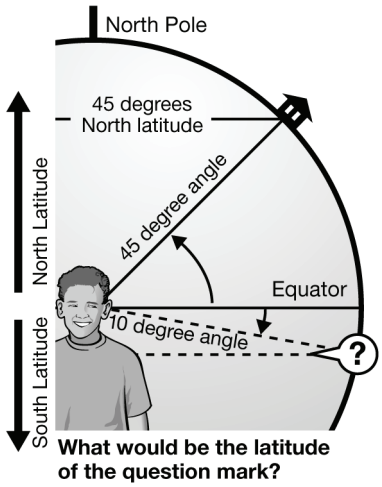
Name: _____ Date: _____

SKILL and PRACTICE 8.1

Latitude and Longitude

READ

History: Latitude and longitude are part of a grid system that describes the location of any place on Earth. When formalized in the mid-18th century, the idea of a grid system was not a new one. More than 2000 years ago, ancient Greeks drew maps with grids that looked much like our maps today. Using mathematics and logic, they postulated that Earth could be mapped in degrees north and south of the Equator and east and west of a line of reference. From the ancient times, geographers and navigators used devices such as the cross-staff, astrolabe, sextant, and astronomical tables to determine latitude. But determining longitude required accurate timepieces, and they were not reliably designed until the 1700's.

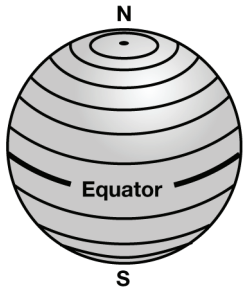


What would be the latitude of the question mark?

Latitude: Think of Earth as a transparent sphere, just as the ancient Greeks did. Now imagine yourself standing so that your eyes are at the center of that sphere. If you tip your head back and look straight up, you will see the North Pole above you. If you look straight down, you will see the South Pole below you. If you turn around while looking straight out at the middle of the sphere, your eyes will follow the Equator, the line around the middle of Earth. The ancient Greeks realized that they could describe the location of any place by using its angle from the Equator as measured from that imaginary place at the center of Earth.

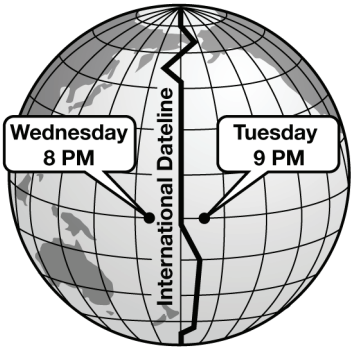
All latitude lines run parallel to the Equator, creating circles that get smaller and smaller until they encircle the Poles. Because latitude lines never intersect, latitude lines are sometimes referred to as *parallels*.

At first, you might be confused because when latitude lines are placed on a map. They appear to run from the left side of the page to the right. You might think they measure east and west, but they don't. The graphic at the right shows latitude lines. If you think of them as steps on a ladder, then you will see the lines are taking you "up" toward the north or "down" toward the south. (Of course, there is no real "up" or "down" on a map or globe, but the association of LAdder and LAtitude may help you.)



The Equator is designated as 0º. The North Latitude lines measure from the Equator (0º) to the North Pole (90ºN). The South Latitude lines measure from the Equator (0º) to the South Pole (90ºS). There are other special latitude lines to note. The Tropic of Cancer is at 23.5ºN latitude, and at 23.5ºS latitude is the Tropic of Capricorn. These lines represent the farthest north and farthest south where the sun can shine directly overhead at noon. Latitudes of 66.5º N and 66.5º S mark the Arctic and Antarctic Circles, respectively. Because of the tilt of the Earth, there are winter days when the Sun does not rise and summer days when the sun does not set at these locations.

Longitude: Now imagine yourself back in the transparent sphere. Look up at the North Pole and begin to draw a continuous line with your eyes along the outside of the sphere to the South Pole. Turn to face the opposite side of the sphere and draw a line from the South Pole to the North Pole. These lines, and all other longitude lines, are the same length because they start and end at the poles. Look at the graphic below and see that although longitude lines are drawn from north to south, they measure distance from east or west.

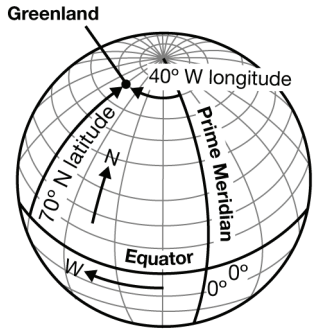


There are no special longitude lines, so geographers had to choose one from which to measure east and west. Longitude lines are also called *meridians*, so this special line is called the Prime Meridian and is labeled 0º. The ancient Greeks chose a *Prime Meridian* that passed through the Greek Island of Rhodes. In the 1700's, the French chose one that passed through Ferro, an island in the Canary Islands. There are maps that show that America even used Philadelphia as their special reference location. But in 1884, the International Meridian Conference met in Washington, DC. They chose to adopt a Prime Meridian that passes through an observatory in Greenwich, England. At the same conference, they also determined a point exactly opposite of the Prime Meridian. This second important longitude line is the 180º meridian. Longitude lines measure eastward and westward from the Prime Meridian (0º) to the180º meridian. Superimposed on the 180º meridian is the *International Dateline*. This special line does not follow the 180º meridian exactly. It zigzags a bit to stay in the ocean, which is an unpopulated area. International agreements dictate that the date changes on either side of the Dateline.

GPS and decimal notations. In the past, latitude and longitude lines always had measurement labels of degrees (º), minutes ('), and seconds ("). The labels of "minutes" and "seconds" did not denote time in these cases. Instead they described places between whole degrees of longitude or latitude more exactly. For example, consider Sacramento, CA. Traditionally, its location was said to be at 38º 34' 54"N (38 degrees, 34 minutes, 54 seconds North) and 121º 29' 36"W (121 degrees 29 minutes, 36 seconds West). Now GPS (Global Positioning System), in decimal notation would say Sacramento is located at 38.58ºN and 121.49ºW. Note: As a matter of custom when giving locations, latitude is listed first and longitude second.

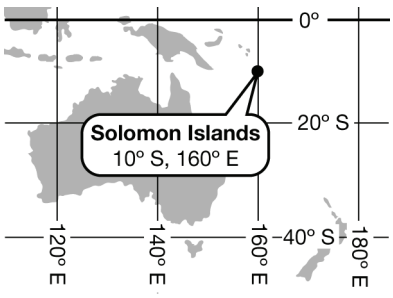
EXAMPLES

Finding a Location on a Globe



You can find any location by using latitude and longitude on a globe. See the example in the diagram. The position is 70ºN and 40ºW. First on the globe, you would find the latitude line 70ºN, seventy degrees north of the Equator. Next you would find the longitude line 40ºW, forty degrees west of the Prime Meridian. Trace the lines with your fingers. Where they intersect, you will find the location. In this case, you have located Greenland.

Finding a Location on a Map



You use the same procedure to find any location on a map. Look at the graphic below. The position is 10ºS and 160ºE. First you would find the latitude line 10ºS, ten degrees south of the Equator. Next you would find the longitude 160ºE, one hundred-sixty degrees east of the Prime Meridian. You have located the Solomon Islands.

SKILL and PRACTICE 8.1

PRACTICE 1

Use an atlas or globe to answer these practice questions.

1. What country will you find at the following latitude and longitude?
   a. 65ºN 20ºW
   b. 35ºN 5º E
   c. 50º S 70ºW
   d. 20ºS 140ºE
   e. 40ºS 175ºE
2. What body of water will you find at the following latitude and longitude?
   a. 20ºN 90ºW
   b. 40ºN 25ºE
   c. 20ºN 38º E
   d. 25ºN 95ºW
   e. 0ºN 60ºW

EXAMPLE

Converting Traditional Notation To Decimal Notation

Sometimes you need to convert the traditional notation of degrees, minutes, and seconds into decimal notation. First you must understand this traditional notation, which was a base-60 system.

One degree = 60 minutes
One minute = 60 seconds
One degree = 3,600 seconds (60 × 60)

Let's look at 34º 15' (thirty-four degrees 15 minutes).

Regardless of the system, the notation will begin with 34 degrees. To change the minutes into a decimal, you must divide 15 by 60, the number of minutes in one degree (15/60). The answer is 0.25. Therefore, the decimal notation would be 34.25º or thirty-four and twenty-five hundredths degrees.

Let's look at 12º 20' 38" (twelve degrees, twenty minutes, thirty-eight seconds). We know the notation will begin with 12 degrees. Next we have to convert the 20 minutes into seconds (20 × 60 = 1,200 seconds. Then we add the 38 seconds for a total of 1,238 seconds. There are 3,600 seconds in one degree, so you must divide 1,238 by 3,600. (1,238 / 3,600). The answer is 0.34. Therefore the decimal notation would be 12.34º or twelve and thirty-four hundredths degrees.

PRACTICE 2

3. Convert the following latitudes in traditional notation to decimal notation. (Round your answer to the nearest hundredth.)
   a. 30º 20' N
   b. 45º 45' N
   c. 20º 36' 40" S
   d. 60º 19' 38" S
4. Convert the following longitudes in traditional notation to decimal notation. (Round your answer to the nearest hundredth.)
   a. 25º 55' E
   b. 145º 15' E
   c. 130º 37' 10" W
   d. 85º 26' 8" W