CHAPTER 2

Mapping Our World

BIG Idea Earth scientists use mapping technologies to investigate and describe the world.

2.1 Latitude and Longitude MAIN IDEA Lines of latitude and longitude are used to locate places on Earth.

2.2 Types of Maps MAIN IDEA Maps are flat projections that come in many different forms.

2.3 Remote Sensing MAIN IDEA New technologies have changed the appearance and use of maps.

GeoFacts

- Maps predate written history. The earliest known map was created as a cave painting in ancient Turkey.
- China spans five international time zones; however, the entire country operates on only one standard time.
- Global Positioning System (GPS) satellites were originally designed for strategic defense and navigation purposes.

Lab Lab

Can you make an accurate map?

If you have ever been asked to give someone directions, you know that it is important to include as many details as possible so that the person asking for directions will not get lost. Perhaps you drew a detailed map of the destination in question.

Procedure

1. Read and complete the lab safety form.
2. With a classmate, choose a location in your school or schoolyard.
3. Use a sheet of **graph paper** and **colored pencils** to draw a map from your classroom to the location you chose. Include landmarks such as drinking fountains and restrooms.
4. Share your map with a classmate. Compare the landmarks you chose and the path each of you chose to get to your locations. If they were different, explain why.
5. Follow your map to the location you and your partner chose. Was your map correct? Were there details you left out that might have been helpful?

Analysis

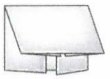
1. **Discuss** with your classmate how you could improve your maps.
2. **Examine** What details could you add?

FOLDABLES™ Study Organizer

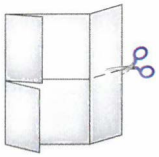
Types of Mapping Technologies Make this Foldable to help organize information about the four major types of mapping technologies.

- STEP 1 Find the middle of a horizontal sheet of paper and mark it. Fold the left and right sides of the paper to the middle and crease the folds.

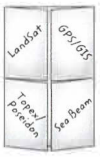
- STEP 2 Fold the piece of paper in half.



- STEP 3 Open the last fold and cut along the fold lines to make four tabs.



- STEP 4 Label the tabs Landsat, GPSIG/5, TOPEXI Poseidon, and Sea Beam.



Use this Foldable with Section 2.3. As you read this section, summarize information about the mapping technologies.

Earth Science Online

Visit glencoe.com to

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  - Interactive Time Lines
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Section 2.1

Objectives

- **Describe** the difference between latitude and longitude.
- **Explain** why it is important to give a city's complete coordinates when describing its location.
- **Explain** why there are different time zones from one geographic area to the next.

Review Vocabulary

time zone: a geographic region within which the same standard time is used

New Vocabulary

cartography
equator
latitude
longitude
prime meridian
International Date Line

Latitude and Longitude

MAIN Idea — Lines of latitude and longitude are used to locate places on Earth.

Real-World Reading Link Imagine you were traveling from New York City, New York, to Los Angeles, California. How would you know where to go? Many people use maps to help them plan the quickest route.

Latitude

Maps are flat models of three-dimensional objects. For thousands of years people have used maps to define borders and to find places. The map at the beginning of this chapter was made in 1570. What do you notice about the size and shape of the continents? Today, more information is available to create more accurate maps. The science of mapmaking is called **cartography.**

Cartographers use an imaginary grid of parallel lines to locate exact points on Earth. In this grid, the **equator** horizontally circles Earth halfway between the north and south poles. The equator separates Earth into two equal halves called the northern hemisphere and the southern hemisphere.

Lines on a map running parallel to the equator are called lines of **latitude.** Latitude is the distance in degrees north or south of the equator as shown in **Figure 2.1.** The equator, which serves as the reference point for latitude, is numbered 0° latitude. The poles are each numbered 90° latitude. Latitude is thus measured from 0° at the equator to 90° at the poles.

Locations north of the equator are referred to by degrees north latitude (N). Locations south of the equator are referred to by degrees south latitude (S). For example, Syracuse, New York, is located at 43° N, and Christchurch, New Zealand, is located at 43° S.

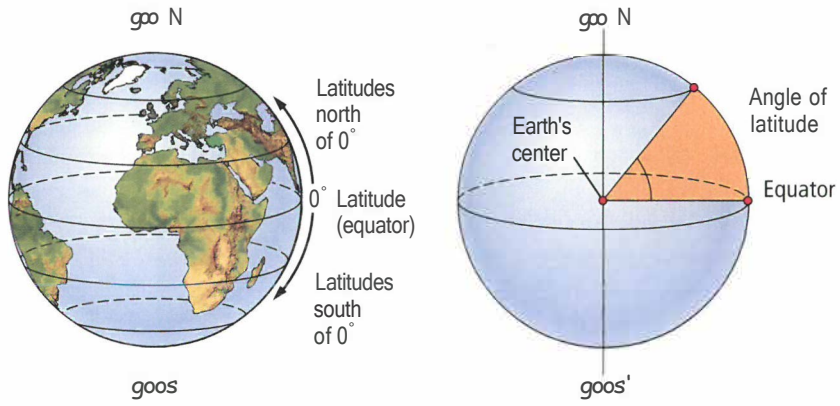

Figure 2.1 Lines of latitude are parallel to the equator. The value in degrees of each line of latitude is determined by measuring the imaginary angle created between the equator, the center of Earth, and the line of latitude as seen in the globe on the right.

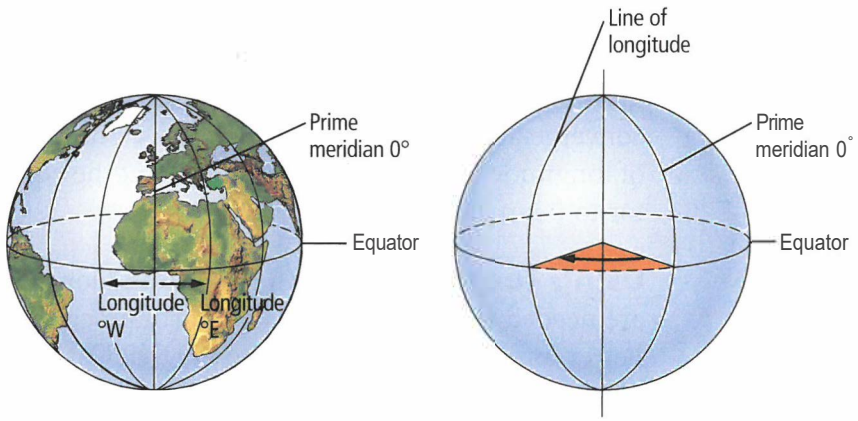

Figure 2.2 The reference line for longitude is the prime meridian. The degree value of each line of longitude is determined by measuring the imaginary angle created between the prime meridian, the center of Earth, and the line of longitude as seen on the globe on the right.

Degrees of latitude Each degree of latitude is equivalent to about 111 km on Earth's surface. How did cartographers determine this distance? Earth is a sphere and can be divided into 360°. The circumference of Earth is about 40,000 km. To find the distance of each degree of latitude, cartographers divided 40,000 km by 360°.

To locate positions on Earth more precisely, cartographers break down degrees of latitude into 60 smaller units, called minutes. The symbol for a minute is '. The actual distance on Earth's surface of each minute of latitude is 1.85 km, which is obtained by dividing 111 km by 60'.

A minute of latitude can be further divided into seconds, which are represented by the symbol ". Longitude is also divided into degrees, minutes, and seconds.

Longitude

To locate positions in east and west directions, cartographers use lines of longitude, also known as meridians. As shown in **Figure 2.2**, **longitude** is the distance in degrees east or west of the prime meridian, which is the reference point for longitude.

The **prime meridian** represents 0° longitude. In 1884, astronomers decided that the prime meridian should go through Greenwich, England, home of the Royal Naval Observatory. Points west of the prime meridian are numbered from 0° to 180° west longitude (W); points east of the prime meridian are numbered from 0° to 180° east longitude (E).

Semicircles Unlike lines of latitude, lines of longitude are not parallel. Instead, they are large semicircles that extend vertically from pole to pole. For instance, the prime meridian runs from the north pole through Greenwich, England, to the south pole.

The line of longitude on the opposite side of Earth from the prime meridian is the 180° meridian. There, east lines of longitude meet west lines of longitude. This meridian is also known as the International Date Line, and will be discussed later in this section.

VOCABULARY

SCIENCE USAGE V. COMMON USAGE

Minute

Science usage: a unit used to indkate a portion of a degree of latitude

Common usage: a unit of time comprised of 60 seconds

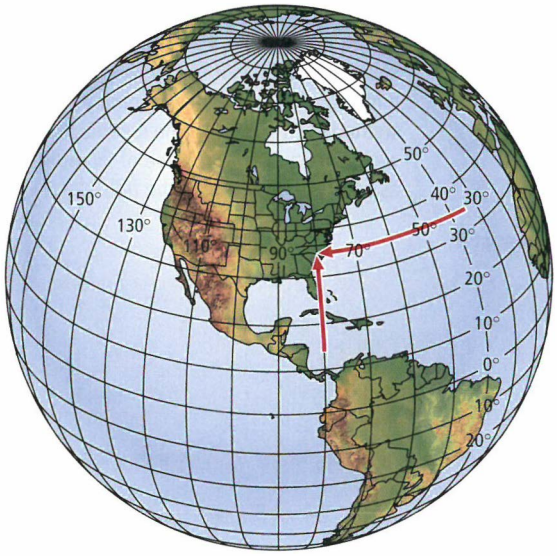

Figure 2.3 The precise location of Charlotte is 35° 14'N, 80° 50'W. Note that latitude comes first in reference to the coordinates of a particular location.

Degrees of longitude Degrees of latitude cover relatively consistent distances. The distances covered by degrees of longitude, however, vary with location. As shown in **Figure 2.2,** lines of longitude converge at the poles into a point. Thus, one degree of longitude varies from about 111 km at the equator to 0 km at the poles.

Using coordinates Both latitude and longitude are needed to locate positions on Earth precisely. For example, it is not sufficient to say that Charlotte, North Carolina, is located at 35° 14' N because that measurement includes any place on Earth located along the 35° 14' line of north latitude.

The same is true of the longitude of Charlotte; 80° 50' W could be any point along that longitude from pole to pole. To locate Charlotte, use its complete coordinates-latitude and longitude-as shown in **Figure 2.3.**

Time zones Earth is divided into 24 time zones. Why 24? Earth takes about 24 hours to rotate once on its axis. Thus, there are 24 times zones, each representing a different hour. Because Earth is constantly spinning, time is always changing. Each time zone is 15° wide, corresponding roughly to lines of longitude. To avoid confusion, however, time zone boundaries have been adjusted in local areas so that cities and towns are not split into different time zones.

MiniLab

Locate places on Earth

How can you locate specific places on Earth with latitude and longitude?

Procedure

1. Read and complete the lab safety form.
2. Use a **world map or globe** to locate the prime meridian and the equator.
3. Take a few moments to become familiar with the grid system. Examine lines of latitude and longitude on the map or globe.

Analysis

1. **Locate** the following places:
   - Mount St. Helens, Washington; Niagara Falls, New York; Mount Everest, Nepal; Great Barrier Reef, Australia
2. **Locate** the following coordinates, and record the names of the places there:
   - 0° 03'5, 90° 30'W; 27° 07'5, 109° 22'W; 41° 10'N, 112° 30'W; 35° 02'N, 111° 02'W; 3° 04'5, 37° 22'E
3. **Analyze** How might early cartographers have located cities, mountains, or rivers without latitude and longitude lines?

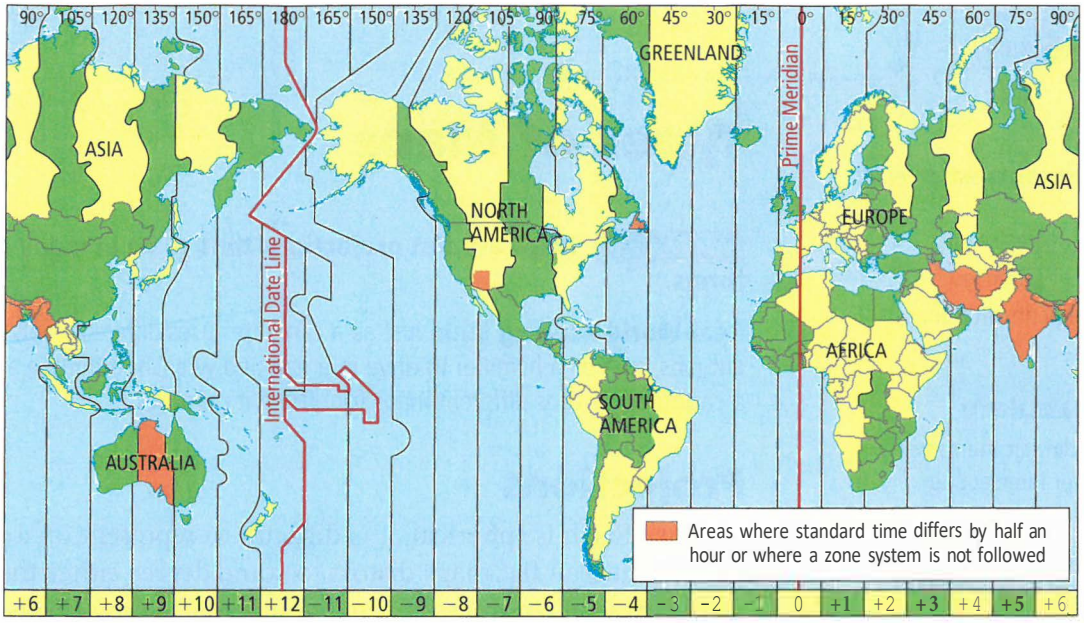

Figure 2.4 In most cases, each time zone represents a different hour. However, there are some exceptions.
Identify *two areas where the time zone is not standard.*

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Interactive Figure To see an animation of time zones, visit glencoe.com.

For example all of Morton County, North Dakota, operates within the central time zone, even though the western part of the county is within the mountain-time-zone boundary. As shown in **Figure 2.4,** there are six time zones in the United States.

International Date Line Each time you travel through a time zone, you gain or lose time until, at some point, you gain or lose an entire day. The **International Date Line,** which is 180° meridian, serves as the transition line for calendar days. If you were traveling west across the International Date Line, you would advance your calendar one day. If you were traveling east, you would move your calendar back one day.

Section 2.1 Assessment

Section Summary

- Latitude lines run parallel to the equator.
- Longitude lines run east and west of the prime meridian.
- Both latitude and longitude lines are necessary to locate exact places on Earth.
- Earth is divided into 24 time zones, each 15° wide, that help regulate daylight hours across the world.

Understand Main Ideas

1. MAIN **Explain** why it is important to give both latitude and longitude when giving coordinates.
2. **Describe** how the distance of a degree of longitude varies from the equator to the poles.
3. **Estimate** the time difference between your home and places that are 60° east and west longitude of your home.

Think Critically

4. **Evaluate** If you were flying directly south from the north pole and reached 70° N, how many degrees of latitude would be between you and the south pole?

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5. Imagine what it would be like to fly from where you live to Paris, France. Describe what it would be like to adjust to the time difference.