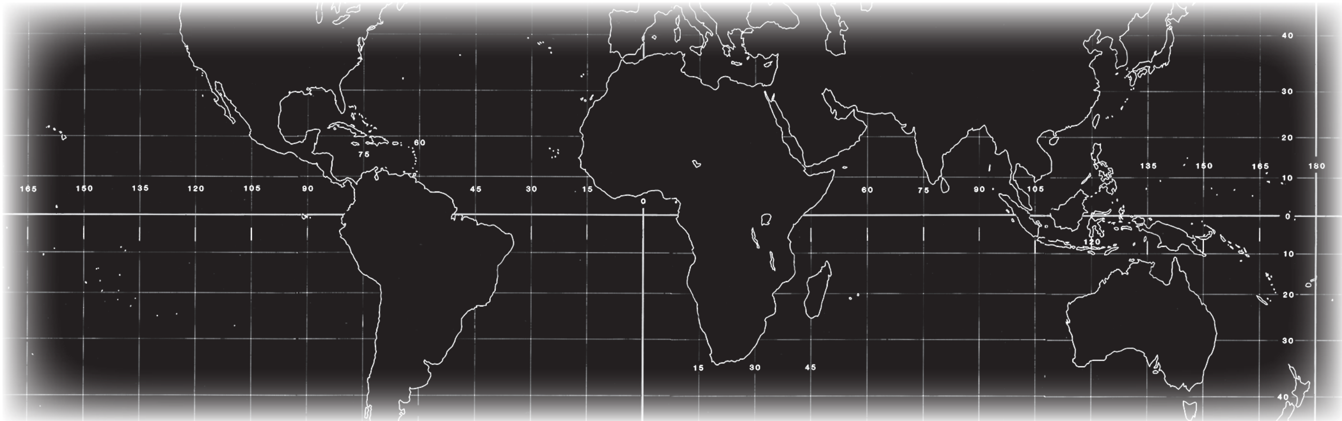


A Collection of Curricula for the STARLAB® Earth Cylinder

Including:

A Look at the Earth Cylinder by Joyce Kloncz

Where on Earth am I??? by Gerald L. Mallon, Ed.D.

Latitude and Longitude by Gerald L. Mallon, Ed.D.

Great Circle Routes by Gerald L. Mallon, Ed.D.

Curriculum Guide Contents

A Look at the Earth Cylinder

Introduction

This cylinder is an excellent tool to teach geography skills to students. The following are some ideas you can use to introduce this cylinder.

> **Note**
>
> *In this planetarium activity, text that is in italics is suggested script for the teacher to use.*

Objectives

To locate continents and oceans, hemispheres, lines of latitude and longitude, and to use that information to find specific locations on our earth.

Process Skills

Describing • observing • interpreting • communicating • inferring • working cooperatively

Procedure

- Before showing the cylinder, have the house lights dimming and the projection lights slowly brightening. Ask the children to imagine that they are in the middle of a glass earth. If we really were in the center, what might be different from what you see here? (The continents would appear backward, rather than the way they look here.)
- For very young children, talk about continents and oceans. With older students, name the continents and oceans. Find significant countries of the world. Point out those countries with which students may be familiar, such as the United States, England, India, Japan, Russia, China, etc. Take turns using the pointer flashlight and reviewing the above concepts.
- Hand out a world map (similar to the one you would find in the curriculum guide *Where on Earth Am I???*). Pass out pencils and have students write the following on their maps as you discuss the locations of:

  Pacific Ocean, Atlantic Ocean, Indian Ocean, Arctic Ocean

  North America, South America

  Africa, Asia, Europe

  Australia, Antarctica

  Northern Hemisphere, Southern Hemisphere, Eastern Hemisphere, Western Hemisphere
- With older children, introduce latitude and longitude. Talk about the lines called longitude (which are measured east or west of the prime meridian), and the lines called latitude (which are measured north or south of the equator). (Note: I like to tell children that latitude sounds like ladder, so those lines are like the steps on a ladder.)

Ask: "How many lines of latitude do you think there are on this global representation?"

- Slowly tilt the cylinder so children can count with you. With the pointer flashlight, start at 0° (the equator), and move up to 10, 20, 30, 40, 50, 60, 70, 80 and 90° north latitude. Do the same counting by degrees south of the equator.

Materials

- STARLAB Portable Planetarium
- Earth Cylinder
- worksheets
- pencils
- clipboards
- arrow pointers
- red flashlights (for reading, optional)

Ask: "What is the latitude of the North Pole?" (90° north latitude) "The South Pole?" (90° south latitude).

Latitude is measured north or south of the equator. Find the line of latitude closest to your home. What latitude would that be?

- Rotate the cylinder so that all of the latitude numbers are showing, and use the pointer flashlight to move to your location and find your hometown's latitude.

Lines of latitude and longitude are used by sailors and pilots to determine where they are. If you are in the middle of an ocean, you do not have any landmarks to guide you, so latitude and longitude can help find directions.

Ask: "Do you know why we have longitude lines on our cylinder?"

When railroads were just beginning to use timetables to show their times of arrivals and departures, they realized that time needed to be standardized. Before that time, time was determined at all locations by solar noon — the time when the sun was at its highest point in the sky. But solar noon for Minneapolis was different from what it was for a town 100 miles west. That confused railroad passengers, so it was determined by the railroad industry as well as astronomers that it was necessary to standardize times. They met in Greenwich, England and divided the earth into 24 lines of longitude. That made sense, since there were twenty-four hours in a day. (With the pointer flashlight, count the 24 lines of longitude.) Astronomers used the line going through Greenwich, England, as the prime meridian, the starting point for measuring longitude. Longitude is measured east or west of the prime meridian.

Now it would be easy to set the times, because each line was 15° apart. By multiplying 15° x 4° per minute equaled 60 minutes, which was the spread of time between each line of longitude. But there was a point when the time went from 12:00 midnight to 1 a.m., which was the next day. It didn't make sense to have that line anywhere near a populated area, as that would cause too much confusion, so they chose the most unpopulated area on earth, in the middle of the Pacific Ocean. They called that line the international date line.

- Show it with the arrow pointer, and note that there are no land masses here. When you move north on the globe, you'll note that part of Siberia is in the middle of that line, but the experts moved around the Bering Straits so that entire area is one time zone.
- If you can, find a copy of the time zones in the United States and distribute it to the students. Have them determine different times at various places. For example, if it is 9 a.m. in New York City (Eastern Standard Time), what time is it in Minneapolis, or Montana, or California? If it is 1 p.m. in Florida, what time is it in Texas or Arizona? Talk about how some areas use daylight savings time, while other areas do not.
- With older students, use your copy of a map of the world with all of the longitude and latitude lines included. Use your arrow pointer to point out all of the time zones throughout the world. If it is 2 p.m. in New York, what time is it in England, Japan, Australia, India, etc.? Have students take turns finding different time zones in different areas of the world.

Evaluation

From there it is a natural progression to give latitude and longitude coordinates of various cities throughout the world and have students work with a partner to find those coordinates. Hand out about twelve different coordinates to pairs of students. Keep the rotation of the cylinders moving if those coordinates are scattered throughout the earth or just do a hemisphere at a time, such as northern, southern, eastern, or western.

Where on Earth am I???

Note

In this planetarium activity, text that is in italics is suggested script for the teacher to use, but not necessarily intended to be read word for word.

Purpose

To study the earth's coordinate system and to practice its use by locating specific places on earth by means of latitude and longitude.

Objectives

By the end of this unit, students should be able to:

1. Define the terms "latitude" and "longitude" making reference to their beginning points (equator and prime meridian) and their units of measurement (degrees).
2. Locate a specific country on the planetarium dome, if given the coordinates.
3. Identify a particular country by name, if given the coordinates and a musical clue (example "Scotland the Brave" for Scotland, or "Ragam-Kalyani" for India, etc.)

Preparation

Using the Earth Cylinder, the STARLAB projector should be set so that the equator is approximately halfway up the dome and the prime meridian is centered from left to right. Students should already have completed the worksheets on latitude and longitude before attending the planetarium program.

Procedure

Students are welcomed to the planetarium and the purpose of the lesson is explained.

The most accurate way to show the earth's surface is as a globe. A globe is a ball, or sphere, because the earth's shape is like a ball. When the earth is represented on a flat piece of paper, the appearance of the earth's surface is changed. A flat map of the earth is stretched and altered. Such changes are called distortions. For our work today, we will be able to review the system of latitude and longitude in a more accurate manner, by using a model of the earth that is indeed a globe, but not just any globe. For our work, we will be inside the globe!

- Turn on STARLAB projector; turn down the room lights. Give the students a moment to marvel at the image projected onto the dome before continuing the lesson.
- Review the system of latitude and longitude with the class by pointing out particular images on the dome. Use the arrow pointer to highlight the areas mentioned as you convey the following information.

Mapmakers have created a series of imaginary lines on the globe to help locate points. The best known of these imaginary lines is the equator. It circles the globe in an east-west direction, halfway between the North Pole and the South Pole. Other imaginary lines running in an east-west direction are known as parallels because they are parallel to the equator and to each other. The imaginary lines running from the North Pole to the South Pole are known as meridians. The meridians are not parallel to each other. They are farthest apart at the equator and they come together at the poles. Together this system of parallels and meridians creates a grid that allows particular points to be plotted. This is the system of latitude and longitude and is

Materials

- STARLAB Portable Planetarium
- Earth Cylinder
- inflatable earth globe "beachball"
- earth map worksheets
- pencils
- slides and transparencies
- overhead projector
- slide projectors
- tape player
- tape of appropriate musical clues (see sample list)

measured in degrees. Now, let's see if you can answer a few questions about this system.

Ask: "What is the starting point for measuring latitude called?" (Student Response: the equator.) "What is the starting point for measuring longitude called?" (Student Response: the prime meridian.) "What is the maximum measurement in either north or south latitude?" (Student Response: 90°.) "What is the maximum measurement for east longitude?" (Student Response: 180°.)

- After this introduction and review, begin the first activity as follows. Explain to the students that you will be tossing an earth globe "beachball" to some member of the class. The person so chosen must catch the ball, look it over, and select a point on the globe. The student should then state the latitude and longitude for the unknown country (example: 50° North, 10° East). A second student is then chosen (either by volunteer or at random) and using the arrow pointer attempts to locate this point on the dome within 15 seconds. If the second student successfully locates the point on the dome within the time limit, the first student names the country chosen (example: Germany) and then tosses the ball to someone else in the class to continue the activity. If, however, the second student does not find the proper place within the 15 second time limit or points to a wrong location, the first student must use the pointer to show the correct place on the dome, and state its name, before tossing the ball to another student. This activity should be continued for approximately 10 minutes.
- For the second activity, explain that they will be testing their understanding of latitude and longitude as well as their knowledge of the many countries found around the globe, and they will do it with the added element of music. Students will attempt to find a particular set of coordinates on the dome and then identify the particular country that contains those coordinates by listening to a piece of music native to the given country. To keep track of each students progress, worksheets will be distributed for the students to complete and these will be checked at the end of class. (If you wish, you may give extra credit for those scoring perfect papers.) The worksheet will consist of three columns. In the first column, there will be space for the students to list the coordinates for some unknown points around the globe. In the second column, there will be space to list the name of the country that they think would match the given coordinates, and in the final column, there will be space to list the actual names of the chosen countries, so that they can check their level of success.
- To begin the activity, distribute Activity 3 Worksheet to the students. Announce the first set of coordinates, instructing the class to list the coordinates in column one on their worksheets (see following list). Choose a student to find the given location on the dome and while this is happening, play music native to the unknown country. Play approximately 30-60 seconds of the music and then ask the students to name the country. Students should list the name of the chosen country in the second column. The actual name should not be given until the end of the activity. Continue with this procedure until the ten countries have been identified on the dome and the students have finished their list of predicted names. After the last country has been identified, ask the students to exchange their papers and then proceed to read the correct answers. Students should check the papers by writing down the correct answer in column three for each problem as it is announced. Perfect papers may be rewarded with extra credit of some small token.
- Conclude the lesson by stressing the importance of coordinates to our everyday lives and the tremendous value that can be gained by understanding and

appreciating the many cultures that make up our home planet, Earth.

Coordinates	Country	Musical Clue
40°N, 5°W	Spain	Los Aljibes
55°N, 5°W	Scotland	Scotland the Brave
32°N, 100°W	USA (Texas)	Texas Star
50°N, 10°W	Germany	O Alte Burschenerrlichkelt
20°N, 105°W	Mexico	La Reginita
15°N, 77°E	India	Ragam-Kalyani
23°S, 43°W	Brazil	Little Train of the Caipira
35°N, 135°E	Japan	Sukiyaka
10°N, 10°E	Nigeria	Ore Elese To Ku
25°S, 135°E	Australia	Tie Me Kangaroo Down, Sport

Sources of Suggested Music

Los Aljibes: The Soul of Flamenco/Cuadro Flamenco, HS 72002 Nonesuch Records, 15 Columbus Circle, New York, NY 10023

Scotland the Brave: Golden Hours of Scottish Favourites, Golden Hour GH 507 PYE Records, Ltd., ATV House, Great Cumberland Place, London

Texas Star: Basic Square Dance Music LP 504, Educational Activities, Inc., Box 392, Freeport, NY, 11520

O Alte Burschenherrlichkeit: Music of Romantic Old Heidelberg, T 10329 Capitol Records

La Reginita: The Real Mexico in Music & Song, HS 27003 Nonesuch Records, 15 Columbus Circle, New York, NY 10023

Little Train of the Caipira: (From Bachinianas — Brasileiras by Villa Lobos), Making Music Your Own (Grade 7), Silver Burdett Company, Morristown, NY

Sukiyaka: Walt Disney Presents — It's a Small World, DQ 1 289, Disneyland Records

Ore Elese To Ku: The Music of Africa, RDC 4393, BBC Records, London, Horizon/American Heritage Publishing Company, 551 Fifth Avenue New York, NY 10017

Tie Me Kangaroo Down, Sport, Larrikin Records, Australia

Sources of the Earth Globe "Beachball"

Many museum gift shops and toy stores carry this item, or it can be ordered directly from the manufacturer at the address below.

Orbis, P. O. Box 4226, Bellingham, WA 98227, Phone: 360-671-8108 or 360-376-4320

Materials

- Worksheets
- earth globe

Pre-visit Activity

Purpose

To examine the use of the earth's coordinate system of latitude and longitude as a means of locating given places on earth.

Objectives

By the end of this unit, students should be able to:

1. Explain the mechanics of using coordinate systems, giving examples such as road maps and latitude and longitude.
2. Locate a series of countries, if given the coordinates of points (latitude and longitude) within the country's boundaries and an appropriate map of the earth.
3. Define some of the terms used in longitude and latitude measurements, in particular: equator, prime meridian, poles, etc.

Note

This exercise may be done either in class or as a homework assignment. If it is to be administered in class, then the following procedure applies.) Use the earth globe and explain to the class the purpose of the activity.

Procedure

Distribute the materials to the class. Circulate among the students, offering help as needed. When the students have finished, ask them to exchange their papers and then announce the correct answer for each question so that students can check their papers. When the papers have been corrected, return them to their rightful owners, and then review any questions that seemed to cause a large number of wrong answers.

The most accurate map of the earth is a globe. It is a scale model of the earth. A globe is a ball or sphere because the earth's shape is like a ball. Several important points and lines are marked on a globe. Two opposite points are called the north and south poles. They are the points farthest north and farthest south. The equator is an imaginary line that circles the earth halfway between the North Pole and the South Pole. It is the beginning point for measuring latitude. The maximum north or south would be 90°. The prime merdian is a line that runs from the North Pole through Greenwich, England. This line is defined as the axis of a special telescope at the Greenwich Observatory. It is the beginning point for measuring longitude. East longitude extends to the east of the prime meridian. West longitude extends to the west of the prime meridian. The maximum east and west longitude would be 180°. To test your knowledge of latitude and longitude, you are now going to be asked to complete a worksheet on this subject. Pay careful attention to the instructions as you proceed.

Post-visit Activity

Purpose

To examine how a curved line might actually be a shorter distance between two cities than a straight line.

Objectives

By the end of this unit, students should be able to:

1. Define the term "great circle" as any circle that divides the earth in half, such as the equator.
2. Explain why a globe is the only true model that can show the earth's surface without distortion.
3. Determine whether a straight line path or a great circle path is the shortest distance between a set of given cities.

Note

This exercise may either be done in class or as a homework assignment. If it is to be administered in class then the following procedure applies.) Explain to the class the purpose of the activity.

Procedure

- Each pair will need a globe, a piece of string, a ruler and a pencil. Distribute the worksheets. Circulate among the students, offering help as needed.
- At the end of the activity, review the correct answers and have a few students read their responses as to why they think ships and planes might follow great circle routes. (Student Response: It is a shorter route so it will take less fuel and a shorter amount of time.)

The earth is a sphere, therefore the most accurate way to show the earth's surface is with a globe. A globe shows the sizes and shapes of the continents and oceans correctly. No flat map can give a perfect picture of any large part of this sphere. As you might expect, the distortion on a world map can make it difficult to measure distances. If two cities are far apart, most maps cannot tell you the shortest distance between them. On a flat surface, the shortest distance between two points is a straight line.

Because earth has a curved surface, however, the shortest distance between two places on earth is a curved line. The shortest route between any two points on earth is part of a great circle. Any circle that divides the earth in half, such as the equator, is called a great circle.

To find out more about great circle routes, you are going to work with a partner to answer a series of questions on a worksheet.

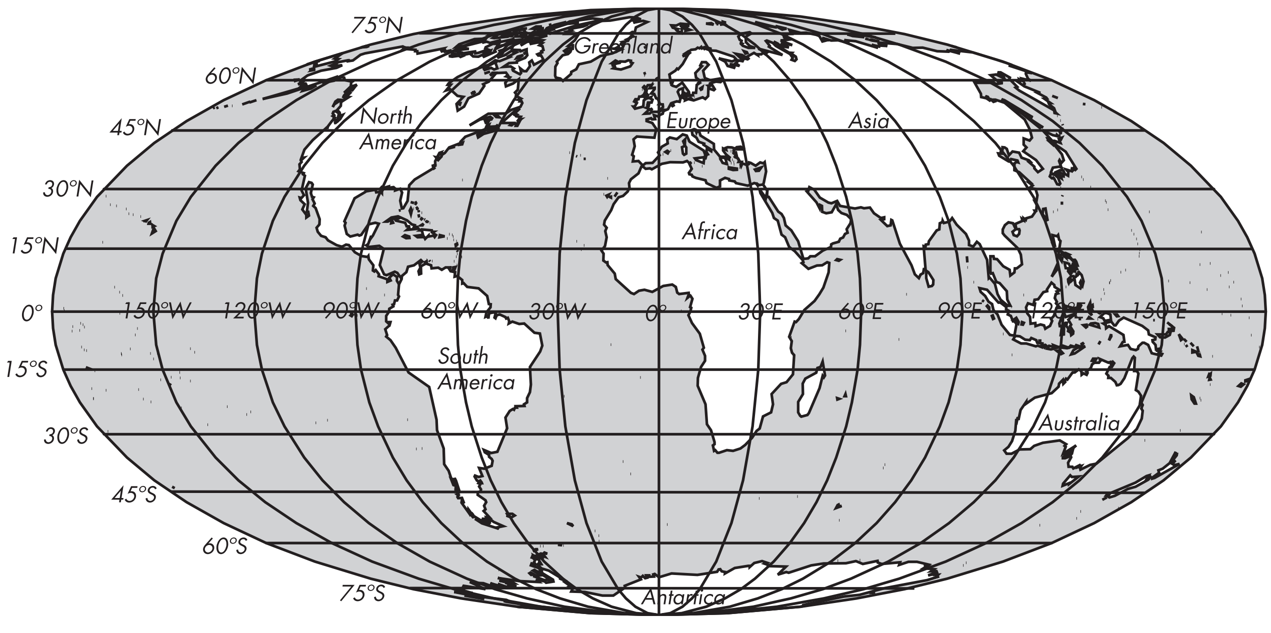
Materials

- Worksheets
- globes
- * strings
- rulers
- pencils

Name____ Date____________________

Latitude & Longitude

The most accurate map of the earth is a globe. It is a scale model of the earth. A globe is a ball or sphere, because the earth's shape is like a ball. Two opposite points are called the north and south poles. They are the points farthest north and farthest south. The equator is an imaginary line that circles the earth halfway between the North Pole and the South Pole. It is the beginning point for measuring latitude. The maximum latitude north or south would be 90°. The prime meridian is a line that runs from the North Pole to the South Pole through Greenwich, England. It is the beginning point for measuring longitude. East longitude extends to the east of the prime meridian. West longitude extends to the west of the prime meridian. The maximum east and west longitude would be 180°.



Activity 1: Latitude and Longitude

Complete the following questions, writing your answer on the blank provided on the worksheet or on the appropriate map. For some of the questions, you will need to use either the small map of the earth shown on this page, or the large map of the earth on page 10. Good luck!

1. The farthest point south on earth is at latitude:
   a) 40° S
   b) 0° latitude
   c) 90° S
2. If you were at 40° South, you would be the same distance from the equator as someone who was at:
   a) 45°N
   b) 40°N
   c) 20°N
3. What is the 0° line of latitude called?
   a) prime meridian
   b) Tropic of Cancer
   c) equator

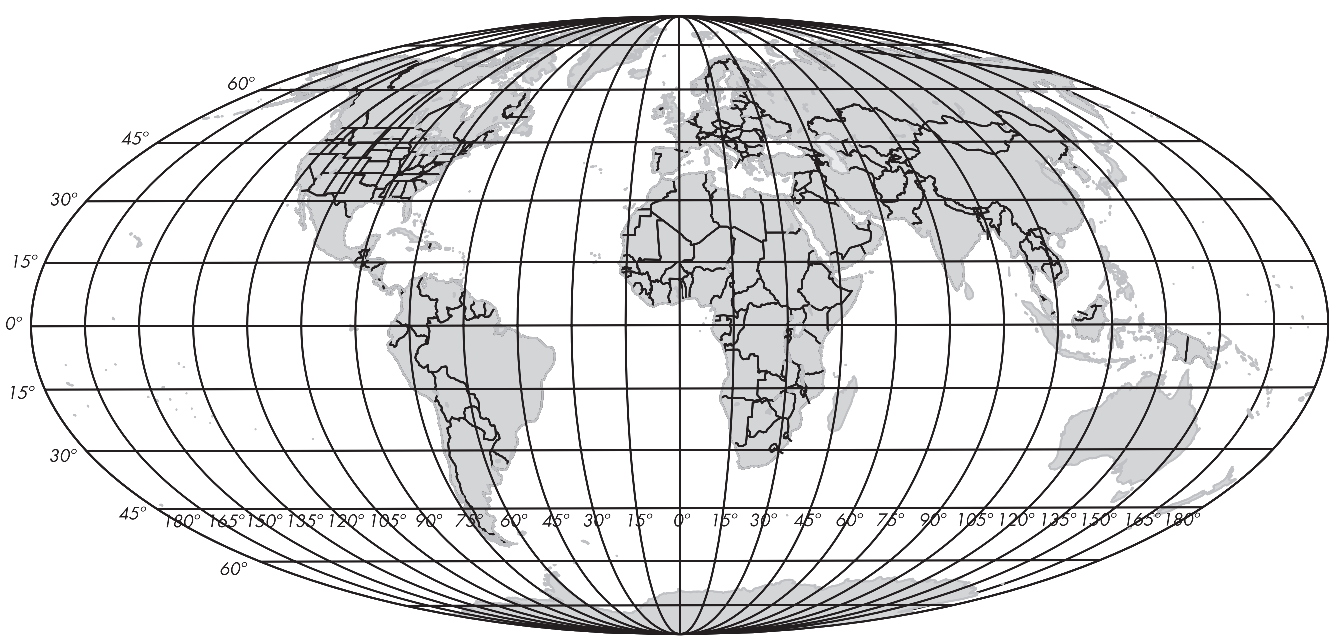
Name____ Date______________________

4. If your position was 40° N and 20° E, you would be in which continent?
   a) South America
   b) Europe
   c) Africa
5. If your position was 20° S and 60° W, you would be in which continent?
   a) South America
   b) Europe
   c) Africa

Activity 2: Countries of the World

On the map of the earth below, use the following coordinates to locate a major city in the country listed below. Label the name of each country on the map.

6. 19° N, 99°W	Mexico
7. 56° N, 38° E	Russia
8. 36° N, 140° E	Japan
9. 24° S, 47° W	Brazil
10. 7° N, 4° E	Nigeria
11. 34° S, 151° E	Australia
12. 30° N, 31° E	Egypt
13. 30° N, 90° W	U. S. A.
14. 49° N, 2° E	France
15. 19° N, 73° E	India



Name____ Date______________________

Activity 3: Where on Earth am I?

Instructions

You will be given a set of coordinates for some unknown country. Write the given coordinates in the first column. Next, while someone tries to locate the country on the dome, you will hear music from the chosen country. Using either the musical clue or your knowledge of the globe, write down the name of the country in the second column. At the end of class, papers will be exchanged and the actual country names for the given coordinates will be announced in order to check your work. Good luck!

	Coordinates	Predicted Country Name	Actual Country Name
1.	____________	____________________	__________________
2.	____________	____________________	__________________
3.	____________	____________________	__________________
4.	____________	____________________	__________________
5.	____________	____________________	__________________
6.	____________	____________________	__________________
7.	____________	____________________	__________________
8.	____________	____________________	__________________
9.	____________	____________________	__________________
10.	____________	____________________	__________________

Name____ Date______________________

Great Circle Routes

The earth is a sphere, therefore, the most accurate way to show the earth's surface is with a globe. A globe shows the sizes and shapes of the continents and oceans correctly. No flat map can give a perfect picture of any large part of this sphere. As you might expect, the distortion on a world map can make it difficult to measure distances.

If two cities are far apart, most maps cannot tell you the shortest distance between them. On a flat surface, the shortest distance between two points is a straight line. Because earth has a curved surface, however, the shortest distance between two places on earth is a curved line. The shortest route between any two points on earth is part of a great circle. Any circle that divides the earth in half, such as the equator, is called a great circle.

Activity 4: Great Circle Exercise

For this activity, you will need a globe, a ruler, and a piece of string (about 50 cm long.) Use the globe, ruler, and string to answer the following questions.

1. Beijing in China and New York in the U.S.A. are both at approximately the same latitude. Determine which route between the cities is shortest, a line following the parallel of latitude, or a great circle route. First lay the piece of string across the globe in an east-west line so that it runs from New York City west across the Pacific and Japan to China. Put a mark on the string with a pen or pencil to show that distance and use the ruler to measure the length of the string. Next pull the string tight between New York and Beijing and mark the length of the string in this position. Use the ruler to measure the length of the string user this way. List your answers below.

   Length of string straight across the parallel of latitude ______________________________

   Length of string following a great circle route ___________________________________

2. Dakar is on the west coast of Africa. Determine which U.S. city is closer to Dakar — New York or Miami. Use the string, ruler, and globe to measure the distance between Dakar and each of the two cities. Which one is closer?

   The city closest to Dakar is ____

3. If you flew from Fairbanks, Alaska to Oslo, Norway following a great circle route, you would first fly north and then what direction?

   a) south

   b) east

   c) west

Name____ **Date**____________________

4. Manila in the Philippines lies southwest of San Francisco. But, if you go from San Francisco to Manila by the most direct route (a great circle route) what direction will you be traveling when you start out?

   a)southwest

   b) southeast

   c) northwest

5. In the space below, explain why you think ships and airplanes usually follow the curve of a great circle rather than a straight line between two distant cities.

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