Geography 417
Geography Lab - Using the Geographic Grid
Vocabulary and Conceptual Primer

Latitude and Longitude Basics
The earth is nearly a sphere and in order to locate any point on the surface of this sphere cartographers have devised a number of strategies to help us identify places using latitude and longitude coordinates.

Remember, you use latitude (those lines that go around the earth, parallel to the equator) to describe how far north or south a place is. The equator is zero degrees latitude and the North Pole is 90 degrees north latitude. Longitude is used to describe the distance any place is from the Prime Meridian, a line that runs perpendicular to Equator through Greenwich, England. Places are east or west from the Prime Meridian by degrees of longitude. On the opposite side of the earth, running essentially through the middle of the Pacific Ocean is the International Date Line; it is 180 degrees west (or east) of the Prime Meridian.

When you describe a location using latitude and longitude, always provide latitude (north or south) first.

Common Coordinate Systems
There are several means to subdivide and express (write out) degrees of latitude and longitude so that one may provide a more precise location. Three formats are most common: DM (Degrees Minutes) and DMS (Degrees Minutes Seconds) and the decimal degrees (DD) system. Wikipedia frequently uses the DMS system, but Google Earth and many GPS systems in cars use the DD system.

Each system uses the common 360 degree system to express the largest unit of division, with a maximum of 180 degrees longitude and 90 degrees latitude.

The DM and DMS systems use a sexigesimal or base-60 system to subdivide degrees, much like clocks do in the course of subdividing hours. The DM system divides degrees only into minutes, and the DMS system further divides minutes into seconds, much like a clock with a seconds feature. Therefore precisely halfway between 39 and 40 degrees north would be expressed in the D.M.S. system as 39 degrees, 30 minutes and 0 seconds north.

The decimal degree system, while using the same number for degrees, subdivides degrees based on a base 10 format commonly used for most mathematical expressions of a fraction. Halfway between 39 and 40 degrees north would be 39.5 degrees north

Converting between Coordinate Systems
To convert between DD and DMS simply start by remembering that both systems will use the same number for degrees.

To convert minutes from DMS to DD, multiply the number in the minutes place by 1/60 or .0166667.

To convert seconds from DMS to DD, multiply the number in the seconds place by (1/60*1/60) or 0.000278.

You must then add the decimal fractions from both conversions (minutes and seconds) to get a base ten decimal that you would then add to your decimal. An example follows:

Sample Conversions

Let's take Alcatraz Island's geographic coordinates as an example. Alcatraz's exactly location could be written in DMS format as:

37°49'36" N, 122°25'24"W

To read this you would say,
"37 degrees, 49 minutes, 36 seconds north; 122 degrees, 25 minutes, 24 seconds, west."

To convert Alcatraz's latitude into decimal degrees (DD), you would use the following steps:

1. multiply degrees by one: 37 *1 = 37
2. multiply minutes by one-sixtieth (.0.016666667)   49 * (1/60) =0.816667
3. multiply seconds by one-sixtieth times one-sixtieth (0.000277778)   36 * (1/60) * (1/60) =.01
4. add the products together   37.826667

In the decimal degree (DD) system, Alcatraz's geographic coordinates are:

37.826667, -122.423333
*note that direction is not indicated by cardinal directions, but by the presence or absence of a negative (-) sign
*south latitude and west longitudes are indicated by the a minus, negative sign.

To read this you would say,
"37 point 82667 degrees north; 122 point 42333 degrees west."

To convert the Alcatraz's longitude from the DD system in to the DMS system you would do the following:

1. multiply degrees by one to get degrees: -122 *1 = -122
2. multiply the decimal fraction by 60 to get minutes   .4233 * 60 =25.3998
3. multiply the decimal fraction from step 2 by 60 to get seconds   .3998 * 60 =23.998
4. round as necessary, add the directional notation (north?) and compile to get: **122°25'24"W**

Additional web links to consider, including some that have conversion calculators:

http://en.wikipedia.org/wiki/Geographic_coordinate_system

http://en.wikipedia.org/wiki/Geographic_coordinate_conversion

http://zonalandeducation.com/mmts/trigonometryRealms/degMinSec/degMinSec.htm

http://www.fcc.gov/mb/audio/bickel/DDDMMSS-decimal.html