

## **Instructors' Notes:** **Where's the Math??**

**The Earth and Moon Viewer:** <http://www.fourmilab.ch/earthview/>

**Topics:** coordinate geometry, measurement, number operations.

**Purpose:** Learners will use the Earth and Moon Viewer to investigate a variety of questions having to do with coordinate geometry and number operations. The learner activity sheet leads them through activities dealing with latitude/longitude coordinates, world time zones, the 24-hour clock, and charts of sunrise/sunset data. These investigations are done in the context of the learner's location and time zone.

**Materials:** Computers with Internet access, learner activity sheet, globe or map.

**Prior Knowledge:** This activity is most successful if learners recognize the continents of the world and the general location of their home city. It is helpful if learners already understand latitude and longitude, but they can learn this concept through this activity. (See Related Links)

**Description:** The Earth's latitude and longitude grid is an excellent example of the coordinate plane. The Earth and Moon Viewer website can be used to introduce the concept of coordinate geometry or to provide practical applications once the concept has been learned. When used in conjunction with the U.S. Naval Observatory website, the Earth and Moon Viewer provides practice using basic mathematical operations in dealing with time and daylight.

**Assessment:** The concepts in these activities can be quickly tested in interesting ways. After completing the activities suggested in the learner activity sheet, learners can provide each other with questions, such as "What is the latitude/longitude of Tokyo, Japan?", or "What major world city will you find at approximately 34° S, 151° E?" (Learners must also know the answers to the questions they are asking each other). Similarly, learners can construct questions about time zones: "Fifi is leaving New York at 6 pm local time Friday to fly to Paris. If the flight time is approximately 7 hours, what time and day will it be in Paris when she arrives?"

### **Notes:**

1. Time zones west of the Prime Meridian (Greenwich Mean Time; Universal Time Coordinated) are often indicated by negative numbers, while eastward zones are indicated by positive numbers. This can serve as a visual representation of the number line and positive/negative numbers.
2. The latitude/longitude measurements are given in decimal form at the Naval Observatory and the Tiger Gazetteer websites, rather than in the more traditional degrees/minutes/seconds. The decimal form can be entered into the Earth and Moon Viewer website, where it will be automatically converted into degrees/minutes/. The degree/minutes form will be displayed at the top of the webpage. Learners may be confused about this apparent difference in numbers. For example, Corvallis, Oregon, is described and located either way:

44.6N, 123.3 W (decimal notation)  
44°36'N, 123°18' W (degrees/minutes notation)

3. These explorations of latitude, longitude, time, and the seasons can be connected to a real-time investigation of Eratosthenes' experiment to estimate the Earth's circumference. Participate in the worldwide science and math experiment to recreate what Eratosthenes measured. For more information about this event, look under the Events and Celebrations section of the Science & Numeracy Special Collection. <http://literacynet.org/sciencelines/eventscelebs.html>

### **Websites used in learner activity:**

The Earth and Moon Viewer: <http://www.fourmilab.ch/earthview/>

Time Flies: <http://www.planemath.com/activities/timeflies/time1.html>

This website takes one through the workings of 24-hour clock time.

Tiger Gazetteer from US Census: <http://www.census.gov/cgi-bin/gazetteer>

CIA World Factbook <http://www.odci.gov/cia/publications/factbook/docs/ref.html>

Xerox PARC Map Viewer: <http://mapweb.parc.xerox.com/map>

U.S. Naval Observatory World Time Zone Map:

[http://aa.usno.navy.mil/AA/faq/docs/world\\_tzones.html](http://aa.usno.navy.mil/AA/faq/docs/world_tzones.html)

U.S. Naval Observatory, Complete Sun and Moon Data for One Day:

[http://aa.usno.navy.mil/AA/data/docs/RS\\_OneDay.html](http://aa.usno.navy.mil/AA/data/docs/RS_OneDay.html)

World Cities on the Earth and Moon Viewer:

<http://www.fourmilab.ch/earthview/cities.html>

How Far Is It—the Distance Calculator: <http://www.indo.com/distance/>

World Map of Live Web Cams: <http://dove.mtx.net.au/~punky/World.html>

### **Related Links:**

1. Maps:

National Geographic Map Machine:

<http://www.nationalgeographic.com/maps/index.html>

Maps from the CIA World Fact Book:  
<http://www.odci.gov/cia/publications/factbook/docs/ref.html>

Xerox PARC Map Viewer:  
<http://pubweb.parc.xerox.com/mapdocs/mapviewer.html>

## 2. Coordinate geometry:

Project Interactive:  
Graphing and the Coordinate Plane:  
<http://www.shodor.org/interactivate/lessons/fm1a.html>  
Cartesian Coordinate System:  
<http://www.shodor.org/interactivate/lessons/cartesian.html>

Score Mathematics: Coordinate Graphing  
<http://score.kings.k12.ca.us/lessons/graphing.html>  
This website uses the activities from Project Interactive (see above) while providing a quiz and a coordinate grid in pdf files. The student page gives step-by-step instructions for independent work.

Chameleon Graphing—An Introduction to the Coordinate Plane:  
<http://forum.swarthmore.edu/cgraph/cplane/>  
This is an excellent site from the Math Forum, but some of the language and graphics are not age neutral. There are references to “your parents” and “notes to grownups”, and there is a cartoon-cute chameleon. The glossary of terms is excellent.

## 3. Time, time zones, astronomical data:

Definitions of Rise, Set, and Twilight:  
[http://aa.usno.navy.mil/AA/faq/docs/RST\\_defs.html#top](http://aa.usno.navy.mil/AA/faq/docs/RST_defs.html#top)

The World Clock—Time Zones: <http://www.timeanddate.com/worldclock> Click on the name of a city and find out more information about it.

What Time Is It? <http://tycho.usno.navy.mil/what.html> This site gives real-time practice in calculating time. It works best with the Netscape browser.

U.S. Naval Observatory Astronomical Applications:  
<http://aa.usno.navy.mil/AA/faq/>  
This provides an index of the answers to frequently asked questions, such as  
The International Date Line:  
[http://aa.usno.navy.mil/AA/faq/docs/international\\_date.html](http://aa.usno.navy.mil/AA/faq/docs/international_date.html)  
The Phases of the Moon: [http://aa.usno.navy.mil/AA/faq/docs/moon\\_phases.html](http://aa.usno.navy.mil/AA/faq/docs/moon_phases.html)

Time Exhibits: <http://www.time.gov/exhibits.html>

This is an index of exhibits recommended by the National Institute of Standards and Technology and the U.S. Naval Observatory. Here are two good samples:

Calendars from the Sky: <http://webexhibits.org/calendars/> This exhibit gives the history of various calendars used by world cultures and religions.

Daylight Savings Time: <http://webexhibits.org/daylightsaving/> This exhibit gives the history of daylight savings time as well as other interesting information.