WARM UP **Write an equation of the line passing through point *P* that is perpendicular to the given line.**

1. $P(-2, 4)$, $y = \boxed{-\frac{2}{3}}x + \frac{5}{2}$

$\boxed{y-4=\frac{3}{2}(x+2)}$

2. $P(5, 11)$, $y = 8$ Horiz. line.

$\boxed{x=5}$

3. $P\left(\frac{3}{4}, -9\right)$, $y = x$ slope of 1

$\boxed{y+9=-1\left(x-\frac{3}{4}\right)}$

4. $P(1, -7)$, $y = \boxed{2}x + 3$

$\boxed{y+7=-\frac{1}{2}(x-1)}$

5. $P(3, -2)$, $3x - 5y = 4$

$-5y=-3x+4$
$y=\boxed{\frac{3}{5}}x-\frac{4}{5}$

$\boxed{y+2=-\frac{5}{3}(x-3)}$

6. $P\left(-\frac{1}{2}, -\frac{3}{2}\right)$, $x = -3$ vert. line.

$\boxed{y=-\frac{3}{2}}$

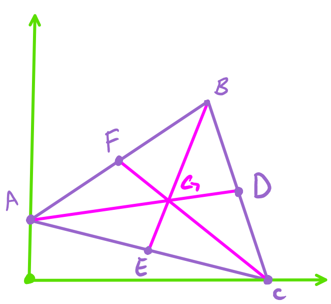
ESSENTIAL QUESTION

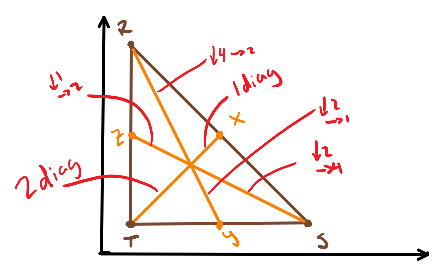
What are the properties of the medians in a triangle? What are the properties of the altitudes in a triangle?

NEEDED VOCAB:
- **Altitude**
- **Centroid**
- **Median**
- **Orthocenter**

GOAL: "I CAN...
Find the points of concurrency for the medians and the altitudes of a triangle."

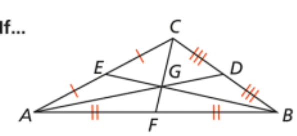
With Your Table
- Draw ΔABC with vertices at: A(0,2), B(6,6) and C(8,0)
- Find the midpoint of all three sides. Starting with the midpoint of BC label them D, E and F. (Clockwise)
- Draw in segment AD. This is called a median of ΔABC.
- Draw in all of the medians of the triangle.
- Label the intersection of the medians as point G.
- What conjecture can you come up with about where the medians of the triangle intersect?
- Need another triangle to figure out the conjecture? Plot R(1,7), S(7,1), T(1,1) and follow the previous steps. This should help you figure out a solid conjecture. Discuss with the table next to you to figure it out.





Centroid Theorem
The centroid of a triangle is two-thirds of the distance from each vertex to the midpoint of the opposite side. The centroid is always inside the triangle.

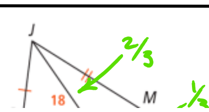
If...



Then...
$AG = \frac{2}{3}AD \quad BG = \frac{2}{3}BE \quad CG = \frac{2}{3}CF$

EXAMPLE 1

In the diagram Q is the centroid. What is the length of $\overline{JN}$?

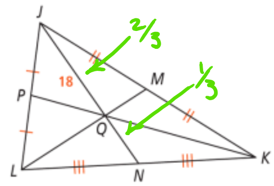


Example 1

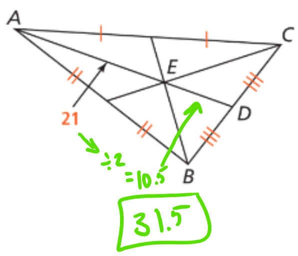
In the diagram Q is the centroid. What is the length of $\overline{JN}$?

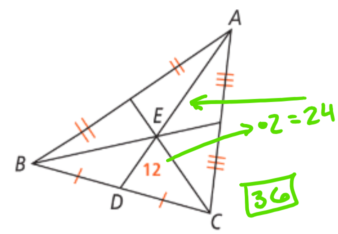
JQ=18 QN=9

$\boxed{JN=27}$



Find AD in both figures.





There are three paths through a triangular park. Each path goes from the midpoint of one edge to the opposite corner. The paths meet at point *P*.

1. Find *PS* and *PC* when *SC* = 2100 feet.

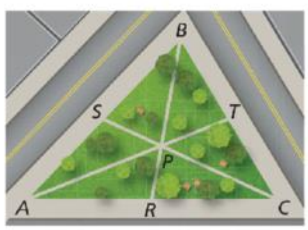
   $\boxed{PS=700 \quad PC=1400}$

2. Find *TC* and *BC* when *BT* = 1000 feet.

   $\boxed{TC=1000 \quad BC=2000}$

3. Find *PA* and *TA* when *PT* = 800 feet.

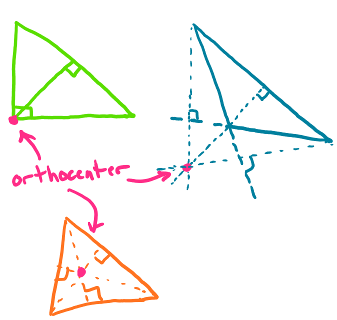
   $\boxed{PA=1600 \quad TA=2400}$



With your Table

- Graph ΔABC and ΔRST. A(4,4), B(7,-2), C(-2,-2), R(7,4), S(7,-4), T(-1,0)
- Make a line from vertex A that intersects segment BC at a perpendicular angle. Label the intersection point D. This is the altitude of the triangle (Height).
- Draw the other two altitudes from B and C and label their intersections E and F respectively.

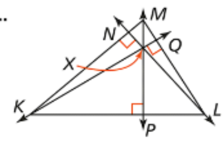
The point of concurrency for the altitudes of a triangle it is call the Orthocenter.



Orthocenter

The lines that contain the altitudes of the triangle are concurrent. This point of concurrency is the orthocenter. It is located IN an acute triangle, ON a right triangle (Vertex of the right angle), and OUTSIDE an obtuse triangle (the obtuse angle points at the orthocenter).

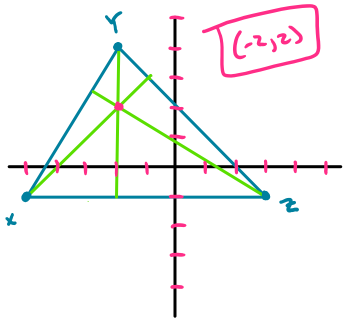
If...



Then... $\overline{KQ}$, $\overline{LN}$, and $\overline{MP}$ are concurrent at X

Example 2

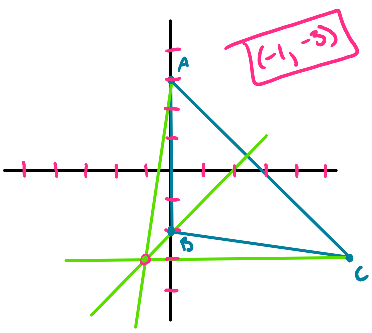
Find the coordinates of the orthocenter of $\triangle XYZ$ with vertices $X(-5, -1)$, $Y(-2, 4)$, and $Z(3, -1)$.



$\boxed{(-2,2)}$

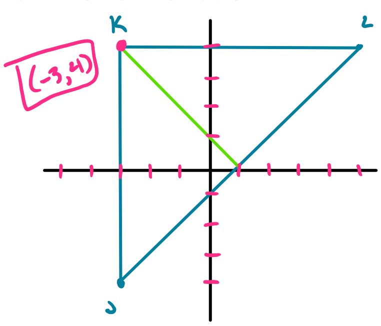
Tell whether the orthocenter of the triangle with the given vertices is *inside*, *on*, or *outside* the triangle. Then find the coordinates of the orthocenter.

6. $A(0, 3)$, $B(0, -2)$, $C(6, -3)$



$\boxed{(-1,-3)}$

7. $J(-3, -4)$, $K(-3, 4)$, $L(5, 4)$



$\boxed{(-3,4)}$

How to find..

Centroid

- Draw the triangle for which you are supposed to find the centroid of.
- Using the slope, find the midpoint of each side of the triangle.
- Using a straight edge, draw in the line between the opposite vertex and the midpoints.

Orthocenter

- Draw the triangle for which you are supposed to find the orthocenter of.
- Find the slope of each side of the triangle.
- Apply the perpendicular slope from the opposite vertex in the direction the orthocenter is.

Homework

Pg. 224
12, 15, 16, 18, 19, 23, 24