

Title: X Marks the Spot! Latitude and longitude

Grade: 4-10

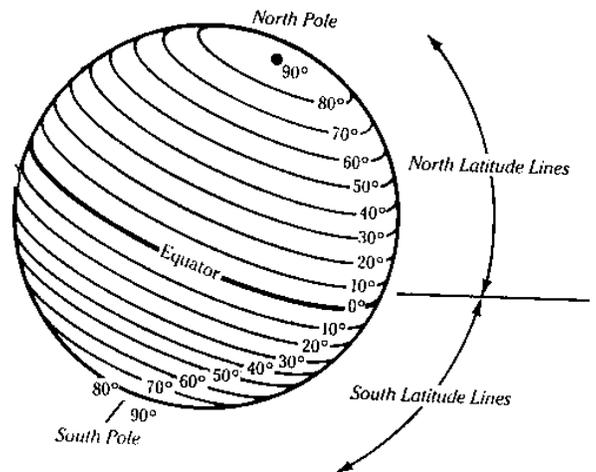
Topic: Nautical science; maps and charts

Summary: Students will be able to plot and read positions using latitude and longitude. Students will measure distances and calculate speed using positions on a chart.

Key words/concepts: latitude, longitude, degrees, minutes, equator, prime meridian, point of reference, nautical mile

Introduction Latitude and longitude provide a grid of coordinates that can be used to pinpoint any position on the earth's surface. Every place has a latitude and longitude! Although this coordinate system has been used on maps and charts for hundreds of years, today it is even more widely used as people acquire Geographic Positioning Systems (GPS) devices, which use latitude and longitude to describe location.

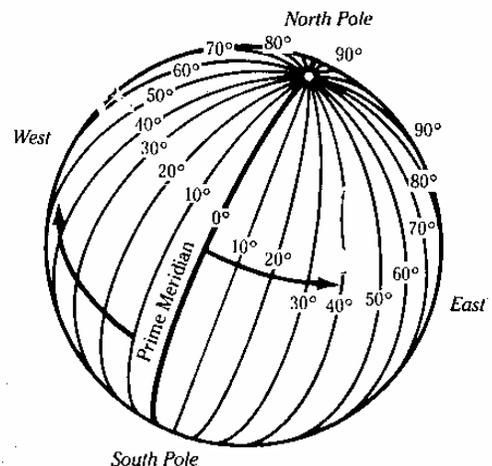
Latitude lines run parallel to the equator, which is designated 0°. Latitude can have any value from 0° to 90° and must be labeled North or South, for its hemisphere. 90° north is at the north pole, and 90° south is at the south pole. As you can see in the diagram, the equator is the largest circle, and the circles get smaller as they near the poles, but the distance between lines of latitude remains constant as you move toward the poles.



Equator and lines of latitude

Graphic adapted from Sunburst Communications

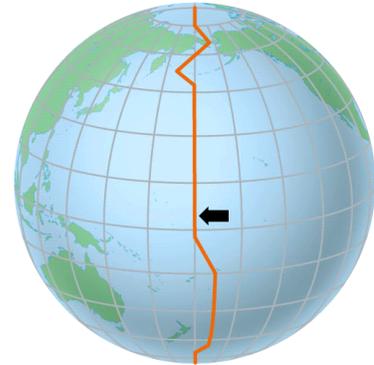
Longitude lines, also called meridians, run from pole to pole. Longitude is measured in degrees east or west of the line running through Greenwich, England, which is designated as 0° longitude and is called the **Prime Meridian**. As you can see in the diagram, all lines of longitude converge at the poles, and the distance between lines of longitude lessens as you move toward the poles. Longitude can have any value from 0° to 180° and must be labeled East or West, according to its position relative to 0°, the prime meridian.



Prime meridian and lines of longitude

Graphic adapted from Sunburst Communications

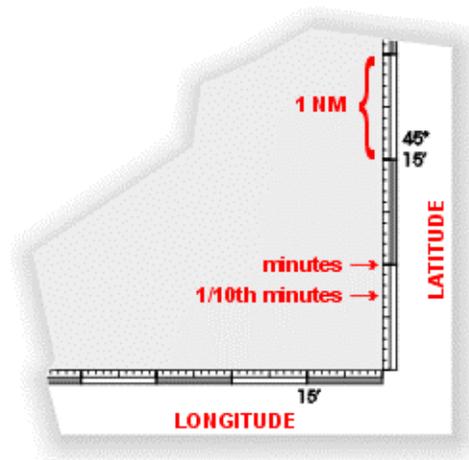
The place where east and west longitude are both 180° is designated as the **international date line**. If you look along this line you can see that there are some areas where the date line is moved away from 180° for political convenience, such as between Russia and Alaska. If you cross the date line heading west, you move ahead or gain one day, and if you cross it heading east, you move back or lose one day.



International Date Line

The American Heritage[®] Dictionary of the English Language: Fourth Edition, 2000

Latitude and longitude are measured in **degrees** ($^\circ$) and **minutes** ($'$). These relate to the 360° in the arc of a circle. Each degree is divided into 60 minutes, so for example, if you move one minute west from $39^\circ 59'$ West longitude, you would be at $40^\circ 00'$ West. Minutes of latitude and longitude have nothing to do with time! They are just a way of subdividing a larger unit, the degree.

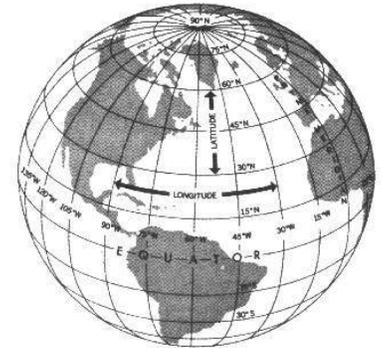


Each **minute of latitude** (but not longitude) is **equal to 1 nautical mile** on the surface of the earth. Because the lines of longitude converge at the poles, the distance of minutes and degrees of longitude is not constant.

Points of reference: Latitude and longitude have always been used at sea because there are no stationary landmarks to refer to when off shore. The need for a point of reference, a place that anyone can identify and use as a basis to describe position, makes latitude and longitude useful even at sea. To illustrate, in describing the location of your school, you might say, "the school is in Smallville (a town known to you and the listener) on South Street (a place marked by a street sign), third building from the end" (a specific point and number of units away). Each of these pieces of information includes a point of reference. At sea, there are no towns, houses, or streets. Instead, the invisible lines of latitude and longitude, marking specific places over the whole globe, provide the necessary points of reference.

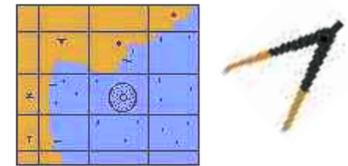
What to expect

- ✧ The best way to introduce latitude and longitude is to first use a world map to show the general pattern, then use a local map as an example of how it works in a small area. If at all possible, obtain some nautical charts of a nearby area or any coastal location of interest to students.
- ✧ Be sure to point out to students that the latitude and longitude grid works in the same way as the familiar graph system with an x and y axis. The difference is that it is wrapped around a globe, so the grid tapers at the top and bottom.
- ✧ It works well to introduce and have students work with degrees first, then introduce the minutes increment.
- ✧ After completing the activities given here, students can make up treasure hunts for each other using positions on the real charts.



Materials

- World map or globe with lines of latitude and longitude
- Local map or chart with lines of latitude and longitude
- Individual charts for students
- Navigational dividers or ruler
- Pencil-top erasers or tokens to use as markers for position



Procedure, Part 1:

1. Show students a world map or globe marked with lines of latitude and longitude.
2. Introduce the latitude and longitude grid system, beginning with latitude (latitude is always given first when describing position). Point out the equator and prime meridian and have students review the range of values for latitude (90° N and S) and longitude (180° E and W).
3. Ask students to estimate the latitude and longitude of your school to the nearest degree. Using a local map (or chart if you are in a coastal area), find the latitude and longitude of your school to the nearest minute. Remember, in the northern hemisphere latitude increases going north, and in the western hemisphere, longitude increases going west.
4. Using the maps and globe, have students make a list displaying the latitude and longitude of places of interest. For example, students might locate a former home town, another school attended, the nearest large city, a place in the news, a foreign capital, a town or village farthest north or south, or a town on the international date line.

Part 2: Hand out the simplified chart provided with this activity. Orient students to the markings around the borders. Degrees are written ($^{\circ}$) and minutes are ($'$). Each degree has 60 minutes. Latitude is always given first when describing position. Guide students to introduce them to the charts using this procedure:

1. Have students look at the scales on the borders of the chart.
2. Find and identify the lines of **latitude**- they run **horizontally** across the page and are labeled at the **sides** of the chart.

3. Find and identify the lines of **longitude**- they run **vertically** up and down the page and are labeled at the **top and bottom** of the chart.
4. How many minutes make up one whole degree of latitude or longitude?
How many minutes are represented by each of the small marks between whole degrees of latitude or longitude?
 - Have students mark each ten minutes from 10' to 50' for the degrees of latitude and longitude.
5. Mark your position on the chart if you are at 37° 00' N, 62° 00' W.
To mark your position: Find the line for 37° N latitude and the line for 62° W longitude. You are at the point where they cross.
6. After sailing all day you are at 37° 30' N, 62° 45' W. Mark your position.
How to mark your position if it is not on a whole degree:
 - Find the correct place on the latitude scale along the sides of the chart, then use the dividers, a ruler, or measure along the length of a pencil to mark the distance along the latitude scale from the nearest whole degree.
 - Keeping this distance the same, move along the line of latitude until you are close to the approximate longitude value.
 - Draw a short, light line parallel to the whole degree latitude line, at the correct distance from it (the distance you measured along the side).
 - Next, measure along the longitude scale along the top or bottom of the chart and again mark the distance from the whole degree of longitude using dividers, ruler, or a length along a pencil.
 - Move along the line of longitude, preserving the distance you measured from it, until you are even with the light mark you made for latitude.
 - Your position is the point where your measured longitude distance crosses the line you drew for latitude.

Evaluation: Students should hand in completed charts with their own treasure routes and a route from a partner marked and labeled.

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