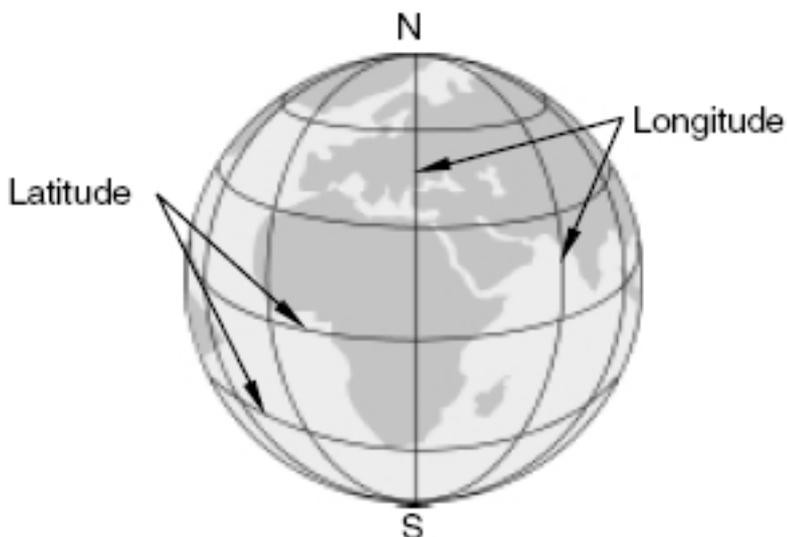


Latitude and Longitude

Latitude and longitude are measuring lines used for locating places on the surface of the Earth. They are angular measurements, expressed as degrees of a circle. A full circle contains 360° . Each degree can be divided into 60 minutes, and each minute is divided into 60 seconds. The symbol for minutes is (') and for seconds is (").

Latitude lines (called parallels) circle the planet's surface in lines parallel to the equator, which lies halfway between the North and South poles. Latitude lines circle the planet from east and west, beginning at 0° at the equator and increasing to 90° North or 90° South.

Longitude lines (called meridians) run north and south and circle the planet from pole to pole. Each line is identified by the number of degrees east or west from a starting point at Greenwich, England, known as the prime meridian. The longitude at the prime meridian is 0° . Longitude lines mark the distance westward, to 180° West, and eastward, to 180° East.



6.10 Latitude & Longitude

Latitude and longitude measurements can be written in several ways. For example, 211 degrees, 22 minutes, and 30 seconds is written as $211^{\circ} 22' 30''$, or with spaces: 211 22 30; or with a decimal after the degrees $211.22' 30''$, or with a decimal after the minutes $211 22.30$. One degree of latitude equals about 69 miles. One minute is just over a mile, and one second is about 100 feet.

When adding or subtracting degrees, convert to minutes and seconds as necessary and borrow the appropriate amount (see Section 1.3). For example, when borrowing 1 degree from 360° , change to $359^{\circ} 60'$. To borrow 1 minute from $359^{\circ} 60'$, change to $359^{\circ} 59' 60''$.

Example 1 $320^{\circ} 25' 32'' - 210^{\circ} 50' 41''$

$$\begin{array}{r} \\ 320^{\circ} 25' 32'' \\ - 210^{\circ} 50' 41'' \\ \hline 109^{\circ} 34' 51'' \end{array}$$

Step 1. Subtract 1 from 2.

$$2 - 1 = 1$$

Step 2. Borrow 1 minute from the 5 for the seconds.

There are 60 seconds in 1 minute.

$$60 + 30 = 90$$

Step 3. Subtract 4 from 9.

$$9 - 4 = 5$$

Step 4. Subtract 0 from 4.

$$4 - 0 = 4$$

Step 5. Borrow 1 degree from 20° for the minutes. There are 60 minutes in 1 degree.

$$60 + 20 = 80$$

Step 6. Subtract 5 from 8.

$$8 - 5 = 3$$

Step 7. Subtract 210 from 319.

$$319 - 210 = 109$$

$$109^{\circ} 34' 51''$$

6.10 Latitude & Longitude

Example 2 - Add $142^{\circ} 54' 43'' + 85^{\circ} 36' 44''$.

$$\begin{array}{r} 142^{\circ}54'43'' \\ + \underline{85^{\circ}36'44''} \\ \hline 228^{\circ}31'27'' \end{array}$$

Step 1. Add the seconds. $43 + 44 = 87$
Sixty seconds equals 1 minute.

Step 2. 87 is greater than 60, so subtract 60 seconds from 87 seconds. There are 60 seconds in 1 minute, so add 1 minute to the minute column.
 $87 - 60 = 27$ seconds

Step 3. Add the minutes.
 $54 + 36 + 1$ (carried over from the seconds) = 91 minutes

Step 4. 91 is greater than 60, so subtract 60 minutes from 91 minutes. There 60 minutes in 1 degree, so add 1 to the degree column. $91 - 60 = 31$ minutes

Step 5. Add the degrees.
 $142 + 85 + 1$ (carried over from the minutes) = 228 degrees

$$228^{\circ}31'27''$$

Example 3 - Name the range of latitude and longitude for the borders of Wyoming.

Step 1. Find Wyoming on a map.

Step 2. Locate the east and west borders of Wyoming.

Longitude $111^{\circ}W$ to $104^{\circ}W$. It is west of the Greenwich Longitude.

Step 3. Find the north and south borders of Wyoming.

Latitude $41^{\circ}N$ to $45^{\circ}N$. The location is north of the equator.