

Making a Contour Map¹

Reid Sherman

Introduction:

The point of making a map is to condense a lot of information into an understandable form. It is much easier to look at a map than to read through a description of where all the roads in an area go. The most common type of map shows an area as seen from above with the location of various things of interest labeled. You're probably familiar with maps oriented with north at the top of the map, so that the vertical axis of the map is north-south (or latitude), while the horizontal axis is east-west (or longitude). However, there are plenty of variables besides longitude and latitude that we might want to know about a place, like temperature, rainfall, or altitude. How do we fit these things on a map?

One common way of mapping a third variable is to use contours. Contours are lines drawn on a map where every point on the line has the same value for the variable being plotted. For instance, on a temperature map of the United States, there might be a contour where every place that the line crosses is at a temperature of 70 degrees. This is useful because to find the value of the variable at any point, you just have to see which contour crosses that point.

We'll make our own contour map of the elevation across a clay landscape. Water settles to have a flat surface, so if we add a certain amount of water, all the points along the shoreline of that water will have the same elevation. If we draw lines along the shoreline, the line will form a path of constant elevation, which is the definition of a contour.

Materials:

Fish tank with landscape
Water

Ruler or meter/yard stick
Plumb line

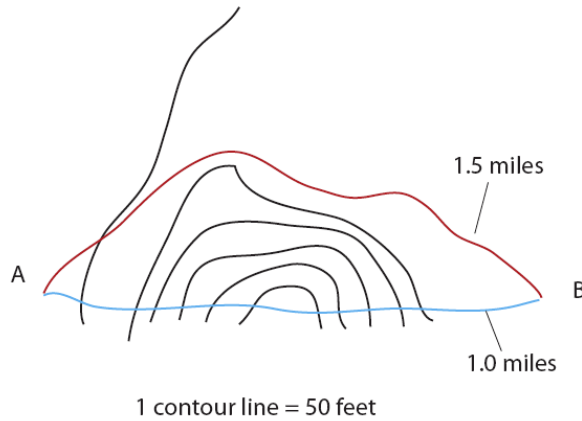
Procedure:

- 1) First, decide on a scale to use for your map. You want the map to be as big as possible, but still fit on the paper you are using. Make your axes, and write down the scale.
- 2) Measuring up the side of the fish tank from the bottom, mark points every half-inch.
- 3) Pour water into your tank until the water level is even with your lowest mark.
- 4) Measure the shape and position of the "shoreline" and replicate it on your map. One way to do this is:
 - a. Find and mark any key points along the shoreline, like sharp corners and points where the shoreline meets the tank wall.
 - b. Resting a ruler or tape measure across the top of the tank, with the plumb line measure the distance of the key points from the sides of the tank.
 - c. Mark those points on your map, and draw lines connecting them, estimating the curves of the shoreline as best you can.
- 5) Pour more water in until the water level is even with your next mark.
- 6) Repeat steps 4 and 5 until the land is completely covered.

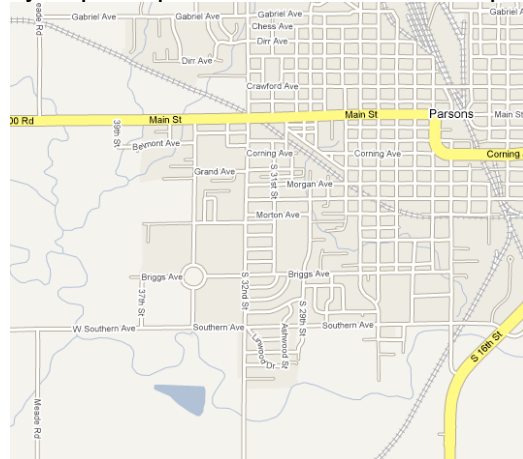
¹ Adapted from "Projections" lab taught at 2007 KICP Yerkes Summer Institute (see <http://kicp.uchicago.edu/education/explorers/2007summer-YERKES/>)

Questions:

- 1) Pick out two routes across your landscape: one that avoids steep climbs and drops, and another that includes them. Now sketch these routes onto your contour map. What do you notice about the routes and the contour lines?
- 2) As we noted, the shores of a lake or ocean define a contour, so a contour map of a region with a lake or ocean would have one contour running along the shore. Is this true for a river? In other words, will a single contour run along the banks of a river?
- 3) Look at the contour map below. Let's say a hiker ordinarily goes at 3 miles per hour across flat ground. However, for every 100 feet she climbs, she takes an extra 10 minutes. While going downhill, she can go faster, saving 5 minutes for every 100 feet she descends. Which path should she take to reach point B in the shortest amount of time? What height of hill would make the two paths take the same amount of time?



- 4) Can you pick up clues to elevation changes by looking at a map that doesn't have contours? What clues to the landscape can you pick up from these two road maps?



- 5) Let's say you are planning a road. The road has to reach the top of a hill that has a slope of 30 degrees above horizontal. If you don't want the road to go any steeper than 8 degrees, what will be the angle between your road and the contour lines when it is drawn on a map?