Geography skills provide the tools and methods for us to understand the relationships between people, places, and environments. We use geographic skills when we make daily personal decisions—where to buy a home; where to get a job; how to get to the shopping mall; where to go on vacation. Community decisions, such as where to locate a new school or how to solve problems of air and water pollution, also require the skillful use of geographic information.

This Geography Skills Handbook introduces you to the basic geographic tools—globes, maps, graphs—and explains how to use them. From this foundation, you will gain more reinforcement and practice in the SkillBuilder features located throughout the textbook. These resources will help you get the most out of your geography course—and provide you with skills you will use for the rest of your life.

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Thinking Like a Geographer

Geographers use a wide array of tools and technologies—from basic globes to high-tech global positioning systems—to understand the earth. These help them collect and analyze a great deal of information. However, the study of geography is more than knowing a lot of facts about places. Rather, it has more do with asking questions about the earth, pursuing their answers, and solving problems. Thus, one of the most important geographic tools is inside your head: the ability to think geographically.

Skills for Learning Geography

Geography educators have identified a set of five skills that are key to geographic understanding. These skills, highlighted in the Geography for Life national geography standards, are listed in the chart below. Maps, globes, charts, graphs, satellite photos, global positioning systems, geographic information systems, library materials, the Internet, and this textbook are some of the resources available to help you in your study of geography.

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<th>Examples</th>
<th>Tool and Technologies</th>
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<td>• Ask questions about why traffic has increased along a particular road.</td>
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<td>• Determine what factors should be considered in order to build a new</td>
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<td>community sports facility.</td>
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<td>Acquiring Geographic Information</td>
<td>• Compare aerial photographs of a region taken over time.</td>
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<td>• Design a survey to determine who might use a community facility.</td>
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<td>Organizing Geographic Information</td>
<td>• Compile a map that shows the spread of housing development over a</td>
<td>• Field maps</td>
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<td>period of time.</td>
<td>• Databases</td>
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<td></td>
<td>• Summarize information obtained from interviews.</td>
<td>• Statistical tables</td>
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<td></td>
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<tr>
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<td>Analyzing Geographic Information</td>
<td>• Draw conclusions about the effects of road construction on traffic</td>
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<td>patterns.</td>
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<td>• Compare the information from different maps that show available</td>
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<td></td>
<td>land and zoning districts.</td>
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<td>Answering Geographic Questions</td>
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</table>
Latitude, Longitude, and Location

Geography is often said to begin with the question: Where? The answer can be described in many ways, including direction, distance, country, or region. However, the basic tool for answering the question is location. Lines on globes and maps provide information that can help you locate places. These lines cross one another, forming a pattern called a grid system. This system helps you find exact places on the earth’s surface.

Latitude

Lines of latitude, or parallels, circle the earth parallel to the Equator and measure the distance north or south of the Equator in degrees. The Equator is measured at 0° latitude, while the Poles lie at latitudes 90° N (north) and 90° S (south). Parallels north of the Equator are called north latitude, and parallels south of the Equator are called south latitude.

Longitude

Lines of longitude, or meridians, circle the earth from Pole to Pole. These lines measure distances east or west of the starting line, which lies at 0° longitude and is called the Prime Meridian. By international agreement, the Prime Meridian is the line of longitude that runs through the Royal Observatory in Greenwich, England. Places east of the Prime Meridian are known as east longitude, and places west of the Prime Meridian are known as west longitude.

The Global Grid

Every place has a global address, also called its absolute location (see page 9). You can identify the absolute location of a place by naming the longitude and latitude lines that cross exactly at that place. For example, the city of Tokyo, Japan, is located at 36°N latitude and 140°E longitude. For more precise readings, each degree of latitude and longitude is subdivided into 60 units called minutes.
From Globes to Maps

A globe is a scale model of the earth. Because the earth is round, a globe presents the most accurate depiction of geographic information such as area, distance, and direction. However, globes show little close-up detail.

A printed map is a symbolic representation of all or part of the planet on a flat piece of paper. Unlike globes, maps can show small areas in great detail. Another advantage of printed maps is that they can be folded, stored, and easily carried from place to place.

From 3-D to 2-D

Think about the surface of the earth as the peel of an orange. To flatten the peel, you might have to cut it like the globe shown here. To create maps that are not interrupted, mapmakers, or cartographers, use mathematical formulas to transfer information from the three-dimensional globe to a two-dimensional map. However, when the curves of a globe become straight lines on a map, distortion of size, shape, distance, or area occurs. The purpose of the map usually dictates which projection is used.

How Map Projections Work

To create maps, cartographers project the round earth onto a flat surface—making a map projection. There are more than a hundred kinds of map projections, some with general names and some named for the cartographers who developed them. Three basic categories of map projections are shown here: planar, cylindrical, and conic.

Planar Projection

A planar projection shows the earth centered in such a way that a straight line coming from the center to any other point represents the shortest distance. Also known as an azimuthal projection, it is most accurate at its center. As a result, it is often used for maps of the Poles.
Great Circle Routes

A straight line of true direction—one that runs directly from west to east, for example—is not always the shortest distance between two points on Earth. This is due to the curvature of the earth. To find the shortest distance between any two places, stretch a piece of string around a globe from one point to the other. The string will form part of a great circle, or imaginary line that follows the curve of the earth. Traveling along a great circle is called following a **great circle route**. Ship captains and airline pilots use great circle routes to reduce travel time and save fuel.

The idea of a great circle shows one important difference between globes and maps. Because a globe is round, it accurately shows great circle routes, as indicated on the partial globe shown (top). However, on a flat map, such as the Mercator projection (right), the great circle distance (dotted line) between Tokyo and Los Angeles appears to be far longer than the true direction distance (solid line). In fact, the great circle distance is 345 miles (555 km) shorter.

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Cylindrical Projection

A cylindrical projection is based on the projection of the globe onto a cylinder. This projection is most accurate near the Equator, but shapes and distances are distorted near the Poles.

Conic Projection

A conic projection comes from placing a cone over part of a globe. Conic projections are best suited for showing limited east–west areas that are not too far from the Equator. For these uses, a conic projection can indicate distances and directions fairly accurately.
Common Map Projections

The curved surface of the earth cannot be shown accurately on a flat map. Every map projection stretches or breaks the curved surface of the planet in some way as it is flattened. Distance, direction, shape, or area may be distorted.

Cartographers have developed many map projections, each with some advantages and some degree of inaccuracy. Four of the most popular map projections, named for the cartographers who developed them, are shown on these pages.

Winkel Tripel Projection

Most general reference world maps use the Winkel Tripel projection. Adopted by the National Geographic Society in 1998 for use in most maps, the Winkel Tripel projection provides a good balance between the size and shape of land areas as they are shown on the map. Even the polar areas are depicted with little distortion of size and shape.

Robinson Projection

The Robinson projection has minor distortions. The sizes and shapes near the eastern and western edges of the map are accurate, and the outlines of the continents appear much as they do on the globe. However, the shapes of the polar areas appear somewhat distorted.
**Goode’s Interrupted Equal-Area Projection**

An interrupted projection map looks something like a globe that has been cut apart and laid flat. Goode’s Interrupted Equal-Area projection shows the true size and shape of the earth’s landmasses, but distances are generally distorted.

**Mercator Projection**

The Mercator projection, once the most commonly used projection, increasingly distorts size and distance as it moves away from the Equator. This makes areas such as Greenland and Antarctica look much larger than they would appear on a globe. However, Mercator projections do accurately show true directions and the shapes of landmasses, making these maps useful for sea travel.

**Geographic Information Systems**

Modern technology has changed the way maps are made. Most cartographers use computers with software programs called geographic information systems (GIS). A GIS is designed to accept data from many different sources, including maps, satellite images, and printed text and statistics. The GIS converts the data into a digital code, which arranges it in a database. Cartographers then program the GIS to process the data and produce the maps they need. With GIS, each kind of information on a map is saved as a separate electronic “layer” in the map’s computer files. Because of this modern technology, cartographers are able to make maps—and change them—quickly and easily.
Reading a Map

In addition to scale and the lines of latitude and longitude, maps feature other important tools to help you interpret the information they contain. Learning to use these map tools will help you read the symbolic language of maps more easily.

**Key**

Cartographers use a variety of symbols to represent map information. Graphic symbols are easily understood by people around the world. To be sure that the symbols are clear, however, every map contains a **key**—a list that explains what the symbols stand for. This key shows symbols commonly used on a political map.

**Compass Rose**

Most maps feature a **compass rose**, a marker that indicates directions. The four **cardinal directions**—north, south, east, and west—are usually indicated with arrows or points of a star. The **intermediate directions**—northeast, northwest, southeast, southwest—may also be shown, usually with smaller arrows or star points.

Sometimes a compass rose may point in only one direction because the other directions can be determined in relation to the given direction. The compass rose on this map indicates north only.

**Cities**

Cities are represented by a dot. Sometimes the relative sizes of cities are shown using dots of different sizes.

**Boundary Lines**

On political maps of large areas, boundary lines highlight the borders between different countries, states, or counties.

**Scale Bar**

The **scale bar** shows the relationship between map measurements and actual distances. By laying a ruler along the scale bar, you can calculate how many miles or kilometers are represented per inch or centimeter.

**Capitals**

National capitals are often represented by a star within a circle.
Using Scale

All maps are drawn to a certain scale. Scale is a consistent, proportional relationship between the measurement shown on the map and the measurement of the earth’s surface. The scale of a map varies with the size of the area shown.

Use the scale bar to find actual distances on a map. The scale bar gives the relationship between map measurements and actual distances. Most scale bars are graphic representations, allowing you to use a ruler to calculate actual distances.

Small-Scale Maps

A small-scale map, like this political map of Mexico, can show a large area but little detail. Note that the scale bar for this map indicates that about ½ of an inch is equal to 300 miles and a little more than ½ of a centimeter is equal to 300 kilometers.

Large-Scale Maps

A large-scale map, like this map of Mexico City, can show a small area on the earth’s surface with a great amount of detail. Study the scale bar. Note that the map measurements correspond to much smaller distances than on a small-scale map.

Absolute and Relative Location

As you learned on page 3, a place’s absolute location is found at the precise point where one line of latitude crosses a line of longitude. Another way that people indicate location is by relative location. You may be told, for example, to look for a street that is “two blocks north” of another street. Relative location is the location of one place in relation to another place.

To find relative location, find a reference point—a location you already know—on a map. Then look in the appropriate direction for the new location. For example, locate Vienna (your reference point) on this map. The relative location of Budapest can be described as southeast of Vienna.
Types of Maps

Maps are prepared for many uses. The use for which a map is intended determines the kinds of information it contains. Learning to recognize a map’s purpose will help you make the best use of its content.

General-Purpose Maps

Maps that show a wide range of information about an area are called **general-purpose maps**. General-purpose maps are typically used for reference, education, and travel. Two common forms of general-purpose maps are **physical maps** and **political maps**.

**Physical Maps**

A physical map shows the location and the **topography**, or shape, of the earth’s physical features. Physical maps use colors or patterns to indicate **relief**—the differences in **elevation**, or height, of landforms. Some physical maps have **contour lines** that connect all points of land of equal elevation. Physical maps may show mountains as barriers to transportation. Rivers and streams may be shown as routes into the interior of a country. These physical features often help to explain the historical development of a country.

**Political Maps**

A political map shows the boundaries between countries. Smaller internal divisions, such as states or counties, may also be indicated by different symbols. Political maps often show human-made features such as capitals, cities, roads, highways, and railroads.
**Special-Purpose Maps**

Maps that emphasize a single idea or a particular kind of information about an area are called **special-purpose maps**. There are many kinds of special-purpose maps, each designed to serve a different need. You can learn more about several types of special-purpose maps in the SkillBuilder features in this textbook: relief maps (page 126), climate maps (page 172), population density maps (page 232), vegetation maps (page 432), elevation profiles (page 580), economic activity maps (page 680), and cartograms (page 754).

Some special-purpose maps—such as economic activity maps and natural resource maps—show the distribution of particular activities, resources, or products in a given area. Colors and symbols represent the location or distribution of activities and resources.

**An Economic Activity Map**

The special-purpose map above shows the distribution of land use and natural resources in Southwest Asia. Geographers use maps like this one to study the distribution of natural resources. Governments and industry leaders use land use maps and natural resource maps to monitor the economic activities of countries and regions.
Graphs, Charts, and Diagrams

In addition to globes and maps, geographers use other visual representations to display and interpret data. Graphs, charts, and diagrams provide valuable information in forms that are well organized and easy to read.

Graphs

A graph is a visual presentation of information. There are many kinds of graphs, each suitable for certain purposes. Most graphs show two sets of data, one displayed along the vertical axis and the other displayed along the horizontal axis. Labels on these axes identify the data being displayed.

Line Graphs

A line graph shows changes in two variables, or changing sets of circumstances over periods of time. To analyze data on a line graph, study the changes and trends as shown by the line. Then draw conclusions based on the information. This line graph shows U.S. population growth between 1900 and 2000. The vertical axis lists population, and the horizontal axis indicates the passage of time.

Bar Graphs

A bar graph shows comparisons. To analyze a bar graph, note the differences in quantities. Then make generalizations or draw conclusions based on the data. This bar graph shows lumber production among the top five lumber-producing countries in the world. The vertical axis shows the amount of lumber produced.
Charts and Tables

Data are arranged in columns and rows in a chart or table. Charts and tables display facts in an organized manner and make comparisons easy. To find key information in a chart or table, look for the intersections of columns and rows.

The table at right displays information about the population and land area of the world’s continents.

### Contents of the World

<table>
<thead>
<tr>
<th>Continent</th>
<th>Population</th>
<th>Land Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>818,000,000</td>
<td>11,698,111 sq. mi.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30,298,107 sq. km</td>
</tr>
<tr>
<td>Antarctica</td>
<td>No permanent inhabitants</td>
<td>5,500,000 sq. mi.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13,209,000 sq. km</td>
</tr>
<tr>
<td>Asia</td>
<td>3,720,000,000</td>
<td>12,262,691 sq. mi.</td>
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<tr>
<td></td>
<td></td>
<td>31,760,369 sq. km</td>
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<tr>
<td>Australia</td>
<td>19,400,000</td>
<td>2,988,888 sq. mi.</td>
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<tr>
<td></td>
<td></td>
<td>7,741,220 sq. km</td>
</tr>
<tr>
<td>Europe</td>
<td>727,000,000</td>
<td>8,875,867 sq. mi.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>22,988,496 sq. km</td>
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<tr>
<td>North America</td>
<td>491,000,000</td>
<td>8,747,613 sq. mi.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>22,656,317 sq. km</td>
</tr>
<tr>
<td>South America</td>
<td>350,000,000</td>
<td>6,898,579 sq. mi.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>17,867,319 sq. km</td>
</tr>
</tbody>
</table>


### Circle Graphs

A circle graph, or pie graph, shows the relationship of parts to a whole. Percentages are indicated by relative size and sometimes by color. To analyze a circle graph, study the relationships of areas to one another and to the whole. This circle graph shows the land areas of the world’s continents and other landmasses, such as islands, expressed as percentages of Earth’s total landmass.

Diagrams

A diagram is a drawing that shows what something is or how something is done. Many diagrams feature several drawings or sections that show the steps in a process.

The diagram at left shows the way the moon seems to change shape as it goes through its phases each month. Note that as the moon revolves around the earth, it goes from the new moon phase, when it is almost invisible, to the full moon phase, when it appears as a giant globe.
As you read about the world’s geography, you will encounter the terms listed below. Many of the terms are pictured in the diagram.

**absolute location**  exact location of a place on the earth described by global coordinates

**basin**  area of land drained by a given river and its branches; area of land surrounded by lands of higher elevations

**bay**  part of a large body of water that extends into a shoreline, generally smaller than a gulf

**canyon**  deep and narrow valley with steep walls

**cape**  point of land that extends into a river, lake, or ocean

**channel**  wide strait or waterway between two landmasses that lie close to each other; deep part of a river or other waterway

**cliff**  steep, high wall of rock, earth, or ice

**continent**  one of the seven large landmasses on the earth

**delta**  flat, low-lying land built up from soil carried downstream by a river and deposited at its mouth

**divide**  stretch of high land that separates river systems

**downstream**  direction in which a river or stream flows from its source to its mouth

**elevation**  height of land above sea level

**Equator**  imaginary line that runs around the earth halfway between the North and South Poles; used as the starting point to measure degrees of north and south latitude

**glacier**  large, thick body of slowly moving ice

**gulf**  part of a large body of water that extends into a shoreline, generally larger and more deeply indented than a bay

**harbor**  a sheltered place along a shoreline where ships can anchor safely

**highland**  elevated land area such as a hill, mountain, or plateau

**hill**  elevated land with sloping sides and rounded summit; generally smaller than a mountain

**island**  land area, smaller than a continent, completely surrounded by water

**isthmus**  narrow stretch of land connecting two larger land areas

**lake**  a sizable inland body of water

**latitude**  distance north or south of the Equator, measured in degrees

**longitude**  distance east or west of the Prime Meridian, measured in degrees

**lowland**  land, usually level, at a low elevation
map drawing of the earth shown on a flat surface
meridian one of many lines on the global grid running from the North Pole to the South Pole; used to measure degrees of longitude
mesa broad, flat-topped landform with steep sides; smaller than a plateau
mountain land with steep sides that rises sharply (1,000 feet or more) from surrounding land; generally larger and more rugged than a hill
mountain peak pointed top of a mountain
mountain range a series of connected mountains
mouth (of a river) place where a stream or river flows into a larger body of water
ocean one of the four major bodies of salt water that surround the continents
ocean current stream of either cold or warm water that moves in a definite direction through an ocean
parallel one of many lines on the global grid that circles the earth north or south of the Equator; used to measure degrees of latitude
peninsula body of land jutting into a lake or ocean, surrounded on three sides by water
physical feature characteristic of a place occurring naturally, such as a landform, body of water, climate pattern, or resource
plain area of level land, usually at low elevation and often covered with grasses
plateau area of flat or rolling land at a high elevation, about 300 to 3,000 feet (90 to 900 m) high
Prime Meridian line of the global grid running from the North Pole to the South Pole at Greenwich, England; starting point for measuring degrees of east and west longitude
relief changes in elevation over a given area of land
erver large natural stream of water that runs through the land
sea large body of water completely or partly surrounded by land
seacoast land lying next to a sea or an ocean
sound broad inland body of water, often between a coastline and one or more islands off the coast
source (of a river) place where a river or stream begins, often in highlands
strait narrow stretch of water joining two larger bodies of water
tributary small river or stream that flows into a large river or stream; a branch of the river
upstream direction opposite the flow of a river; toward the source of a river or stream
valley area of low land usually between hills or mountains
volcano mountain or hill created as liquid rock and ash erupt from inside the earth