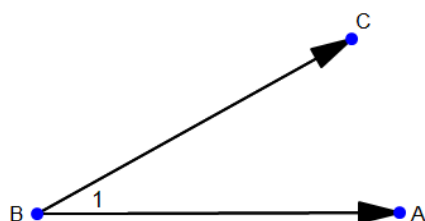


## Angle Measurement

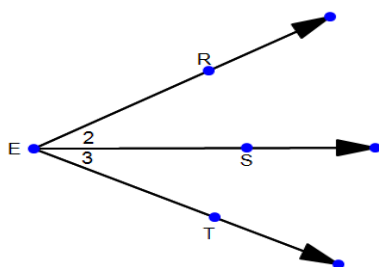
### Definition 1

An angle is a figure formed by two rays with a common endpoint. The two rays are called the sides of the angle and the common endpoint is called the vertex of the angle.

The sides of the angle shown are  $\overrightarrow{BA}$  and  $\overrightarrow{BC}$ . The vertex is point B. The angle can be called  $\angle B$ ,  $\angle CBA$ ,  $\angle ABC$ , or  $\angle 1$ . If three letters are used to name an angle, the middle letter must be the vertex.



When you talk about this  $\angle B$ , everyone knows what angle you mean. But if you tried to talk about  $\angle E$  in the diagram, people wouldn't know which angle you meant. There are three angles with the vertex E.



To name any particular one of them you need to use either three letters or a number.

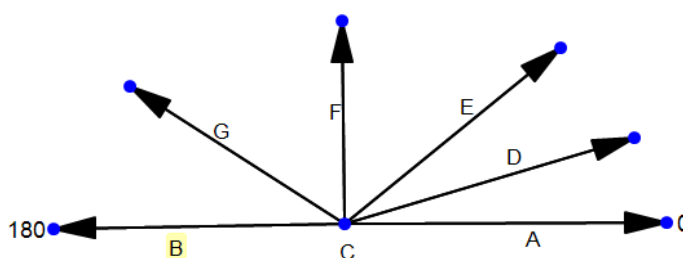
$\angle 2$  is  $\angle RES$  or  $\angle SER$

$\angle 3$  is  $\angle SET$  or  $\angle TES$

$\angle RET$  is  $\angle TER$ .

A **protractor** is used to measure an angle in **degrees** (symbol:  $^\circ$ ). If the measure of the angle BOC is 70 degree, this is written " $m\angle BOC = 70^\circ$ ".

Using the protractor to measure an angle suggests that every angle has a measure, a basic assumption in geometry.

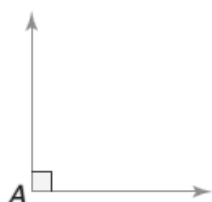


### Postulate 1: Protractor Postulate

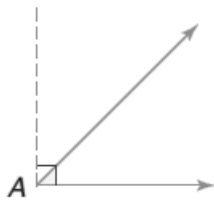
Given  $\overleftrightarrow{AB}$  and a number  $r$  between 0 and 180, there is exactly one ray with endpoint  $A$ , extending on each side of  $\overleftrightarrow{AB}$ , such that the measure of the angle formed is  $r$ .

In general, the Protractor Postulate says that to every angle there corresponds exactly one real number  $n$  such that  $0 < n \leq 180$ . The measure of the angle is  $n$ . We assume that the rays of an angle are distinct and cannot coincide. Therefore, an angle cannot have measure 0.

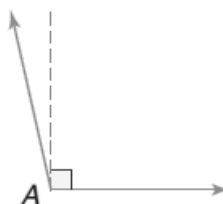
Once the measure of an angle is known, the angle can be classified as one of three types of angles. These types are defined in relation to a right angle.



A right angle is an angle whose measure is  $90^\circ$

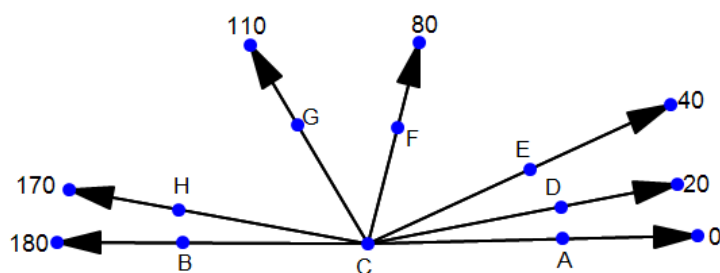


An acute angle is an angle whose measure is less than  $90^\circ$



An obtuse angle is an angle whose measure is greater than  $90^\circ$  and less than  $180^\circ$

**Example 1:** Find the measure of  $\angle HCE$ ,  $\angle GCD$ ,  $\angle FCD$ , and then classify each angle.



a)  $m\angle HCE$

$$m\angle HCE = |170 - 40| = |130| = 130 \text{ Obtuse}$$

b)  $m\angle GCD$

$$m\angle GCD = |110 - 20| = |90| = 90 \text{ Right}$$

c)  $m\angle FCD$

$$m\angle FCD = |80 - 20| = |60| = 60 \text{ Acute}$$

**Definition 2**

Congruent ( $\cong$ ) angles are angles that have the same measure.

$\angle A \cong \angle B$  means " $\angle A$  is congruent to  $\angle B$ ".

In the figure, similar marking (arcs) are used to indicate that  $\angle A$  and  $\angle B$  are congruent. Unless marked as such, angles should not be assumed congruent.

By definition, congruent angles are angles that have the same measure. Therefore, the statements  $\angle A \cong \angle B$  and  $m\angle A = m\angle B$  are equivalent.

