

Measuring the Earth

- I. Earth's shape
 - A. From space, it looks round
 - B. Actually, it bulges slightly at the equator, and is flattened at poles (called an **oblate spheroid**)

- II. Spheres of the earth
 - A. Lithosphere – solid rock crust of earth (most dense)
 - B. Hydrosphere – water (oceans) on the lithosphere (70% of earth's surface)
 - C. Atmosphere – layered shell of gases surrounding earth (least dense)
 1. see Ref. Tables, page 14, for layers of the atmosphere**See Ref. Tables, page 1, for chemical composition of these spheres.**

- III. **The coordinate system** - based upon earth's rotation and our observation of the sun and stars.
 - A. Measured in degrees, minutes, and seconds
 - 1 circle = 360°
 - 1 degree = 60' (minutes)
 - 1 minute = 60" (seconds)
 - B. Most topographic maps are either 7'30" or 15' on a side.
 - C. Latitude and Longitude
 1. **Latitude** – angle above (N) or below (S) the ***equator***
 - a.) also called parallels
 - b.) range from 0° (the equator) to 90° (the poles)
 2. **Longitude** – angle left (W) or right (E) of the ***Prime Meridian***
 - a.) also called meridians
 - b.) range from 0° (Prime Meridian) to 180° (International Date Line)

IV. Determining location

A. **Latitude** - use the angle of Polaris above the horizon

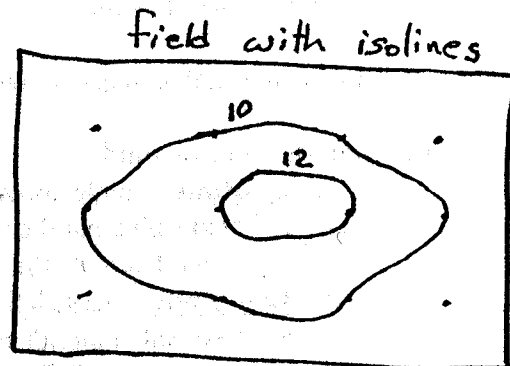
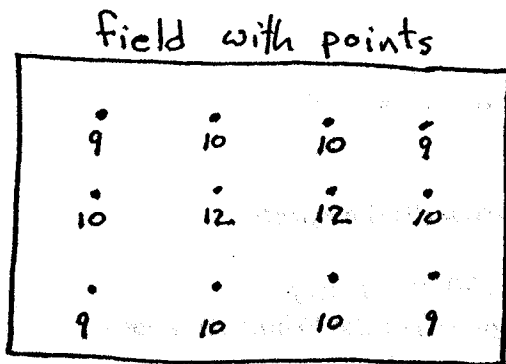
B. **Longitude** – comparing local noon at your location with Greenwich Mean Time (at Prime Meridian).

1. Each hour difference = 15° of longitude due to earth's rotation.
(your time earlier = West ... your time later = East)
2. The earth's rotation provides a basis for our system of local time.
 - a) All locations on the same **LONGITUDE** have the same local time.
3. Meridians of longitude are the basis for earth's **TIME ZONES**.
(are 15° of longitude wide)
 - a) East of us is **LATER** than our time.
 - b) West of us is **EARLIER** than our time.

V. Fields

A. Any region of space that has some measurable quantity at every point.

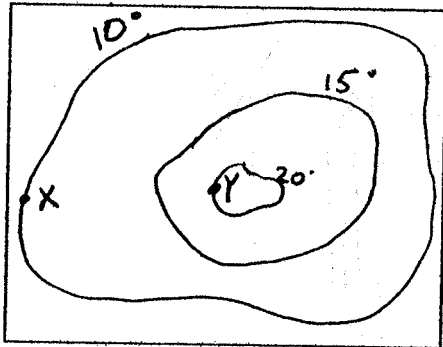
B. **Representing fields** - use **ISOLINES**, lines that connect all points of equal value.



C. **Gradient** – expresses the *rate* of change in a field (steepness)

1. See equation on Ref. Tables ... p. 1)

ex. If points X and Y are 5km apart on the map below, what is the temperature gradient between them?



$$\text{gradient} = \frac{\text{change in field value}}{\text{distance}}$$

$$\text{gradient} = \frac{20^{\circ} - 10^{\circ}}{5 \text{ km}} \quad \text{or} \quad \frac{10^{\circ}}{5 \text{ km}}$$

$$\text{gradient} = 2.0 \text{ }^{\circ} / \text{km}$$

(This means that for every km you travel between X and Y, the temperature changes by an average of 2°)

VI. Topographic Maps

A. Use **contour lines** (brown) – isolines of equal elevation -- to show the topography (hills, valleys, streams, etc.) of an area.

1. Contour interval – change in elevation between 2 adjacent contour lines (usually 20 feet)
2. Index contour – a darker contour line on the map with the **actual** elevation marked along it

B. **Scale** – relationship between distance on a map and the actual outside distance

1. Shown in margin of map. Can be a verbal, ratio, or bar scale.

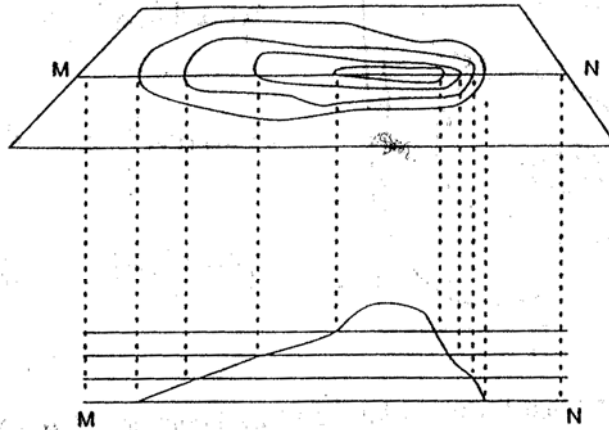
C. **Culture** – things like houses, highways, and railroads. Shown with symbols

D. SOME MAP FACTS...

1. The closer together the contour lines, the **steeper** the hill.
2. As contour “circles” get smaller, you are usually approaching the top of a hill. (Check contour values to confirm)
3. **Rule of V’s** – when a contour line crosses a stream, that contour line forms a “V” that points **UPHILL**.
4. A **depression** is shown by a contour line with tick marks on the inside of the circle.
5. For New York State, ALL **latitudes** are labeled **NORTH** and ALL **longitudes** are labeled **WEST**.

E. **Profiles** – show a side-view of a portion of a map

1. Top of hill on profile MUST be **rounded** (*not* straight across from the one contour crossing point going uphill to the next one going back downhill.)



The relationship between a contour map and its profile. Notice that along baseline M-N, the gradient (slope) is the steepest where the isolines are closest.

F. **Rescue routes**

1. Topographic maps can be used to plot efficient rescue routes.
 - a) avoid cliffs (where contour lines are close together)
 - b) avoid swamps, and rivers that could flood
 - c) be aware of existing roads