DESIGN&PITCH CHALLENGE

HOW TO USE GEOGEBRA FOR POWER ME UP

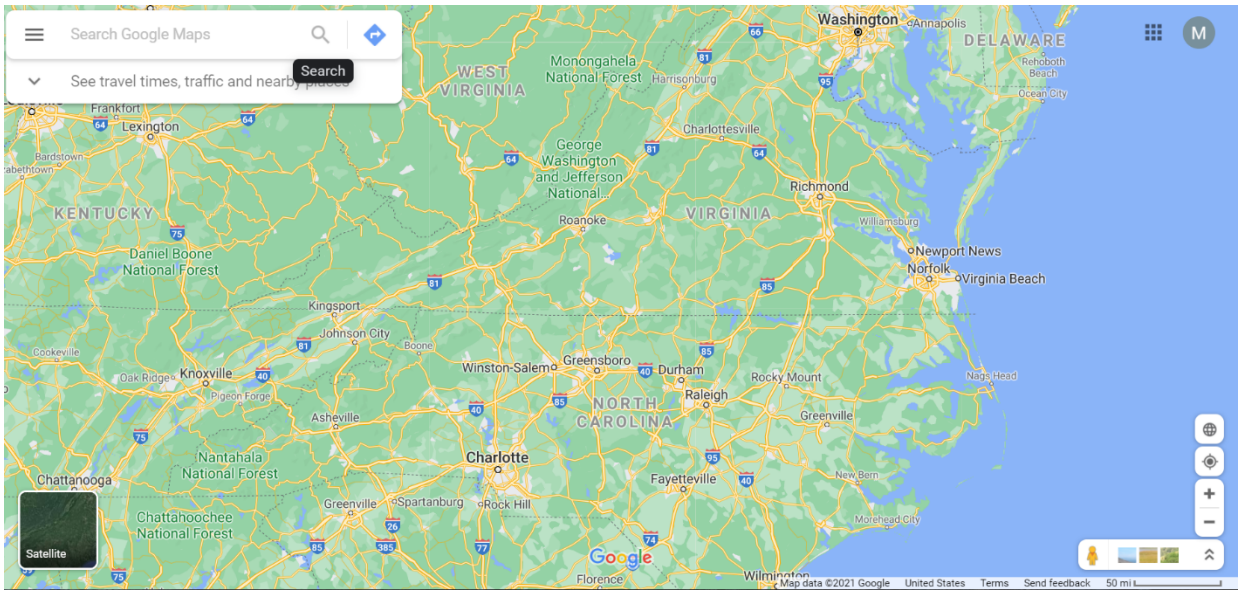
Using Google Maps and GeoGebra to Plan where to Build Charging Stations

In the Power Me Up challenge, you will need to show where you plan to build your electric car charging stations. This tutorial will show you how to use Google Maps and GeoGebra to:

1) Plot points on a map,
2) Measure distances between points on a map, and
3) Plot points so that they are a desired distance apart.

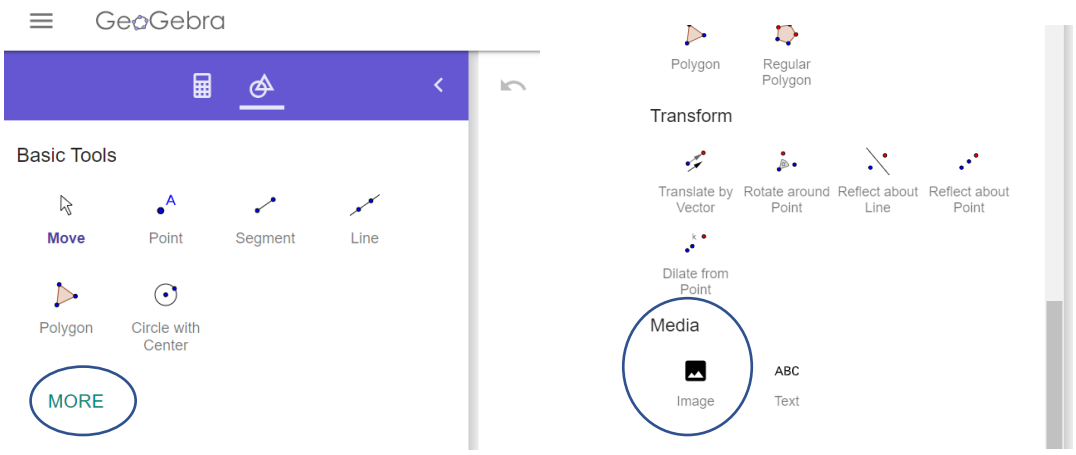
Plotting Points on a Map

1. Open Google Maps and take a screenshot of the area in which you plan to build your charging stations (***Note:*** make sure your screenshot includes the map scale in the bottom right corner of Google Maps, you will need it later). Once you are happy with your screenshot, save it. For this tutorial, we took a screenshot of North Carolina and Virginia.

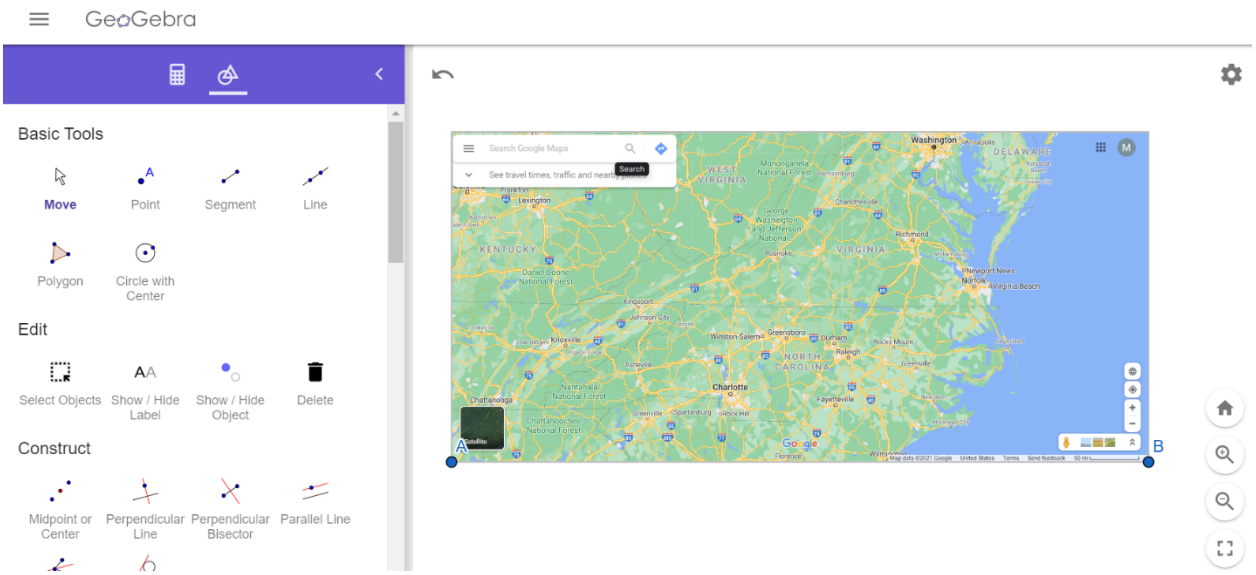


2. Now that you have your map, you will need to import it to GeoGebra so that you can add points. Open the Geometry app in GeoGebra (https://www.geogebra.org/geometry).

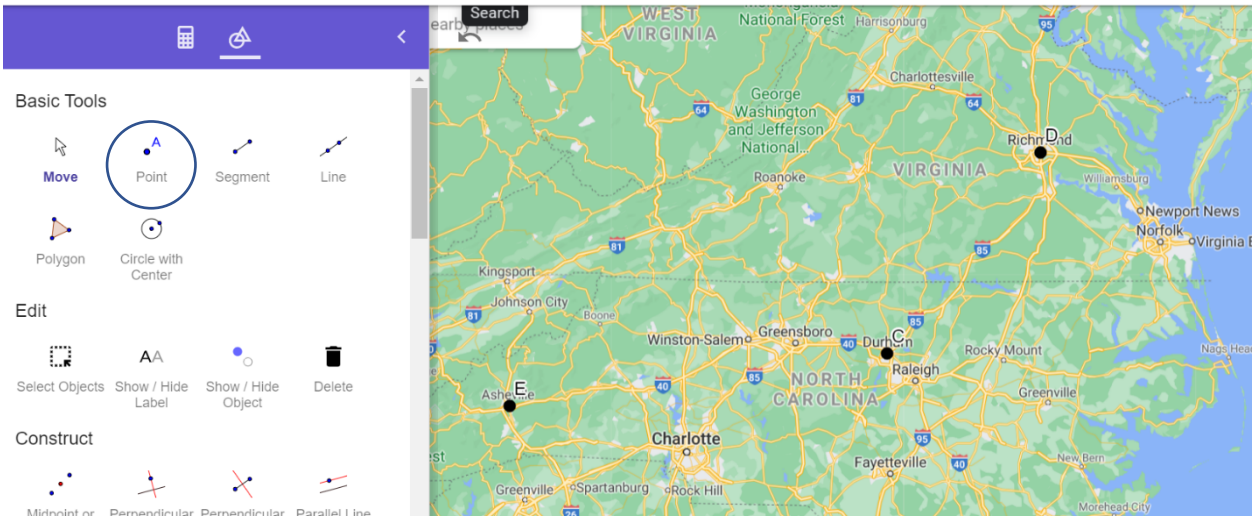
3. In the tool menu on the left of the screen, select “more” and then “image.” Select your Google Maps screenshot to add it to your workspace.



4. Your Google Maps screenshot should now be in your workspace. Try zooming in and out on your map and moving and resizing your map. To zoom, use the zoom magnifying glasses (bottom right) or a two-finger scroll on your computer touchpad. To move your image, select “move” in the tool bar, then click and drag the image. To resize your image, click and drag point A or point B (bottom left and right corners of the image).



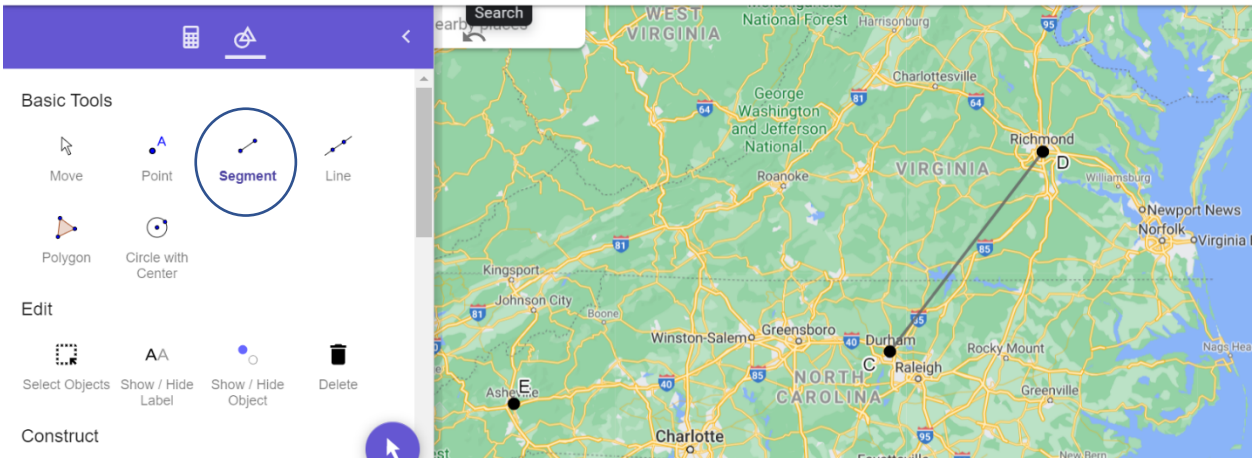
5. Now, add points to your map using the “Point” tool. Select “Point” in the tool menu, then click on the map where you want to add a point. We added points in Durham, NC (point C), Richmond, VA (point D), and Asheville, NC (point E). Try adding points to your map. These points could represent your charging stations.



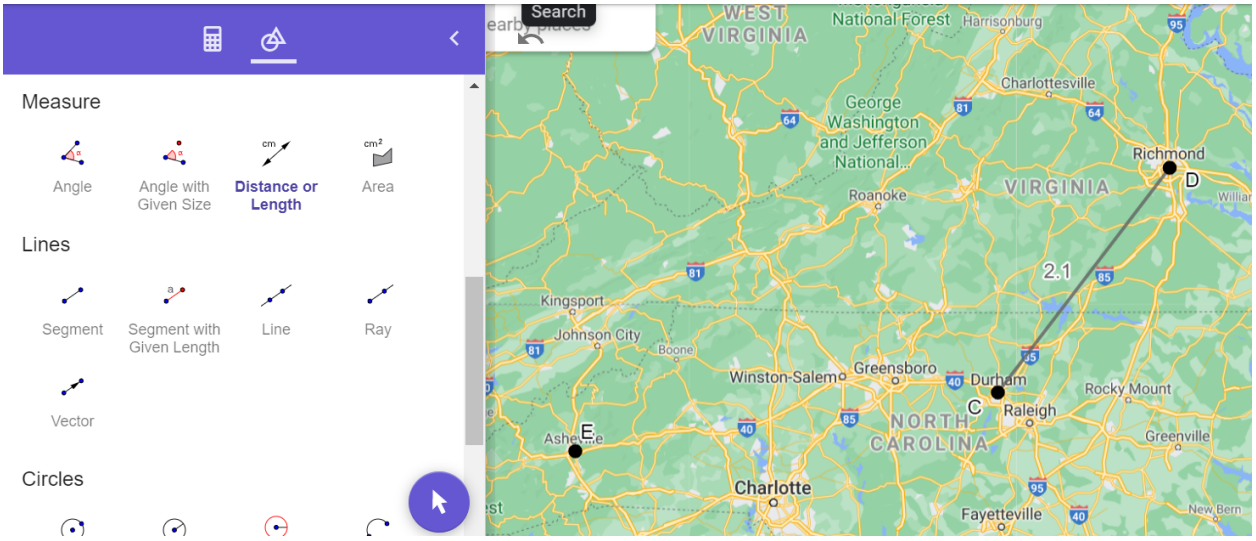
Measuring the Distance Between Points

GeoGebra can also help you plan and measure distances between stations (or points).

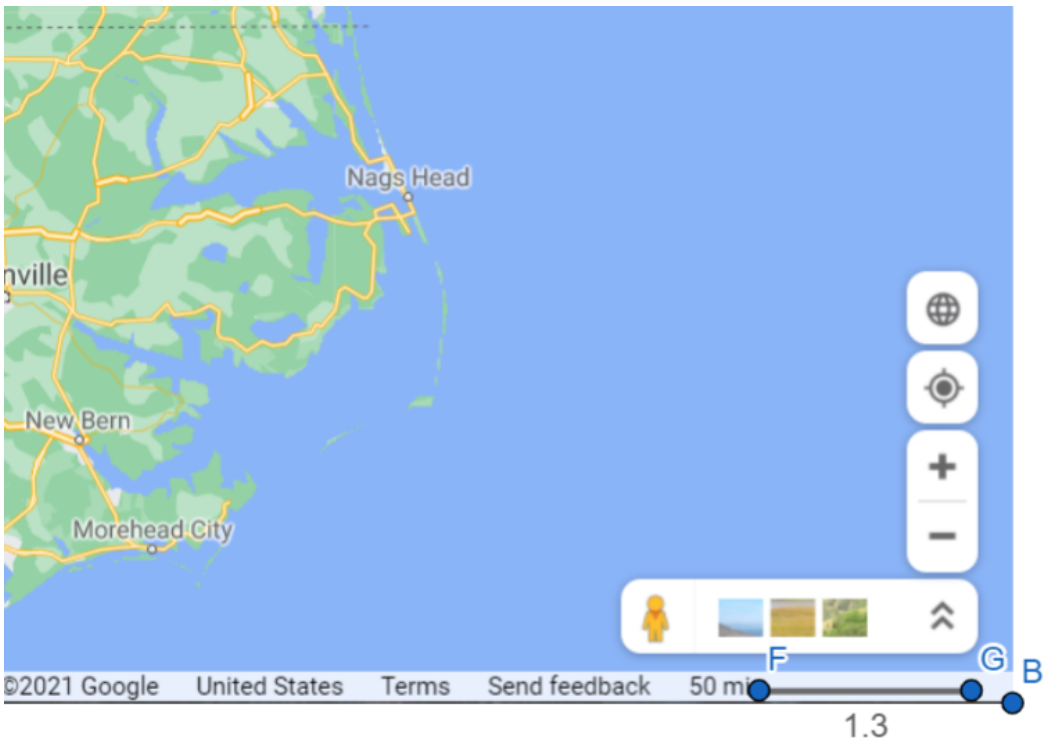
1. To measure the straight-line distance between point C (Durham, NC) and point D (Richmond, VA), create segment CD. To do this, select “Segment” in the tool menu. Then, click point C and point D. Points C and D should now be connected by a line segment. Pick two points on your map and create a line segment.



2. To find the length of segment CD, select “Distance or Length” in the tool menu. Then, click on the line segment. This will give you a numeric value that represents the length of the segment. In this case, segment CD has a length of 2.1 units. Find the length of your segment.



3. To convert this length into miles, use the scale located in the bottom right corner of the map. Create a segment the same length as the scale and measure its length. In the example below, the segment that is 1.3 units long represents 50 miles.



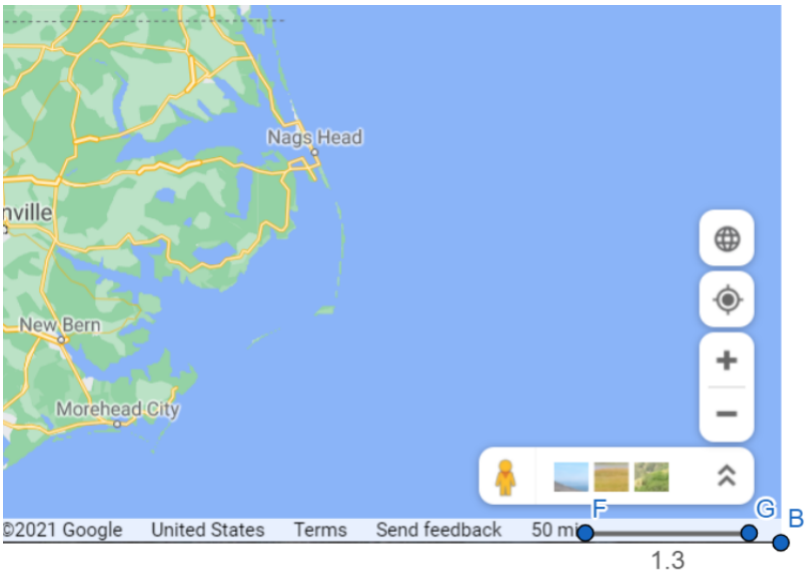
4. Now, use ratio reasoning to convert the length of segment CD into miles. What is the straight-line distance in miles from Durham, NC (point C) to Richmond, VA (point D)?

	GeoGebra Units	Miles
Scale (units)	1.3	50
Durham to Richmond (mi.)	2.1	**?**

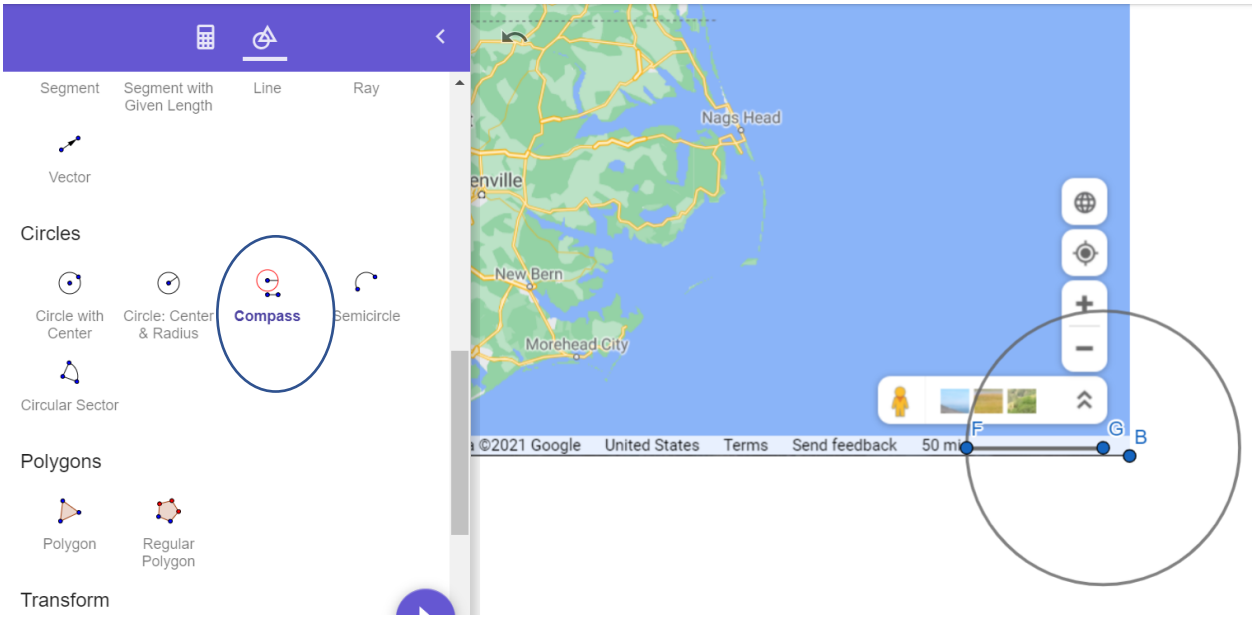
Using the Compass Tool to Locate Stations within a Desired Distance

Suppose you want each of your stations to be within 50 miles of another station. You can use GeoGebra and the compass tool to do this. In this example, our goal is to find a location that is no more than 50 miles from Durham, NC.

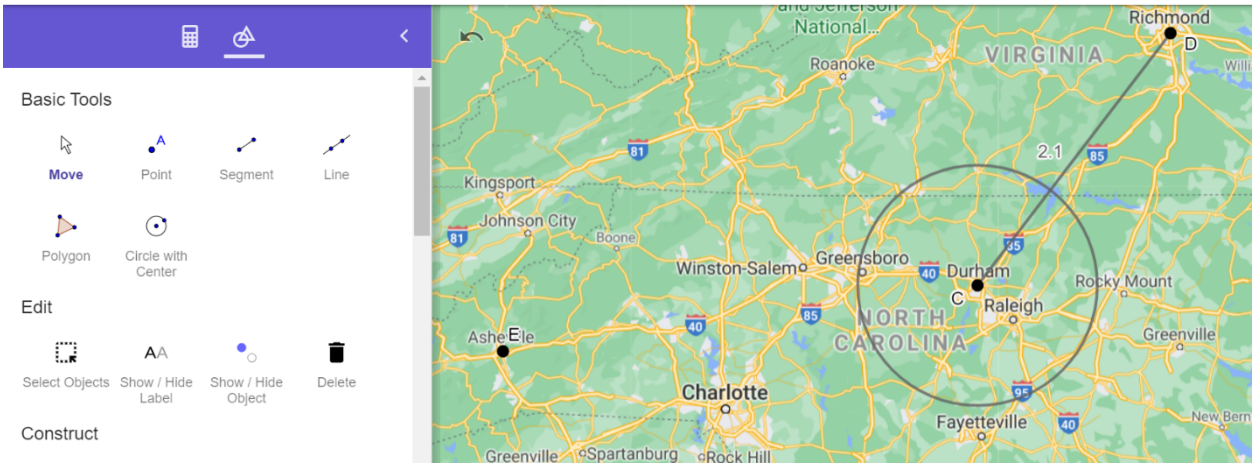
1. Start by using your scale segment (segment FG in the example below). Remember, this segment represents a length of 50 miles in the map.



2. In the tool menu, select the compass tool. Then, select point F and then point G. This will create a circle with a radius of 50 miles (the length of the scale segment).



3. Move the compass so that point C (Durham, NC) is the center of the circle. How can you tell from the picture that Rocky Mount, NC is more than 50 miles away from Durham? Where could you build a second charging station so that it is within 50 miles of Durham?



4. On your map, use the compass tool to find three charging station locations (H, I, and J) so that:
    a. The straight-line distance from H to I is less than or equal to 50 miles, and

    b. The straight-line distance from I to J is less than or equal to 50 miles, but the distance from H to J is greater than 50 miles and less than 100 miles.