

Mapping Earth

Maps

..... Before You Read

Before	Statement	After
	1. Maps help determine locations on Earth.	
	2. All Earth models are spherical.	
	3. World maps are drawn accurately for every location.	

..... Read to Learn

Understanding Maps

You likely have used a map before to find information. You might use a map to get to a place you have never visited. You might also use a map to help you find your way. Maps help people get where they are going without getting lost.

Your school might have various kinds of maps. Perhaps you used a map on the first day of school to find all of your classrooms. Or maybe you used a map of the school to practice for a fire drill or a disaster drill. Some maps show all the exits in a building or the safest room to go to if there were a tornado.

There are many different kinds of maps, such as road maps, trail maps, and weather maps. Each type of map shows different information. Each type of map serves a different purpose. ✓

A map is a model of Earth. As you know, Earth is round. Most maps are flat. So they are a model of an area of Earth's surface. If you want to model the entire planet and its shape, you can make a globe.

Key Concepts

- How can a map help determine a location?
- Why are there different map projections for representing Earth's surface?

Mark the Text

Identify Main Ideas

As you read, underline the main ideas under each heading. After you finish reading, review the main ideas that you have underlined.

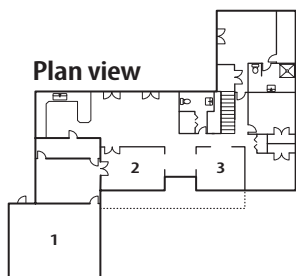
Reading Check

- 1. Name** three different kinds of maps.

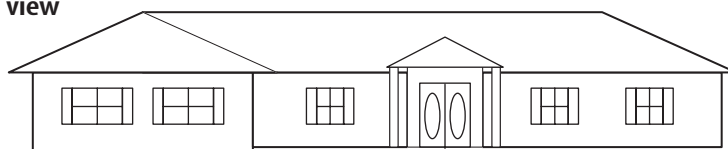
Map Views

Most maps are drawn in map view. A **map view** shows an area of Earth's surface as if you are looking down from above. A map view can also be called a plan view.

Cross sections are drawn in profile view. A **profile view** is a drawing showing a vertical "slice" through the ground. A profile view is like a side view of a house. A map view and a profile view of a house are shown below.



Profile view



Visual Check

2. Contrast What is the difference between a map view and a profile view?

Reading Check

3. Explain What is the purpose of a map legend?

Visual Check

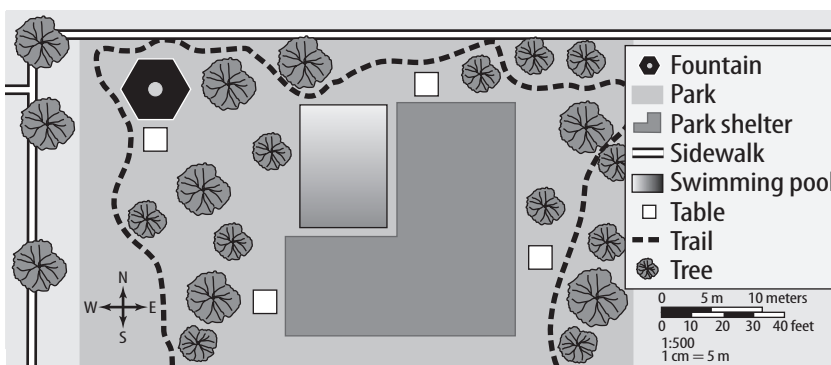
4. Identify Circle the tables. Highlight the trail.

Map views and profile views are used to describe topographic maps and geologic maps. You use profile views when you study models of the inner structures of Earth.

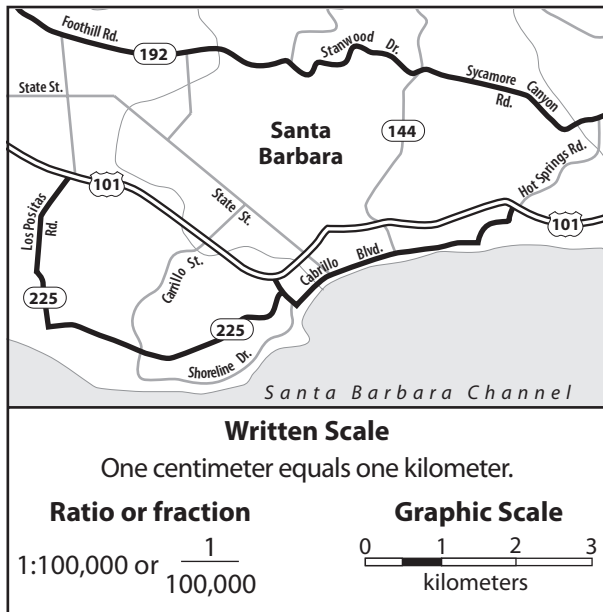
Map Legends and Scales

Maps have two features to help you read and understand them. One feature is a series of symbols called a map legend. The other is a ratio, which establishes the map scale.

Map Legends Maps use specific symbols to represent certain features on Earth's surface, such as roads in a city or restrooms in a park. These symbols keep maps from being too cluttered. All maps include a map legend. A **map legend** is a key that lists all the symbols used on the map. It also explains what each symbol means. A map legend is shown below. In this map legend a broken line represents a trail on the map. ✓



Map Scales When mapmakers draw a map, they need to decide how big or small to make the map. They need to decide on the map's scale. A **map scale** is the relationship between a distance on the map to the actual distance on the ground.



Visual Check

5. Determine Which scale would you use to measure the distance between the rivers along Route 192?

A map scale can be written with words, such as “1 centimeter is equal to 1 kilometer.” A map scale also can be written with numbers as a ratio, such as 1:100. Because this is a ratio, there are no units. To explain the ratio, you would say, “Every unit on the map is equal to 100 units on the ground.” If your unit were 1 cm on the map, it would be equal to 100 cm on the ground. If you drew a map of your school at a scale of 1:1, your map would be as large as your school.

The road map above gives a scale that is written with words, a ratio scale, and a scale bar in the map legend. Each one is useful in different ways. The graphic scale, or scale bar, would be useful in measuring distances on the map. You would have to measure it, however, to find that 1 cm is equal to 1 km.

Model builders usually use scale to make the model measurements accurately reflect the measurements of the real object. They do this when the model is smaller than the real objects and when it is bigger than the real object.

Reading Maps

To find your way to a specific place, you first need to know where you are on Earth. Imagine trying to describe your exact position on the snow-covered continent of Antarctica. It would be difficult to describe. Ship captains have the same problem when trying to plot their courses across the oceans. Similarly, airplane pilots have the same problem as they fly above a cloud-covered Earth.

Math Skills

A ratio is a comparison of two quantities by division. For example, a map scale is the ratio of the distance on the map to the actual distance. A map might use a scale in which 1 cm on the map represents 5 km of actual distance. This might be written as a ratio:

$$1 \text{ cm to } 5 \text{ km or}$$

$$1 \text{ cm: } 5 \text{ km or}$$

$$\frac{1 \text{ cm}}{5 \text{ km}}$$

This ratio is the map scale.

6. Use Ratios A map uses a scale of 1 cm: 1 km. If the distance between two points on the map is 3 cm, what is the actual distance between the points?

WORD ORIGIN

longitude

from Latin *longitudo*, means “length”

ACADEMIC VOCABULARY

prime

(*adjective*) first in rank

A Grid System for Plotting Locations

Checkerboards have grid lines. They help you choose your moves using the location of the pieces on the board. Early mapmakers created a system for identifying locations on Earth that uses a similar grid system. This system uses two sets of imaginary lines. These lines go around Earth. The two sets of lines are called latitude and longitude. When a line of latitude crosses a line of longitude, that point can be used to identify a location on a map or a globe.

Longitude Mapmakers started the grid system with a line that circles Earth and passes through the North Pole and the South Pole. One-half of the circle passes through Greenwich, England, and is known as the prime meridian. The other half of the circle is on the opposite side of the globe. It is known as the 180° meridian. Similar circles are drawn at every degree east and west of the prime meridian.

Longitude *is the distance in degrees east or west of the prime meridian.* The prime meridian and the 180° meridian combine to divide Earth into east and west halves. The halves are known as hemispheres—the eastern hemisphere and the western hemisphere. The lines east of the prime meridian are called east longitude. The lines west of the prime meridian are called west longitude. They both meet at the 180° meridian. All the meridians pass through the North Pole and the South Pole, as shown below.

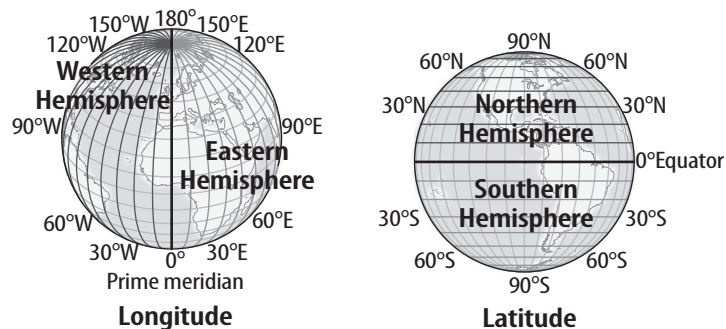
Latitude Mapmakers also drew lines east to west around Earth. These lines of latitude are somewhat perpendicular to lines of longitude. The center line, called the equator, divides Earth into the northern hemisphere and the southern hemisphere. **Latitude** *is the distance in degrees north or south of the equator.* Lines of latitude form parallel circles, as shown below. The equator is the largest circle. All other circles become smaller and smaller the closer they are to Earth’s poles. The North Pole and the South Pole are each shown by a dot.

Key Concept Check

7. Describe What relationship do lines of longitude and lines of latitude have?

Visual Check


8. Identify Highlight the equator and the prime meridian.



Plotting Locations


Earth is a sphere. A sphere is a ball-shaped object. If you look straight down on a sphere, it looks like a circle. Like a circle, a sphere can be divided into 360 degrees. This is why latitude and longitude are measured in degrees.

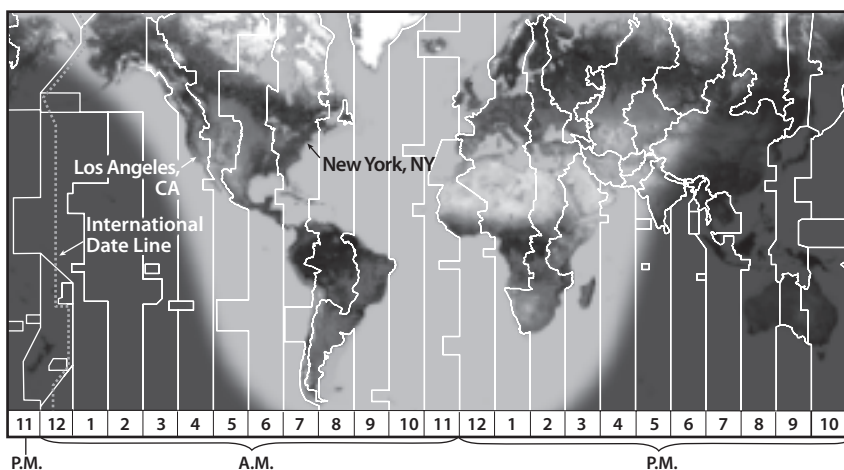
The latitude at the equator is 0°. All other lines of latitude are measured either north or south from the equator. The North Pole is located at 90 degrees north latitude (90°N). The South Pole is located at 90 degrees south latitude (90°S). The longitude at the prime meridian is 0°. There are 180 degrees of east longitude and 180 degrees of west longitude.

Any location on Earth can be described by the intersection of the closest line of latitude and the closest line of longitude. Latitude is always stated before longitude. 

Minutes and Seconds Latitude and longitude lines are far apart. To help identify locations, each degree of latitude and longitude is divided into 60 minutes (') and each minute is divided into 60 seconds (").

Time Zones It is exactly noon in your location when the Sun is directly overhead. However, it is exactly noon in only certain locations on Earth. How do you know what time it is in other places? Time zones were set up to make travel and doing business easier. A **time zone** is the area on Earth's surface between two meridians where people use the same time.

The reference, or starting point, for time zones is the prime meridian. The width of a time zone is 15°, but, as shown below, time zones do not follow the meridians exactly. The borders of the time zones are sometimes crooked so that whole countries can fit into them. Notice how the time changes by one hour at the boundary of each time zone. 



Key Concept Check

9. Explain How do latitude and longitude describe a location on Earth?

Reading Check

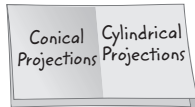
10. Describe Why do we need a starting point for time zones?

Visual Check

11. Identify If it is 2:00 P.M. in New York City, what time is it in Los Angeles, California?

FOLDABLES®

Make a folded book to record information about map projections.

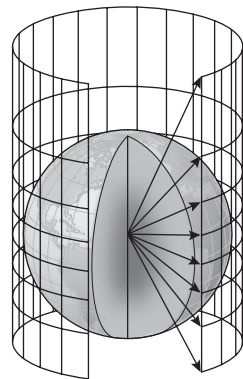


Visual Check

12. Identify the projection that shows the shape of Greenland more accurately.

International Date Line The line of longitude 180° east or west of the prime meridian is called the **International Date Line**. When you cross the date line from east to west, it is a day later. So, if on Sunday you were sailing west toward the International Date Line, after you crossed it, it would be Monday. If you turned around and sailed back across the International Date Line from west to east, it would be Sunday again.

The International Date Line does not follow the 180° meridian exactly. This is because some island groups would be divided by the line. It would be one day on some islands and a different day on others. So that the day is the same for all islands of one group, the date line bends around them.



Cylindrical Projection




Conical Projection

Map Projections

Because a globe is a sphere like Earth, Earth's features on a globe appear as they do on Earth. Maps, however, are flat. How can a flat map be made from a sphere? One way to show features from a globe on a map is to make a projection.

Cylindrical Projections Imagine a light at the center of a globe and a sheet of paper wrapped around the globe. The light would throw shadows of the continents and the latitude and longitude lines onto the paper. Because the paper is a cylinder, as shown above, this is called a cylindrical projection. A map made in this way represents shapes near the equator very well. However, shapes near the poles are enlarged.

Conical Projections Wrapping a cone around the globe makes a conical projection. This type of map is a good representation of the shapes near the line of latitude where the cone touches the globe. Other areas are distorted or not represented well. All types of projections distort the shapes on a sphere. 

Key Concept Check

13. Compare What are the advantages and disadvantages of cylindrical projections and conical projections?

..... After You Read

Mini Glossary

International Date Line: the line of longitude 180° east or west of the prime meridian

latitude: the distance in degrees north or south of the equator

longitude: the distance in degrees east or west of the prime meridian

map legend: a key that lists all the symbols used on a map

map scale: the relationship between a distance on a map and the actual distance on the ground

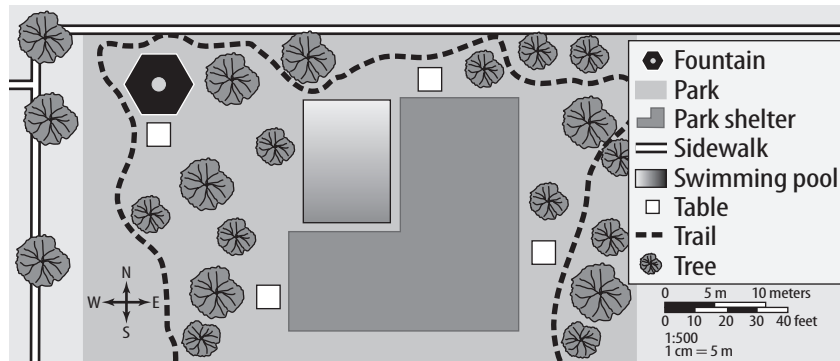
map view: a map drawn as if you are looking down on an area from above Earth's surface

profile view: a drawing showing a vertical "slice" through the ground

time zone: the area on Earth's surface between two meridians where people use the same time

1. Review the terms and their definitions in the Mini Glossary. Write a sentence using a glossary word to describe something you find on a map that helps you interpret the map.

2. Use the map shown below to answer the following questions: How many tables are there? What is the graphic scale for this map?



3. Name one main idea about maps you underlined in this lesson.

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What do you think NOW?

Reread the statements at the beginning of the lesson. Fill in the After column with an A if you agree with the statement or a D if you disagree. Did you change your mind?



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