MISSION PREP

A Teacher's Activity Guide

Another in the Series of
Challenger Learning EdVentures
from

Latitude and Longitude

Background

The importance of identifying a specific location on Earth has long been a concern to travelers and explorers. This information was vital in planning for adequate supplies during voyages and for charting courses. Great effort was used by early mapmakers to show relationships between locations on Earth. Improvements in technology used for measuring distances led to increasingly more accurate maps.

Astronomers and geographers use coordinate systems for designating positions. You may be familiar with the system of longitude and latitude used by geographers. The system is regularly used to define positions on the Earth's surface. *Latitude* lines circle the planet parallel to the equator. Therefore, when stating a latitude, you must specify a number of degrees north or south of the equator. For example, 40 degrees North latitude relates to an Earth location on a line with New York in the United States; Madrid, Spain, in Europe; and Beijing, China, in Asia. Looking to the other side of the equator, 23 degrees South latitude refers to a location near Rio de Janeiro, Brazil, in South America, and Alice Springs in Australia.

Longitude lines on Earth run north to south, measuring angles east and west. Zero degrees longitude is defined as the line that runs through Greenwich, England, near London. The longitude for locations in North and South America is called west longitude. New York City is located at 74 degrees West longitude. Longitude for locations in most of Europe, Asia, and Africa are designated East longitude. Tokyo, Japan, is at 139 degrees East longitude.

By naming both the latitude and longitude, a very precise position on Earth can be specified. For example, New York City is located at a point where the 40-degree North latitude line crosses the 74-degree West longitude line. To be very specific, we would need to divide the latitude and longitude numbers into smaller increments called minutes of arc and seconds of arc.

Skills

- Coordinating systems
- Using longitude and latitude
- Estimating
- Measuring
- Making models and grids

Objectives

Students will:

- Construct a model demonstrating the longitude and latitude lines on Earth.
- Use longitude and latitude lines to find locations on their model.

Overview

Using a balloon and string students will create a model grid system similar to the longitude and latitude lines we use on maps and globes. Students will use this grid system to identify selected positions on the model.

Key Question

How do lines of latitude and longitude help us locate position?

Key Concepts

- Coordinate systems are useful in helping people locate positions.
- Lines of longitude and latitude are commonly used to find geographic locations.

Materials & Preparation

- 1 thirty cm diameter round balloon per student
- Kite or package string
- 1 Flexible measuring tape or meter stick per pair
- Felt tip markers: red, black, green, blue
- Transparent tape
- Scissors

1. Assign two students per team.
2. Review background information, particularly reasons for having a system of determining

locations on Earth.

3. Review the student procedures, creating a sample model if time permits.

Management

This activity may take one or two classes to complete. Care should be taken when using scissors.

Reflection & Discussion

1. What is the difference between longitude and latitude?
2. In the coordinates 40° N, 120° W, which is longitude and which is latitude?
3. Find the coordinates of a big city closest to where you live.
4. How does the balloon model differ from the real Earth?
5. How do you explain where something is when it doesn't directly lie on a line of latitude or longitude?
6. Why is it important to have coordinate systems?

Transfer & Extension:

1. Draw in the continents on the balloon.
2. Research and give an oral report about the methods used by astronomers to define coordinates in the sky.
3. Find several different maps of the Earth and compare them. Are some more accurate than others? What factors are involved in making a map that is accurate?
4. Research Greenwich, England, and how it became the Prime Meridian. What is meant by Greenwich Mean Time?
5. How do the time zones relate to longitude?
6. How do minutes and seconds tie into longitude and latitude coordinates?
7. Using maps in the library or on the Internet, find a few obscure or remote locations on Earth and note their latitude and longitude as specifically as possible. Challenge the students to find the coordinates of the location, providing only the name of the location as a clue.

STUDENT WORKSHEET

Latitude and Longitude

Student Procedures

1. Get with your partner and gather the materials that you will need for the activity.
2. Blow up the balloon and tie it closed with string. The balloon represents the Earth with the balloon's opening marking the south pole of the Earth.
3. Using the tape measure, find the distance around the balloon from the north pole through the south pole and back to the north pole. This is the circumference of the balloon. Record this length here: _____ cm.
4. Cut 6 pieces of kite string this length. Fold each in half and mark the halfway point with a black marker. Fold each in half again and mark the fold with a red marker. Again fold each in half and mark with the green marker.
5. Wrap each piece of string from the south pole to the north pole, around to the south pole again and tape into place. Space the strings equally distant from each other, overlapping them at the north and south poles. Choose one to be the prime meridian (zero longitude) and use the marker to color this string blue.
6. Wrap a piece of string around the center (the equator) of the balloon, lining it up with the red marks on the longitude string. Cut it exactly the right length to fit once around the balloon's center and measure the total length of the string. Divide this number by 6 and make a mark with the black marker at each 1/6 point along the equator.
7. Tape the equator line into place adjusting it so the longitude lines intersect the equator at the marks at right angles.
8. Place a piece of string around the Earth above and below the equator to line up with the green marks on the longitude lines. These represent 45° north and south latitude. Cut to the correct length and tape into place.
9. Estimate a point halfway above and halfway below each of these new latitude lines. Cut and place strings to mark these latitude lines so that they circle the balloon.
10. Label each line of latitude as they would appear on a globe of the Earth. Be sure to designate whether or not the lines are north or south of the equator.
11. Similarly, label the longitude lines, remembering to record which lines are east and west of your prime meridian.
12. Draw six small shapes (use something simple, such as a triangle, star, circle, or square) on the balloon with a marker. Make each shape different. At least three of your marks cannot lie at the intersection of two strings.

13. Write down the shapes and their coordinates here:

Shape	Latitude	Longitude

14. Turn to your partner and have each of you call out one of the shapes and its coordinates. (For instance: "I have a star at 33 degrees N and 127 degrees W.") On your own balloon, locate the position that your partner gave you. When you find it, draw in the shape your partner indicated.

15. Repeat step 14 until all 6 coordinates have been located.

Questions

1. Do the shapes drawn on your balloon match those of your partner? If there are differences, go back to steps 12 and 13 to see where there was an error. Once it is fixed, describe what went wrong the first time.
2. Are all latitude lines of equal length? Are all longitude lines of equal length? When are longitude and latitude lines equal in length to each other?
3. Observe the angles made by the intersection of the latitude and longitude lines. At what angle do they intersect? Is it always the same angle?
4. How did you find the coordinates of the shapes that were not located at an intersection of the string? Is this way of determining the coordinates very accurate? How could you modify the balloon to make it more accurate?