Honors Geometry
Notes –Section 5.2 Bisectors of Triangles

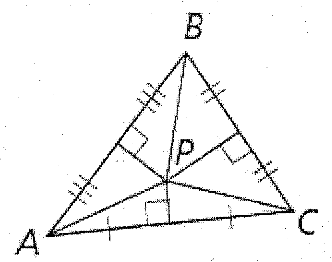
Name________________________________
Date__________________________Period_______

I. **Circumcenter** of a Triangle

A. **Concurrent** – When THREE OR MORE lines intersect at one point.

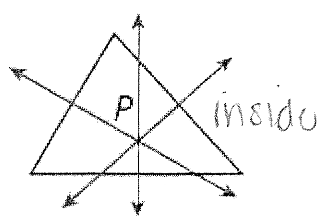
B. **Point of Concurrency** – The point where the lines intersect.

C. **Circumcenter** – Point where the perpendicular bisectors of each side of a triangle intersect.

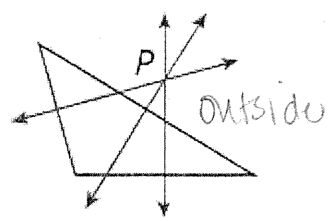
Circumcenter Theorem	Example	What can we conclude?
The **circumcenter** of a triangle is equidistant from the vertices of the triangle. Point P formed by the intersection of ⊥ bisectors.		AP = BP = CP $\overline{AP} \cong \overline{BP} \cong \overline{CP}$

The **circumcenter** can be inside the triangle, outside the triangle, or on the triangle.

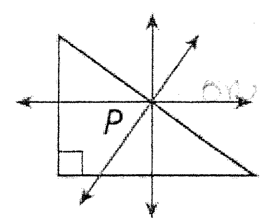
BUT when does this occur? In what types of triangles?



acute triangle



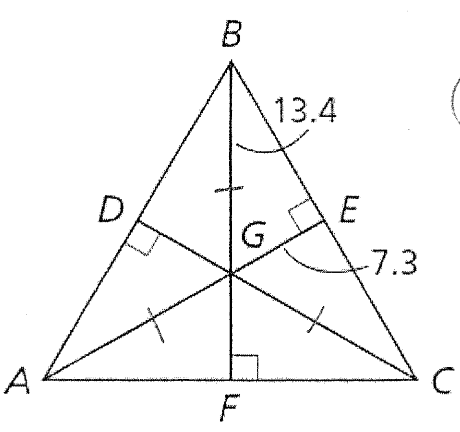
obtuse triangle



right triangle

Example #1: Using Properties of Perpendicular Bisectors

A. $\overline{DG}, \overline{EG}$, and $\overline{FG}$ are the perpendicular bisectors of ΔABC. Find GC. Explain your answer.

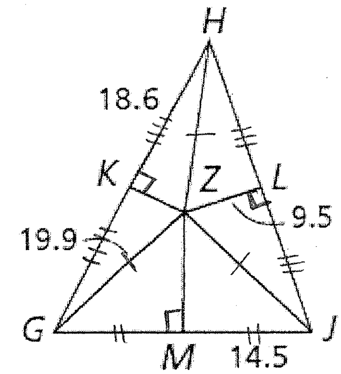


GC = 13.4, because the circumcenter, G, is equidistant from the vertices of the triangle.

GB = GC = GA

13.4 13.4 13.4

B. $\overline{KZ}, \overline{LZ}$, and $\overline{MZ}$ are perpendicular bisectors of ΔGHJ. Find each measure:



1. HZ = 19.9

2. GM = 14.5

3. GK = 18.6

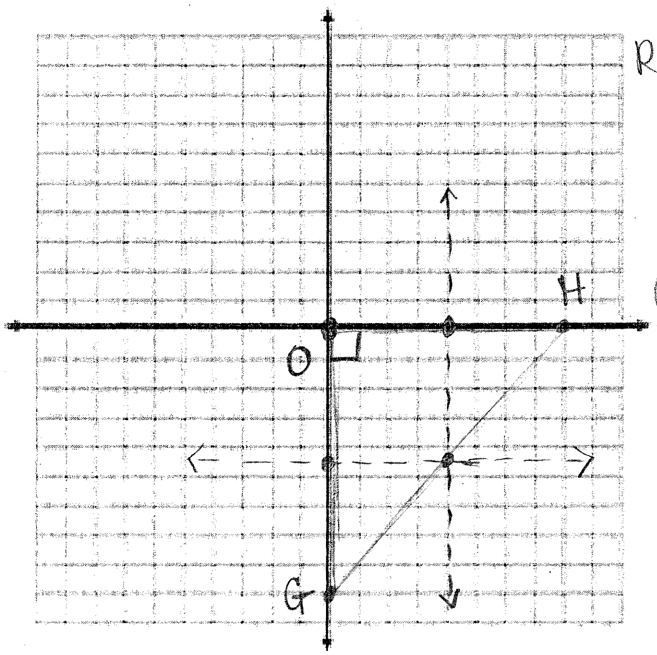
4. JZ = 19.9

Find 2 of 3 ⊥ bisectors!

Example #2: Finding the Circumcenter of a Triangle

↳ Find the intersection of all 3 ⊥ bisectors!

A. Find the circumcenter of ΔGOH with vertices $G(0, -9)$, $O(0,0)$, and $H(8,0)$.



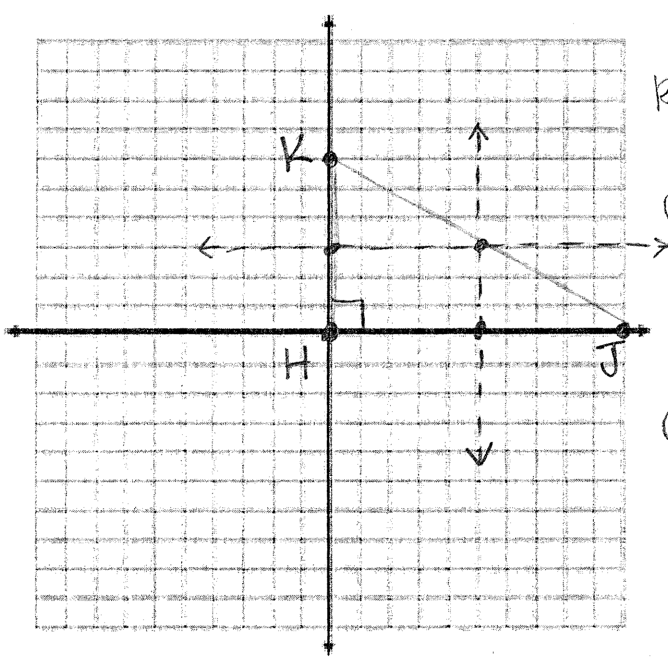
Right triangle, so circumcenter is ON the Δ.

① ⊥ bis. of $\overline{OH}$: $x = 4$

② ⊥ bis. of $\overline{OG}$: $y = -4.5$

circumcenter: (4, −4.5)

B. Find the circumcenter of ΔHJK with vertices $H(0,0)$, $J(10,0)$, and $K(0,6)$.



Right triangle, so circumcenter is ON the Δ.

① ⊥ bis. of $\overline{KH}$: $y = 3$

② ⊥ bis. of $\overline{HJ}$: $x = 5$

circumcenter: (5, 3)

ALWAYS USE THE HORIZONTAL/VERTICAL SIDE(S)!

Honors Geometry Name KEY

Focus – Finding the Circumcenter of a Triangle on the Coordinate Plane

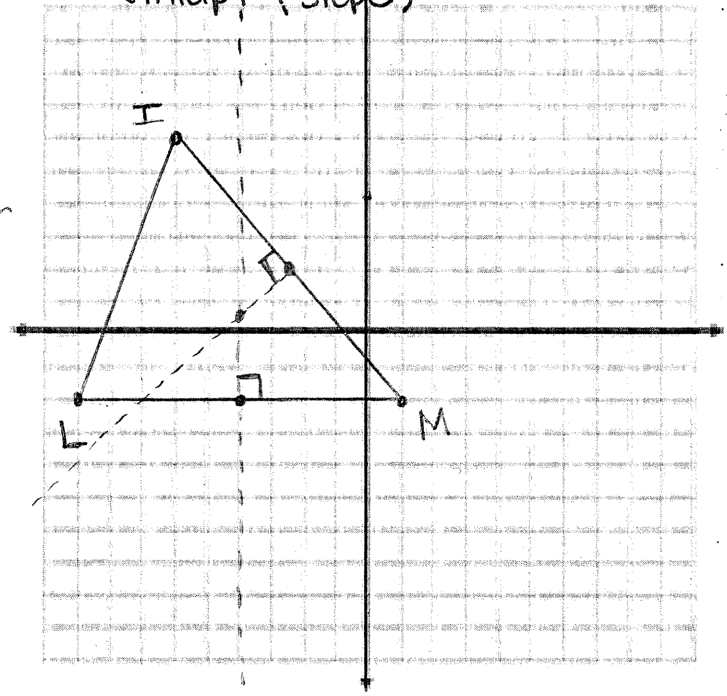
With a partner, think about the following problem: (Be sure to show all work!)

Find the circumcenter of ΔILM (I Love Math) with vertices I(-6,6), L(-9,-2) and M(1,-2).

↳ Find the $\perp$ bisectors and see where they intersect.
(midpt & slope)

Acute Δ
so the circumcenter
is inside the Δ.

* must find 2 of 3
$\perp$ Bisectors.



$\overline{LM}$: $x = -4$

$\overline{IM}$: $m = \left(\frac{-6+1}{2}, \frac{6+(-2)}{2}\right) = \left(\frac{-5}{2}, 2\right) = (-2.5, 2)$

Slope $\overline{IM} = \frac{-2-6}{1+6} = \frac{-8}{7}$

$\perp$ Bis $\Rightarrow \frac{7}{8}$

$y - 2 = \frac{7}{8}\left(x + \frac{5}{2}\right)$

$y - 2 = \frac{7}{8}x + \frac{35}{16}$

$y = \frac{7}{8}x + \frac{67}{16}$

$\cancel{\overline{IL}: m = \left(\frac{-6+(-9)}{2}, \frac{6+(-2)}{2}\right) = \left(\frac{-15}{2}, \frac{4}{2}\right) = (-7.5, 2)}$ DON'T NEED THIS ONE!

$$\begin{cases} x = -4 \\ y = \frac{7}{8}x + \frac{67}{16} \end{cases}$$

$y = \frac{7}{8}(-4) + \frac{67}{16}$

$y = \frac{-28}{8} + \frac{67}{16} \Rightarrow y = \frac{-56}{16} + \frac{67}{16} = \frac{11}{16}$

* $\boxed{(-4, 11/16)}$ *