PRACTICE & PROBLEM SOLVING

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Practice Tutorial

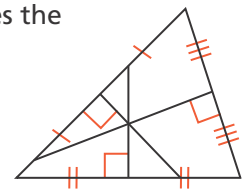
Additional Exercises Available Online

UNDERSTAND

10. Make Sense and Persevere Describe the process for finding the orthocenter of a triangle that is on a coordinate plane.

11. Look for Relationships Given the midpoints of a triangle, which two points of concurrency can you locate? Which point of concurrency can you locate if you only know the angle bisectors? Which two points of concurrency can you locate by only drawing perpendicular segments?

12. Error Analysis A student uses the following explanation to identify the triangle's point of concurrency. Explain the student's error.

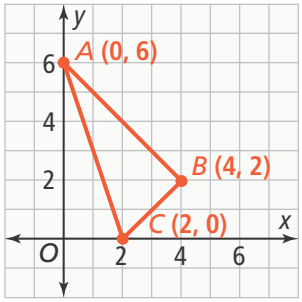


> A perpendicular segment bisects each side of the triangle. According to the Concurrency of Altitudes Theorem, the segments are concurrent. The point of concurrency is the orthocenter. ✗

13. Reason Draw several different types of triangles and compare the locations of the centroid and the circumcenter of each triangle. What conjecture can you make about the type of triangle that has a common centroid and circumcenter? Explain.

14. Mathematical Connections Where is the centroid of $\triangle ABC$?

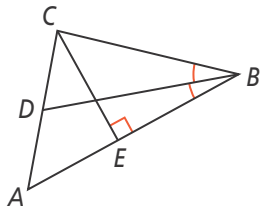
- Locate the midpoints of any two sides.
- Find the equations of two medians using the vertex and the opposite midpoint.
- Solve the system of the two equations to find the coordinates of the centroid.

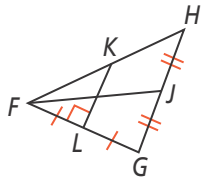


How can you verify that the coordinates you found are correct?

PRACTICE

15. Identify whether each segment is an altitude, an angle bisector, a median, or a perpendicular bisector. SEE EXAMPLE 1

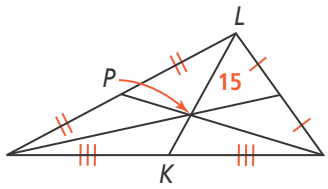




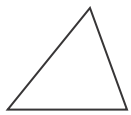
a. $\overline{BD}$ **b.** $\overline{FJ}$

c. $\overline{CE}$ **d.** $\overline{KL}$

16. What is the value of $\overline{KL}$? SEE EXAMPLE 2

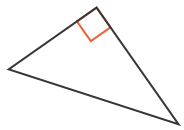


17. Copy the triangle and use its medians to locate the centroid. SEE EXAMPLE 3

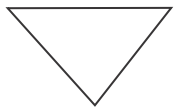


18. State whether the orthocenter of each triangle is inside the triangle, outside the triangle, or on the triangle. Explain your reasoning. SEE EXAMPLE 4

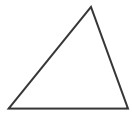
a.



b.



c.



d.

19. Find the coordinates of the orthocenter of a triangle with vertices at each set of points on a coordinate plane. SEE EXAMPLE 5

a. (0, 0), (8, 4), (4, 22)

b. (3, 1), (10, 8), (5, 13)

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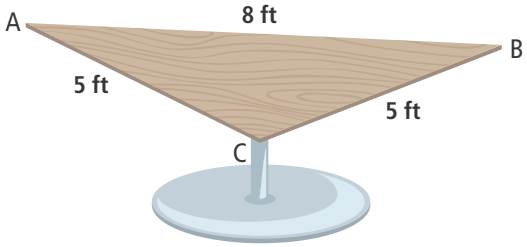
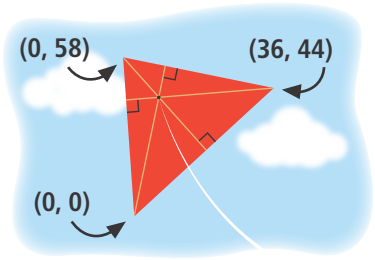
APPLY

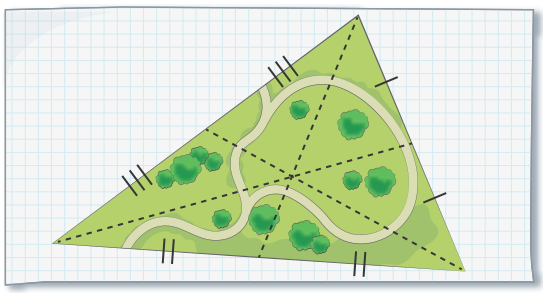
20. Model With Mathematics A large triangular-shaped table is supported by a single pole at the center of gravity. How far is vertex *C* from the center of gravity?



21. Reason To support a triangular kite, Hana attaches thin strips of wood from each vertex perpendicular to the opposite edge. She then attaches the kite's string at the point of concurrency. To calculate the point of concurrency, she determines the coordinates of each vertex on a coordinate plane. What are the coordinates where the wood strips cross? Round your answer to the nearest hundredth.

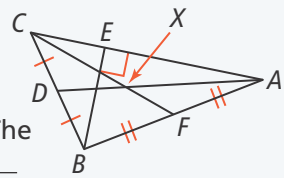


22. Higher Order Thinking A designer wants to place a fountain at the intersection of the shortest paths from each side to the opposite vertex. What mistake is made on her model? At what point of concurrency should the fountain be located?



ASSESSMENT PRACTICE

23. Identify the segments and point in $\triangle ABC$.

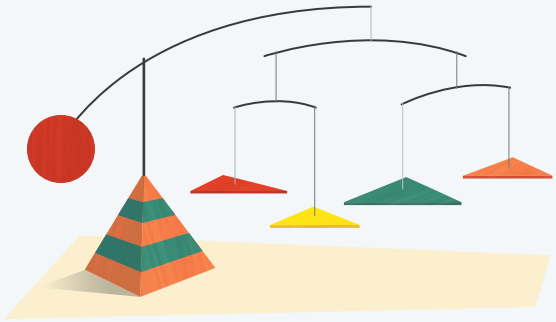


The segment $\overline{AD}$ is a(n) ___?___ of the triangle. The segment $\overline{BE}$ is a(n) ___?___ of the triangle. The point *X* is the ___?___ of the triangle.

24. SAT/ACT A triangle with vertices at (3, 4) and (9, 17) has a centroid at (8, 16). What are the coordinates of the third vertex?

Ⓐ (10, 4)
Ⓑ (10, 7)
Ⓒ (12, 14)
Ⓓ (12, 27)

25. Performance Task Steve is designing a mobile with triangular pieces of wood, where each piece attaches to a wire at the center of gravity and hangs parallel to the ground. The side lengths of the triangles will be between 4 cm and 8 cm.



Part A Describe how Steve can find the center of gravity for any triangular piece. Then model this process by finding the center of gravity of a triangle with side lengths 5 cm, 5 cm, and 6 cm.

Part B Is it possible for a triangle attached at the orthocenter to hang so that it is parallel to the ground? If it is possible, describe the triangle. What are possible side lengths for such a triangle? If it is not possible, explain why not.