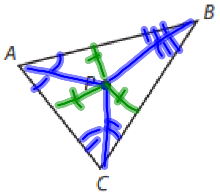
Bell Work

P is the incenter of $\triangle ABC$. Determine whether each statement is true or false. Select the correct answer for each lettered part.



a. Point *P* must lie on the perpendicular bisector of $\overline{BC}$. ○ True ● False

b. Point *P* must lie on the angle bisector of $\angle C$. ● True ○ False

c. If *AP* is 23 mm long, then *CP* must be 23 mm long. ○ True ● False

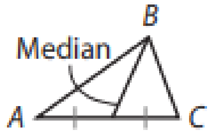
d. If the distance from point *P* to $\overline{AB}$ is *x*, then the distance from point *P* to $\overline{BC}$ must be *x*. ● True ○ False

e. The perpendicular segment from point *P* to $\overline{AC}$ is longer than the perpendicular segment from point *P* to $\overline{BC}$. ○ True ● False

8.3 Medians and Altitudes of Triangles

Tear out pages 383 - 388

A **median** of a triangle is a segment whose endpoints are a vertex of a triangle and the midpoint of the opposite side.

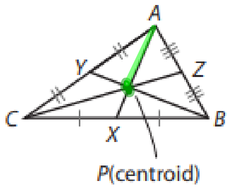


Median - Goes to opposite Midpoint
Does not make 90° angle

Centroid(center of gravity)- the point of concurrency of the three medians of a triangle

Centroid Theorem

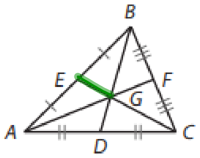
The centroid theorem states that the **centroid** of a triangle is located $\frac{2}{3}$ of the distance from each vertex to the midpoint of the opposite side.



$AP = \frac{2}{3}AX$ $\quad BP = \frac{2}{3}BY$ $\quad CP = \frac{2}{3}CZ$

Example 1 Use the Centroid Theorem to find the length.

$AF = 9$, and $CE = 7.2$



Ⓐ $AG = \frac{2}{3}AF$

$AG = \frac{2}{3}(9)$

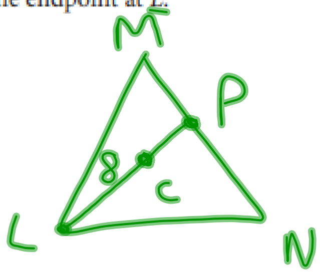
$AG = 6$

Ⓑ $GE = \frac{1}{3}CE$

$GE = \frac{1}{3}(7.2)$

$GE = 2.4$

6. Vertex L is 8 units from the centroid of $\triangle LMN$. Find the length of the median that has one endpoint at L.

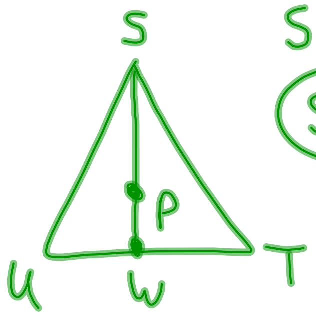


$LC = \frac{2}{3}LP$

$\frac{8}{\left(\frac{2}{3}\right)} = \frac{\cancel{\frac{2}{3}}LP}{\cancel{\frac{2}{3}}}$

$12 = LP$

7. Let P be the centroid of $\triangle STU$, and let $\overline{SW}$ be a median of $\triangle STU$. If $SW = 18$, find SP and PW.

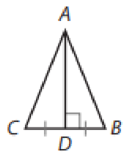


$SP = \frac{2}{3}(18)$

$SP = 12$

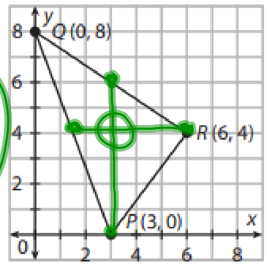
$PW = 6$

8. In $\triangle ABC$, the median $\overline{AD}$ is perpendicular to $\overline{BC}$. If $AD = 21$ feet, describe the position of the centroid of the triangle.



Example 2 Find the coordinates of the centroid of the triangle shown on the coordinate plane.

Median: Angle to M.P. $= \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$



$QR = \left(\frac{0+6}{2}, \frac{8+4}{2}\right)$

$QR = (3, 6)$

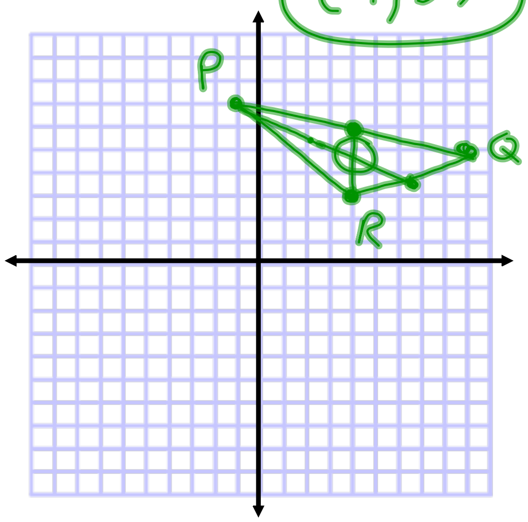
$PQ = \left(\frac{0+3}{2}, \frac{8+0}{2}\right) = (1.5, 4)$

$(3, 4)$

Find the centroid of the triangles with the given vertices. Show your work and check your answer.

9. $P(-1, 7)$, $Q(9, 5)$, $R(4, 3)$

$(4, 5)$



$PQ = \left(\frac{-1+9}{2}, \frac{7+5}{2}\right)$

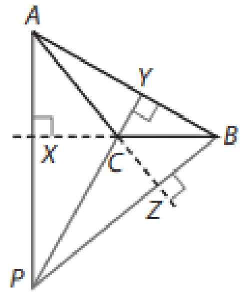
$PQ = (4, 6)$

$RQ = \left(\frac{9+4}{2}, \frac{5+3}{2}\right)$

$RQ = (6.5, 4)$

An **altitude** of a triangle is a perpendicular segment from a vertex to the line containing the opposite side. Every triangle has three altitudes. An altitude can be inside, outside, or on the triangle.

The orthocenter of a triangle is the point of concurrency of the altitudes in a triangle. Point C is the orthocenter for Triangle ABP



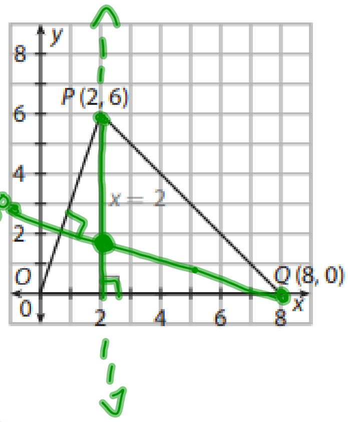
Example 3 **Find the orthocenter of the triangle by graphing the perpendicular lines to the sides of the triangle.**

Altitudes - Vertex to opp. side

Must make 90°

Opp. Rec. Slopes

Slope OP $= \frac{6}{2} = \frac{3}{1} \rightarrow \boxed{-\frac{1}{3}}$

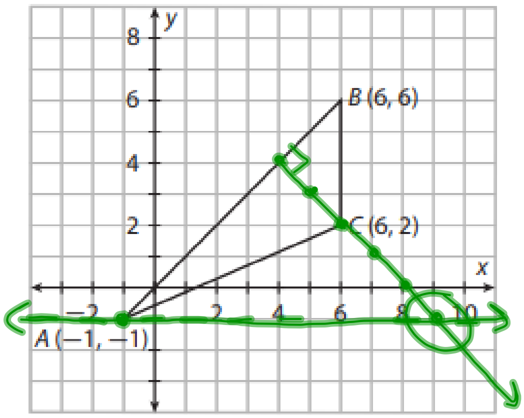


(2, 2)

(B)

$AB = \frac{1}{1} \rightarrow \frac{-1}{1}$

$(9,-1)$



Homework

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