

**Lesson Title:** Coordinates

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**Lesson Summary:** Students will review concepts of location using geographic coordinates (Latitude and Longitude). They will identify various important lines of latitude and longitude and global hemispheres. Students will learn different ways to record coordinate pairs and use absolute and relative location to discuss spatial information.

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Before you begin using this module, you will need to know about using the ArcGIS Server Web-based GIS viewer. You can do this by watching the server tutorial video or working through the tutorial. The tutorial video, student activity, and Web-based GIS Tutorial Viewer can be found at <http://gis.lanecc.edu>. Go to the “Modules” tab and click the Tutorial link. You will need a high speed Internet connection and a current version of Adobe Flash Player.

**Prior Skills:** For this activity, you will need to know how to turn on and off layers, query layers, use of the zoom tool, and use of the ID tool.

Review concepts of Longitude and Latitude by reading the article on the National Atlas page below [http://www-atlas.usgs.gov/articles/mapping/a\\_latlong.html](http://www-atlas.usgs.gov/articles/mapping/a_latlong.html)

Remember that computer steps are indicated by a ► symbol. Questions you need to answer are numbered.

Please record your answers on a separate sheet of paper.

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- Connect to the webpage at: <http://gis.lanecc.edu>
- Click on the Modules link.
- Click on the link to Coordinates.
- Choose Link to the web-based map.



The page will take a minute or two to load. The base map will load first then the other data layers. If it stalls at 55%, just click the **refresh** button on your browser.

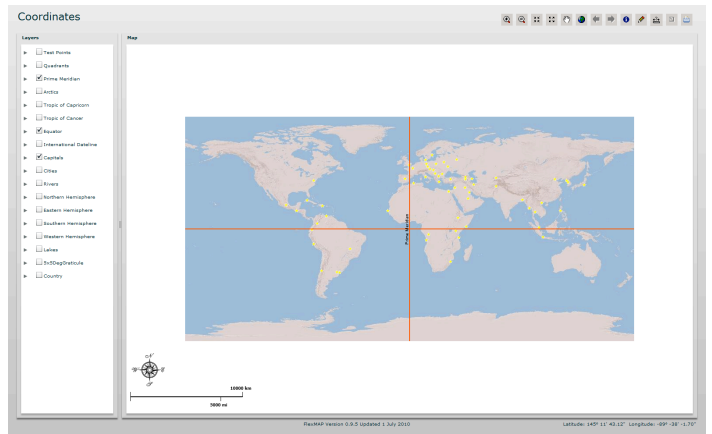
- Choose Coordinates.



▶ Your map should look like the image.

▶ Turn on Cities, Lakes, and the Quadrants layers.


▶ Zoom in to the largest scale you can (large scale means the scale bar will be about 2 miles) on the quadrant II symbol.(orange triangle).



▶ Use the mouse to hover over the symbol for quadrant II. Read the latitude and longitude from the southeast corner of the map page.

1) What is the latitude and longitude in degrees, minutes, and seconds? The seconds show decimal increments.

▶ Zoom out to a scale bar of about 100 mi.

▶ Use the identify tool  to find the name of the closest city west of the quadrant II symbol.

2) What is the city name and what are the coordinates (latitude and longitude) for the city? This is the absolute location for this city.

You can record coordinates in two ways using a cardinal direction like N, S, E, W or using + or -

Latitudes are either in the northern hemisphere ( N or + ) or in the southern hemisphere (S or -)

Longitude is either in the eastern hemisphere ( E or +) or western hemisphere (W or -)

▶ Use the zoom to full extent tool to see the entire map.



▶ Turn off City, Quadrant, and Lakes.

▶ Turn on the Northern Hemisphere layer.

3) Which quadrants are in the northern hemisphere?

▶ Turn on the Western Hemisphere layer.

4) Which quadrants are in the Western Hemisphere?

Quadrant II is located northern and western hemispheres.

5) Indicate the hemispheres for the following quadrants: QI, QIII, QIV

▶ Turn on Cities, and zoom in so you can see quadrant II and the two cities west of the numeral II.

Minneapolis is the city to the west of St Paul (the city you identified in question 2). There are two ways to record the coordinates or absolute location:

- a)  $45^{\circ} 55' 42.92'' \text{ N}, 93^{\circ} 18' 44.56'' \text{ W}$
- b)  $45^{\circ} 55' 42.92''$  ,  $- 93^{\circ} 18' 44.56''$  ( the + sign is not needed to indicate north or east)

6) Write the coordinates for St Paul using both methods.

Latitude and longitude are ways to identify an **absolute location**. Another type of absolute location is a street address. For example: My house is located at  $45^{\circ} 15' 30''$  north latitude and  $123^{\circ} 24' 15''$  west longitude or at 1234 West Winters Street, Salem Oregon. Both are ways to identify absolute locations.

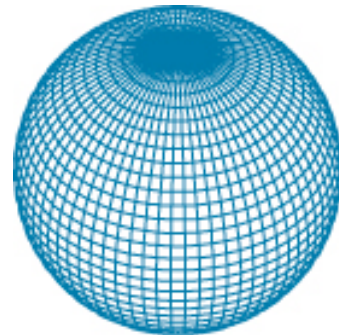
**Relative location** is when you describe where a place is with respect to another place. For example: My house is 1 mile north of the Wilson Park and two blocks east of the river. It is the third house from the corner on the south side of the street.

- 7) How far is this city in miles from the quadrant II symbol? How far it is from the Lake Superior?
- 8) What direction is it from quadrant II and from Lake Superior?
- 9) Write a description of the relative location of the city you identified in question 2.

## Map Projections and the Graticule


- ▶ Turn on  $5^{\circ} \times 5^{\circ}$  graticule (5x5DegGraticule)
- ▶ Zoom to the full extent

The viewer displays the graticule as an even grid. Here the longitude lines look parallel to each other. This is because the map is drawn using a geographic or equirectangular projection. A projection is a way to represent a three dimensional object like the earth, onto a flat surface such as a piece of paper or a computer screen. Projections always have some type of distortion. On a globe, a more accurate model for our spherical earth, the lines of longitude meet at the poles. This spherical projection shows the longitude lines converging, but you can only see a portion of the earth at a time. To read more about projections go to:



[Http://www.colorado.edu/geography/gcraft/notes/mapproj/mapproj\\_f.html](http://www.colorado.edu/geography/gcraft/notes/mapproj/mapproj_f.html)

## Major Geographic Reference Lines

- ▶ Zoom to full extent  and turn on the Tropic of Cancer, the Tropic of Capricorn and the Arctics.

- 11) What are the Latitudes for the Tropic of Capricorn and the Tropic of Cancer?
- 12) What are the Latitudes for Arctic Circle and the Antarctic Circle?
- 13) What line of longitude is used for the prime meridian?

- ▶ Turn on the International Date Line? This special meridian, or longitude line, is not straight. Explore this line using the Zoom tool.

14) What is your hypothesis for the irregular shape of the International Dateline?

### Practice with Longitude and Latitude

- ▶ Turn on the Test Points layer. Find the Test Point which is in the northern hemisphere, and about 3,500, miles east of the Prime Meridian.

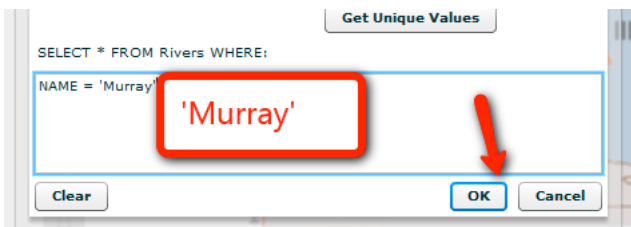
15) What is the number of the Test Point and its coordinates?

- ▶ Find the Test Point that is in the western hemisphere and approximately 4000 miles southwest of the location where the prime meridian and the equator cross?

16) What is the number of the Test Point and its coordinates?

### Find and Measure a specific feature

- ▶ Make Rivers visible.
- ▶ Right Click Rivers and select Query Layer.
- ▶ Write this query expression Name = 'Murray'



- ▶ Click OK.

17) What is the latitude and longitude for the Test Point on the Murray River? (Hint – Zoom in to the south east area of the large island continent in the south eastern hemisphere).

18) What is the name and the coordinates for the capital city which is in Quadrant I. It is between 40° and 45° East longitude and between 30° and 35° north latitude?

### Career Extension

- ▶ Go to the website: <http://www.esri.com/industries.html>
- ▶ Find a career that might be of interest to you. For example, in the Natural Resources list there is a link to Forestry. In the forestry link there are several job descriptions in the Industry Focus.
- ▶ Prepare a half-page summary of the types of things that someone would do in this career using GIS.
- ▶ Search the Internet and look for job possibilities, salary, and locations.