



# Perpendicular bisectors

from the Esri GeoInquiries™ collection for Mathematics

Target audience – Geometry learners

Time required – 15 minutes

## Activity

Starting with the location of all Life Flight hospitals in a state, use perpendicular bisectors to draw boundaries between Life Flight regions, which will inform first responders.

## Math Standards

**CCSS: Math.Content.HSG.CO.C.9.** Prove theorems about lines and angles. Theorems include points on a perpendicular bisector of a line segment that are exactly those equidistant from the segment's endpoints.

**CCSS: Math.Content.HSG.CO.D.12.** Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, and so on), constructing perpendicular lines, including the perpendicular bisector of a line segment.

## Learning Outcomes

- Students will construct a perpendicular bisector.
- Students will show that all points on a perpendicular bisector are equidistant from the endpoints and draw a response area boundary.

Map URL: <http://esriurl.com/mathGeoInquiry13>



## Engage

### Who do you call?

- Click the link above to launch the map.
- Read aloud: “North Carolina has seven hospitals with helicopter ambulances that can fly 150 miles to an emergency. Show first responders in Caldwell County, North Carolina, which hospital to contact depending on where in the county the emergency is located.”
- ? Which parts of the county are closer to Asheville, to Winston-Salem, and to Charlotte? *[Student responses will vary.]*
- With the Details button depressed, click the button, (Show) Contents.
- Click the checkbox to the left of the layer name, Life Flight Ranges.
- ? What do these represent? *[Responses will vary]*



## Explore

### Where do you draw the line?

- Read aloud: “Each circle represents the 150-mile range each helicopter could potentially reach. Three Life Flight helicopters could reach any part of Caldwell County.”
- You will find the boundaries for Caldwell County showing which hospital to call.
- Turn off the layer, Life Flight Ranges,
- Turn on the layer, Asheville/Charlotte Ranges.
- ? How could these two circles be used to draw a boundary showing which of the two hospitals is closest? *[Draw a line connecting intersections of the circles.]*
- Turn on the layer, Asheville/Charlotte Boundary.
- ? In geometry, what is this boundary called? *[Perpendicular bisector]*

## Explain

### Why does a perpendicular bisector work?

? Why does the perpendicular bisector form the proper boundary? *[Points on a perpendicular bisector are exactly equidistant from the segment's endpoints.]*

- Turn on the layer, Asheville/Winston-Salem Ranges And Boundary . Note the perpendicular bisector between those two cities.
- Turn on the Charlotte/Winston-Salem Ranges And Boundary layer to see the perpendicular bisector between those two cities.
- Read aloud, “All three perpendicular bisectors cross Caldwell County.”
- Zoom in to Caldwell County and determine which parts of those bisectors form the boundaries for the nearest-hospital sections.
- Turn on the layer, Nearest Hospital Boundaries. Note how the perpendicular bisectors divide Caldwell County.

## Elaborate

### Will the boundaries help others?

- Zoom out to the counties around Caldwell.
- ? Could the perpendicular bisectors that you constructed help any of these other counties' first responders determine which hospital to call? *[Yes, it would help Alexander County's first responders.]*

## Evaluate

### Is there another county like Caldwell?

- Zoom out to look at the map of all the counties of North Carolina.
- ? Are there any other counties that might need to be divided into three sections, similar to Caldwell County? *[Yes, Montgomery County]*

## USE THE MEASURE TOOL

- Click Measure, select the Distance button, and from the drop-down list, choose a unit of measurement.
- On the map, click once to start the measurement, click again to change direction, and double-click to stop measuring.
- Hint: Position the area of interest on the map so that it is not obscured by the Measure window.

## ADD MAP NOTES

- Click Add and from the drop-down list, choose Add Map Note.
- Type a name, select a template from the drop-down list, and click Create.
- In the Add Features pane, choose a symbol and click in the map to place it.
- In the pop-up window, add your desired information.

## Next Steps

DID YOU KNOW? ArcGIS Online is a mapping platform freely available to public, private, and home schools. A school subscription provides additional security, privacy, and content features. Learn more about ArcGIS Online and how to get a school subscription at <http://www.esri.com/schools>.

THEN TRY THIS...

- Create buffers around each Life Flight hospital using the maximum distances found in the pop-up to find the small area of North Carolina not reachable by any of the North Carolina Life Flight helicopters.
- Use the Derive New Locations function in the Analysis tools to create the boundaries for Caldwell County only.

## TEXT REFERENCES

This GIS map has been cross-referenced to material in sections of chapters from these high school texts.

- *Geometry by Holt, Rinehart & Winston — Chapter 5*
- *Geometry by Houghton Mifflin — Chapter 4*
- *Geometry by Moise & Downs — Chapter 6*