

Goals:

- To prove the congruence of two triangles.
- Learn definitions pertaining to triangles, and theorems concerning triangles.

Definition: Any two triangles that have their 3 angles being congruent and 3 sides are congruent are said to be **congruent triangles**. If two triangles are congruent we write this as  $\triangle ABC \cong \triangle EFG$ .

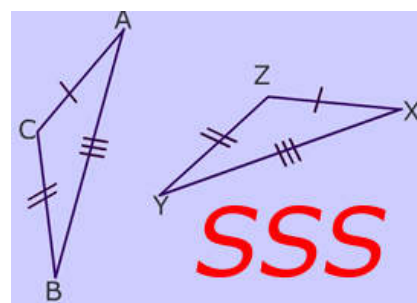
**Postulates** are foundational assumptions about what is accepted as a known truth. Example, at the time, it was a postulate that the earth was flat. **Theorems** are truths that are derived by logical deduction based upon the accepted definitions and postulates.

### Three Postulates pertaining to the Congruence of Triangles:

#### Side Side Side Postulate (SSS)

If two triangles have three sides congruent to the three sides of the other triangle, then the triangles are congruent, which implies that they share all their angles and sides are congruent as well.

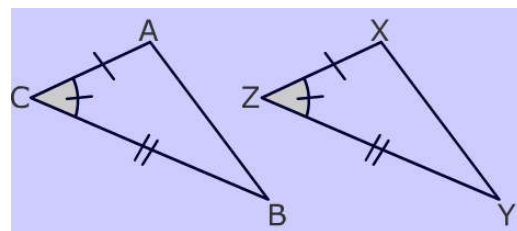
In other words if two triangles have 3 congruent sides, then we know that the triangles will have all 6 defining parts (3 angles and 3 sides) congruent, and will then be known to be congruent.



#### Side Angle Side Postulate (SAS)

If a triangle has two sides and their included angle being congruent to two sides and the included angle of a second triangle, then we can determine that the two triangles are congruent, which implies that they share all their angles and sides are congruent as well.

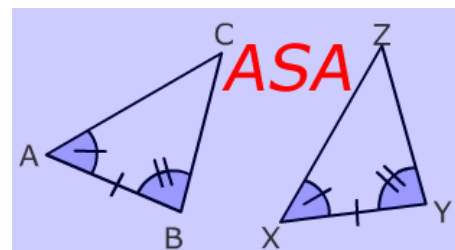
In other words, if two triangles share congruent sides and the angles included by these sides are also congruent, then we can determine that all 6 defining parts (3 angles and 3 sides) congruent, and will then be known to be congruent.



#### Angle Side Angle Postulate (ASA)

If a triangle has two angles and their included side being congruent to two angles and the included side of another triangle, then then we can determine that the two triangles are congruent, which implies that they share all their angles and sides are congruent as well.

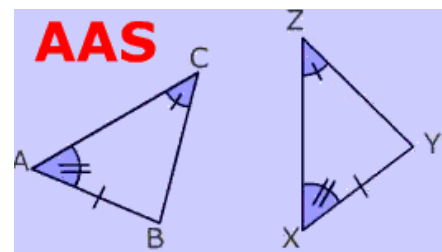
In other words, if two triangles share two congruent angles and their included sides are also congruent, then we can determine that all 6 defining parts (3 angles and 3 sides) congruent, and will then be known to be congruent.



Theorems about Congruence of Triangles Derived from the previous Postulates

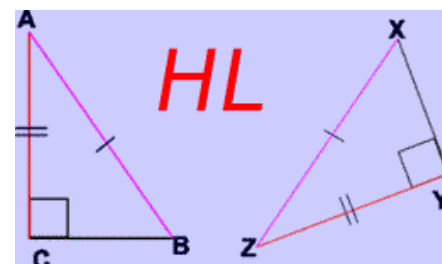
Angle Angle Side Theorem (AAS)

If two angles and a non-included side of one triangle is congruent to two angles and a non-included side of a second triangle, then then we can determine that the two triangles are congruent, which implies that they share all their angles and sides are congruent as well.



Hypotenuse Leg Theorem (HL)

If two right triangles have congruent hypotenii and each triangle has an additional leg that is congruent to the leg of the other right triangle, then these triangles are congruent, which implies that they share all their angles and sides are congruent as well.



Corresponding Parts of Congruent Triangles are Congruent (CPCTC)

The title says it all, if two triangles are congruent, then by definition, all their congruent parts are congruent.

Prove that the diagonal of any rectangle bisects the rectangle into two congruent triangles.

Prove that all isosceles triangles have congruent base angles.(use an altitude or a median)

## Similar Triangles

Definition: If two triangles have their 3 angles congruent to the other, and the sides are proportionate, then we say the triangles are **similar** and we write  $\triangle ABC \approx \triangle DEF$

If two triangles are similar, this means they are scaled copies of each other, like Dr. Evil and Mini Me from Austin powers, but for triangles. Or like a car and a model replica of that car. All the angles are exactly the same but the lengths of everything is scaled down by the same ratio.

### Angle Angle Angle Postulate (AAA)

If two triangles have all their angles congruent to all the angles of the other triangle, then these triangles are similar to each other.

### Angle Angle Theorem (AA)

If two triangles have two angles congruent to two angles of the other triangle, then these triangles are similar to each other.

### Corresponding Sides of Similar Triangles are Proportionate (CSSTP)

As the name suggests, if two triangles are known to be similar, then their sides will be proportionate. And additionally

### The Corresponding Angles of Similar Triangles are Congruent (CASTC)

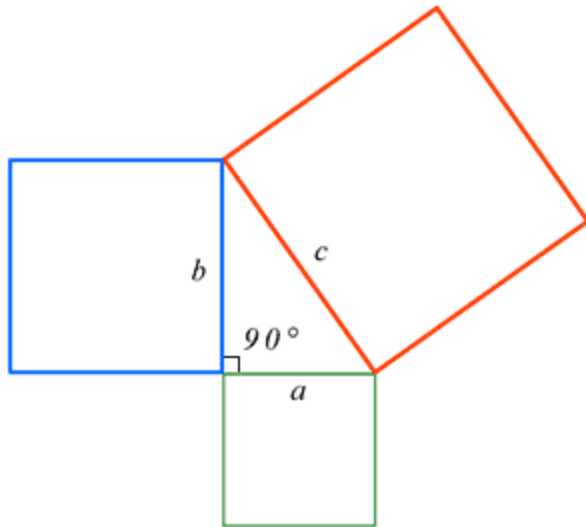
Example: There are some simple ways to determine the heights of tall objects like trees and buildings. Watch this [video](#) and prove that the method discussed will indeed find the height of a tall object from your eye level to the top of the tree/object. Then on your own test your new skill on the height of a tall object of known height.

Pythagorean Theorem:

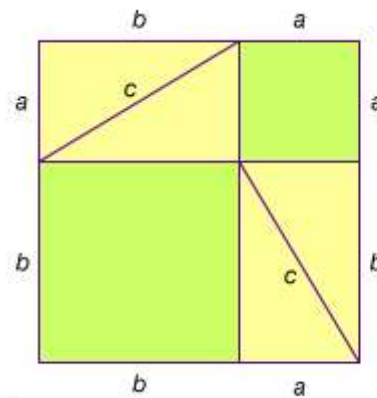
Given any right triangle, the square of the length of the hypotenuse is equal to the sum of the remaining two sides when each side length is squared and then added together.

I.E.

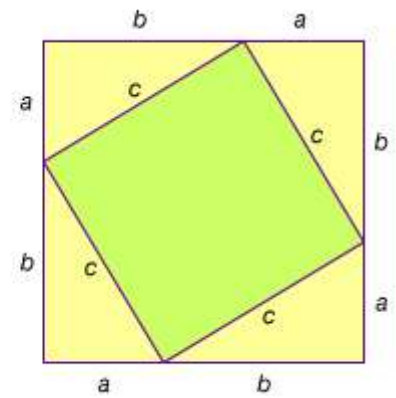
$$a^2 + b^2 = c^2$$



Pythagoras's Proof:



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Bhaskara's Proof:

