Name ____ Date __________

6.3 Medians and Altitudes of Triangles

For use with Exploration 6.3

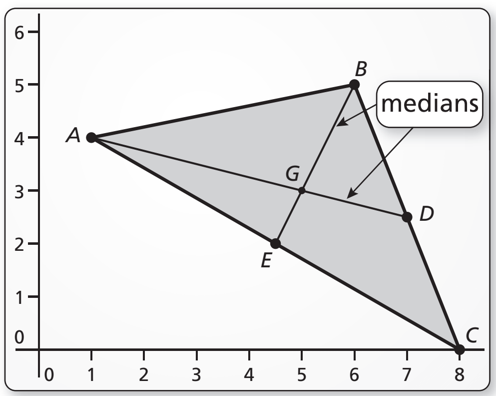
Essential Question What conjectures can you make about the medians and altitudes of a triangle?

1 EXPLORATION: Finding Properties of the Medians of a Triangle

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

Work with a partner. Use dynamic geometry software. Draw any $\triangle ABC$.

a. Plot the midpoint of $\overline{BC}$ and label it D. Draw $\overline{AD}$, which is a *median* of $\triangle ABC$. Construct the medians to the other two sides of $\triangle ABC$.



Sample
Points
$A(1, 4)$
$B(6, 5)$
$C(8, 0)$
$D(7, 2.5)$
$E(4.5, 2)$
$G(5, 3)$

b. What do you notice about the medians? Drag the vertices to change $\triangle ABC$. Use your observations to write a conjecture about the medians of a triangle.

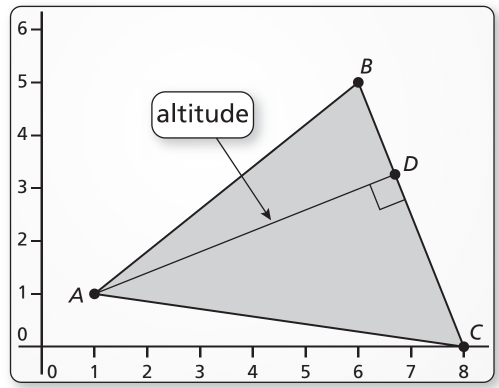
c. In the figure above, point G divides each median into a shorter segment and a longer segment. Find the ratio of the length of each longer segment to the length of the whole median. Is this ratio always the same? Justify your answer.

2 EXPLORATION: Finding Properties of the Altitudes of a Triangle

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

Work with a partner. Use dynamic geometry software. Draw any $\triangle ABC$.

a. Construct the perpendicular segment from vertex A to $\overline{BC}$. Label the endpoint D. $\overline{AD}$ is an *altitude* of $\triangle ABC$.



b. Construct the altitudes to the other two sides of $\triangle ABC$. What do you notice?

c. Write a conjecture about the altitudes of a triangle. Test your conjecture by dragging the vertices to change $\triangle ABC$.

Communicate Your Answer

3. What conjectures can you make about the medians and altitudes of a triangle?

4. The length of median $\overline{RU}$ in $\triangle RST$ is 3 inches. The point of concurrency of the three medians of $\triangle RST$ divides $\overline{RU}$ into two segments. What are the lengths of these two segments?

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6.3 Notetaking with Vocabulary

For use after Lesson 6.3

In your own words, write the meaning of each vocabulary term.

median of a triangle

centroid

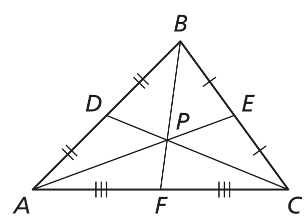
altitude of a triangle

orthocenter

Theorems

Theorem 6.7 Centroid Theorem

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



The medians of $\triangle ABC$ meet at point P, and

$AP = \frac{2}{3}AE$, $BP = \frac{2}{3}BF$, and $CP = \frac{2}{3}CD$.

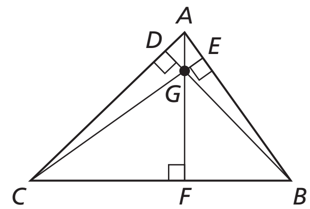
Notes:

Core Concepts

Orthocenter

The lines containing the altitudes of a triangle are concurrent. This point of concurrency is the **orthocenter** of the triangle.

The lines containing $\overline{AF}$, $\overline{BD}$, and $\overline{CE}$ meet at the orthocenter G of $\triangle ABC$.

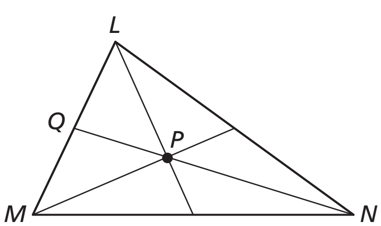


Notes:

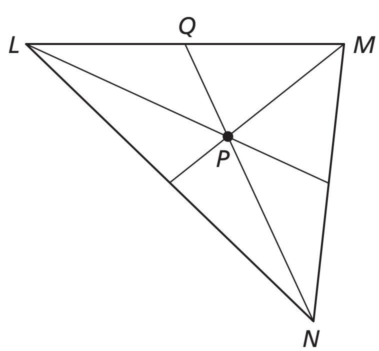
Extra Practice

In Exercises 1–3, point *P* is the centroid of △*LMN*. Find *PN* and *QP*.

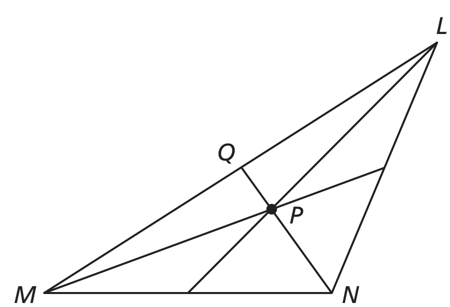
1. $QN = 33$



2. $QN = 45$



3. $QN = 39$



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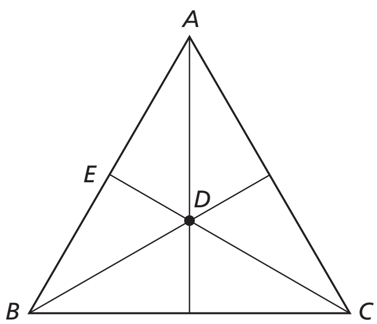
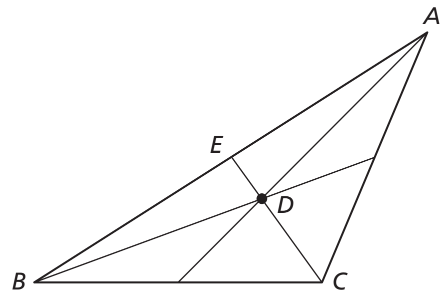
6.3 Notetaking with Vocabulary (continued)

In Exercises 4 and 5, point *D* is the centroid of $\triangle ABC$. Find *CD* and *CE*.

4. $DE = 7$

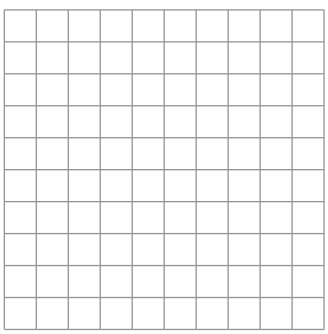


5. $DE = 12$

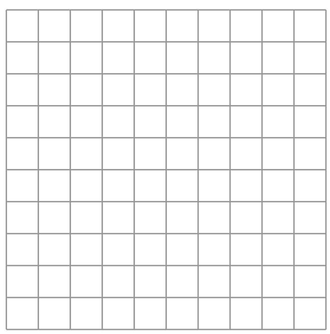


In Exercises 6–8, find the coordinates of the centroid of the triangle with the given vertices.

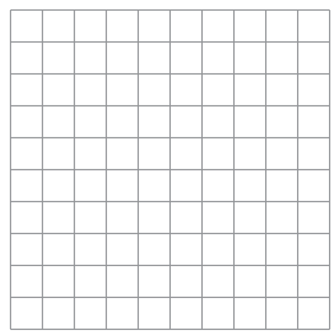
6. $A(-2, -1), B(1, 8), C(4, -1)$



7. $D(-5, 4), E(-3, -2), F(-1, 4)$

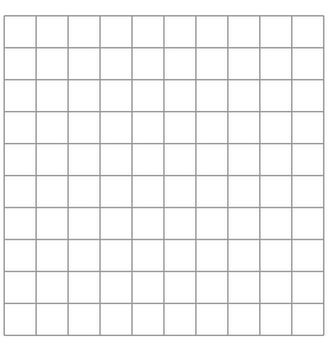


8. $J(8, 7), K(20, 5), L(8, 3)$

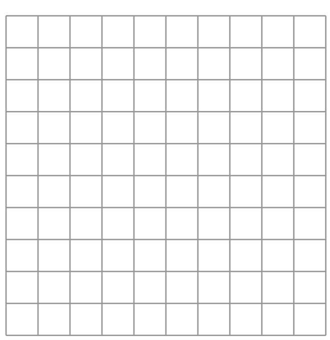


In Exercises 9–11, tell whether the orthocenter is *inside, on,* or *outside* the triangle. Then find the coordinates of the orthocenter.

9. $X(3, 6), Y(3, 0), Z(11, 0)$



10. $L(-4, -4), M(1, 1), N(6, -4)$



11. $P(3, 4), Q(11, 4), R(9, -2)$