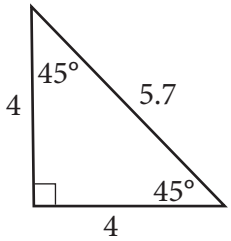
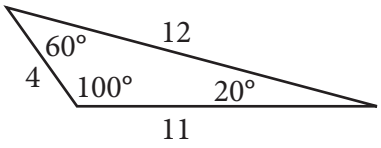
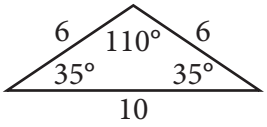
Teaching Tips

- Students need to understand that information about a triangle may be provided in different ways. A triangle may be drawn with congruent marks for congruent sides or side lengths may be labeled on the triangle. Students may need to visually see if an angle is acute, right or obtuse or the degree measures of the angles may be provided.
- An isosceles triangle has at least two congruent sides which means an equilateral triangle is a special isosceles triangle. Too often, students think an isosceles triangle can only have two congruent sides.
- Stress with students that some triangles are not possible (e.g., right equilateral) and have them explain why using pictures or words.
- Triangles can be classified using only angles, only sides or using both angles and sides. Students will see these variations throughout the lesson and Practice Problems.
- Students may not have experienced Venn diagrams before. Show students the diagram just helps them organize information. They will need to think about examples that fit in each part as well as non-examples to fully understand the properties of shapes in the diagram. Try having them draw a Venn diagram using their name and a friend's name for the two circles. How are they different? How are they alike?

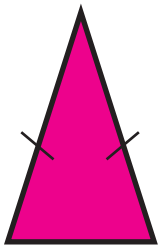
An equilateral triangle is also a special isosceles triangle. It has at least two congruent sides.



Use both the angle and side names when classifying a triangle. The chart below shows an example of each type of triangle when it is classified by its sides and angles.

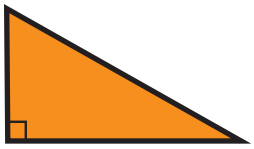
	Scalene	Isosceles	Equilateral
Acute	 acute scalene triangle	 acute isosceles triangle	 equilateral triangle
Right	 right scalene triangle	 right isosceles triangle	Not possible
Obtuse	 obtuse scalene triangle	 obtuse isosceles triangle	Not possible

Classify the triangles below using angles and sides. Circle the angle name and the side name.



(acute) right obtuse

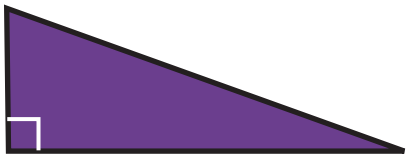
scalene (isosceles) equilateral



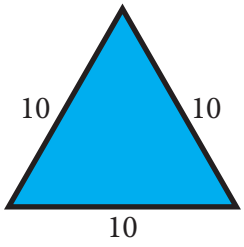
acute (right) obtuse

(scalene) isosceles equilateral

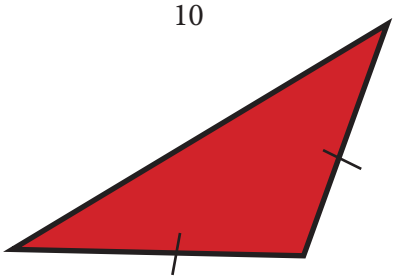
The names for the triangles below show how to classify triangles.



This is a **right scalene triangle**.



This is an **equilateral triangle**.
An equilateral triangle always has 3 acute angles. Each angle is 60°. The word acute is not included in its name.

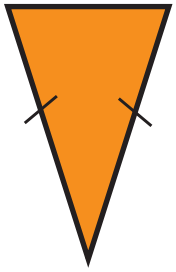


Angle name

This is a(n) obtuse

isosceles **triangle**.

Side name

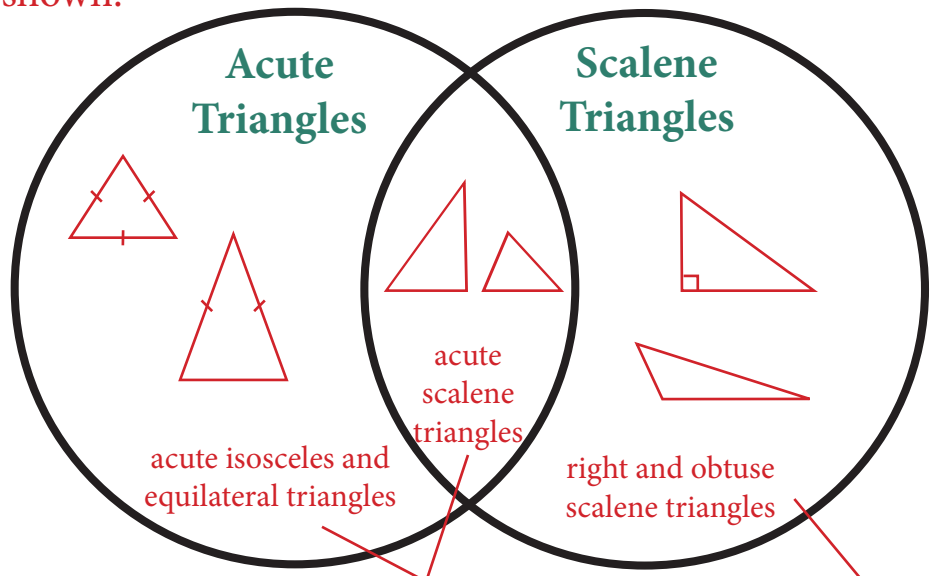


This is a(n) acute

isosceles **triangle**.

Draw two triangles that fit each part of the Venn diagram below.

Examples shown:



Match each description to part of the Venn diagram above by drawing a line from the rectangle to the correct section of the Venn diagram.

Triangles that are acute and scalene.	Triangles that are acute and not scalene.	Triangles that are scalene and not acute.

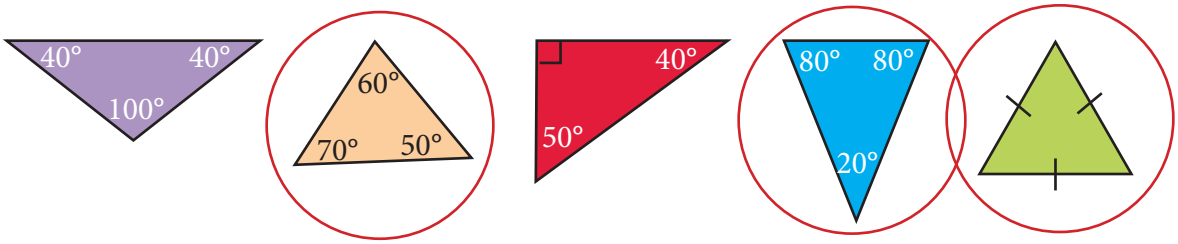
Valerie says an equilateral triangle can also be called an isosceles triangle. Is she correct? Explain your reasoning.

Yes; an equilateral triangle can also be called an isosceles triangle. An isosceles triangle has at least two congruent sides. An equilateral triangle has three congruent sides which means it has at least two congruent sides and fits the the definitiion for an equilateral triangle.

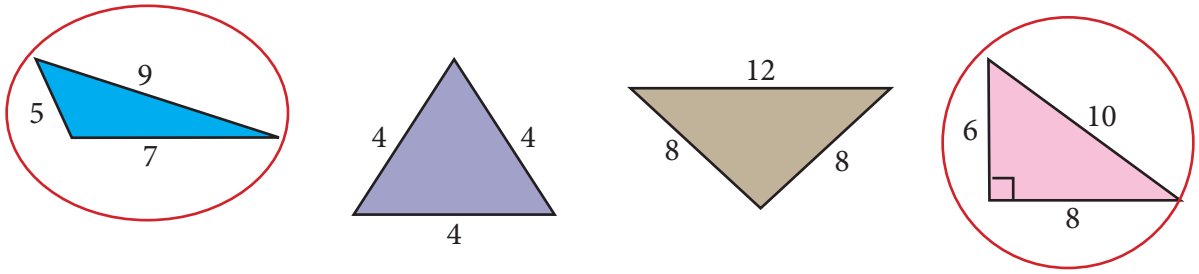
Name:

Practice

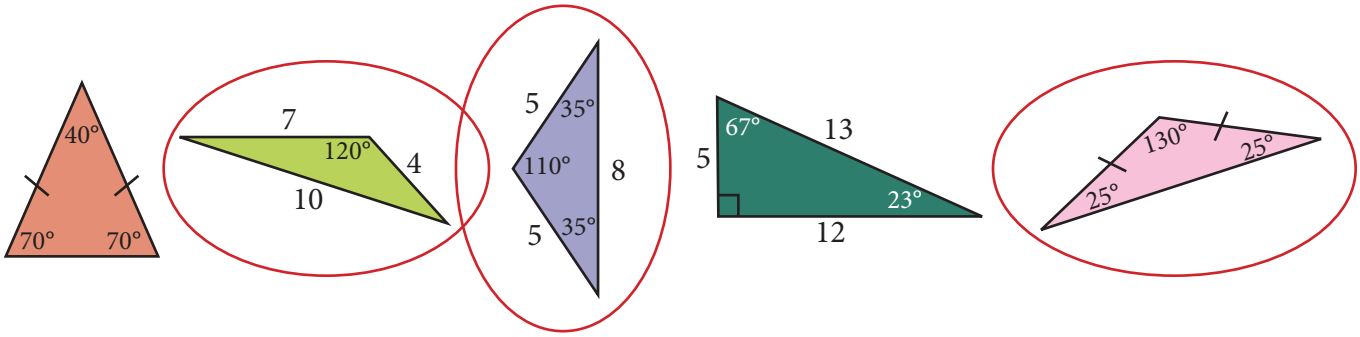
1. Circle the acute triangles.



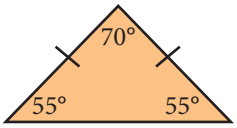
2. Circle the scalene triangles.



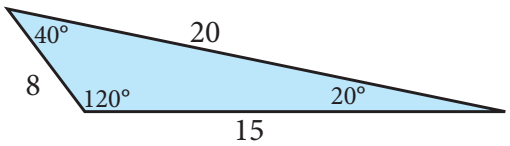
3. Circle the obtuse isosceles triangles.



4. Classify each triangle by its angles and sides.



acute isosceles



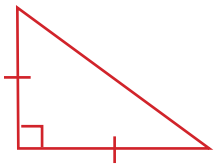
obtuse scalene

5. Can you draw an obtuse right triangle? No If so, draw it. If not, explain why not.

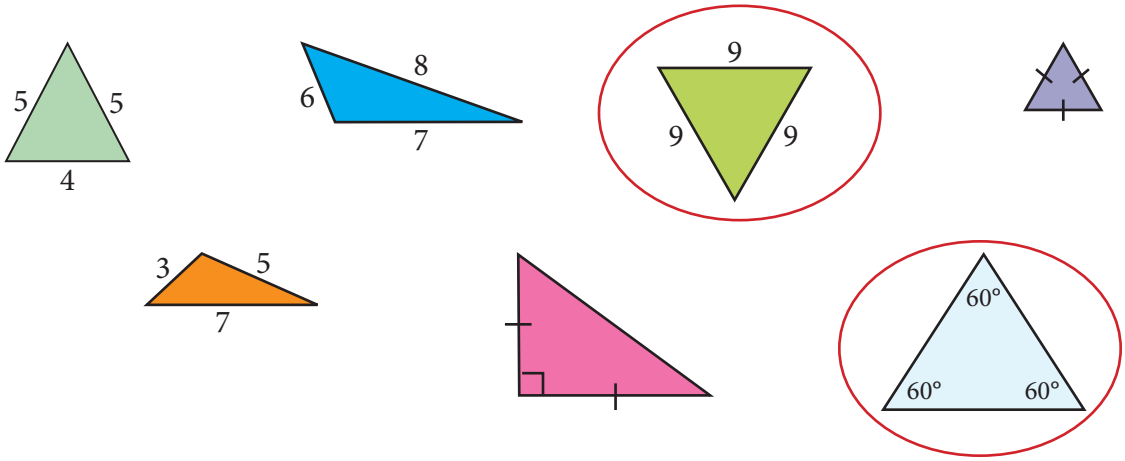
A triangle with a right angle and obtuse angle would have three sides like those shown. The left and right sides will never intersect to make a triangle.

6. Can you draw a right isosceles triangle? Yes If so, draw it. If not, explain why not.

Example:



7. Circle the equilateral triangles.



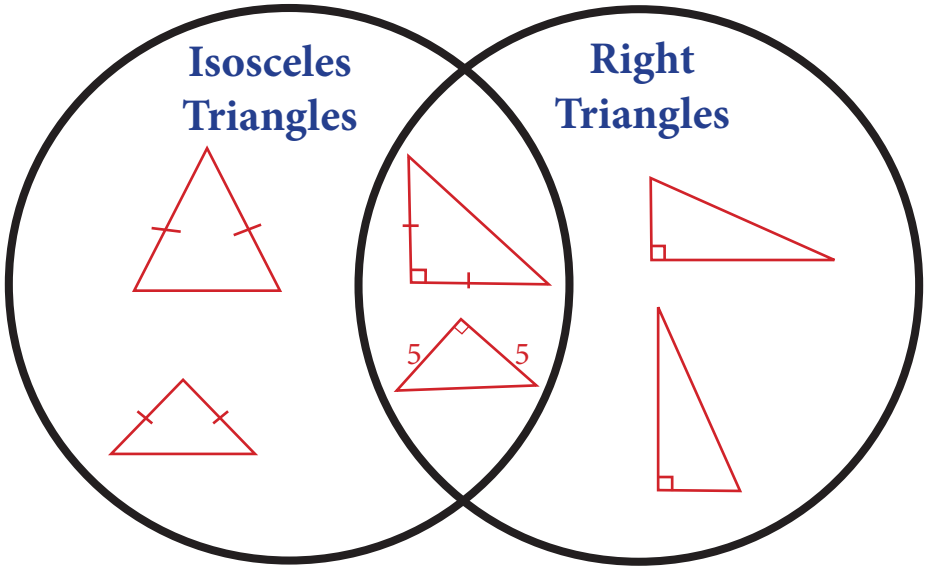
8. For each statement, circle ALWAYS, SOMETIMES or NEVER.

a. A right triangle is isosceles. **ALWAYS** **SOMETIMES** **NEVER**

b. An obtuse triangle has three obtuse angles. **ALWAYS** **SOMETIMES** **NEVER**

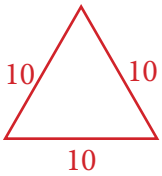
c. An equilateral triangle is isosceles. **ALWAYS** **SOMETIMES** **NEVER**

9. Draw two triangles that fit each part of the Venn diagram below.

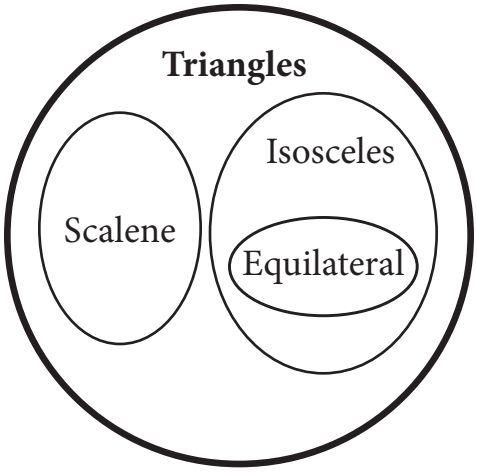


10. Two sides of a triangle have lengths of 10 inches. The third side has a length of 8 inches. What is the best name for the triangle? Use a picture and/or words to explain your answer.

acute isosceles triangle;
see student work.



11. Lyle drew the Venn diagram to the right.



a. Why is the circle with the name "Equilateral" inside the circle named "Isosceles"?

All equilateral triangles are isosceles.

b. Why don't the circles named "Scalene" and "Isosceles" overlap?

Scalene triangles have no congruent sides while isosceles triangles have at least two congruent sides. These triangles are different so they are separate in the Venn diagram.