Using Maps

Reader

N

W — E

S

Compass rose

Ferdinand Magellan

Map reading

Completion of Transcontinental Railroad, 1869

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Using Maps

Reader

AFRIC

0°

H E R E

W

60° W
SOUTH
AMERICA

30° W

ATLANTIC
OCEAN

Prime Meridian

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W ← → E

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Core Knowledge®

Using Maps

Table of Contents

Jonas Clarke's House

Medford

Charlestown

Charles River

Boston

Old North Church

Boston Harbor

Using Maps
Reader
Core Knowledge Sequence History and Geography 4

Chapter 1
Measuring Distance on a Map

How Far Is It? The place is Boston, Massachusetts. It is about 10:00 p.m. on the night of April 18, 1775. Paul Revere steps into a boat and crosses the Charles River. After a short boat ride, Revere lands in Charlestown. There, he borrows a horse. He's on an important mission, and there is no time to lose.
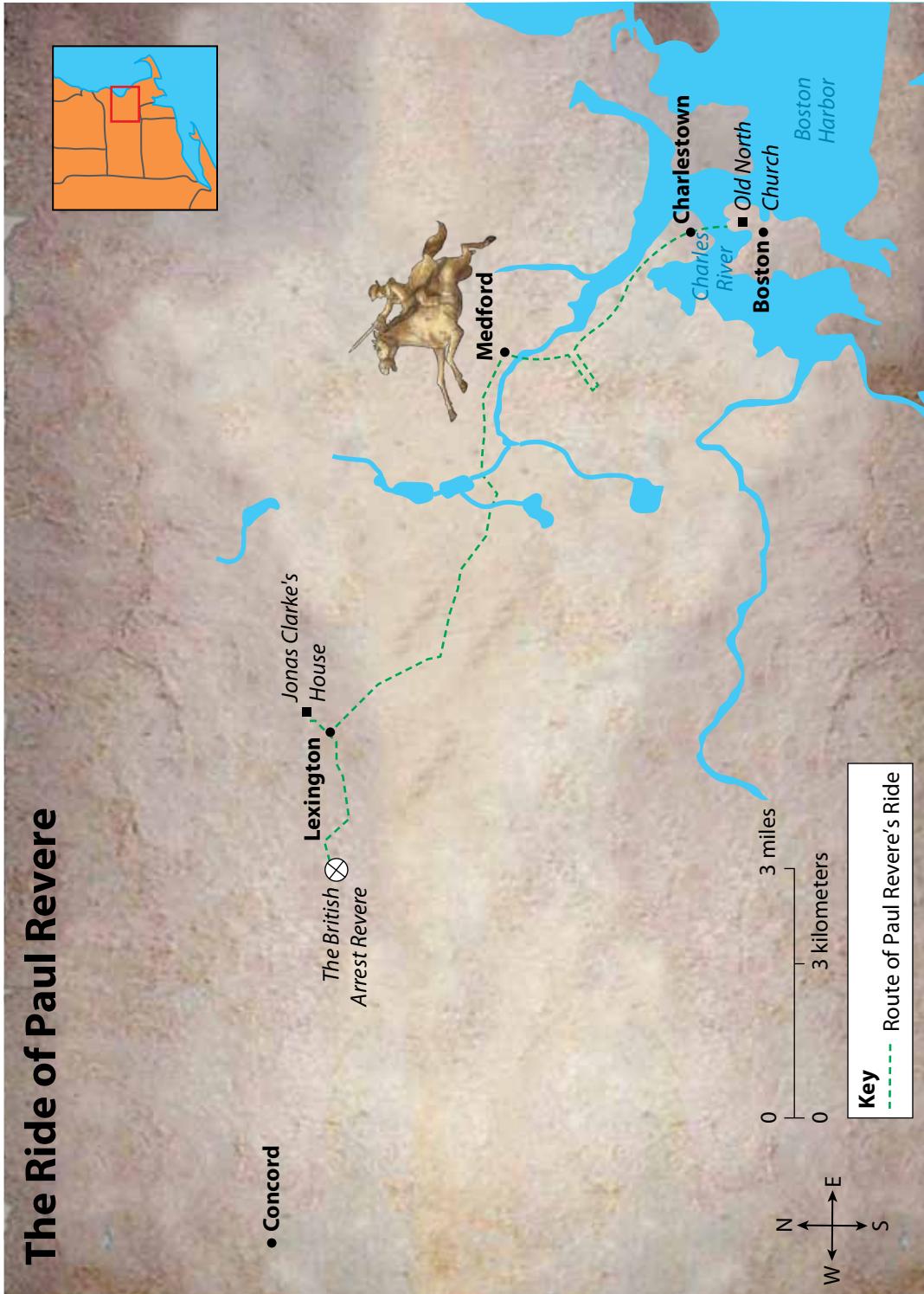
The Big Question

Why do we need different kinds of maps?

Revere knows he must get to Lexington and warn Samuel Adams and John Hancock. These two American leaders are in danger. British troops are marching to Lexington to arrest them. The American colonies need Adams and Hancock to provide leadership. Paul Revere must get to them first.

As he rides, Revere calls out, "The regulars are coming out!" He wants to let people know that British troops—the "regulars"—are marching out of Boston. The people in the area need to be ready to defend themselves.

The Ride of Paul Revere

With this map of Paul Revere's ride, which began on the night of April 18, 1775, you can measure how far Revere rode to warn Samuel Adams and John Hancock that the British were coming to arrest them.

About 11:30 p.m., Revere reaches the town of Medford. He rides on until he gets to Jonas Clarke's house near Lexington. Adams and Hancock are there, and Revere warns them to flee.

Next, Revere heads toward the nearby town of Concord. Before he gets there, a British patrol arrests him. But Revere has done his duty. He has already warned Adams and Hancock. The men have managed to get away.

Later, on the morning of April 19, 1775, colonial soldiers and British troops would fight the Battles of Lexington and Concord. These battles would mark the beginning of the American Revolution.

Today, you can trace Paul Revere's route. All you need is a good **map** and the directions.

As you know, a map is a drawing of a real place. **Symbols** on the map represent different features of the place. For example, a symbol for a road on a map stands for a real road.

Look at the map of Paul Revere's Ride on page 3. In the bottom corner, there's a small box. This is the **map key**. The map key contains information to help you decode and understand the symbols on the map. In this case, the key tells you that a dotted line stands for the path of Paul Revere's ride.

Vocabulary

map, n. a drawing or picture on a flat piece of paper of a specific place or area of Earth's surface that shows different features

symbol, n. an object or picture that stands for something else

"map key," (phrase), a table or chart that tells you what the parts of a map mean; the key is usually found in one of the corners of the map

The map also contains a small image that looks like a ruler. This image shows the **map scale**. A map scale shows you how a distance on the map compares to the actual distance on the ground.

The map scale shows that one-and-a-half inches on the map is equal to three miles or to well over three **kilometers** on the ground. How do you know this? Take a ruler and place it under the map scale. Beginning at the left side of the map scale, measure one-and-a-half inches. There is a mark at this same place on the map scale. The mark is labeled *three miles*. To the left is a mark labeled *three kilometers*.

You can use this information to figure out distances on a map. For example, what if you wanted to follow Revere's route from Medford to Lexington? How far would you have to walk? First, measure the distance with your ruler. The route measures about three inches. The map scale tells you that one-and-a-half inches on the map equals three miles in real distance. One-and-a-half times two equals three. Therefore, three inches on the map equals six miles in real life.

Now see if you can figure out about how far Paul Revere rode. He began in Charlestown. First he rode to Medford and then to Jonas Clarke's house. Next he rode toward Concord. He was captured along the way. How far did he ride in total?

Finding the distance for the entire ride is a little tricky. It's hard to measure this distance on the map using a ruler. A ruler is straight, but Revere's route was not. You can measure the distance more easily with a string. Place one end of the string on Charlestown. Next place the string on the map as close as you can to the exact route Revere followed. Then measure the string. You will find that the string is about six inches long. Now look back at the map scale: one-and-a-half inches equals three miles. This means that three inches would equal six miles. How many miles would six inches equal? That's about how many miles Paul Revere rode between Charlestown and his arrest.

Different Maps and Scales

There are many different kinds of maps that show different kinds of information. A map of a small area can show lots of details. For example, the map of Paul Revere's ride even shows where a house and church are located. If the map covered a larger area, it would not be easy to show details like this. Entire cities appear as small dots on a map of the United States. Some states are smaller than a dime.

Travelers often use different maps when going from one place to another. That's because they need different information at different points on their trip. Today, when looking at or reading maps, we often use our computers. We also use software applications that do some of the work of reading a map for us. Still, it is important to be able to read maps. So, let's go on a journey to test your map-reading skills!
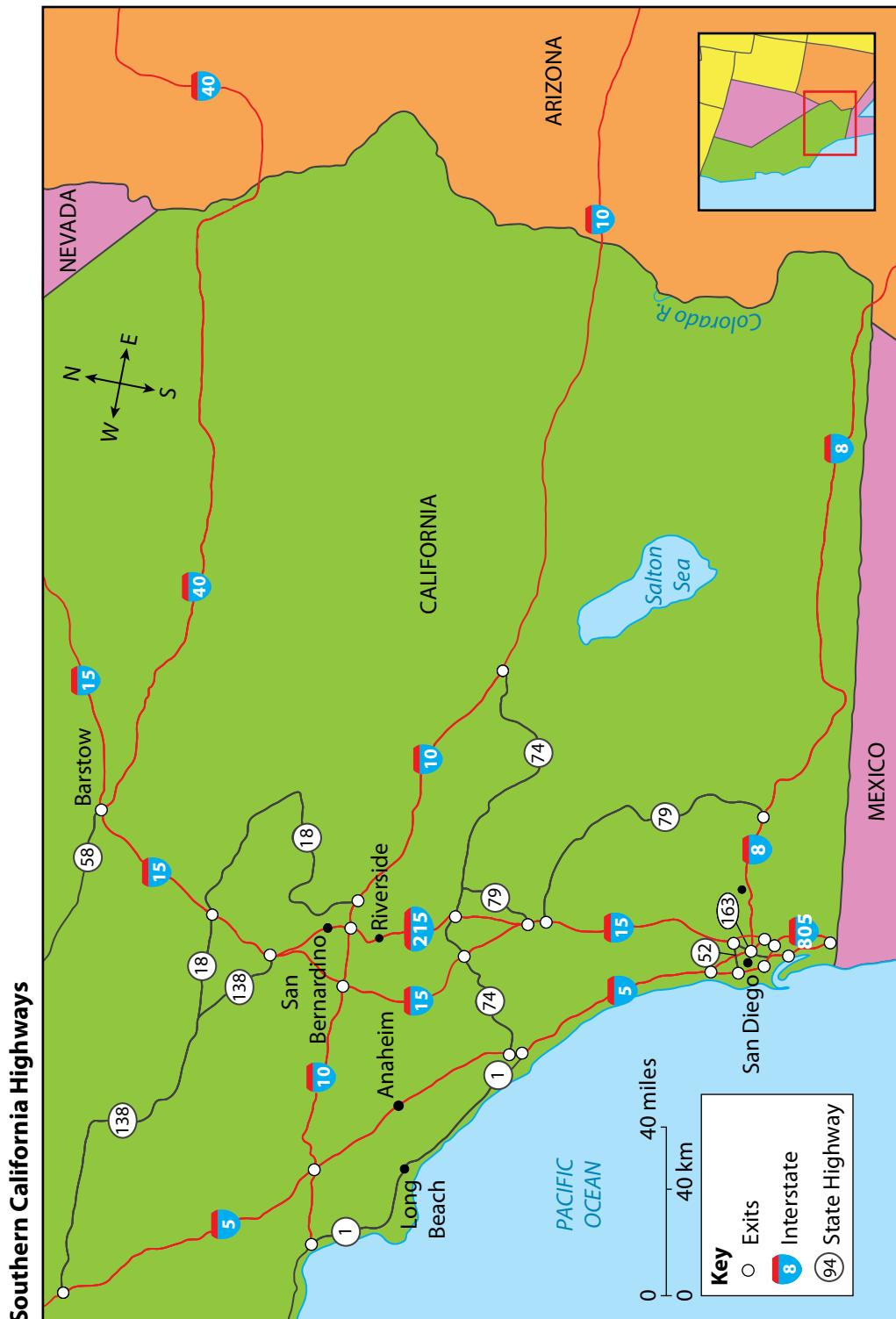
Suppose that you and your family live in Barstow, California. You want to travel to San Diego to visit the zoo. You might use two maps on your trip. First, you might use a map of Southern California to get to San Diego. Once you reach the city, you might use a map of the city to find the zoo. Look at the maps on pages 8 and 9. The map of San Diego shows one small part of the map of Southern California. It shows a lot of details, including many smaller streets. Can you find the San Diego Zoo? Find the area marked *Balboa* (/bal*boe*uh/) *Park*. The zoo is inside this large park.

You may have noticed a difference between the two maps. Their scales are not the same. The map scale for Southern California shows that one inch on the map represents forty miles on the road. The map of San Diego has a scale of three-quarters of an inch to three miles. Both maps show **distance** correctly. Because the areas shown in the two maps differ in size, the map scales are different.

Vocabulary

distance, n. how far it is from one point to another

In fact, it is true to say that both of these maps will be useful to you if you are traveling from Barstow to the San Diego Zoo. The Southern California map will help you get from Barstow to the San Diego area. The San Diego map will help you find the zoo once you're in San Diego.

Southern California Highways

Use this map to find your way from Barstow, California, to San Diego, California.

Roadways in San Diego, California

Use this map to find the way to the San Diego Zoo, where you can see animals like this polar bear.

Finding Your Way

When using a map, one thing all travelers need to know is the **direction** in which they must travel. Look at the map titled Southern California Highways. Find the symbol with four arrows pointing in different directions. This symbol is called the **compass rose**. It shows you which way north, south, east, and west are. In which direction will you be traveling from your

Vocabulary

direction, n. where a person or object is facing or moving toward

compass rose, n. a symbol on a map that shows the directions for north, south, east, and west

home in Barstow to San Diego? If you said south, you're ready to travel in the right direction!

It's 9:00 a.m. when you leave Barstow. Your mother asks, "What is the best way to get to San Diego?" She hands you two maps. It's up to you to find the way!

First, find Barstow on the map of Southern California. Put your finger there. Then find San Diego and put another finger there. Next, look at the roads connecting the two. What is the shortest way to get from one city to the other?

You see that Interstate 15, or I-15, goes all the way from Barstow to San Diego. **Interstate highways** are a type of road. Interstates, as they are called, have no crossing traffic, no sharp turns, and no stoplights. They cross over or under other roadways. This means cars can travel faster than on other types of roads. You suggest that your mother get on Interstate 15 heading south.

After a few hours of driving, you approach San Diego. You put away the map of Southern California. You pull out the San Diego map.

Look at the map titled Roadways in San Diego, California. You will see that the green area shows the city limits. As you enter the city on I-15, you pass signs that show exits from the highway. The exits allow drivers to leave the highway and get onto the many smaller roads that criss-cross the city. One exit is for Balboa Avenue. Another is for Aero Drive.

How do you find these exits on the map? Look for the white circles. You'll see them where I-15 crosses Balboa Avenue and Aero Drive. Interstate highways do not have exits for every road they cross over or under. For example, you can see on the map on page 9 that there is no exit from I-15 at El Cajon Boulevard.

Tell your mother to keep going south on I-15. Soon she will see signs for Interstate 8. She will follow these signs leading her onto I-8 heading west. After a few miles on I-8, she will come to state highway 163. She will take this road south directly to the San Diego Zoo.

Almost all of the roads on the map from Barstow to San Diego are highways. This map shows interstate highways and state highways. Some places have other types of roads and highways, too, How many different routes can you find between Barstow and San Diego?

Chapter 2
Latitude and Longitude

Where in the World Are You? Water laps against the side of the ship. You can smell the salt in the air. You look around. There's nothing but water in every direction. You have no idea where on Earth you are. How does the captain know where he's going?

The Big Question

How are meridians and parallels—lines identifying longitude and latitude—helpful?

You've been on this ship for days. You were seasick the first day. You couldn't even leave your room. Now you don't know where you are. You visit the captain, looking for answers. He has lots of equipment. He has a compass and **radar**. He also has a **Global Positioning System**, or **GPS**, which uses technology to tell him his exact location. These tools are helpful. But some of his most important tools are maps. He opens up a book and shows you a map of Earth. "This is everything you need to know," he says.

Sailors at sea must be able to identify their location, just like people on land.

Making Sense of the Lines

Look at the map on page 15. The lines running from side to side (from east to west) are called **parallels**. They measure distance in **latitude** north and south of the **equator**. The lines are called parallels because they are straight lines that never meet or cross. The parallel of latitude that runs around the middle of Earth is called the equator. The other parallels circle the globe to the north and south of the equator.

These lines don't actually exist on Earth. Mapmakers put them on maps to help people locate places precisely. You'll see how this works shortly.

On a flat map like the one you see on page 15, the parallels of latitude look like straight lines. They appear to end when they reach the ends of the map. However, this flat map represents something that is shaped like a ball—the planet Earth. Imagine you could take this map and shape it into a ball. The left and right sides of the map would meet. The parallels that end at the right edge of the flat map would form a ring around the ball. In other words, those parallels of latitude are actually circles.

Vocabulary
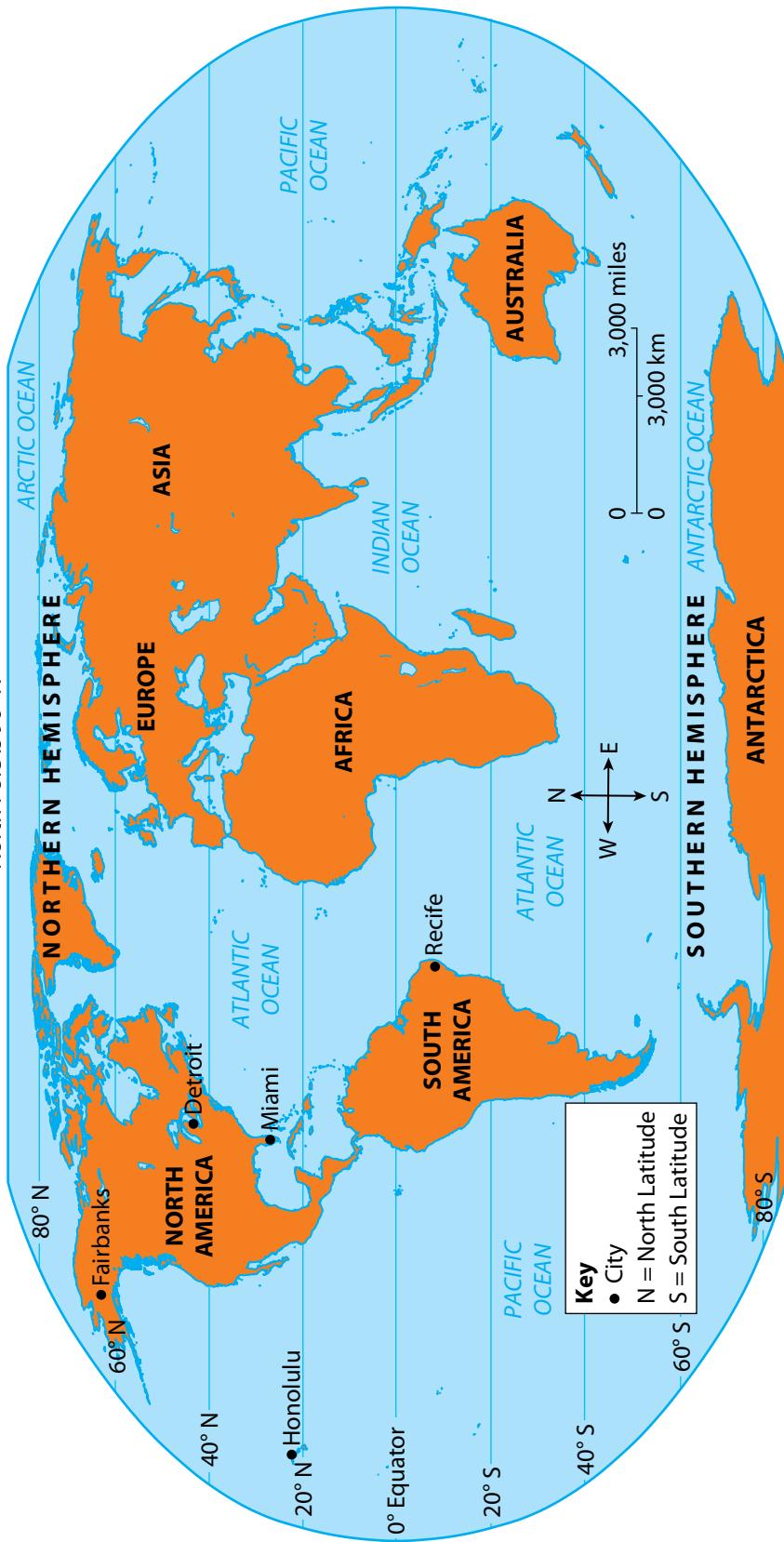
parallel, n. an imaginary line on a globe or map that circles Earth in the same direction as the equator. Parallels mark degrees of latitude

latitude, n. the distance between the equator and a place north or south of the equator; measured in degrees

equator, n. the imaginary east-west line on a globe or map that is an equal distance from the North and South Poles; 0° latitude

World Map: Parallels of Latitude

North Pole is 90° N

Parallels of latitude make it possible to measure how far north or south of the equator a city or other location is.

South Pole is 90° S

Key
● City
N = North Latitude
S = South Latitude

In fact, there is a type of world map that's shaped like a ball. It's called a **globe**. Suppose you could place your finger on one of the parallels of latitude just north of the equator. Follow the parallel all the way around the globe. Do this until you come back to the place where you started. Then choose a parallel of latitude closer to the North Pole. Follow that parallel around the globe, too. Can you see that this second circle is smaller than the circle just north of the equator? The circles get smaller and smaller as you move north or south of the equator.

Vocabulary

globe, n. a representation of Earth's surface in the form of a ball

degree, n. a unit used to measure the distance between parallels and meridians

On Earth itself, each parallel is sixty-nine miles from the next parallel. We use the word *degree* for the distance between each parallel. The symbol ° is used for *degree*. The equator is at 0 degrees (0°) latitude. Sixty-nine miles to the north of the equator is called 1° N. Sixty-nine miles south is called 1° S.

Travelers like the captain use parallels of latitude to measure how far north or south they are from the equator. So, let's say the captain reported that his ship was at 1° N. You would know that the ship was sixty-nine miles north of the equator.

Notice that many maps do not show all the parallels of latitude. The map here only has every twentieth parallel printed on it. The first parallel on the map north of the equator is marked 20° N. The parallel after that is 40° N, and so on. The North Pole is 90° N.

What Latitude Tells You

In general, the closer you are to the equator, the warmer the climate is. So, places at low latitude are usually warm year-round. Places located at a high latitude are usually colder. That is true both north and south of the equator. The North and South Poles, at 90°N and 90°S, are cold all year.

Most of the United States lies between 25° N and 47° N. Miami, Florida is located at about 25° N. The weather in Miami is usually warm. Even in the winter, it is often warm enough to wear shorts. Detroit, Michigan, is located at about 42° N. What do you think the winters are like in that city?

Winters in Detroit are cold! Often, the Detroit River freezes over as ice forms on the surface. The city also gets lots of snow and several months of freezing weather.

Fairbanks, Alaska, is located at 64° N. Honolulu, Hawaii, is located at 21° N. How do you think the January temperatures in Fairbanks and Honolulu compare?

Now look south of the equator. The tip of South America reaches to about 55° S. It's almost as far south of the equator as Alaska is north. The climate there is cold all year long. Farther north in South America, the weather becomes warmer. The city of Recife, Brazil, is located at about 8° S. Recife is warmer than Miami. This is because it is so much closer to the equator.

When you visited the captain, he told you the ship was at 1° N. By now, you probably have a good idea what the temperature is likely to be there.

Parallels of latitude also help us name parts of the globe. The equator divides Earth into two **hemispheres** (/hem*uh*sfeerz/). A hemisphere is half of a sphere or ball. The area north of the equator is called the Northern Hemisphere. The area south of the equator is called the Southern Hemisphere.

Meridians of Longitude

Imagine that you and 359 of your friends are spread out along the equator. Each of you is sixty-nine miles apart. Together, you make a dotted line around the world. All 360 of you begin walking directly north toward the North Pole. For most of your journey, you can't see your friends. If everyone walks straight toward the North Pole, you will slowly get closer together. By the time you reach the pole, all 360 of you will be trying to stand in the same place.

Now imagine you can see the footprints you left behind you. Your steps make up lines called **meridians**. Meridians measure the **longitude** to the east or west of a specific meridian. (You'll learn more about meridians shortly.) Like parallels, meridians are imaginary lines that mapmakers put on maps. They run from the North Pole to the South Pole. They are not parallel, however. They get closer to each other as they near each pole.
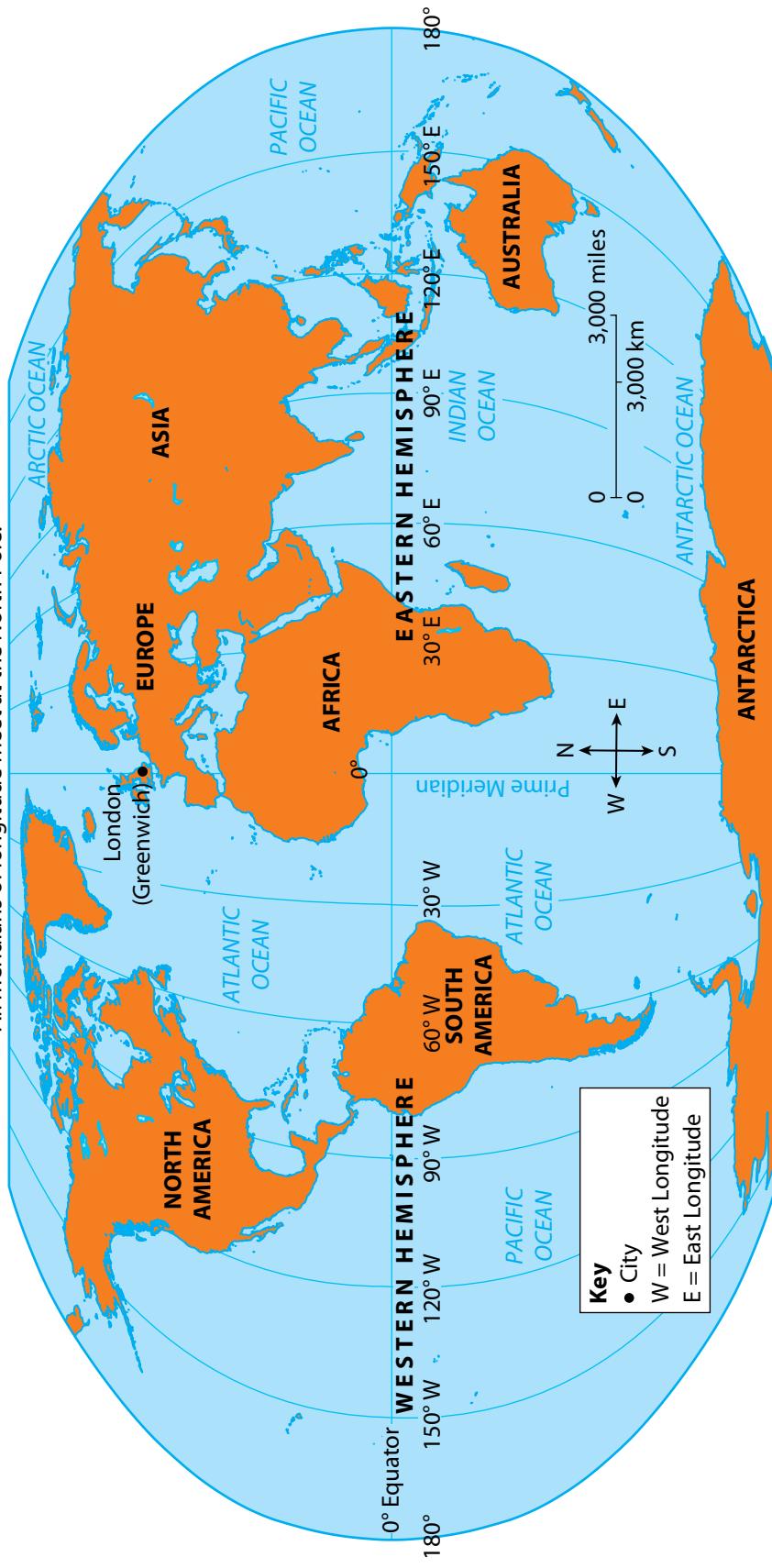
World Map: Meridians of Longitude

All meridians of longitude meet at the North Pole.

ARCTIC OCEAN

PACIFIC OCEAN

ASIA

EUROPE

AFRICA

AUSTRALIA

INDIAN OCEAN

EASTERN HEMISPHERE

30° E   60° E   90° E   120° E   150° E   180°

0°

ANTARCTIC OCEAN

ANTARCTICA

Prime Meridian

NORTH AMERICA

SOUTH AMERICA

ATLANTIC OCEAN

PACIFIC OCEAN

ATLANTIC OCEAN

WESTERN HEMISPHERE

180°   150° W   120° W   90° W   60° W   30° W

0° Equator

London (Greenwich)●

N
W — E
S

3,000 miles
3,000 km
0
0

Key
● City
W = West Longitude
E = East Longitude

All meridians of longitude meet at the South Pole.

Meridians of longitude get closer together as they near the North or South poles.

19

Like parallels of latitude, meridians of longitude are measured in degrees. There are 360 degrees of longitude. The map of the world on page 19 shows lines that are 30° apart. At the equator, each meridian is sixty-nine miles apart. At the poles, all the meridians meet at a single point. You can see this if you look at a globe.

The equator is a parallel that divides Earth into northern and southern halves. There is a meridian that divides Earth into eastern and western halves. This meridian is numbered 0°, and it is called the **prime meridian**. It runs through Greenwich (/gren*itch/), England. This is a small part of London. There was once an important observatory in Greenwich. An observatory is a place where scientists study the stars. In the 1800s, it was decided that this place would mark 0° longitude.

Meridians east of the prime meridian are numbered 1° E, 2° E, and so on. They go all the way to 179° E. Meridians to the west of the prime meridian are numbered from 1° W to 179° W.

The prime meridian does not circle the entire world. In fact, it is only half of an imaginary circle around the world. The other half of the circle is called the 180° meridian. You'll learn more interesting things about this meridian in Chapter 4.
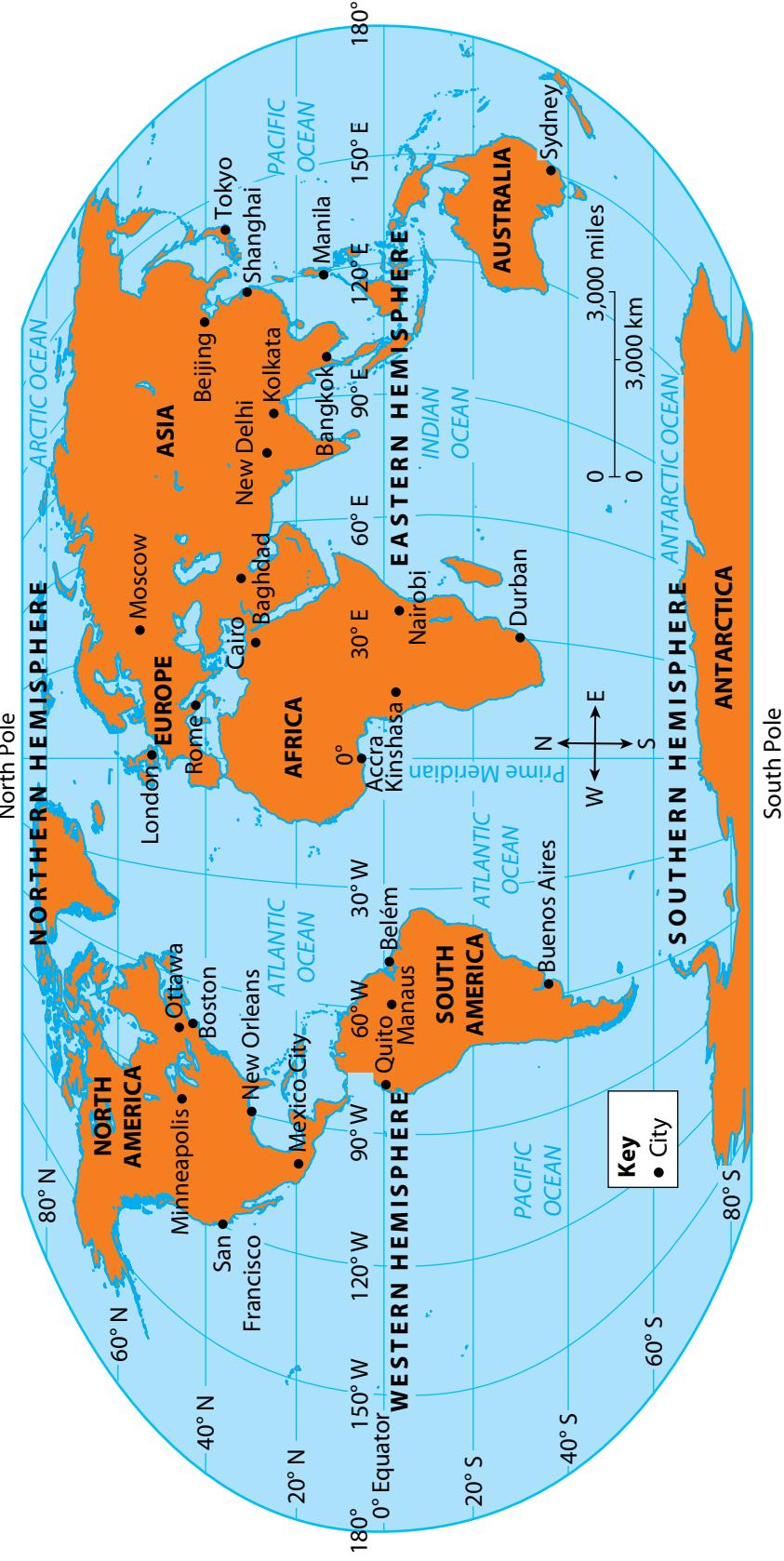
The Coordinate System

Parallels and meridians—the lines that help us mark degrees of latitude and longitude—help us name parts of the globe. The

World Map: Parallels of Latitude and Meridians of Longitude

You can find any place on Earth by using the coordinate system created on a map by meridians and parallels. Can you find what city lies at about 30°N and 90°W?

prime meridian divides Earth into two hemispheres. The area east of the prime meridian is called the Eastern Hemisphere. The area west of the prime meridian is called the Western Hemisphere.

How does longitude help the captain know where he is and where he is going? Do you remember how he reported his boat's location at 1° N? You know he is sixty-nine miles north of the equator—but that's all. Is he in the Atlantic Ocean? The Pacific Ocean? The Indian Ocean? You can't tell. But, what if you knew his longitude, too? Longitude gives you east-west information. Latitude gives you north-south information. When you put them together, you can know exactly where you are. For example, your captain knows that the ship is at 1° N and 90° W. This means that the ship is at the spot where those two lines cross. The two numbers are called **coordinates** (/coe*or*dih*nihts/). These are sets of numbers that help you find your place on a globe or map.

On the map on page 21 titled World Map: Parallels of Latitude and Meridians of Longitude, find the line of latitude labeled 1° N. Place your right index finger on this line. Then find the line of longitude labeled 90° W. Place your left index finger on it. Now follow the two lines with your fingers until they meet. The point where the two lines meet is exactly where your ship is. You are sailing on the Pacific Ocean. You are off the coast of South America.

Now you know you're in the Pacific Ocean. But do you know where you're headed? At that moment, the captain passes by. You ask him, "Where are we going?"

He nods and says, "We're headed for a city located just to the south of 40° N and 120° W. We'll be there in a few days."

Look at the map. Find the coordinates. Trace the lines with your fingers. You can find the spot where your ship is headed.

Chapter 3
Fnding a Place on a Map

Crossing the United States Back in the 1860s, building
the Transcontinental Railroad was
backbreaking work. The workers
didn't have any modern equipment.
They used hammers, shovels, and
explosives to move earth and rock.
They carried each heavy steel rail by
hand.
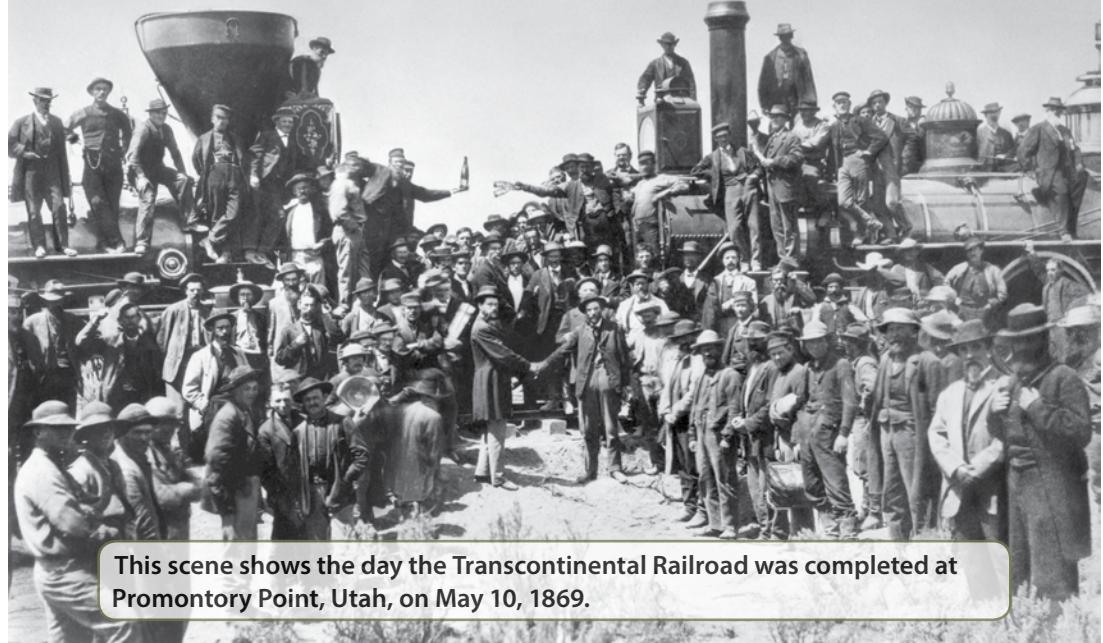
Workers placed the rails on wooden ties and hammered steel
spikes into place to hold the rails. Then the workers moved on.
They placed more ties. They hauled more rails. They drove more
spikes.

There were different crews of laborers. For one long section of the
railway line a crew started in Omaha, Nebraska. This crew built the

The Transcontinental Railroad

This scene shows the day the Transcontinental Railroad was completed at Promontory Point, Utah, on May 10, 1869.

railway heading west. The other crew started in Sacramento, California. This crew built the railway heading east.

It seemed like an impossible job. But the two armies of workers laid mile after mile of track. For six years the work progressed. Finally, on May 10, 1869, the two railroads met. The place was Promontory Point, Utah.

Dividing the Lines

Where on Earth is Promontory Point? Its exact location is 41°38′ N, 112°30′ W.
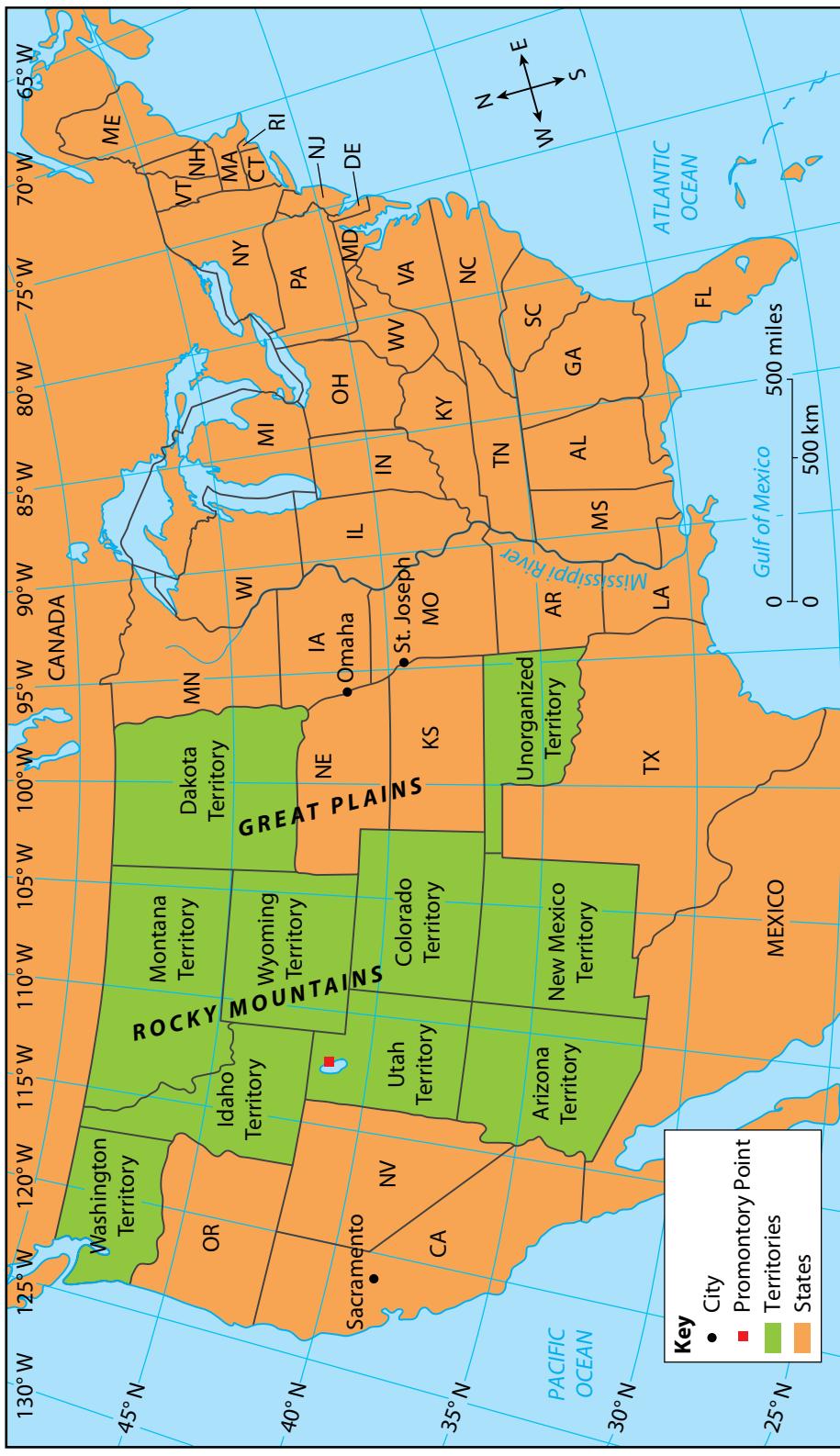
You've studied latitude and longitude. You know about degrees. What are the extra numbers in the coordinates? The extra numbers are called **minutes**.

> **Vocabulary**
>
> **minute,** n. a unit of measure equal to one-sixtieth of a degree of latitude or longitude

The first coordinate for Promontory Point is 41°38′ N. That is short for forty-one degrees, thirty-eight minutes north. Recall, parallels of latitude are sixty-nine miles apart. Meridians are also many miles apart in most places. Sometimes, mapmakers want to be able to pinpoint spots between parallels of latitude and between meridians of longitude. So they divide degrees into smaller units. There are sixty minutes in one degree. When writing the coordinates, they use the symbol ′ to stand for minutes. So 38′ is read as thirty-eight minutes.

The United States, 1869

Map labels:

- 130°W, 125°W, 120°W, 115°W, 110°W, 105°W, 100°W, 95°W, 90°W, 85°W, 80°W, 75°W, 70°W, 65°W
- 45°N, 40°N, 35°N, 30°N, 25°N

CANADA

PACIFIC OCEAN

ATLANTIC OCEAN

Gulf of Mexico

MEXICO

Mississippi River

ROCKY MOUNTAINS

GREAT PLAINS

Washington Territory, OR, NV, CA, Idaho Territory, Montana Territory, Wyoming Territory, Utah Territory, Colorado Territory, Arizona Territory, New Mexico Territory, Dakota Territory, NE, KS, Unorganized Territory, TX

MN, WI, IA, MO, AR, LA, IL, MI, IN, KY, TN, MS, AL, GA, FL, OH, WV, VA, NC, SC, PA, NY, ME, VT, NH, MA, CT, RI, NJ, DE, MD

Cities: Sacramento, Omaha, St. Joseph

N E S W (compass)

Scale: 0 — 500 miles; 0 — 500 km

Key
- • City
- ■ Promontory Point
- ▉ Territories
- ▉ States

This map shows the United States as it was when the Transcontinental Railroad was completed. You can use this map to locate Promontory Point.

Remember, minutes of latitude and longitude are not units of time. Instead, they are units of *space*. You can't assume that because two points are two minutes apart in latitude that it would take you two minutes to get from one to another.

The coordinates for Promontory Point are: 41°38' N, 112°30' W. You can use these coordinates to find the location of Promontory Point on a map. You know that latitude measures distances north and south of the equator. So the coordinate that ends with 'N' for north or 'S' for south is the latitude. That would be 41°38' N. Longitude indicates locations east and west of the prime meridian. So 112°30' W is the longitude.

Where Parallels and Meridians Cross

Look at the map on page 27 which shows the United States in 1869. You will recognize most of the states. However, many of the states west of the Mississippi River had not yet been formed. The government called these places *territories*. Somewhere out in the territories is Promontory Point. Can you find it?

This map shows parallels and meridians every five degrees. See if you can locate the coordinates for Promontory Point. First look along the west side of the map. You won't find 41°38' N, so locate the parallel of latitude closest to it. That is the 40° N parallel. The place you're looking for will be 1°38' north of this parallel. Think about it this way. There are five degrees between each parallel shown on the map. So one degree is less than half of the distance

between the parallels. Estimate, or carefully guess, where that place is. Put your left index finger there.
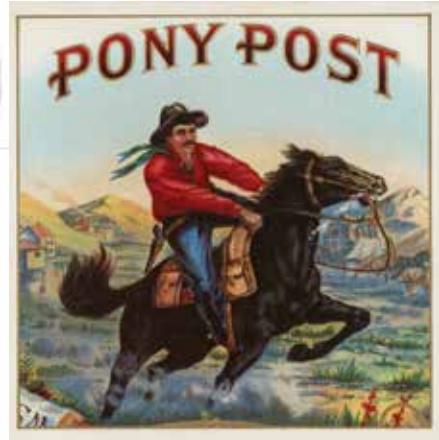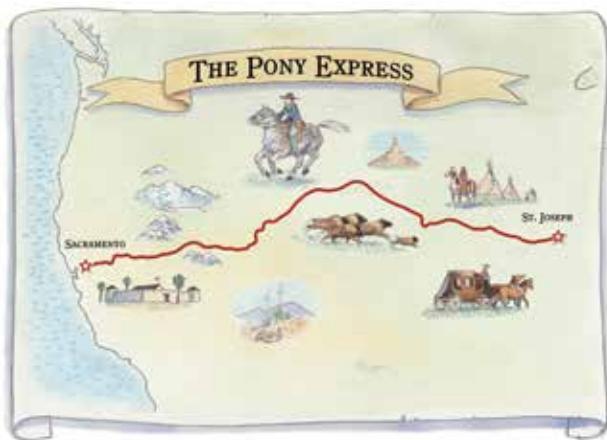
Now look along the northern area of the map. Locate the meridian of longitude closest to 112°30′ W. Once again, this exact meridian is not shown. But 112°30′ W will be about halfway between the 110° and 115° meridians. Put your right index finger on this meridian.

With your two fingers still on the map, move them toward each other, following the parallel and meridian they are marking. The place where your two fingers meet—where the meridian and parallel cross—is Promontory Point.

Now look at the map and find Omaha, Nebraska. Omaha is located at 41°18′ N and 95°57′ W. Compare the coordinates of Omaha and Promontory Point (41°38′ N, 112°30′ W). You can see that the railroad went a long way west. But it only went a tiny bit (20′) north.

Finding an Exact Location

The Transcontinental Railroad linked the eastern United States with the West Coast. Even earlier, the Pony Express was the way mail was sent across the "Wild West." Riders on horseback carried the mail along the Pony Express route. They changed horses about every ten miles. After one hundred miles, a rider handed the mail to another rider. The new rider carried it for another hundred miles. The route

Pony Express riders carried the mail between St. Joseph, Missouri, and Sacramento, California in about ten days.

ran from St. Joseph, Missouri, to Sacramento, California. It was almost two thousand miles long. Mail took about ten days to get from one end to the other.

Today, there is the Pony Express Museum in St. Joseph. There you can learn all about the Pony Express. You can see pictures of the riders. You can also learn about the dangers they faced.

Let's imagine that your parents or relatives have agreed to take you to the museum. First you have to find out where St. Joseph, Missouri, is located. Remember, you can use computers and applications to find this information. But it is also useful to know the skills for finding this kind of information in other ways.

To find St. Joseph, you could start with a book of maps called an **atlas**. An atlas has an **index**. Look at the sample index on page 31.

> **Vocabulary**
>
> **atlas,** n. a book of maps
>
> **index,** n. an alphabetical list of names or places that appear in a book, that usually includes the page(s) on which the name appears

Place	Page	Lat.	Long.
St. George, Utah	119	37°10′ N	113°58′ W
St. James, Missouri	111	37°99′ N	91°61′ W
St. Johnsbury, Vermont	109	44°42′ N	72°02′ W
St. Joseph, Missouri	121	39°77′ N	94°85′ W
St. Louis, Missouri	117	38°63′ N	90°20′ W
St. Paul, Minnesota	118	44°94′ N	93°09′ W
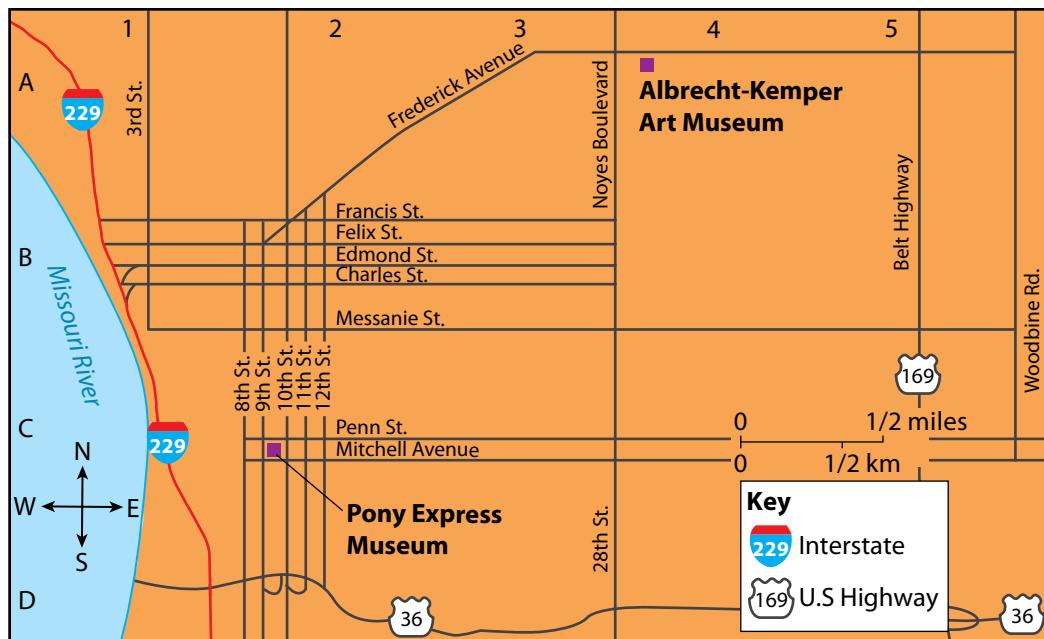
The index for an atlas might look like this.

It shows coordinates for St. Joseph. It also shows the page where you will find the map in which St. Joseph appears.

Using Road Map Coordinates

Let's take a closer look at St. Joseph, Missouri, to learn about different types of coordinates that are used on road maps. Imagine that you are on a sightseeing trip with your family. Since you are such a map expert, you have been given the map. Your task is to find the Pony Express Museum on a map of St. Joseph. Instead of looking all over the map, start with the road map index. This is like the index in a book. It lists all the places shown on the map. It also

St. Joseph, Missouri

Instead of using a coordinate system of latitude and longitude, some maps use a system of letters and numbers to create a grid system.

gives their coordinates. The index gives you these coordinates: C-2. You're puzzled. These are different coordinates from those for latitude and longitude.

Many local highway maps give coordinates as letters and numbers. They are simpler to use on maps of small areas.

Look at the map of St Joseph above. Notice that the letters run down the side of the map. Meanwhile, the numbers run along the top. You are looking for the coordinates C-2. Put one finger on the space marked 2. Put another finger on the space marked C. Follow the spaces until they meet. Somewhere close to where your fingers meet is the Pony Express Museum.

You have a great time at the Pony Express Museum. Your mother decides she wants to see the Albrecht-Kemper Art Museum. But she can't find it on the map. Can you? The map index will tell you that the coordinates are A-4. But how will you get there? And about how far is it from the Pony Express Museum?

Chapter 4
Time Zones

A Puzzle About Time A family is traveling by ship from China east toward Los Angeles, California. The mother is about to have twin babies. At 1:00 a.m. on Monday, January 1, 2001, the ship nears 180° longitude. The woman has a baby girl.

The ship then crosses the 180° line of longitude. An hour later, the woman gives birth to a second girl.

Baby One's birth certificate says she was born at 1:00 a.m. on Monday, January 1, 2001. Baby Two's birth certificate says she was born at 2:00 a.m. on Sunday, December 31, 2000.

The baby's father is confused. There must be an error on the birth certificates. How could Baby One have a later birth date than Baby Two?

The International Date Line

The puzzle about the two children is easy to explain. You already know that geographers have drawn imaginary lines from the North Pole to the South Pole. One of these lines is at about 180° longitude. At this point, one day changes to another. If it is Monday on the east

People who crossed the wide oceans used to face a confusing situation as they crossed the 180° line of longitude.

side of the line, it is Tuesday on the west side. There is a difference in time of twenty-four hours. We call this line the **international date line**.

Vocabulary

international date line, n. generally follows 180° longitude; by international agreement, the calendar day on the east side of the line is one day earlier than the calendar day on the west side of the line

The international date line is the same as the 180° meridian in most places. In some places, it curves around areas of land. This is so the line doesn't run through the middle of countries. People on one side of a street might be a day behind people on the other side. Just think how confusing that would be! To solve that problem, the international date line is placed over oceans.

Most people do not notice the international date line. It doesn't have much to do with local events or local time. People traveling between Asia or Australia and the United States are most affected by the international date line. People flying from Japan may arrive in the United States hours before they leave. People flying from the United States will arrive in Japan a day later.

Of course, you don't grow older or younger by crossing the international date line. It takes roughly the same time to fly in both directions. The international date line was created to solve problems facing world travelers. To help you understand these problems, consider the story of one of history's greatest travelers.

Ferdinand Magellan

Ferdinand Magellan was an explorer in the 1500s. He led the first voyage to circle the globe. Magellan and his crew were the

first to experience the problem that occurs when travelers go all the way around a rotating planet.

Magellan and his crew sailed from Spain to the Americas. They kept traveling west. Eventually they had gone all the way around the world. Magellan himself did not finish the journey. He died along the way. His crew completed the voyage. Members of the crew

Ferdinand Magellan led the first voyage to sail entirely around the world.

kept careful records of their journey. When they reached Spain again, they found that the journey had taken one more day than their records showed.

Later, something similar happened to people traveling east around the world. They would arrive home a day earlier than they expected.

In order to solve this problem, the international date line was created. It's not a perfect solution, however. Odd things can happen, as in the case of the twins born in "reverse order."

Still, you may be wondering: Why did Magellan and other travelers seem to lose or gain a day? Why was the international date line necessary?

Time Zones

The international date line is easier to understand if you first understand **time zones**. Other parts of the United States have different times than where you live. Perhaps you've seen it on TV. A program that begins at 8:00 p.m. on the East Coast, begins at 7:00 p.m. in the Midwest. That same show begins at 6:00 p.m. in the Rocky Mountains and 5:00 p.m. on the West Coast. Viewers in all those places are watching the same show at the same time. But the clocks on their walls say different times.

> **Vocabulary**
>
> **time zone,** n. one of twenty-four zones around Earth within which everyone observes the same time

The United States, including Alaska and Hawaii, has six time zones. Most states are in one of four time zones.
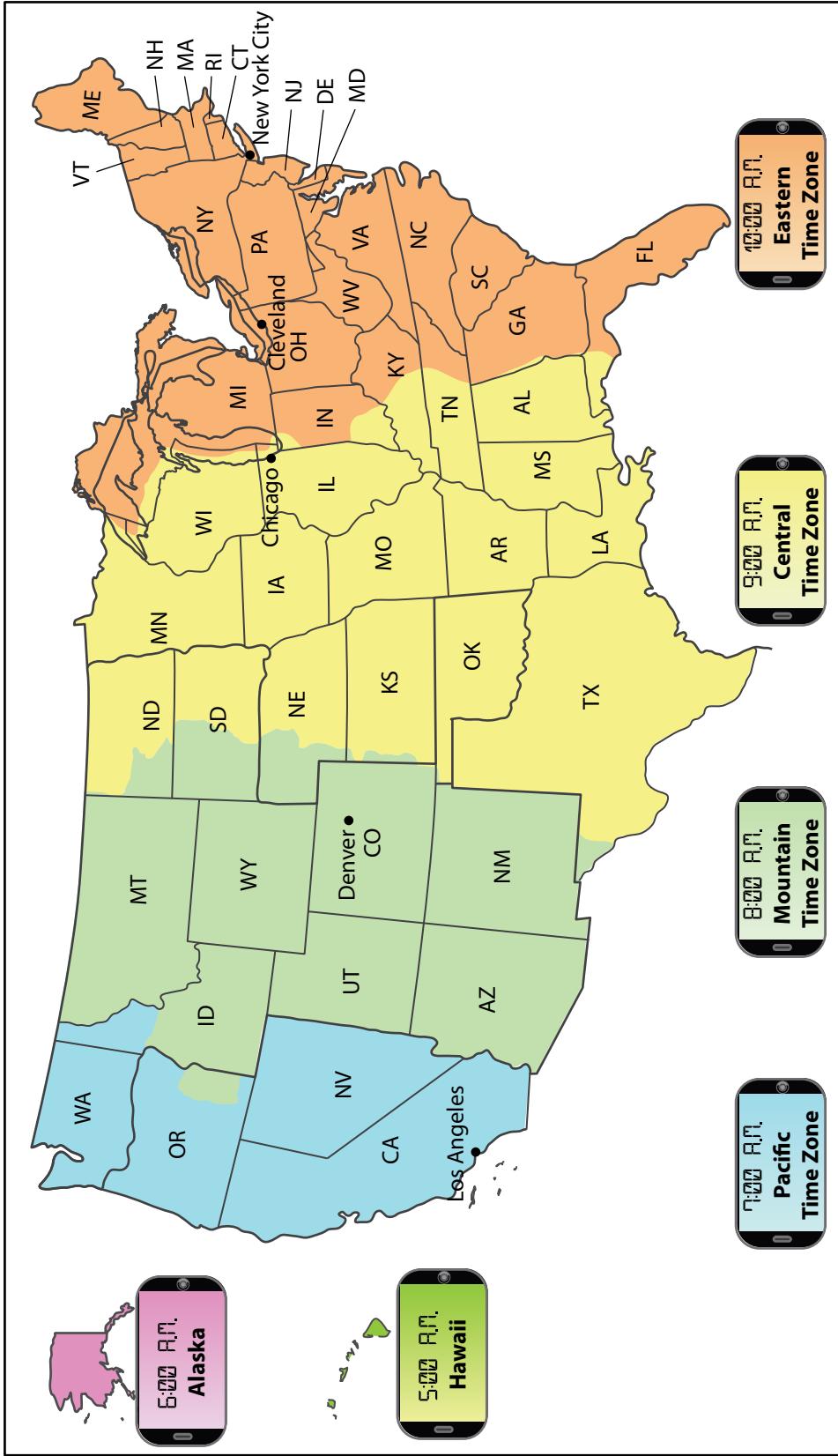
When people travel through the time zones, they gain or lose time. For example, suppose you board an airplane in Cleveland, Ohio. This city is in the Eastern Time Zone. The plane flies to Chicago, Illinois. Chicago is in the Central Time Zone. The flight lasts about one hour. If you leave at 1:00 p.m., you will arrive in Chicago at 1:00 p.m.

How is this possible? Places in the Central Time Zone are one hour earlier than places in the Eastern Time Zone. So even though you spent an hour flying, you gain the hour back by entering the new time zone.

Time Zones in the United States

Map of the United States showing time zones:

Pacific Time Zone — 7:00 A.M.
Mountain Time Zone — 8:00 A.M.
Central Time Zone — 9:00 A.M.
Eastern Time Zone — 10:00 A.M.
Alaska — 6:00 A.M.
Hawaii — 5:00 A.M.

States labeled: ME, NH, MA, RI, CT, New York City, NJ, DE, MD, VT, NY, PA, VA, NC, SC, GA, FL, WV, KY, TN, AL, Cleveland OH, MI, IN, MS, IL, MO, AR, LA, WI, IA, Chicago, MN, ND, SD, NE, KS, OK, TX, MT, WY, Denver CO, NM, ID, UT, AZ, WA, OR, NV, CA, Los Angeles

The United States covers a total of six time zones. There are four time zones between the East and West Coasts.

When you fly back from Chicago to Cleveland, you will "lose" time. If you leave at 8:00 a.m., you will arrive in Cleveland at 10:00 a.m. You fly for one hour. You lose another hour because you change time zones.

Changes in time occur whenever you travel between time zones. If you travel into the next time zone to the east, you lose an hour. If you travel into the next time zone to the west, you gain an hour.

Look at the map of World Time Zones on page 41. What time zone do you live in? What time is it right now? What time is it in Los Angeles? What time is it in New York?
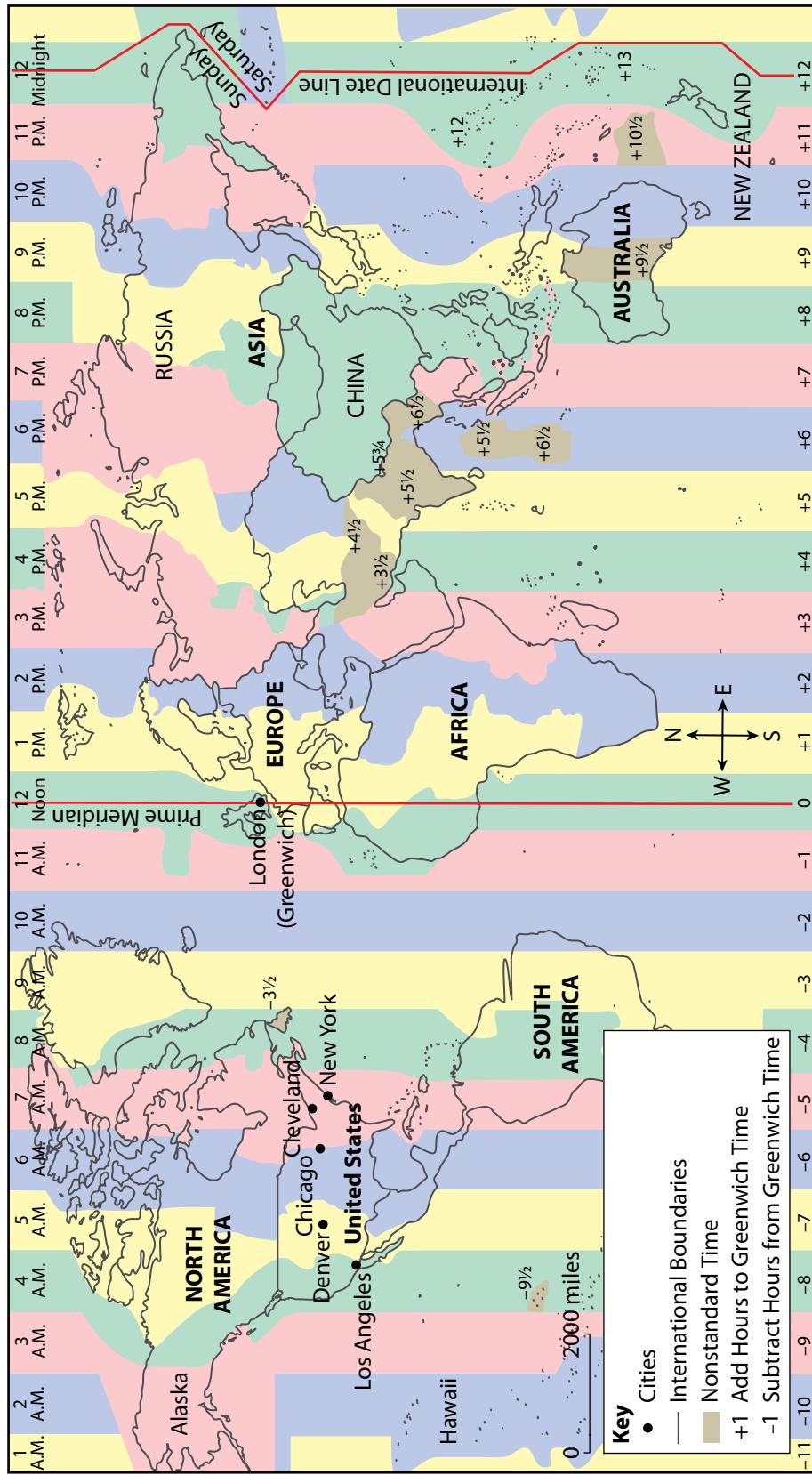
International Time Zones

The time zones in the United States are part of a worldwide system of time zones. There are a total of twenty-four time zones. Think of the time zones as making up a continuous circle that goes around the world from east to west. Each time zone is one hour apart from its neighboring time zones. Each time zone to the east is one hour later than the one to the west. Each time zone to the west is one hour earlier than the one to the east.

The international date line is in the middle of a time zone. The time on the east side of the time zone is one day earlier than the time on the west side of the time zone. Look at the map. Just to the east of the international date line, it is midnight on Saturday. Just to the west of the international date line, it is midnight on Sunday.

Now use what you have learned. If it is 4 a.m. on Tuesday in Los Angeles, California, on the west coast of the United States,

Time Zones Around the World

The world is divided into twenty-four time zones. If it is 9 a.m. where you live, what time would it be in Chicago?

what day is it in Australia? This continent is across the international date line from Alaska. Therefore, Australia is one day ahead of California. Yes, it's Wednesday there, between 8 p.m. and 10 p.m.

Why Have Time Zones?

Why was such a complicated system of time zones created? Here's a clue. Earth is divided into twenty-four time zones. What else is divided into twenty-four parts?

If you said "a day," you are on the right track. The twenty-four time zones on Earth and the twenty-four hours in a day are closely connected. You see, Earth spins on its **axis** at a steady rate. It completes a full **rotation** every twenty-four hours. This means that different areas of Earth are facing the sun at different times. When the United States and its time zones face the sun, they experience daytime. Meanwhile, China and its time zones are facing away from the sun and experiencing nighttime. Time zones were invented because of this rotation. If Earth didn't rotate on its axis, we wouldn't need time zones.

> **Vocabulary**
>
> **axis,** n. an imaginary line around which a spinning object spins
>
> **rotation,** n. the movement of a spinning object

But what about the international date line? Why was it created? This is one of those cases where one thing led to another. First, the time zones were set up. The time zone in Greenwich, England, became the one that all other time zones depended on. This caused a need for a date line.

You can understand this by looking at the map of World Time Zones. First, find the prime meridian. This is the 0° longitude line

that runs through Greenwich, England. Imagine that it is 3:00 a.m. on Saturday, June 10, in the Greenwich time zone. What time will it be in the next time zone to the east? It will be 4:00 a.m., of course. Now count over eleven more time zones to the east. Adjust the time as you go. You should end up in a time zone (shaded green) that includes eastern Russia and New Zealand. If you have counted correctly, you should say that the time in this zone is 3:00 p.m. on June 10.

You may say, "That was easy!" But there's just one small problem. What happens when you count to this same time zone from the west? You will get a different answer. Try it and see.

Go back to Greenwich and count twelve time zones to the west. Adjust the time as you go. If it is 3:00 a.m. on Saturday, June 10, in Greenwich, it will be 2:00 a.m in the next time zone to the west. Then it will be 1:00 a.m., then midnight, and then 11:00 p.m. *on the previous day*—June 9. Keep counting until you have ticked off twelve time zones. You should end up in the same time zone you were in before. It is the green one containing Russia and New Zealand. But what are the date and time? According to this count, it's 3:00 p.m., just as it was before. But it's Friday, June 9, instead of Saturday, June 10!

So which day is it in this time zone? Is it June 9 or June 10? Geographers figured that the only way to solve this problem was to divide this contested time zone into two parts. In the eastern half of this time zone it would be the later date. And that's how the international date line came to be!

Chapter 5
How to Read Physical Maps

Physical Maps Show the Easy Route
Learning how to read a map makes locating places a lot easier. But once you locate a place on a map, how can you find the best route to get there?

The Big Question

What does a physical map reveal that a city road map does not?

Vocabulary

valley, n. an area of low land bordered by land of higher elevation

physical map, n. a type of map that shows the distribution of one or more of Earth's physical features; for example, taller land areas, such as mountains, and lower land areas, such as valleys
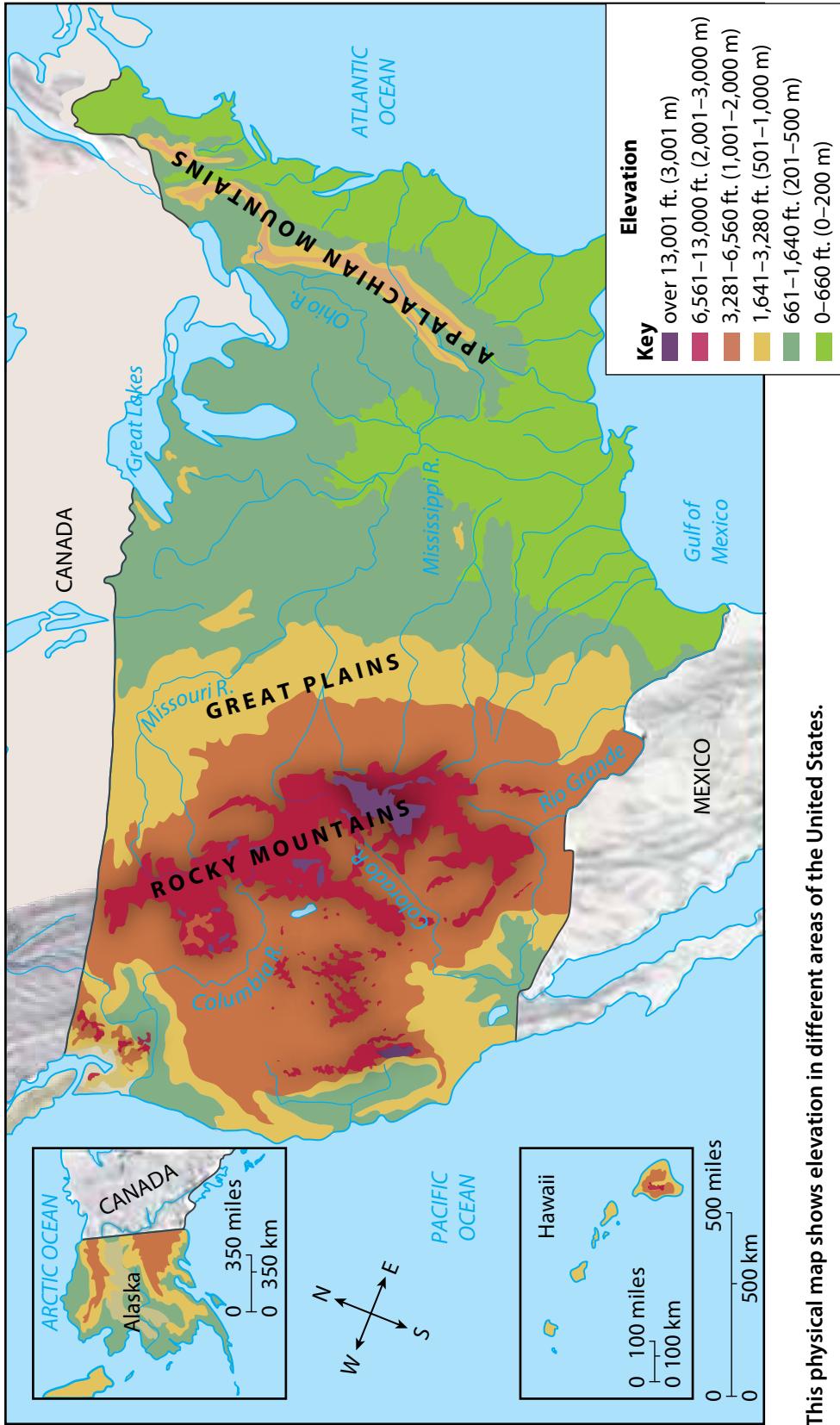
One way to find the best and easiest route to take is by looking at a special kind of map. So far, you've been looking at maps that show roads, towns, cities, and state and national boundaries. These maps tell you where places are located. They also help you figure out the distance between places.

However, these maps do not show you what the land itself looks like. You might want to know about routes that cross mountains and **valleys**. What you need is a **physical map**. This is a special type of map that shows the physical features of the land. A physical map can show

Maps can also provide information about physical features, such as these majestic mountains.

Physical Map of the United States

Key

Elevation

- over 13,001 ft. (3,001 m)
- 6,561–13,000 ft. (2,001–3,000 m)
- 3,281–6,560 ft. (1,001–2,000 m)
- 1,641–3,280 ft. (501–1,000 m)
- 661–1,640 ft. (201–500 m)
- 0–660 ft. (0–200 m)

ATLANTIC OCEAN

APPALACHIAN MOUNTAINS

Ohio R.

Great Lakes

Mississippi R.

CANADA

Gulf of Mexico

Missouri R.

GREAT PLAINS

ROCKY MOUNTAINS

Rio Grande

Colorado R.

Columbia R.

MEXICO

ARCTIC OCEAN

CANADA

Alaska

0   350 miles
0   350 km

N
W   E
S

PACIFIC OCEAN

Hawaii

0   100 miles
0   100 km

0   500 miles
0   500 km

This physical map shows elevation in different areas of the United States.

you things like hills, mountains, and valleys. Physical maps can also show features such as bodies of water, the types of plants that grow in an area, rain and snowfall in an area, and more. Different types of physical maps can show different features.

Some physical maps give information about the **elevation**, or height, of the land. Some maps use lines to show elevation. Others, like the one on page 46, use colors and shading to show elevation.

Look at the map titled Physical Map of the United States found on page 46. From the map you can see that there are two main areas of mountains in the United States. There is one long **mountain range** in the East called the Appalachian Mountains. The Appalachians run in a line that roughly follows the East Coast of the United States. The other area of mountains is in the West. There are several ranges in this region. The biggest is the Rocky Mountains. The Rockies run from Canada southward through the American Southwest. You can see that mountains cover much of the western United States.

These mountains are shown in different colors on the map. In fact, all land areas of the United States appear in color. For example, places where the land is low are shown in green. Yellow shows land that is higher in elevation. Light brown and red mean that the land is very high. The very highest land—the highest mountain **peaks**—is colored purple. Shading also helps show the location and shape of mountains.
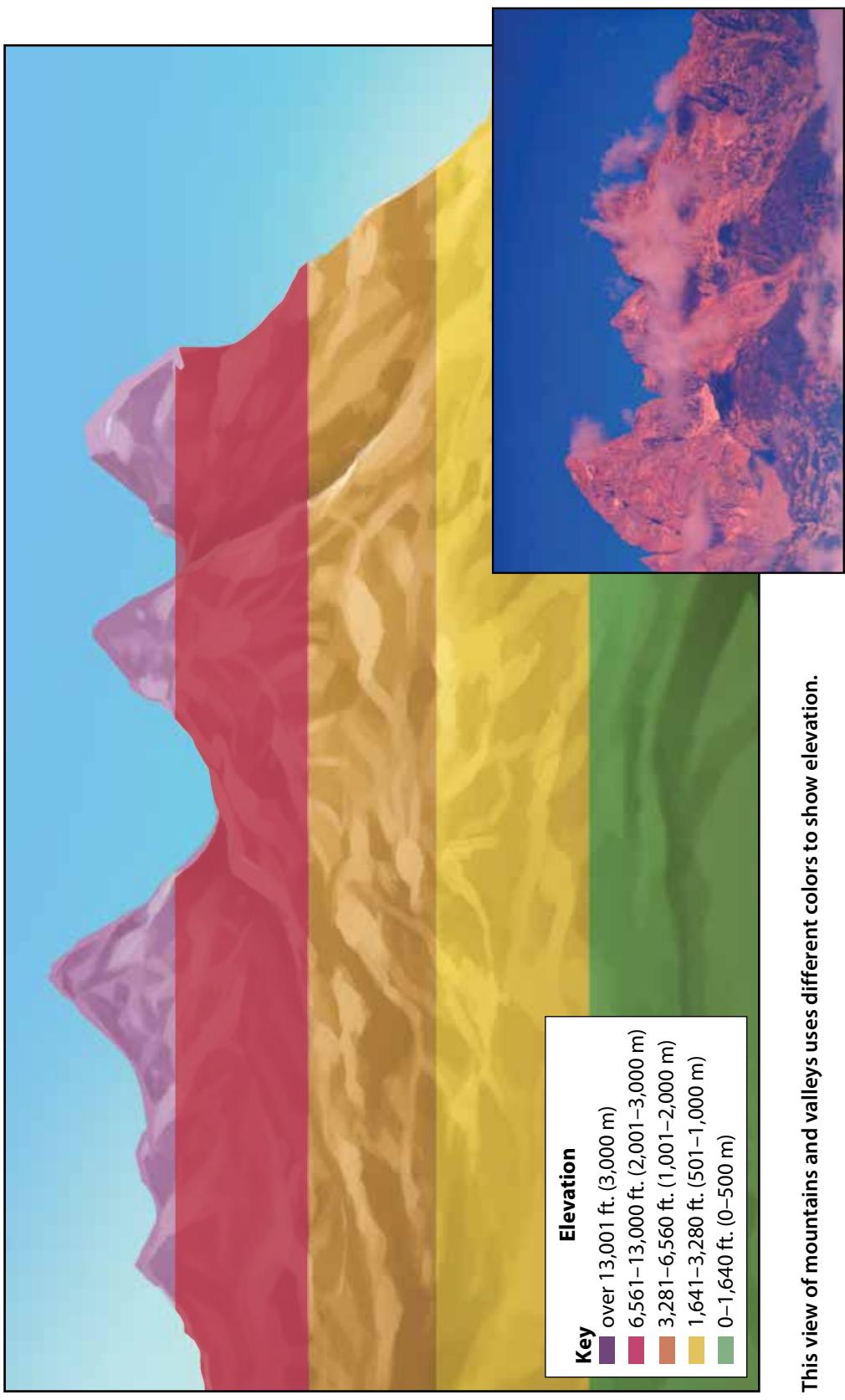
Side View of Land Elevation

Key

Elevation

- over 13,001 ft. (3,000 m)
- 6,561–13,000 ft. (2,001–3,000 m)
- 3,281–6,560 ft. (1,001–2,000 m)
- 1,641–3,280 ft. (501–1,000 m)
- 0–1,640 ft. (0–500 m)

This view of mountains and valleys uses different colors to show elevation.

Understanding a Physical Map

To help you understand the colors on a physical map, look at the image of the mountain scene in the diagram on page 48. The lowest part of the image is a valley. The valley is colored green. Look at the elevation key next to the image. The green color shows elevations from 0 to 1,640 feet. That means that the valley is between 0 feet and 1,640 feet in elevation.

Now imagine that you are a bird. You're flying, looking directly down on the mountains from above. Look at the diagram on page 50. This shows a **bird's-eye view**, or how a bird might see the land from above. It shows areas of higher and lower elevation using color.

> **Vocabulary**
>
> **"bird's-eye-view,"** (idiom), a view of something from above, as a bird might see it
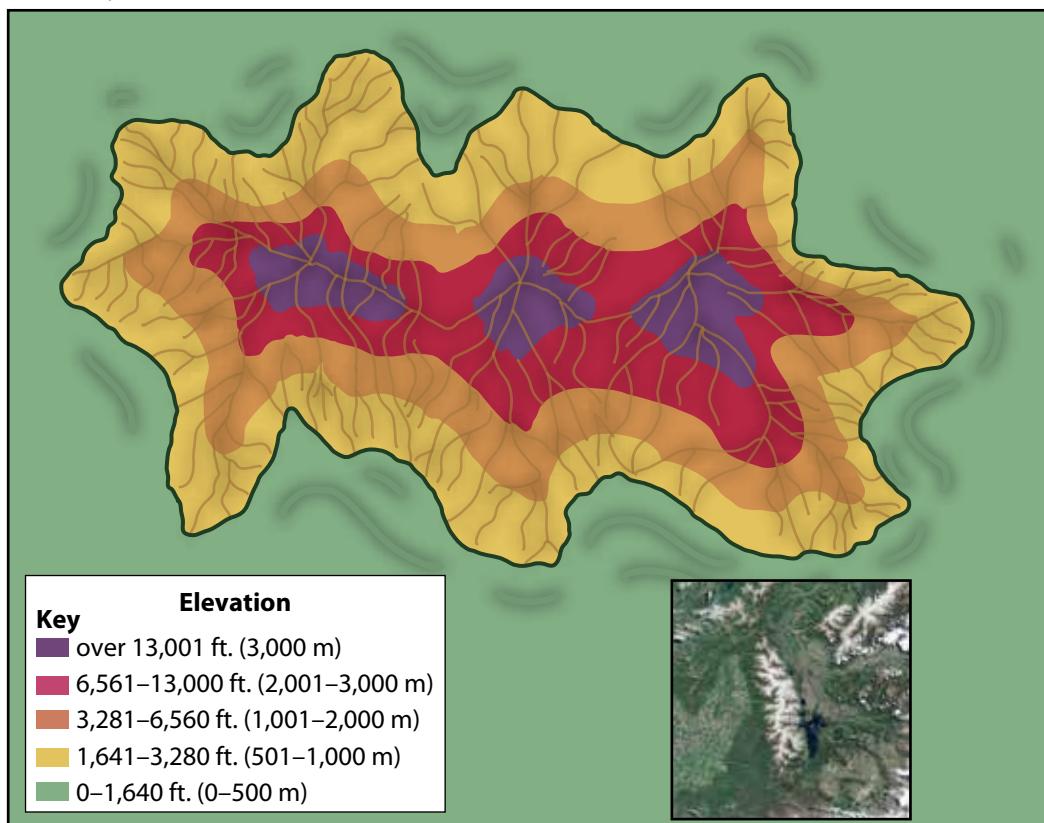
Notice the part of the mountain that is colored yellow. This color shows the same part of the mountains as the yellow on the first image. It shows the part of the mountains that is 1,641 to 3,280 feet high. Now look at the part of the mountain that is colored red. How high is this part of the mountain?

You can learn useful information by looking at an elevation map. For example, suppose you want to get the best view of the surrounding land. Where would you go? You would climb one of the peaks, of course! These peaks are shown as the three purple areas on both images located on pages 48 and 50. What if you wanted to build a railroad through this area? Where would you put it? You would not put it across the purple areas. That land is

Bird's-Eye View of Land Elevation

Key

Elevation
- ■ over 13,001 ft. (3,000 m)
- ■ 6,561–13,000 ft. (2,001–3,000 m)
- ■ 3,281–6,560 ft. (1,001–2,000 m)
- ■ 1,641–3,280 ft. (501–1,000 m)
- ■ 0–1,640 ft. (0–500 m)

This is a bird's-eye view of the same scene shown in the diagram on page 48. How do the two diagrams differ?

steep and high. Instead, you'd build it through the green area. That is where the elevation is low.

So you can see how colors can be used to show the elevation of the land. You can learn a lot about the land by studying an elevation map. However, this kind of map has some limits. For example, look at the bird's-eye diagram again. Notice that all three mountain peaks are purple. The purple means the peaks are over 13,000 feet high. One peak may be 13,000 feet high. Another may be 13,500 feet high. You cannot tell the difference between the two in this diagram.

Now look back at the physical map of the
United States on page 46. The elevation
key tells you how high the land is. How
high are the Great Plains? Most of this area
is shaded yellow and light brown. That
means the elevation is between 1,641

<div style="float:right">

Vocabulary

sea level, n. land
that is the same
elevation as the
surface of the sea or
ocean

</div>

and 6,560 feet high. Which mountains are higher, the Rocky
Mountains or the Appalachian Mountains? The Rocky Mountains
are higher. They are shaded red and purple. That means much
of the land is more than 6,561 feet above **sea level**. Some of it is
more than 13,000 feet above sea level. The Appalachians, on the
other hand, are shaded yellow and light brown. They measure
between 1,641 and 6,560 feet high.

Finding Your Way on an Elevation Map

You may be wondering how you can use this information. Here's
one way. Take a look at the map of Adventure Valley on page 53.
You and your friend are spending the day exploring the area. You
start at Butterfly Meadow. It's on the east side of the map near the
stream. Your goal is to reach Hidden Treasure Cavern. As you can
see, there are two trails to Hidden Treasure Cavern. You could take
Pony Path or Brook Trail. You and your friends can't decide which
one to choose. Look at your map. What does it tell you about
the trails?

On the map, the area around Butterfly Meadow is shown in green.
Look at the elevation. Green is land that is between 201 and 400 feet
high. Pony Path goes up Peacock Hill. It climbs from green to pink,
and then to dark green. Next it crosses into purple and orange.
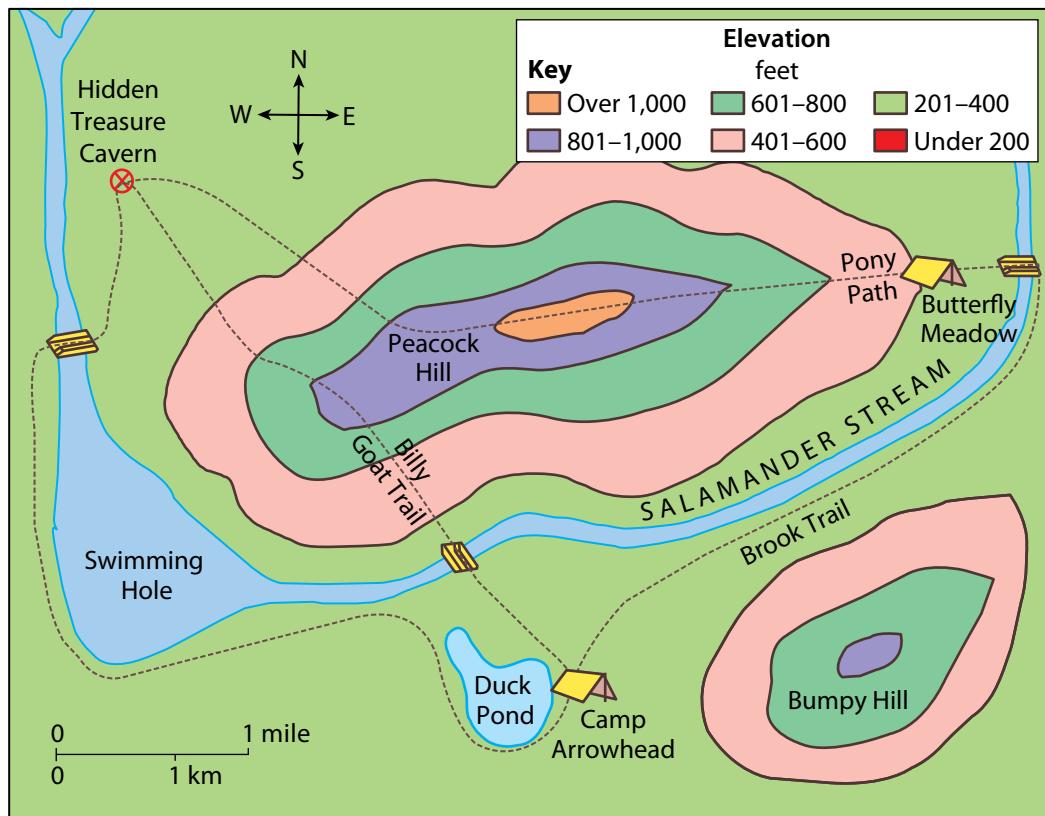
Hidden Treasure Cavern is shown in the green area. This tells you that you will first climb from Butterfly Meadow all the way to the top of Peacock Hill. Since the top is colored orange, you know the elevation will be over 1,000 feet.

Brook Trail follows Salamander Stream. The map is colored green for all of the way. This means your trail will be level all the way.

Do you want to climb up the hill and then hike down the hill again to Hidden Treasure Cavern? Or do you want to follow the level trail to get there? Of course, you might also think about the distance. Using a string to measure, you'll find the distance along Pony Path is about five miles. The distance along Brook Trail is over ten miles. Do you want to walk five miles with a big hill, or ten miles on a flatter trail: you pick!

After visiting Hidden Treasure Cavern, you plan to hike to Camp Arrowhead. Again, you have a choice of two trails. Which trail will you choose and why? You can see why being able to read maps is so important!

Elevation Map of Adventure Valley

Key

Elevation feet
- Over 1,000
- 601–800
- 201–400
- 801–1,000
- 401–600
- Under 200

Hidden Treasure Cavern

Pony Path

Butterfly Meadow

Peacock Hill

SALAMANDER STREAM

Billy Goat Trail

Brook Trail

Swimming Hole

Bumpy Hill

0 — 1 mile
0 — 1 km

Duck Pond

Camp Arrowhead

By using this elevation map of Adventure Valley, you can find the easiest and quickest routes to visit the places you want to see.

Glossary

A

atlas, n. a book of maps **(30)**

axis, n. an imaginary line around which a spinning object spins **(42)**

B

"bird's-eye view," (idiom), a view of something from above, as a bird might see it **(49)**

C

compass rose, n. a symbol on a map that shows the directions for north, south, east, and west **(9)**

coordinates, n. a pair of numbers on a globe or map that shows where something is located **(22)**

D

degree, n. a unit used to measure the distance between parallels and meridians **(16)**

direction, n. where a person or object is facing or moving toward **(9)**

distance, n. how far it is from one point to another **(7)**

E

elevation, n. the height of something; on maps, elevation is shown as the number of feet above or below sea level **(47)**

equator, n. the imaginary east-west line on a globe or map that is an equal distance from the North and South Poles; 0° latitude **(14)**

G

Global Positioning System (GPS), n. electronic equipment that uses radio waves from satellites to provide precise information about location and direction **(12)**

globe, n. a representation of Earth's surface in the form of a ball **(16)**

H

hemisphere, n. either of two halves of the earth **(18)**

I

index, n. an alphabetical list of names or places that appear in a book, that usually includes the page(s) on which the name appears **(30)**

international date line, n. generally follows 180° longitude; by international agreement, the calendar day on the east side of the line is one day earlier than the calendar day on the west side of the line **(36)**

interstate highway, n. a major divided highway that runs through more than one state **(10)**

K

kilometer, n. a distance of one thousand meters, or 0.62 miles **(5)**

L

latitude, n. the distance between the equator and a place north or south of the equator; measured in degrees **(14)**

longitude, n. the distance east or west of an imaginary line on the globe that goes from the North Pole to the South Pole and passes through Greenwich, England; measured in degrees **(18)**

M

map, n. a drawing or picture on a flat piece of paper of a specific place or area of Earth's surface that shows different features **(4)**

"map key," (phrase), a table or chart that tells you what the parts of a map mean; the key is usually found in one of the corners of the map **(4)**

"map scale," (phrase), a measuring tool on a map that shows how distances on the map relate to actual distances on the ground **(5)**

meridian, n. an imaginary line that runs north-south on a globe or map but measures degrees of longitude east or west of the prime meridian **(18)**

minute, n. a unit of measure equal to one-sixtieth of a degree of latitude or longitude **(26)**

mountain range, n. a line or group of mountains **(47)**

P

parallel, n. an imaginary line on a globe or map that circles Earth in the same direction as the equator. Parallels mark degrees of latitude **(14)**

peak, n. the top or highest point on a mountain **(47)**

physical map, n. a type of map that shows the distribution of one or more of Earth's physical features; for example, taller land areas, such as mountains, and lower land areas, such as valleys **(44)**

prime meridian, n. the imaginary north-south line that runs through Greenwich, England; 0° longitude **(20)**

R

radar, n. a tool that uses radio waves to help determine the location, distance, and speed of an object **(12)**

rotation, n. the movement of a spinning object **(42)**

S

sea level, n. land that is the same elevation as the surface of the sea or ocean **(51)**

symbol, n. an object or picture that stands for something else **(4)**

T

time zone, n. one of twenty-four zones around Earth within which everyone observes the same time **(38)**

V

valley, n. an area of low land bordered by land of higher elevation **(44)**

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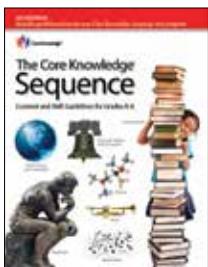
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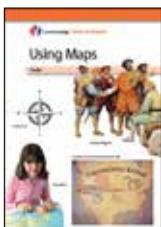
Using Maps
Core Knowledge Sequence History and Geography 4

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