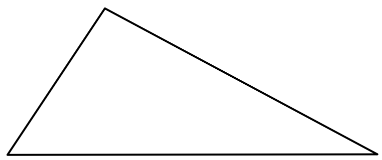
Objective: Identify and use the altitudes in a triangle and their properties

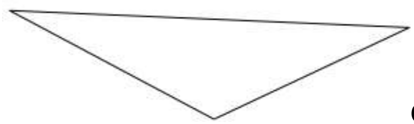
An ____________________ of a triangle is a segment from a vertex to the line containing the opposite side and perpendicular to the line containing that side. Because they are perpendicular to the side, they form a _______ angle with the side that they intersect. Another word for altitude is ______________.

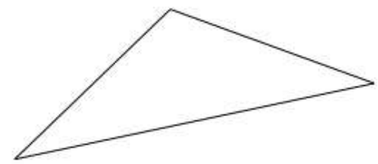
Drawing an altitude

- If using a compass, you would line up the straight line on top of the side for which you are drawing the altitude, and make sure that the ruler side of the compass crosses the vertex across that side.
- If you use a straightedge, you would line up the corner of the straightedge with the side for which you are drawing the altitude, and draw a segment that crosses the vertex across from that side.

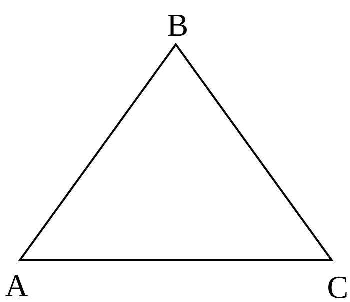
Example 1: Draw all altitudes in each triangle below.

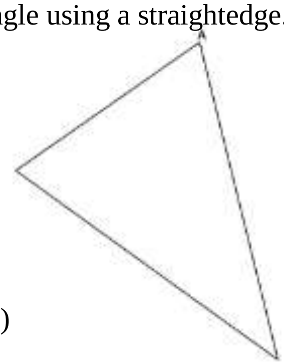
A) 

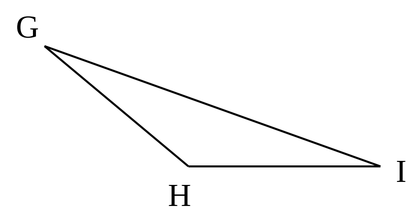
B) 

C) 

Practice 1: Draw all altitudes in each triangle using a straightedge.

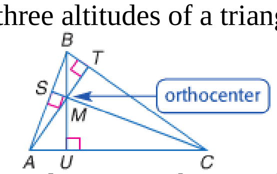
A) 

B) 

C) 

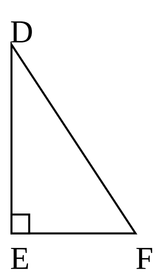
Point of concurrency

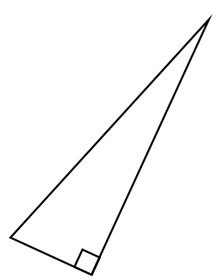
The point of intersection of the three altitudes of a triangle is called the ____________________.

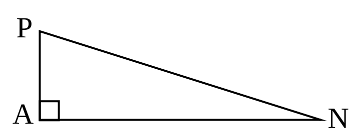


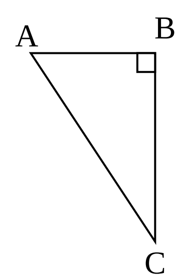
Because the altitudes form right angles, in a right triangle, two of the altitudes will be the ________, and the orthocenter (the point where all the altitudes meet) will be the ____________ formed between both legs.

Example and practice 2: Circle the orthocenter of the triangles below:

A) 

B) 

C) 

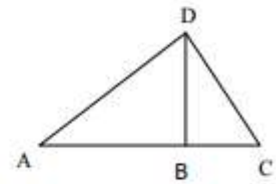
D) 

<u>Using algebra with altitudes</u>

When solving an equation dealing with an altitude, the main point to remember is that altitudes form ______ angles; therefore, if you are dealing with an angle formed by an altitude, you have to set the value of the angle equal to _____, and then solve for the variable.

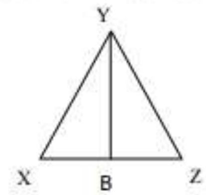
Example 3:

$\overline{DB}$ is an altitude of $\triangle ADC$, and $m\angle DBC = (n^2 + 81)°$. Find the value of n.

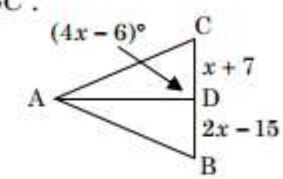


Practice 3:

9) $\overline{YB}$ is an altitude of $\triangle XYZ$, and $m\angle YBZ = (6x - 6)°$. Find the value of x. What is the measure of $\angle YBZ$?

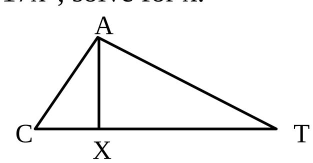


Find x, CD, and DB, if $\overline{AD}$ is an altitude of $\triangle ABC$.



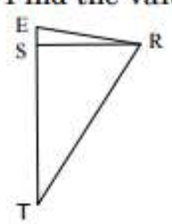
Notice that the altitudes form two __________ ____________ inside of the main triangle. Therefore, if instead of having the algebraic value of the angle formed by the altitude you have the value of the other two angles in one of those two right triangles, then you can ______ those two values, set them equal to _____, and solve for the variable.

Example 4: $\overline{AX}$ is an altitude of ΔCAT. If $m\angle C = (9x + 38)°$ and $m\angle CAX = 17x°$, solve for x.



Practice 4:

$\overline{RS}$ is an altitude of $\triangle RTE$, $m\angle SRT = (4x - 8)°$, and $m\angle STR = (6x + 13)°$. Find the value of x.



Practice 5 (Putting it all together):

17) $\triangle WHA$, if $\overline{WP}$ is a median and an angle bisector, $AP = 3y + 11$, $PH = 7y - 5$, $m\angle HWP = x + 12$, $m\angle PAW = 3x - 2$, and $m\angle HWA = 4x - 16$, find x and y. Is $\overline{WP}$ also an altitude, explain?