You will construct using only a compass and straight edge 5 Missions to demonstrate knowledge of the points of concurrency in Geometry. You may use different color pens or pencils to aid you in showing the points of concurrency. For each mission, you must label ALL congruent angles and segments created.

**This project is Due _____________________ and Late assignment will have a 10% deduction for each school DAY it is late.**

You MUST have construction marks visible for full credit.

For examples on how to do each type of construction, please reference videos found at:

https://www.mathopenref.com/tocs/constructionstoc.html
They have each type of construction; videos and written instructions are available there.

**Constructions used in each mission:**

- **Mission #1** - Lines - Perpendicular bisector of a line segment (midpoint)
- **Mission #2** - Lines - Perpendicular bisector of a line segment ("bisect sides")
- **Mission #3** - Lines - Perpendicular to a line from an external point (Altitude) – the “external point” is the opposite vertex of the segment you are using.
- **Mission #4** - Angles - Bisect an angle
- **Mission #5** - Lines - Perpendicular bisector of a line segment (bisect a given line)

**Hints:** Use pencil and LIGHT arc marks. Remember, don’t touch the pencil, use the compass like a pencil, turn the paper, not your hand. Take your time.
Mission #1 – The Circumcenter

- Construct the Perpendicular Bisectors of the three sides: $\overline{KG}$, $\overline{GF}$, and $\overline{FK}$.
- Label the Midpoints: A, B, and C so A is the midpoint of $\overline{KG}$, B is the midpoint for $\overline{GF}$ and C is the midpoint for $\overline{KF}$.
- The point where the bisectors meet is called the Circumcenter. Label it P.
- Draw a circle with a center of P and a radius of $\overline{PK}$. **Note – the distance from the center of a circle to the outer edge is congruent in all directions**

What segments or angles do you know is congruent in this figure based on the constructions? Write down all congruent pairs:
Mission #2 – The Centroid

- Bisect the three sides: $\overline{KG}$, $\overline{GF}$ and $\overline{FK}$. The point where the bisector intersects $\overline{KG}$, $\overline{GF}$ and $\overline{FK}$ are your midpoints
- Label the Midpoints: R (on $\overline{KG}$), S (on $\overline{GF}$), and T (on $\overline{FK}$)
- Draw the three Medians: Connect Vertices to opposite midpoints so you have the following Medians: $\overline{FR}$, $\overline{GT}$, and $\overline{KS}$
- The point where the Medians meet is called the Centroid. Label it M.

What segments or angles do you know is congruent in this figure based on the constructions? Write down all congruent pairs:
Mission #3 – The Orthocenter

- Construct the Altitudes to the three sides: $\overline{KG}$, $\overline{GF}$, and $\overline{FK}$. Label the FEET of the altitudes: $Q$ (on $\overline{KG}$), $N$ (on $\overline{GF}$), and $E$ (on $\overline{FK}$).
- The point where the altitudes meet is the Orthocenter. Label it $O$.
- Find the Midpoints of: $\overline{OK}$, $\overline{OF}$, and $\overline{OG}$.
- Label the points: H, J, and Z.

We learned basically what an altitude is in chapter 6 section 2.

What segments or angles do you know is congruent in this figure based on the constructions? Write down all congruent pairs:
Mission #4 – The Incenter

- Bisect the three angles of the triangle.
- The point where the bisectors meet is the Incenter. Label it I.
- From the point I, construct a line that is perpendicular to segment $KF$. Label the foot of the perpendicular W.
- With a radius of $IW$, inscribe a circle within the triangle.

What segments or angles do you know is congruent in this figure based on the constructions? Write down all congruent pairs:
Mission #5 – Euler’s Circle / Feuerbach’s Circle

- You must have completed Missions #1 and #3.
- Use Mission #1 to copy the points A, B, C and P onto this page *** (look through the paper, you don’t have to re-construct these).
- From Mission #3, copy the points Q, N, E, H, J, Z, and O onto this page.
- Draw line segment $\overline{OP}$.
- Bisect $\overline{OP}$ and label the Midpoint $V$.
- With the center of the compass at $V$ and a radius equal to $\overline{VA}$ draw a circle.
- Note: Poncelet named this circle “The Nine – Point Circle.” French Geometers called it “Euler’s Circle.” German geometers refer to it as “Feuerbach’s Circle.”

How many of the marked points are on the circle? Write this answer as a sentence: