Geographic Coordinates

Latitude, longitude and elevation constitute geographic coordinates for any location on or above the Earth. These coordinates can be obtained from a map or measured using a GPS receiver.

Explorer's Guide

Before You Start

Using a map of the United States, match the following cities with the following pairs of geographic coordinates (latitude and longitude):

City	Latitude	Longitude
Saint Paul, MN	40°48' N	96°40' W
Denver, CO	38°53' N	77°01' W
Lincoln, NE	38°35' N	121°30' W
Sacramento, CA	39°09' N	104°59' W
Washington, DC	44°57' N	93°05' W

What happen to the values of latitude and longitude when you move North (up on the map) or East (right on the map)? In what direction the values of longitude and latitude increase?

Learning by Doing

1. Walk outside and use a GPS receiver to record latitude, longitude and elevation for three points identified by the instructor. Those points might include a flag or chalk mark, a small tree, a fire hydrant, etc. The receiver should be running and Satellite Page displayed. Record your data in the following table:

Point ID	Point Description	Latitude	Longitude	Elevation[1]
1				
2				
3				

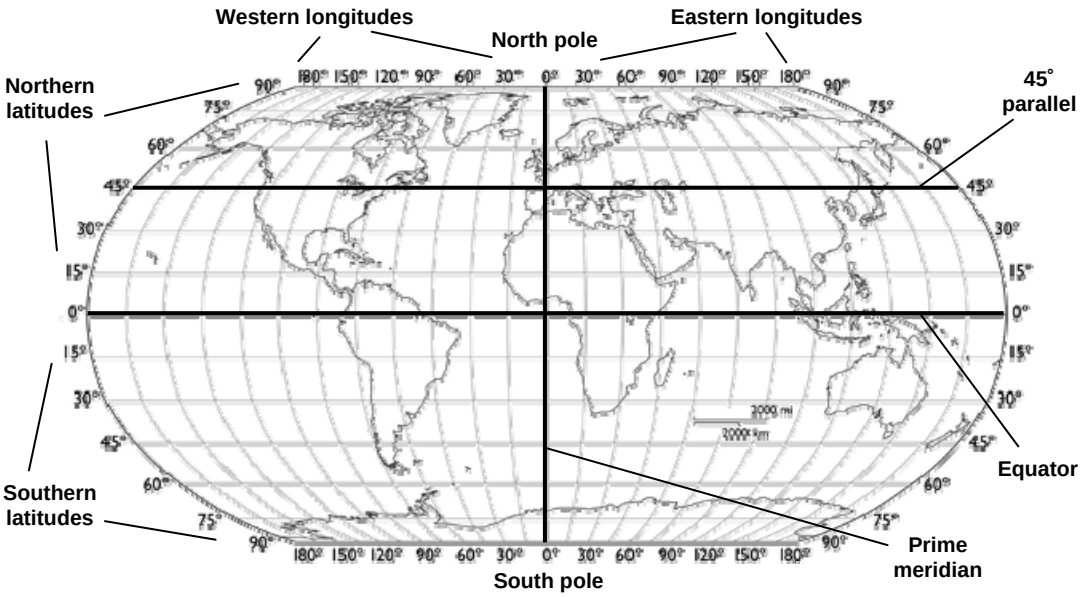
2. Using your data, relate the points to each other (identify which points are located to the North or South, East or West, higher or lower). Record your answers in the following table:

Relationship	North/South/None	East/West/None	Up/Down/Level
Point 2 with respected to Point 1 is			
Point 3 with respected to Point 1 is			
Point 3 with respected to Point 2 is			

How Does It Work

As shown in the figure below, geographic latitude represents global location in North/South direction while longitude indicated position with respect to East/West. An imaginary line that has the same latitude is called "parallel". Equator is the longest parallel that has zero latitude. An imaginary line that has the same longitude is called meridian. Prime meridian has zero longitude. All meridians merge in two points called "poles".

[1] Specify if the elevation is measured in meters or feet

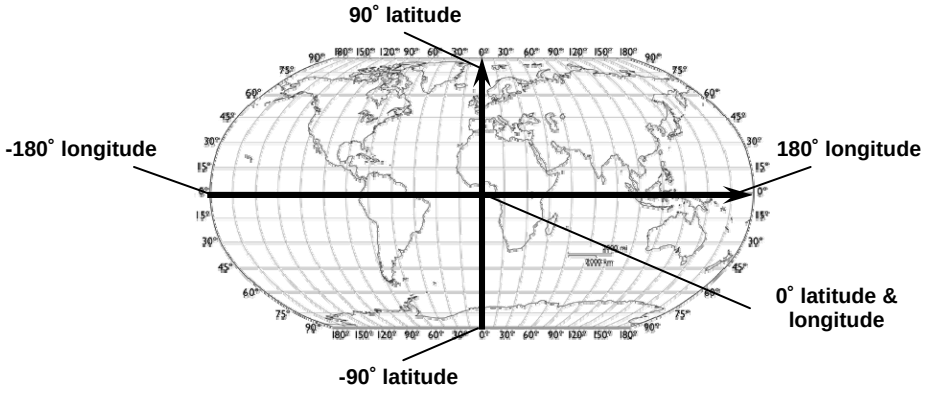


Both the latitude and longitude are angular measurements. As any angle these geographic coordinates can be expressed in degrees (˚). One degree consists of 60 minutes (') and one minute consists of 60 seconds ("). North and South poles are the shortest parallels with 90˚ latitude that are actually just two points. The meridian opposite to the prime meridian has 180˚ longitude.

It is normally said that parallels north of equator have northern latitudes and those south of equator southern latitudes. Similarly, meridians that correspond to the eastern hemisphere have eastern longitudes and those in western hemisphere western longitudes. As shown in the table below, depending on the hemisphere the same travel direction may cause values of latitude and longitude to increase or decrease.

Hemisphere	Going North	Going East
North and East	Latitude increases	Longitude increases
North and West	Latitude increases	Longitude decreases
South and East	Latitude decreases	Longitude increases
South and West	Latitude decreases	Longitude decreases

To make it easier dealing with geographic coordinates when creating maps, it is assumed that western longitudes and southern latitudes have negative values. Therefore, while in Nebraska or other continental states of the US, latitude should be positive and longitude negative (see figure below).



Additional Challenge

The coordinates for Lincoln, Nebraska are 40°48' N and 96°40' W. Find cities with the same latitude or longitude as Lincoln, Nebraska? What latitude and longitude correspond to the opposite side of the Earth? What is situated in this location?

Vocabulary

- ***Latitude*** *indicates geographic position in North-South direction and changes from 0° at the Equator to 90° at both poles. For mapping purposes, southern latitudes are assumed to be negative.*
- ***Longitude*** *indicates geographic position in East-West direction and changes from 0° at Prime Meridian to 180° in both directions (2 x 180° forms a complete circle). For mapping purposes western longitudes are assumed to be negative.*
- ***Elevation****, also called altitude, represents the height above a fixed reference. Although, mean sea level (MSL) elevation is the most common, true GPS elevation is calculated with respect to a mathematical model of the Earth used by GPS.*

Interesting to Know

Latitude comes from the Latin word “latus”, which means "width", and Longitude comes from the Latin word “longus”, which means "length".

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