

## **MEASURING ANGLES**

### **CLASSIFYING TRIANGLES AND TRIANGLE PROPERTIES**

To measure angles we use a protractor which is divided into 180 units to represent  $180^\circ$ . The protractor has two sets of numbers so that the angle may be measured from either the right or left, depending on which way the starting ray is pointing. If the starting ray is pointing to the left, read the top numbers; if it is pointing to the right, read the bottom numbers.

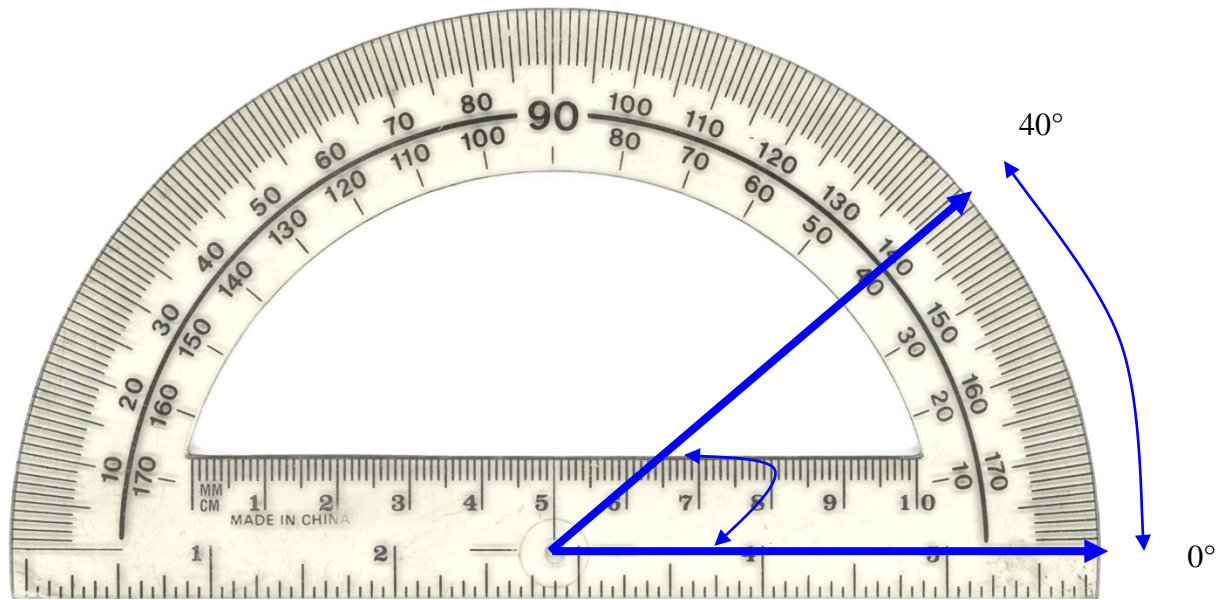
Two types of angles are acute and obtuse. Acute angles measure less than  $90^\circ$ , while obtuse angles measure more than  $90^\circ$  and less than  $180^\circ$ . Two special angles are the right angle, which measures exactly  $90^\circ$ , and the straight angle which measure exactly  $180^\circ$ . First we'll measure and identify angles. We will use a protractor to measure angles and we will refer to benchmark angles to aid in making reasonable measurements of angles.

Triangles also have classifications. Triangles may be classified according to the angles found within the triangle. When classifying triangles by angles, triangles may be identified as acute, obtuse, or right triangles.

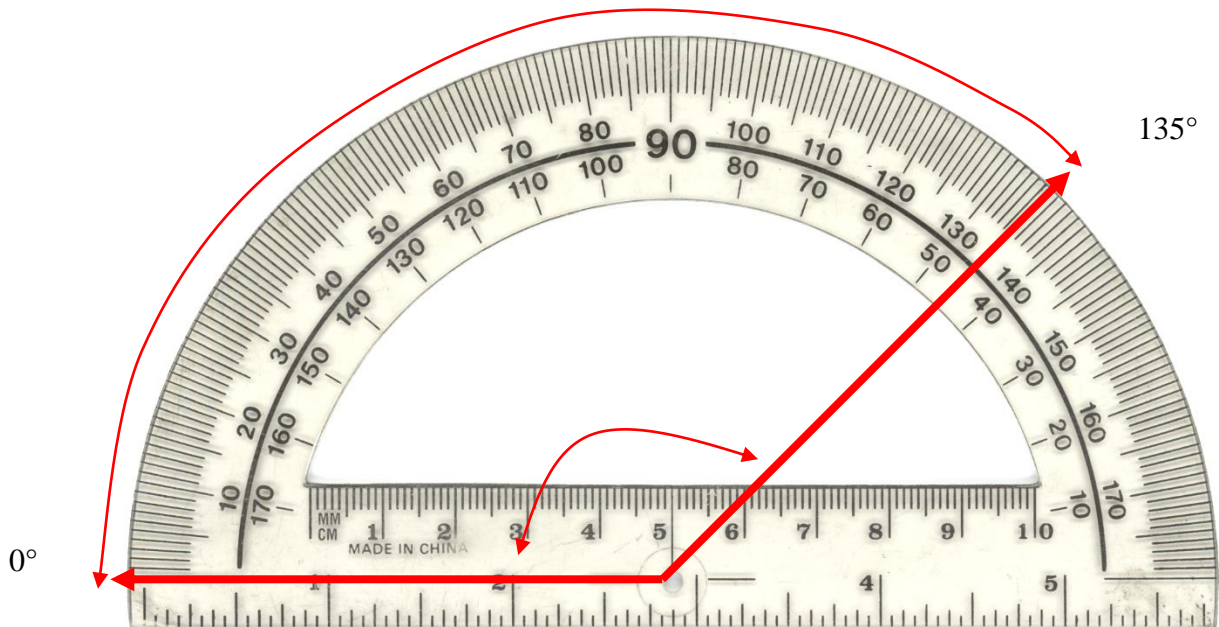
The three angles in a triangle share a special connection. The sum of the angles in a triangle adds up to  $180^\circ$ .

Another type of classification of triangles is determined by the length of the sides of the triangle. When classifying triangles by the length of their sides, triangles may be identified as scalene, isosceles, or equilateral.

## Measuring and Identifying Angles

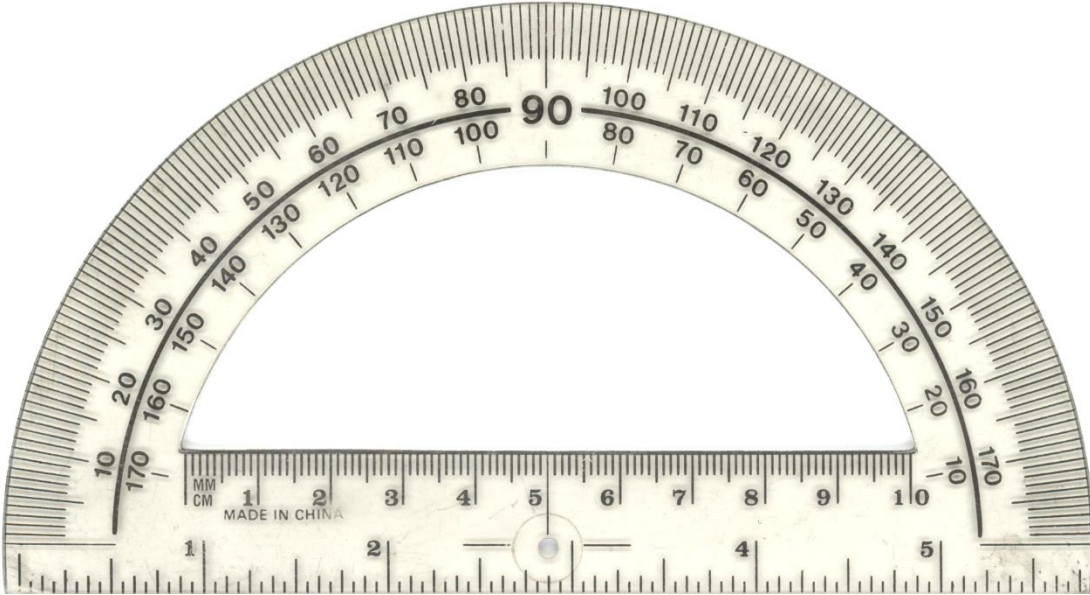


The starting ray, in this case, the bottom ray, is at  $0^\circ$ . Read the other ray. The ray is passing through both  $40^\circ$  and  $140^\circ$ . You must decide which number makes sense. Think about a right angle – it measures  $90^\circ$ . This angle is not as open as a right angle; thus, you would read the smaller number. This angle measures  $40^\circ$ . Notice the numbers near the bottom ray, the lower set of numbers start at 0, then 10, 20, etc. That is the set of numbers that is used to read this angle. The starting ray starts at  $0^\circ$ . This is an **acute angle** because it measures more than  $0^\circ$  and less than  $90^\circ$ .



The starting ray, in this case, the bottom ray, is at  $0^\circ$ . Read the other ray. The ray is passing through both  $45^\circ$  and  $135^\circ$ . You must decide which number makes sense. Think about a right angle – it measures  $90^\circ$ . This angle is open wider than a right angle; thus, you would read the larger number. This angle measures  $135^\circ$ . Notice the numbers near the bottom ray, the upper set of numbers start at 0, then 10, 20, etc. That is the set of numbers that is used to read this angle. The starting ray starts at  $0^\circ$ . This is an **obtuse angle** because it measure more than  $90^\circ$  and less than  $180^\circ$ .

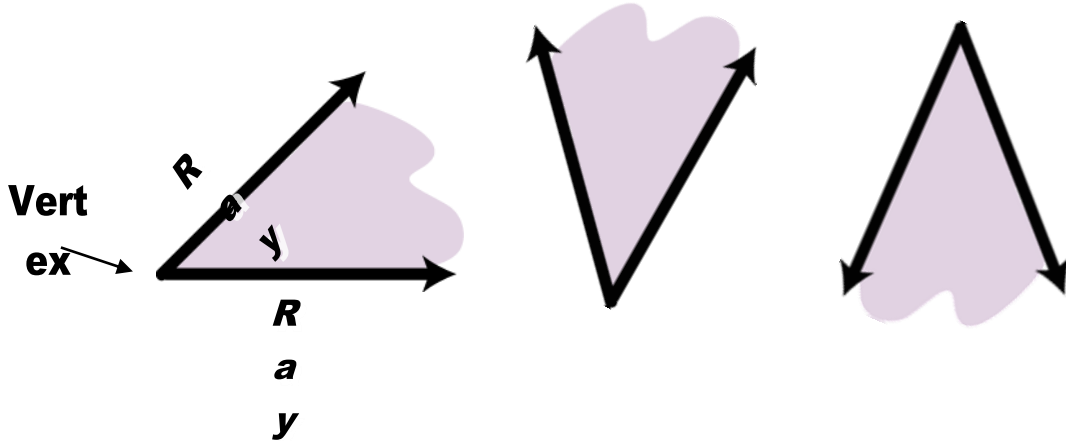
# Protractor



## Benchmark Angles

Here are some angles to help you measure angles. Use these angles to estimate the size of the angle you are drawing.

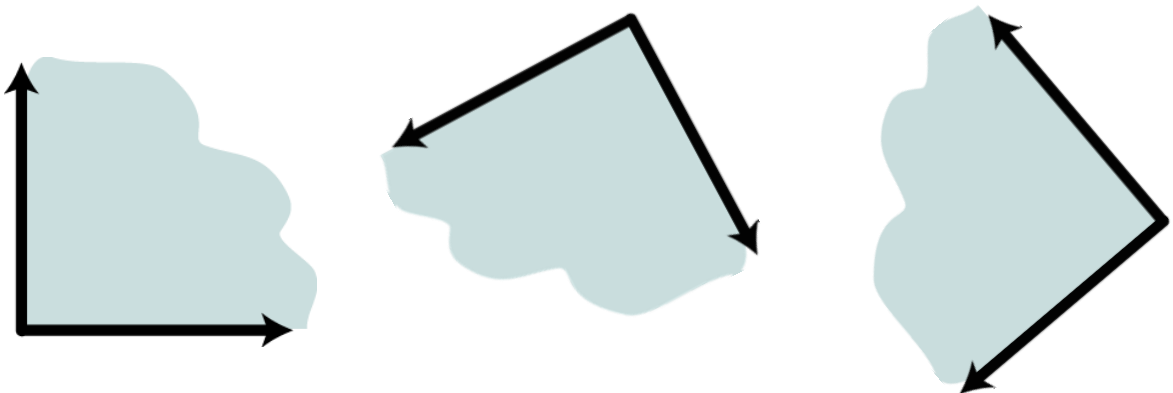
All of these angles are  $45^\circ$ . The manner in which they are turned does not affect the size of the angle. The rays form a  $45^\circ$  at the vertex.



All of these angles are  $120^\circ$ . The rays form a  $120^\circ$  at the vertex.



All of these angles are  $90^\circ$ . The rays form a  $90^\circ$  angle at the vertex.



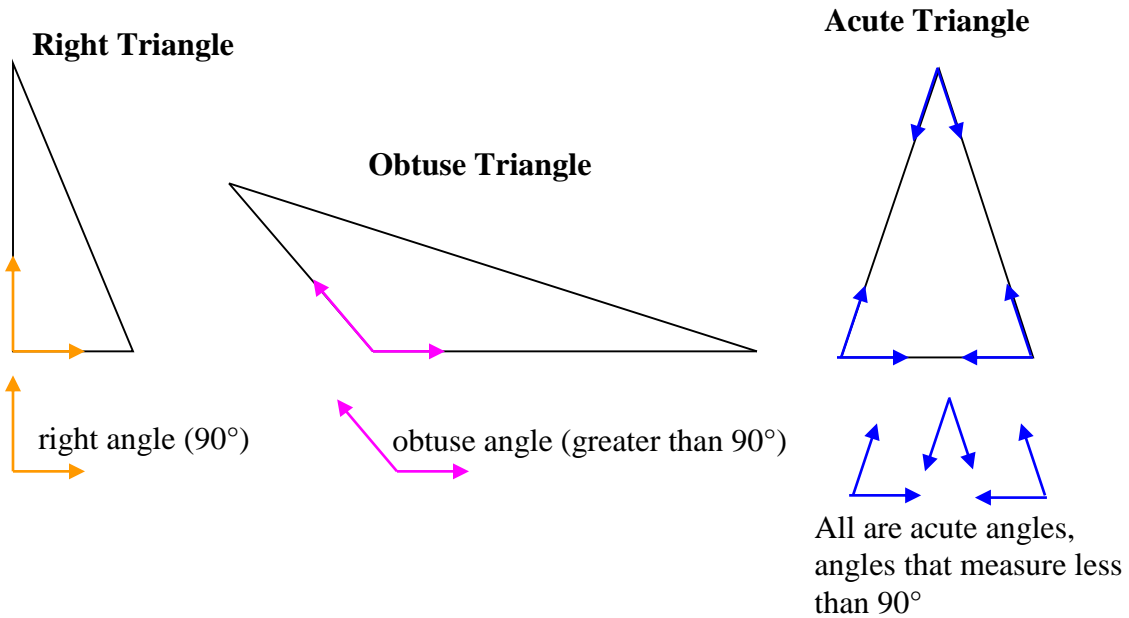
# Classifying Triangles by Angles

A triangle can be classified by the types of angles that are formed by its three sides.

If a triangle has one right angle, then it is called a **right triangle**.

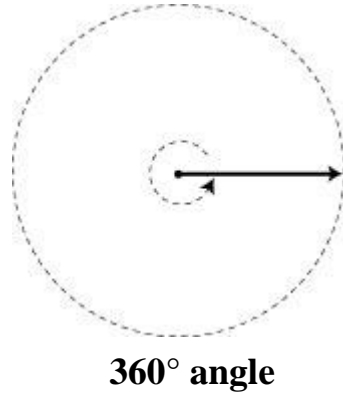
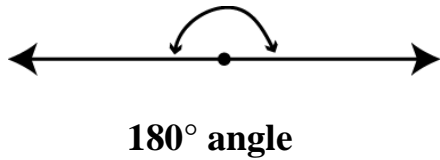
If a triangle has one obtuse angle, then it is called an **obtuse triangle**.

If all the angles in a triangle are acute, then the triangle is called an **acute triangle**.

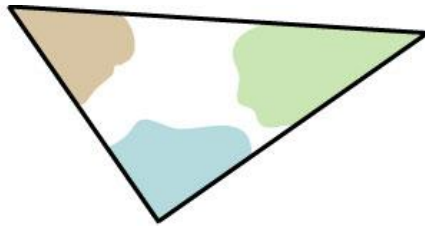


# Sum of Angles in a Triangle

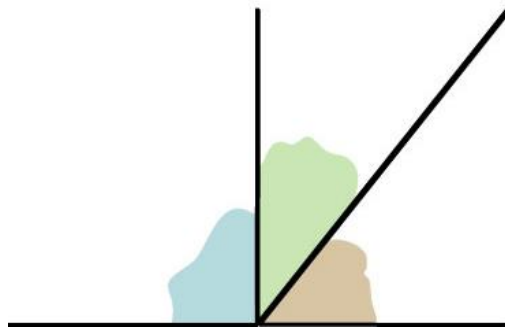
## Special Angles



Look at the angles in the triangle below. Cut the angles away from the triangle.



Place the angles side by side at one vertex point, so that there are no gaps between the angles.



**Notice that the three angles of the triangle together make up a 180° angle.**

# Classifying Triangles by Sides

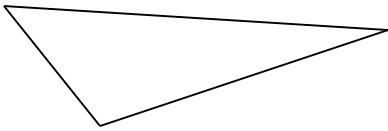
Triangles can be classified by the lengths of their three sides.

If a triangle has all sides measuring different lengths, it is a **scalene triangle**.

If a triangle has two sides that measure the same length, it is an **isosceles triangle**.

If a triangle has all three sides measuring the same length, it is an **equilateral triangle**.

**Scalene Triangle**



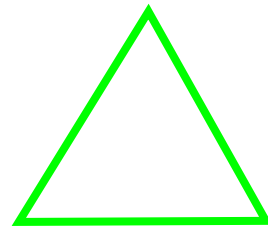
All sides are different lengths.

**Isosceles Triangle**



Two sides are the same lengths.

**Equilateral Triangle**



All three sides are the same lengths.