

Altitudes in a Triangle

Name(s): _____

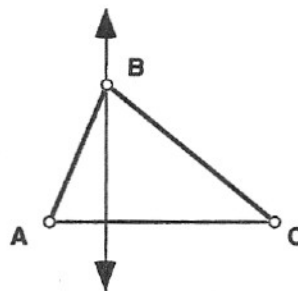
In this investigation, you'll discover some properties of altitudes in a triangle. An *altitude* is a perpendicular segment from a vertex of a triangle to the opposite side (or to a line containing the side). The side where the altitude ends is the *base* for that altitude, and the length of the altitude is the *height* of the triangle from that base. Because a triangle has three sides, it also has three altitudes. You'll construct one altitude and make a script for the construction. Then you'll use your script to construct the other two.

Sketch and Investigate

1. Construct triangle ABC .

2. Construct a line perpendicular to \overline{AC} through point B .

Q1 As long as your triangle is acute, this perpendicular line should intersect a side of the triangle. Drag point B so that the line falls outside the triangle. Now what kind of triangle is it?



Select point B and \overline{AC} ; then, in the **Construct** menu, choose **Perpendicular Line**.

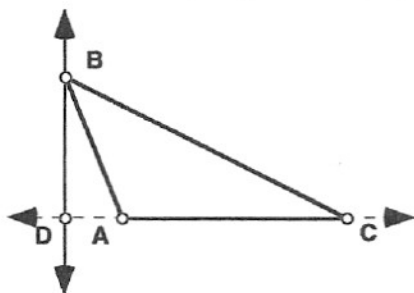
Hold the mouse button down on the **Segment** tool and drag right to choose the **Line** tool. Construct your line through the endpoints of the triangle side.

3. With the perpendicular line outside the triangle, use a line to extend side AC so that it intersects the perpendicular line.

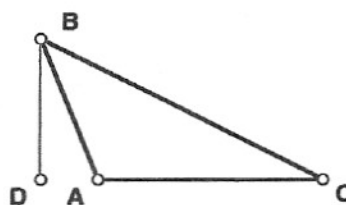
4. Construct point D , the point of intersection of the extended side and the perpendicular line.

5. Hide the lines.

6. Construct \overline{BD} . Segment BD is an altitude.



Steps 3 and 4



Steps 5 and 6

7. Drag vertices of the triangle and observe how your altitude behaves.

Q2 Where is your altitude when $\angle A$ is a right angle?



Altitudes in a Triangle (continued)

Select everything in your sketch; then, in the **Work** menu, choose **Make Script**.

Starting with three points (the script's "givens"), the script will construct a triangle and an altitude from one of the vertices. To use the script, choose it from the **Script** tool and click on the three triangle vertices, or select the vertices first and click **Play** or **Fast** on the script window controls.

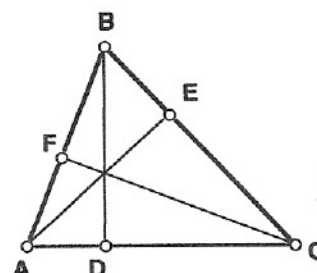
8. Drag your triangle so that it is acute again (with the altitude falling inside the triangle).

9. Make a script for this construction.

10. Use your script on the triangle's vertices to construct a second altitude. Don't worry if you accidentally construct the altitude that already exists. Just use the script on the vertices again in a different order until you get another altitude.

11. Use your script to construct the third altitude in the triangle.

12. Drag the triangle and observe how the three altitudes behave.



Step 11

Q3 What do you notice about the three altitudes when the triangle is acute?



Q4 What do you notice about the altitudes when the triangle is obtuse?

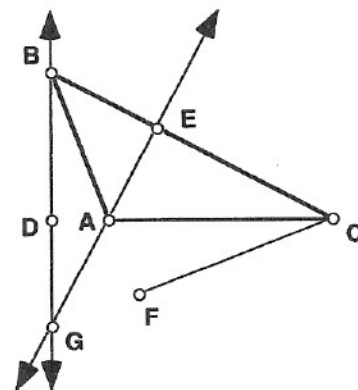


When the triangle is obtuse, the three altitudes don't intersect. But do you think they would if they were long enough? Follow the steps below to investigate that question.

13. Make sure the triangle is obtuse. Construct two lines that each contain an altitude.

14. Construct their point of intersection. This point is called the *orthocenter* of the triangle.

15. Construct a line containing the third altitude.



Steps 13 and 14

16. Drag the triangle and observe the lines.

Q5 What do you notice about the lines containing the altitudes?



Explore More

1. Hide everything in your sketch except the triangle and the orthocenter. Make and save a script. You can use this script in other investigations of triangle centers.