Classify Triangles by Angles

One way to classify a triangle is by the measures of its angles.

- If one of the angles of a triangle is an obtuse angle, then the triangle is an **obtuse triangle**.
- If one of the angles of a triangle is a right angle, then the triangle is a **right triangle**.
- If all three of the angles of a triangle are acute angles, then the triangle is an **acute triangle**.
- If all three angles of an acute triangle are congruent, then the triangle is an **equiangular triangle**.

**Example**

Classify each triangle.

a.

![Triangle ABC with angles 60°, 60°, 60°]

All three angles are congruent, so all three angles have measure 60°. The triangle is an equiangular triangle.

b.

![Triangle DEF with angles 35°, 120°, 25°]

The triangle has one angle that is obtuse. It is an obtuse triangle.

c.

![Triangle GHJ with angles 90°, 30°, 60°]

The triangle has one right angle. It is a right triangle.

**Exercises**

Classify each triangle as **acute**, **equiangular**, **obtuse**, or **right**.

1. ![Triangle KLM with angles 67°, 90°, 23°]  
   - **Right Scalene**

2. ![Triangle NOP with angles 30°, 30°, 120°]  
   - **Obtuse Isosceles**

3. ![Triangle ORQ with angles 60°, 60°, 60°]  
   - **Acute Equilateral**

4. ![Triangle TVU with angles 65°, 65°, 50°]  
   - **Acute Isosceles**

5. ![Triangle WXY with angles 45°, 90°, 45°]  
   - **Right Isosceles**

6. ![Triangle FBD with angles 28°, 60°, 92°]  
   - **Obtuse Scalene**
Classify Triangles by Sides  You can classify a triangle by the measures of its sides. Equal numbers of hash marks indicate congruent sides.

- If all three sides of a triangle are congruent, then the triangle is an **equilateral triangle**.
- If at least two sides of a triangle are congruent, then the triangle is an **isosceles triangle**.
- If no two sides of a triangle are congruent, then the triangle is a **scalene triangle**.

### Example
Classify each triangle.

a. Two sides are congruent. The triangle is an **isosceles triangle**.

b. All three sides are congruent. The triangle is an **equilateral triangle**.

c. The triangle has no pair of congruent sides. It is a **scalene triangle**.

### Exercises
Classify each triangle as **equilateral**, **isosceles**, or **scalene**.

1. **Equilateral**

2. **Acute Equilateral**

3. **Acute Scalene**

4. **Isosceles**

5. **Acute Isosceles**

6. **Acute Equilateral**

7. Find the measure of each side of equilateral \( \triangle RST \) with \( RS = 2x + 2, ST = 3x \), and \( TR = 5x - 4 \).

8. Find the measure of each side of isosceles \( \triangle ABC \) with \( AB = BC \) if \( AB = 4y, BC = 3y + 2 \), and \( AC = 3y \).

9. Find the measure of each side of \( \triangle ABC \) with vertices \( A(-1, 5), B(6, 1) \), and \( C(2, -6) \). Classify the triangle.
Skills Practice

Classifying Triangles

Use a protractor to classify each triangle as **acute**, **equiangular**, **obtuse**, or **right**.

1.  
2.  
3.  
4.  
5.  
6.  

Identify the indicated type of triangles.

7. right  
8. isosceles  
9. scalene  
10. obtuse

**ALGEBRA** Find $x$ and the measure of each side of the triangle.

11. $\triangle ABC$ is equilateral with $AB = 3x - 2$, $BC = 2x + 4$, and $CA = x + 10$.

12. $\triangle DEF$ is isosceles, $\angle D$ is the vertex angle, $DE = x + 7$, $DF = 3x - 1$, and $EF = 2x + 5$.

Find the measures of the sides of $\triangle RST$ and classify each triangle by its sides.

13. $R(0, 2)$, $S(2, 5)$, $T(4, 2)$  
   - Acute Isosceles
   
14. $R(1, 3)$, $S(4, 7)$, $T(5, 4)$  
   - Acute Scalene
4-1 Practice

Classifying Triangles

Use a protractor to classify each triangle as acute, equiangular, obtuse, or right.

1. 
2. 
3. 

Identify the indicated type of triangles if \(AB \cong AD \cong BD \cong DC, BE \cong ED, AB \perp BC,\) and \(ED \perp DC\).

4. right 
5. obtuse 
6. scalene 
7. isosceles

ALGEBRA Find \(x\) and the measure of each side of the triangle.

8. \(\triangle FGH\) is equilateral with \(FG = x + 5, GH = 3x - 9,\) and \(FH = 2x - 2\).

9. \(\triangle LMN\) is isosceles, \(\angle L\) is the vertex angle, \(LM = 3x - 2, LN = 2x + 1,\) and \(MN = 5x - 2\).

Find the measures of the sides of \(\triangle KPL\) and classify each triangle by its sides.

10. \(K(-3, 2), P(2, 1), L(-2, -3)\)

11. \(K(5, -3), P(3, 4), L(-1, 1)\)

12. \(K(-2, -6), P(-4, 0), L(3, -1)\)

13. DESIGN Diana entered the design at the right in a logo contest sponsored by a wildlife environmental group. Use a protractor. How many right angles are there?
Pre-Activity  Why are triangles important in construction?

Read the introduction to Lesson 4-1 at the top of page 178 in your textbook.

• Why are triangles used for braces in construction rather than other shapes?

• Why do you think that isosceles triangles are used more often than scalene triangles in construction?

Reading the Lesson

1. Supply the correct numbers to complete each sentence.
   a. In an obtuse triangle, there are _2_ acute angle(s), _0_ right angle(s), and _1_ obtuse angle(s).
   b. In an acute triangle, there are _3_ acute angle(s), _0_ right angle(s), and _0_ obtuse angle(s).
   c. In a right triangle, there are _2_ acute angle(s), _1_ right angle(s), and _0_ obtuse angle(s).

2. Determine whether each statement is always, sometimes, or never true.
   a. A right triangle is scalene. Sometimes
   b. An obtuse triangle is isosceles. Sometimes
   c. An equilateral triangle is a right triangle. Never
   d. An equilateral triangle is isosceles. Always
   e. An acute triangle is isosceles. Sometimes
   f. A scalene triangle is obtuse. Sometimes

3. Describe each triangle by as many of the following words as apply: acute, obtuse, right, scalene, isosceles, or equilateral.
   a. Acute scalene
   b. Obtuse isosceles
   c. Right scalene

Helping You Remember

4. A good way to remember a new mathematical term is to relate it to a nonmathematical definition of the same word. How is the use of the word _acute_, when used to describe _acute pain_, related to the use of the word _acute_ when used to describe an _acute angle_ or an _acute triangle_?