Triangle Centers: Medians and Altitudes

Why isn't there a special name for the tops of your feet?

- Lily Tomlin

We have several special segments inside and sometimes outside of triangles.

These lines are often concurrent lines, which means they intersect at a single point.
Altitude - a perpendicular segment from a vertex to the line containing the opposite side

Altitudes are concurrent and the point of concurrency lies...

Acute Triangles - Inside

Right Triangles - on the $\Delta$ (vertex of Right Angle)

Obtuse Triangles - Outside

Point of concurrency is called Orthocenter
Median

- a segment connecting a vertex to the midpoint of the opposite side.

The medians are concurrent and the point of concurrency is always inside the triangle.

The point of concurrency is called the centroid.

Construction Activity

1. On construction paper draw a large triangle ABC.
   Leave enough room to do midpoint construction.

2. Construct midpoint of $\overline{AB}$. Label O.

3. Construction midpoint of $\overline{AC}$. Label N.

4. Construct midpoint of $\overline{BC}$. Label M.

5. Draw $\overline{AM}$, $\overline{BN}$, $\overline{CO}$. Label intersection G.
Measure AG, GM, BG, GN, CG, and CO. Label lengths in centimeters on triangle.

7. Cut out triangle ABC

The centroid is the center of gravity for a triangle.

Try balancing the triangle on the tip of a finger using the centroid.
What do you notice about AG and GM?

\[ AG = 2(GM) \]

What do you notice about BG and GN?

\[ BG = 2(GN) \]

What do you notice about CG and GO?

Theorem 10-4

The medians of a triangle intersect in a point that is two-thirds of the distance from each vertex to the midpoint of the opposite side.
Example 1: \( \overline{AD} \) and \( \overline{BE} \) are medians of triangle \( ABC \). Find \( GD \) and \( BG \).

\[
\begin{align*}
AG &= 2(AD) \\
9 &= 2(4.5) \\
BG &= 2(\overline{GE}) \\
4.5 &= 2(4)
\end{align*}
\]

Closure:

What is special about the centroid?

How do you find the orthocenter?

How many medians do you need to draw to find the centroid?