

Latitude, Longitude and the Prime Meridian

The latitude-longitude system is the system most commonly used to locate features on topographic and other maps. Lines of latitude form the top and bottom margins of the map and lines of longitude from the left and right margins. Latitude is the angular distance measured with respect to a central point along a plane passed through the earth at the position of the earth's largest circumference. This plane is designated as a line of zero degrees (0°) and is referred to as the equator of the earth. Latitude then varies between 0° and 90° north and south of the equator.

Longitude is the angular distance measured east or west from a plane that passes through the north and south poles at the position of Greenwich, England. This line of longitude is referred to as the prime meridian and is assigned a value of 0° longitude. The position of the prime meridian was chosen arbitrarily. Because the earth is essentially a sphere, lines of longitude range from 0° to 180° east and west of the prime meridian with 0° east and west longitude beginning at the prime meridian and 180° east and west longitude being at a point on the other side of the earth directly opposite the prime meridian. The line defining the 180° east and west longitude is referred to as the International Date Line. International time is measured with respect to the prime meridian, while the International Date Line serves to mark the change in days. The plane defined by the prime meridian and the International Date Line serves to divide the earth into eastern and western hemispheres.

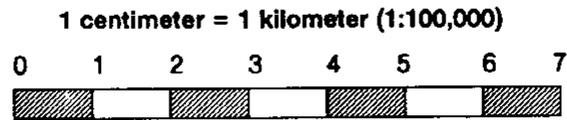
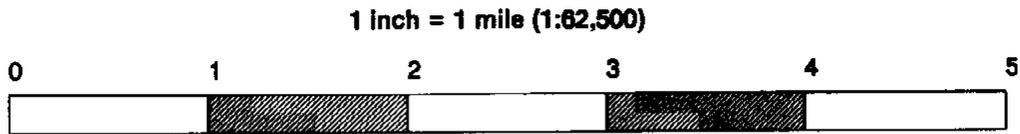
Latitude and longitude provide a very accurate method for locating points on the surface of the earth or for defining a specific area such as the area covered by a topographic map. This accuracy is the result of the way in which latitude and longitude are measured where 1° of latitude or longitude is divided into 60 equal interval or 60 minutes ($60'$), and each minute is subdivided into 60 equal intervals or 60 seconds ($60''$). The apostrophe symbol ($'$) is used to denote the minutes of a degree ($^\circ$), and the quotation symbol ($''$) denotes the seconds of one minute. Thus $1^\circ = 60' = 3600''$.

Map Scales

In order to make topographic maps useful for relating the position of features on the map to the actual land surface, conventions of scale have been standardized. The common and standard map scales are:

- 1:1,000,000 for area of 4° to 6°
- 1:500,000 for area of 2° to 3°
- 1:250,000 for area of 1° to 3°
- 1:125,000 for $30'$ quadrangles
- 1:62,500 for $15'$ quadrangles
- 1:24,000 for $7\frac{1}{2}'$ quadrangles

A map scale defines the relationship between distance on a map and the corresponding distance on the ground. Such a scale is usually expressed as either a numerical ratio (those listed above are numerical ratios) or shown graphically by bar scales marked in meters and kilometers or feet and miles. Because the construction of topographic maps still utilizes the English system of measurement (inches, feet, miles), examples and problems relating to topographic maps will use the English system of measurement rather than the metric system.



Map scales in form of bar scales corresponding to ratio scales 1:62,500 (1 inch = 1 mile) and 1:1,000,000

Contour Lines

Contour lines are the means of relating the vertical dimension (the third dimension) of the topography of an area to the two-dimensional surface of a topographic map. Contour lines should be visualized as the intersection of the land surface with a series of equally spaced, horizontal planes that pass through this surface. The vertical distance separating these planes is termed the contour interval (C.I.). Contour intervals are determined by the map scale and the amount of topographic variation within the map area. As viewed on a topographic map, the spacing of contour lines (but not the contour interval) varies according to the changes in slope angle of topographic features. Because of this relationship, a few simple Rules of Contour Lines will prove helpful in interpreting the vertical dimension of topographic maps.

1. Gentle slopes (low angle from horizontal) on topographic maps with a given interval will be represented by widely spaced contour lines.
2. Steep slopes (high angles from the horizontal) on topographic maps with a given contour interval will be represented by closely spaced contour lines. Thus, a vertical cliff large enough to be represented as a topographic feature would be represented by contour lines that merge (i.e., stacked together because of the 90° slope).
3. Contour lines that cross streams flowing through valleys of noticeable relief will form a V-shaped deflection with the apex of the V pointing upstream. This relationship between contour lines and stream valleys is referred to as the RULE of V's. Because a V will always point upstream, the orientation of V's can always be used to determine the direction of the slope of the surface as well as the direction of the flow of the water.
4. Concentric circles of contour lines indicate a hilltop; concentric circles with hachure marks indicate a close depression.