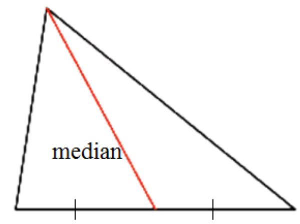
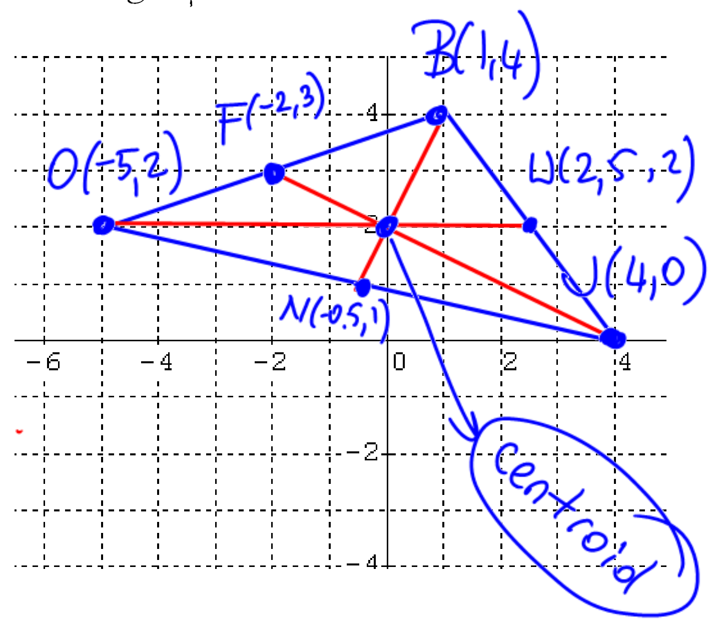
# MEDIAN




Median: A line segment from a vertex to the midpoint of the opposite side.

Ex1. Plot and connect the points J(4, 0), O(-5, 2) and B(1, 4) on the grid provided.




*Median from J to OB:*

1. Determine the midpoint of OB algebraically.

$F(x,y) = \left(\frac{-5+1}{2}, \frac{2+4}{2}\right) = (-2, 3)$

2. Join J to that midpoint. Calculate the slope of the median. (Remember, you have two points: J (4, 0), and the midpoint at (-2, 3).

$m_{FJ} = \frac{y_2-y_1}{x_2-x_1} = \frac{3-0}{-2-4} = \frac{3}{-6} = -1/2$

3. Determine the equation of the median in y=mx+b form.

☑ slope ☑ a point J(4,0)

$y = m(x-p)+q$ (p, q)

$y = -0.5(x-4)+0$

$\boxed{y = -0.5x+2}$

$\frac{1}{2} = 0.5$

*Median from O to JB:*

Step1: Find midpoint

$W(x,y) = \left(\frac{4+1}{2}, \frac{0+4}{2}\right) = (2.5, 2)$

Step2: Find the slope

$m_{WO} = \frac{2-2}{-5-2.5} = 0$

Step3: $y = m(x-p)+q$ W(2.5, 2)

$y = 0(x-2.5)+2$

$\boxed{y=2}$

*Median from B to OJ:*

Step1: $N(x,y) = \left(\frac{4+(-5)}{2}, \frac{0+2}{2}\right) = (-0.5, 1)$

Step2: $m_{NB} = \frac{4-1}{1-(-0.5)} = \frac{3}{1+0.5} = \frac{3}{1.5} = 2$

Step3: $y = m(x-p)+q$ m=2 N(-0.5, 1)

$y = 2[x-(-0.5)]+1$

$y = 2(x+0.5)+1$

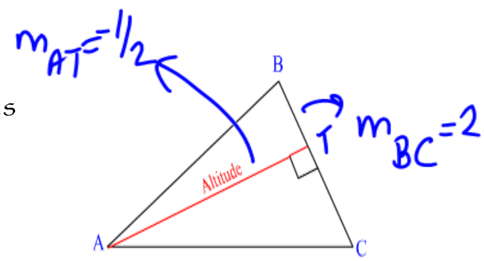
$y = 2x+1+1$

$\therefore y = 2x+2$

The three medians join at the: CENTROID

## ALTITUDE (height)

**Altitude:** The perpendicular line segment from a vertex to the line that contains the opposite side.

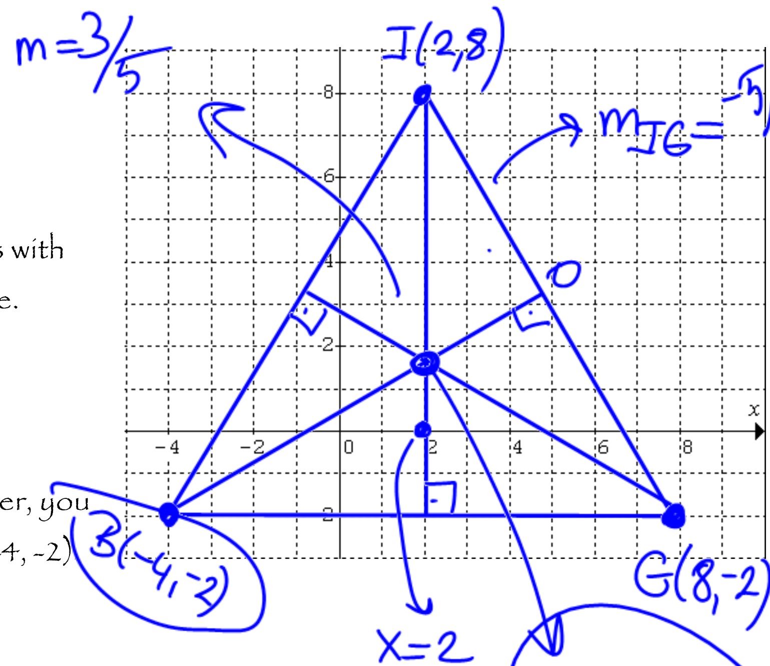



Ex2. Plot and connect the points B (-4, -2), I (2, 8) and G (8, -2) on the grid provided.

*Altitude from B:*

1. Determine the slope of IG.

$$m_{IG}=\frac{-2-8}{8-2}=\frac{-10}{6}=-5/3$$




2. Draw a **perpendicular** line segment that intersects with line IG through B. Determine the slope this altitude.
**(The opposite reciprocal of the slope of line IG)**

$$m_{BO}=3/5$$

3. Determine the equation of this altitude. Remember, you have the slope and one point: slope = $3/5$, and B (-4, -2)

$y=m(x-p)+q \quad m=3/5 \quad B(-4,-2)$

$y=0.6(x-(-4))+(-2)$

$y=0.6(x+4)-2$

$y=0.6x+2.4-2$

$\boxed{y=0.6x+0.4}$

Orthocenter

*Altitude from I:*

$x=2$

*Altitude from G:*

Step1: $m_{BI}=\frac{-2-8}{-4-2}=\frac{-10}{-6}=5/3 \quad m_{altitude}=-3/5$

Step2: $y=m(x-p)+q \quad m=-3/5 \quad G(8,-2)$

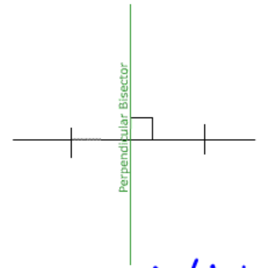
$y=-0.6(x-8)+(-2)$

$y=-0.6x+4.8-2$

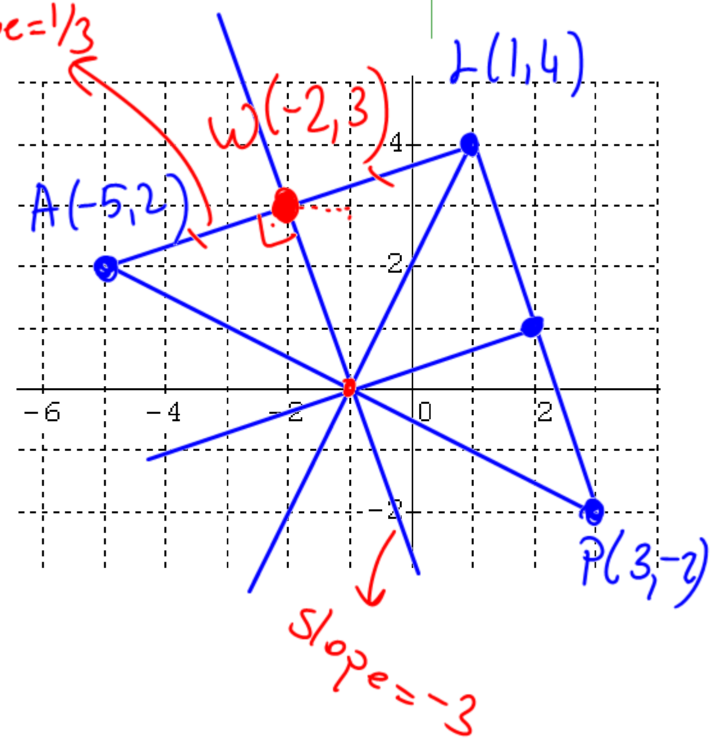
$\boxed{y=-0.6x+2}$ or $y=\frac{-3}{5}x+2$

The three altitudes join at the: ORTOCENTER

# PERPENDICULAR BISECTORS




Perpendicular Bisector: a line (or line segment) that is perpendicular to a segment at its midpoint.




Ex3. Plot and connect the points L(1, 4), A(-5, 2) and P(3, -2) on the grid provided.

## *Perpendicular Bisector of LA:*

1. Determine the midpoint of LA.

$$W(x,y) = \left(\frac{-5+1}{2}, \frac{2+4}{2}\right) = (-2,3)$$

2. Determine the slope of LA.

$$m_{LA} = \frac{4-2}{1-(-5)} = \frac{2}{1+5} = \frac{2}{6} = \frac{1}{3}$$

$$m_{\text{Right bisector}} = \frac{-3 \rightarrow \text{rise}}{1 \rightarrow \text{run}}$$

3. Draw a perpendicular line segment through the midpoint of LA. Determine the slope of right bisector. (The opposite reciprocal of the slope of line segment LA)

$$m_{RB} = -3$$

4. Determine the equation of this perpendicular bisector. Remember, you have the slope and one point: slope = $\underline{-3}$ and the midpoint ($\underline{-2}$, $\underline{3}$).

$$y = m(x-p)+q \qquad m=-3 \qquad (\overset{p}{-2},\overset{q}{3})$$

$$y = -3[x-(-2)]+3$$

$$y = -3(x+2)+3$$

$$y = -3x-6+3$$

$$\boxed{y = -3x-3}$$

*Perpendicular Bisector of AP:*

Step1 : Midpoint of A(-5,2) P(3,-2)

$E(x,y) = \left(\frac{-5+3}{2}, \frac{2+(-2)}{2}\right) = (-1,0)$

Step2 : $m_{AP} = \frac{-2-2}{3-(-5)} = \frac{-4}{8} = \frac{-1}{2}$

$m_{bisector} = 2$

Step : $y = m(x-p)+q$ $m=2$ $E(-1,0)$

$y = 2[x-(-1)]+0$

$y = 2(x+1)$

$\boxed{y = 2x+2}$

*Perpendicular Bisector of LP:*

Step1 : Midpoint of L(1,4) P(3,-2)

$T(x,y) = \left(\frac{1+3}{2}, \frac{4+(-2)}{2}\right) = (2,1)$

Step2 : $m_{LP} = \frac{-2-4}{3-1} = \frac{-6}{2} = -3$

$m_{bisector} = 1/3$

Step3 : $y = m(x-p)+q$ $m = \frac{1}{3}$ $T(2,1)$

$y = \frac{1}{3}(x-2)+1$

$y = \frac{1}{3}x - \frac{2}{3} + 1$

$y = \frac{1}{3}x + \frac{1}{3}$

The three perpendicular bisectors join at the: CIRCUMCENTER