Geometry Info Sheet #31

Triangle Segments, Centers, and Points of Concurrency

Definitions

Perpendicular Bisector: A ray, line, or segment that intersects a segment at its midpoint at a 90º angle

Angle Bisector: A ray, line, or segment that divides an angle into two congruent adjacent angles

Three or more lines are said to be **concurrent** if they intersect at a single point. The point of intersection is called the **point of concurrency**. These terms are generally used when referencing centers of triangles.

Circumcenter: In a triangle, the point of concurrency of the three perpendicular bisectors of the sides of the triangle; the circumcenter of a triangle is equidistant from the vertices of the triangle

For an acute triangle, the circumcenter is inside the triangle.
For an obtuse triangle, the circumcenter is outside the triangle.
For a right triangle, the circumcenter is the midpoint of the longest side (hypotenuse) of the triangle.

Incenter: In a triangle, the point of concurrency of the three angle bisectors of the triangle; the incenter of a triangle is equidistant from the sides of the triangle

The incenter of a triangle will always be inside the triangle.

Median: In a triangle, the segment from a vertex to the midpoint of the opposite side; every triangle has three medians, and they are concurrent

Centroid: The point in a triangle where the three medians intersect; it represents the center of mass of the triangle; the distance from each vertex to the centroid is twice the distance from the centroid to the midpoint of the opposite side (2/3 of the way)

A triangle's centroid will always be inside the triangle.

Altitude: In a triangle, the perpendicular segment from a vertex to the opposite side (or to the line containing the opposite side); every triangle has three altitudes, and they are concurrent

Orthocenter: The point where the three altitudes of a triangle intersect

For an acute triangle, the orthocenter is inside the triangle.
For an obtuse triangle, the orthocenter is outside the triangle.
For a right triangle, the orthocenter is the vertex of the right angle of the triangle.