Problem 1 – An Introduction

Look at the diagram on page 1.3.

- How do the circles change when you drag the vertices of the triangle?

Problem 2 – Medians & the Centroid

A median of a triangle is a segment from a vertex to the midpoint of the opposite side. The point of concurrency of all three medians of a triangle is called the centroid.

- Click on the slider on page 2.1 to step through the problems on medians and the centroid.
- In step 2, move point B to several locations. What is always true about *BD* and *DC*?
- In step 4, move any vertices of the triangle and in relation to the triangle, where is the centroid always located?
- In step 5, move any vertices of the triangle, what is true about the lengths of the two "pieces" of the medians?

Problem 3 – Altitudes & the Orthocenter

An altitude of a triangle is a segment from a vertex perpendicular to the opposite side. The point of concurrency of all three altitudes of a triangle is called the orthocenter.

- Click on the slider on page 3.1 to step through the problems on altitudes and the orthocenter.
- In step 2, move point J to several locations. What is always true about $\angle JAK$?
- In step 3, is the altitude ever outside of the triangle? If the altitude is located outside of the triangle, then what type of triangle is $\triangle HJK$?
- In step 4, all three altitudes of $\triangle HJK$ are shown.
- In step 5, the point of concurrency, the orthocenter, is shown.
- In step 6, move the vertices of the triangle and discover what type of triangle is created when the orthocenter is located …
    - inside the triangle?
    - on the triangle?
    - outside the triangle?

Problem 4 – Angle Bisectors & the Incenter

The point of concurrency of all three angle bisectors of a triangle is called the incenter.

- Click on the slider on page 4.1 to step through the problems on angle bisectors and the incenter.
- In step 1, move point A to several locations. What is always true about m$\angle CAT$ and m$\angle BAT$?

- In step 3, move the vertices of the triangle to several locations. Relative to the triangle where is the incenter always located?

- In step 5, the circle inscribed about $\triangle ABC$ is shown. How are the lengths of $\overline{PQ}$, $\overline{PR}$, and $\overline{PS}$ related?

- In step 6, what is true about the circle in relation to the triangle?

Problem 5 – Perpendicular Bisectors & the Incenter

The point of concurrency of all three perpendicular bisectors of a triangle is called the circumcenter.

- Click on the slider on page 5.1 to step through the problems on perpendicular bisectors and the circumcenter.
- In step 3, move the vertices of the triangle to several locations. Relative to the triangle where is the circumcenter always located?

- In step 5, the circle circumscribed about $\triangle UTV$ is shown. How are the lengths of $\overline{PU}$, $\overline{PT}$, and $\overline{PV}$ related?

- In step 6, what is true about the circle in relation to the triangle?

Problem 6 –Extension – Euler's Line

For ΔABC, the four points of concurrency explored in this activity are shown.

Three of the four points constructed are collinear, even as the shape of the triangle is changed. Which three points?

Draw the line through these three points, known as Euler's line. Drag the vertices once again to verify.