ES486 - Review of Contouring
Use a contour interval of 10 ft, to create a contour map of elevation data shown below.

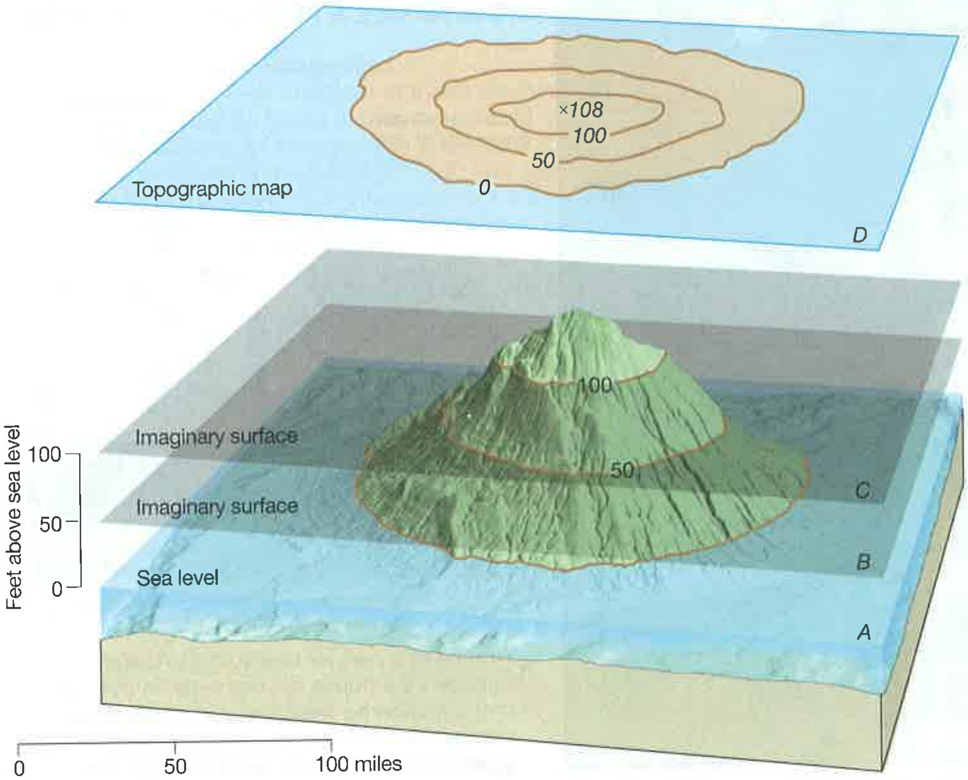


FIGURE 9.10 Topographic map construction. A *contour line* is drawn where a horizontal plane (A, B, or C) intersects the land surface. Where sea level (plane A) intersects the land, it forms the 0-ft contour line. Plane B is 50 ft above sea level, so its intersection with the land is the 50-ft contour line. Plane C is 100 ft above sea level, so its intersection with the land is the 100-ft contour line. D is the resulting topographic map of the island. It was constructed by looking down onto the island from above and tracing the 0, 50, and 100-ft contour lines. The elevation change between any two contour lines is 50 ft, so the map is said to have a 50-ft *contour interval*.

All contour lines on this map represent elevations in feet above sea level and are *topographic contour lines*. (Contours below sea level are called *bathymetric contour lines* and are generally shown in blue.)

Rules for Contour Lines

Each **contour line** connects all points on the map that have the same elevation above sea level (FIGURE 9.12, rule 1). Look at the topographic map in FIGURE 9.3 and notice the light brown and heavy brown contour lines. The heavy brown contour lines are called **index contours**, because they have elevations printed on them (whereas the lighter contour lines do not; FIGURE 9.12, rule 6). Index contours are your starting point when reading elevations on a topographic map. For example, notice that every fifth contour line on FIGURES 9.3 is an index contour. Also notice that the index contours are labeled with elevations in increments of 200 ft. This means that the map has five contours for every 200 ft of elevation, or a **contour interval** of 40 ft. This contour interval is specified at the center of the bottom margin of the map (FIGURE 9.3). All contour lines are multiples of the contour interval above a specific surface (almost always sea level). For example, if a map uses a 10-ft contour interval, then the contour lines represent elevations of 0 ft (sea level), 10 ft, 20 ft, 30 ft, 40 ft, and so on. Most maps use the smallest contour interval that will allow easy readability and provide as much detail as possible.

Additional rules for contour lines are also provided in FIGURE 9.12 and the common kinds of landforms represented by contour lines on topographic maps (FIGURE 9.13). Your ability to use a topographic map is based on your ability to interpret what the contour lines mean (imagine the topography).

Reading Elevations

If a point on the map lies on an index contour, you simply read its elevation from that line. If the point lies on an unnumbered contour line, then its elevation can be determined by counting up or down from the nearest index contour. For example, if the nearest index contour is 300 ft, and your point of interest is on the fourth contour line *above* it, and the contour interval is 20 ft, then you simply count up by 20s from the index contour: 320, 340, 360, 380. The point is 380 ft above sea level. (Or, if the point is three contour lines *below* the index contour, you count down: 280, 260, 240; the point is 240 ft above sea level.)

If a point lies between two contour lines, then you must estimate its elevation by interpolation (FIGURE 9.12, rule 2). For example, on a map with a 20-ft contour interval, a point might lie between the 340 and 360-ft contours, so you know it is between 340 and 360 ft above sea level. If a point lies between a contour line and the margin of the map, then you must estimate its elevation by extrapolation (FIGURE 9.12, rule 3).

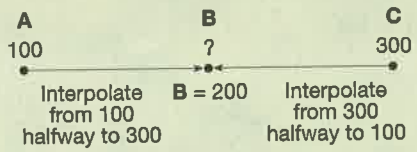
Depressions

FIGURE 9.14 shows how to read topographic contour lines in and adjacent to a depression. *Hachure marks* (short line segments pointing downhill) on some of the contour lines in these maps indicate the presence of a closed

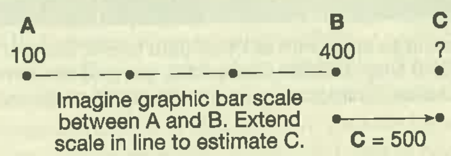
RULES FOR CONTOUR LINES

1. Every point on a contour line is of the exact same elevation; that is, contour lines connect points of equal elevation. The contour lines are constructed by surveying the elevation of points, then connecting points of equal elevation.

2. Interpolation is used to estimate the elevation of a point B located in line between points A and C of known elevation. To estimate the elevation of point B:



3. Extrapolation is used to estimate the elevations of a point C located in line beyond points A and B of known elevation. To estimate the elevation of point C, use the distance between A and B as a ruler or graphic bar scale to estimate in line to elevation C.



4. Contour lines always separate points of higher elevation (uphill) from points of lower elevation (downhill). You must determine which direction on the map is higher and which is lower, relative to the contour line in question, by checking adjacent elevations.

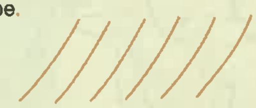
5. Contour lines always close to form an irregular circle. But sometimes part of a contour line extends beyond the mapped area so that you cannot see the entire circle formed.

6. The elevation between any two adjacent contour lines of different elevation on a topographic map is the *contour interval*. Often every fifth contour line is heavier so that you can count by five times the contour interval. These heavier contour lines are known as *index contours*, because they generally have elevations printed on them.

7. Contour lines never cross each other except for one rare case: where an overhanging cliff is present. In such a case, the hidden contours are dashed.

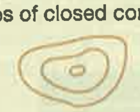
8. Contour lines can merge to form a single contour line only where there is a vertical cliff or wall.

9. Evenly spaced contour lines of different elevation represent a uniform slope.



10. The closer the contour lines are to each other the steeper the slope. In other words, the steeper the slope the closer the contour lines.

11. A concentric series of closed contours represents a hill:



12. *Depression contours* have hachure marks on the downhill side and represent a closed depression:

See Figure 9.14

13. Contour lines form a V pattern when crossing streams. The apex of the V always points upstream (uphill):

14. Contour lines that occur on opposite sides of a valley or ridge always occur in pairs. See Figure 9.13.

FIGURE 9.12 **Rules for constructing and interpreting contour lines on topographic maps.**

Relief and Gradient (Slope)

Recall that **relief** is the difference in elevation between landforms, specific points, or other features on a landscape or map. *Regional relief* (total relief) is the difference in elevation between the highest and lowest points on a topographic map. The highest point is the top of the highest hill or mountain; the lowest point is generally where the major stream of the area leaves the map, or a coastline. **Gradient** is a measure of the steepness of a slope. One way to determine and express the gradient of a slope is by measuring its steepness as an angle of ascent or descent (expressed in degrees). On a topographic map, gradient is usually determined by dividing the relief (rise or fall) between two points on the map by the distance (run) between them (expressed as a fraction in feet per mile or meters per kilometer). For example, if points **A** and **B** on a map have elevations of 200 ft and 300 ft, and the points are located 2 miles apart, then:

$$\text{gradient} = \frac{\text{relief (amount of rise or fall between A and B)}}{\text{distance between A and B}}$$

$$= \frac{100\ \text{ft}}{2\ \text{mi}} = 50\ \text{ft/mi}$$