Geographic Grid

Name _____

The geographic grid refers to the internationally-recognized system of latitude and longitude used to location positions on Earth's surface. Accurate use of this coordinate system is fundamental to the science of geography, which relies so heavily on maps as a medium of communication and analysis. The system of time zones, also internationally accepted, is based on longitude and the speed of Earth's rotation.

Purpose: Practice coordinate location using globes, become familiar with time zone relationships, learn geographic grid terms, such as latitude, longitude, parallel, meridian, equator, pole, prime meridian, international dateline, great circle, and time zone.

Objectives

1. Understand Great Circle routes
2. Learn the geographic grid system
3. Understand the relationship between longitude and time.
4. Use map scale to find ground distances

Great Circle routes

On the globe, find the great circle route (shortest distance route) between the following pairs of places by carefully stretching a string between each pair. For each route, list three features by name (e.g. Andes mountains, Yangtze River, Laos, Singapore, etc.) lying on or near the route:

Locations	Feature 1	Feature 2	Feature 3
Seattle, WA - Tokyo, Japan			
Sydney, Australia - Beijing			
Reykjavik, Iceland - Colombo, Sri Lanka			
Santiago, Chile - Cairo, Egypt			

Latitude and Longitude

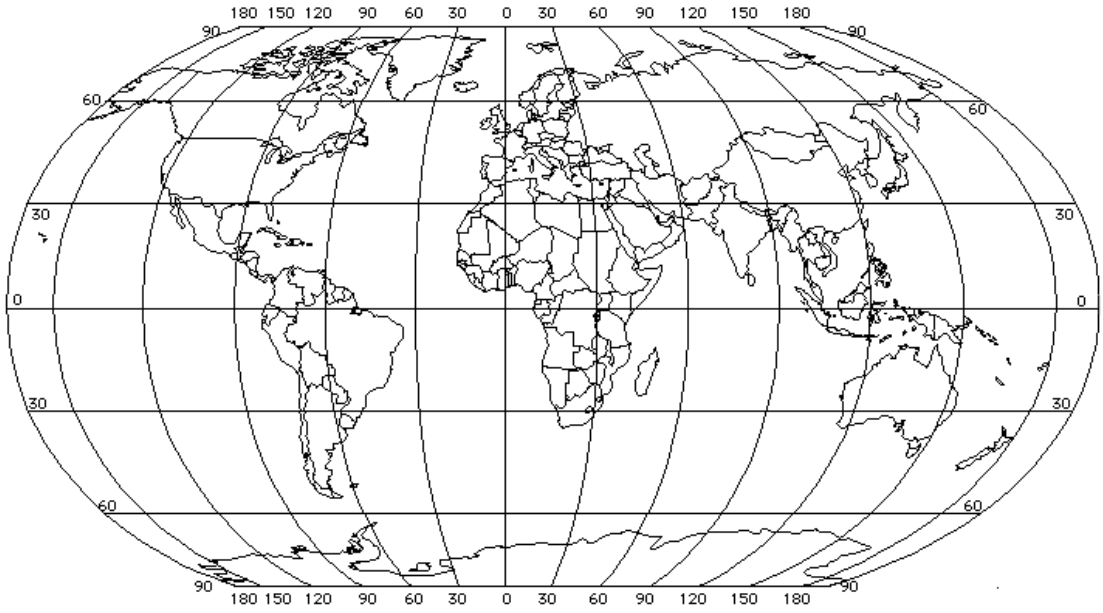
The **geographic grid** refers to the spherical coordinate system of latitude and longitude used to locate positions uniquely anywhere on the surface of the Earth. These coordinates are given as angles, rather than distances used in more familiar rectangular coordinate

systems. Angles are measured in degrees, minutes and seconds, in which 60 seconds = 1 minute, and 60 minutes = 1 degree. By convention, the symbol ° represents degrees, the symbol ' represents minutes, and the symbol " represents seconds. Thus 29° 40' 22" S, means 29 degrees, 40 minutes, 22 seconds South latitude.

Latitude lines, also called **parallels**, are angles north and south of the Equator (0°) , ranging from 90° North (the North Pole) to 90° South (the South Pole). Longitude lines, also called **meridians**, are angles east or west from the Prime Meridian, ranging from 0° to 180° East and West. 180° is the basis for the International Date Line.

Using the geographic grid below, locate and label the following parallels and meridians:

A. Tropic of Cancer
B. Tropic of Capricorn
C. Arctic Circle
D. Antarctic Circle
E. Equator
F. International Date Line
G. Prime Meridian



← Western Hemisphere | Eastern Hemisphere →

On the globe, find the following locations and note the name of the nearest city. It may be easier to find the approximate location on the map above and then look on the globe.

Latitude	Longitude	City
30° N	90° W	
30° N	30° E	
23° S	46° W	
38° N	122° W	
34° S	18° E	

Using the globe, find the geographic coordinates of the following cities. Do not forget to designate North or South for the latitude and East or West for the longitude:

Latitude	Longitude	City
		Honolulu
		Tokyo
		London
		Sydney
		New York

_____ How many degrees latitude difference between Honolulu and London?
_____ How many degrees latitude difference between Sydney and New York?
_____ How many degrees longitude difference between Honolulu and New York?
_____ How many degrees longitude difference between London and Sydney?
_____ How many degrees longitude difference between Honolulu and Tokyo?

You are at 10° S and 165° E; you move to a new location that is 25° northward and 60° eastward of your present position. What will be your new latitude and longitude?

Latitude	Longitude

Time Zones

The Earth rotates 360° in a day (24 hours). Thus, a 15° difference in longitude corresponds to a 1-hour difference in time. So, one hour time zones are 15° longitude wide, and each time zone has a multiple of 15° as its central (standard) meridian. The time at places to the **east is later**, and at places to the **west is earlier**.

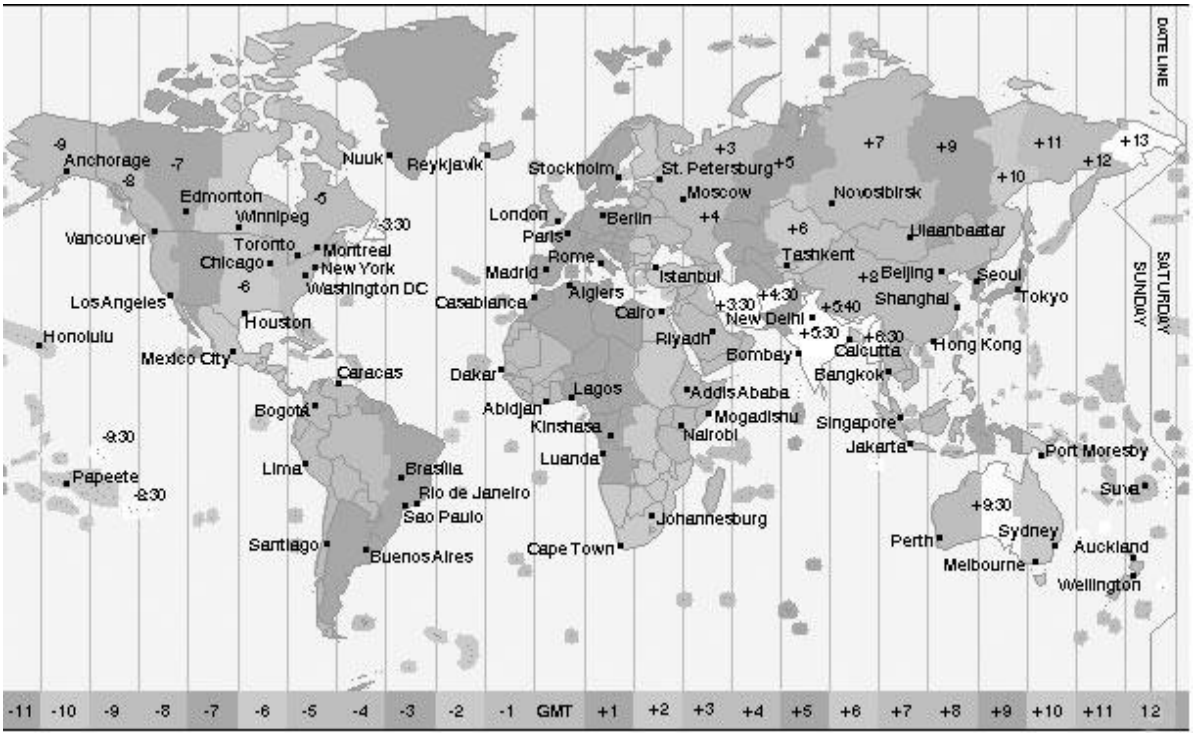
A place 45° East of Hawai'i will have sunrise:

1. Before or After Hawai'i does (circle one)
2. by _____ hour(s).

A place 15° West of Hawai'i will have sunset:

1. Before or After Hawai'i does (circle one)
2. by _____ hour(s)

Time is standardized around the globe so that the Sun reaches its highest point in the sky at approximately noon no matter where you are. Each time zone has a standard meridian, which is a multiple of 15° as noted above. For example, the standard meridian for Hawai'i is 150° W, or -10 as shown on the map below.



The map shows time zones relative to the Prime Meridian (Greenwich Mean Time, GMT, also called Universal Coordinated Time, UTC). The Hawai'i time zone, for example, is -10 or 10 hours earlier than GMT. Figure out the time in each time zone when it is 12 Noon in Hawai'i. Also find the longitude difference and list one or two major cities in each time zone.

Hawaii Time Zone	Other Time Zone	Time Difference	Hawaii Time	Time in Other Time Zone	Longitude Difference	Cities in Other Time Zone
-10	-8	2	12 noon	2 pm	30	Los Angeles, Vancouver
-10	GMT		12 noon			
-10	+10		12 noon			
-10	-3		12 noon			
-10	+8		12 noon			

The day begins at the International Date Line (IDL), the 180° meridian. If you move **westward** across the IDL, it becomes one day **later** (Wednesday becomes Thursday). If you move **eastward**, it becomes one day **earlier** (Saturday becomes Friday).

If it is 3 pm Thursday in Tokyo, what is the day and time in Honolulu (5 time zones difference)?

Time	Day

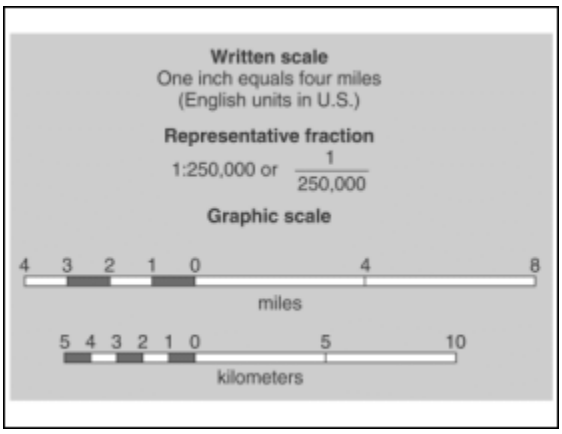
When it is 12 Noon on Monday in Honolulu, what is the day and time in Sydney (4 time zones difference)?

Time	Day

Map Scales

A map scale is the ratio between the size of features on the map and the size of the same features on the ground. Understanding a scale is helpful and important in map interpretation. The figure below illustrates three ways scale can be shown on a map.

Map Scale



Written scales: Written scales are just that: written statements that indicate the relationship between "map space" and "real space".

Representative fractions: These are ratios that tell you how much real space one unit of map space represents. These ratios are constant regardless of what units you are using to measure. For example, one cm on a map represents 250,000 cm in the real world. Two inches on a map represents 500,000 inches in the real world and so on.

Graphic Scales: Graphic scales use a diagram to show you how much real space a given bit of map space represents. These are handy because they remain accurate even if you expand or shrink the map.

Map Scale Calculations

Show calculations for the following problems:

1. A straight section of road is 8 km long in reality on the ground and 4 cm when measured on a map. What is the scale of this map as a representative fraction? (note that 1 km = 100,000 cm)? Use steps (a) and (b) below to calculate the answer.

(a) What is the distance on the road in cm (multiply road length in km by 100,000) _____

(b) What is the ratio of cm on the ground to cm on the map (divide (a) by cm on the map) _____. This is the map scale.

2. Using the scale **shown on the topographic map** of southeast Oahu, what is the approximate distance between Diamond Head and Makapuu Point in kilometers? Round off to nearest whole number. (note that 1 km = 100,000 cm) Use steps (a), (b), and (c) below to calculate the answer.

a) Distance in cm on the map (center to center of dark circles) _____

b) Distance in cm on the ground (multiply (a) by scale ratio) _____

c) Distance in km on the ground (divide (b) by 100,000) _____

3. Bonus Fun (optional)! Show how to calculate the scale of the globe you are using. The distance from Honolulu to San Francisco is about 4000 kilometers. This problem requires the same procedure #1 above, but with different numbers.