Dear Students,

Welcome to AP Human Geography (APHG)! Throughout the school year we will cover seven different themes: nature and perspective, population, culture, politics, agriculture, industry, and urbanization. We will do this using maps, reading our textbook, articles, and other numerous resources. This is your first AP class! To be successful, you must stay focused and work hard.

The purpose of this summer assignment is to become familiar with some of these themes through current events and creating maps. We will cover 13 chapters by April 2019 in order to review for the AP exam. The purpose of this summer assignment is to give us a jump-start by introducing you to the types of reading and questions you will face in class.

There are 3 parts to this assignment. This will be due on the first day of class. You will use this assignment to contribute to and/or complete other assignments/tests. We will use the maps throughout the year so please take care to make them legible.

Part 1: Current Events
Part 2: Create and label maps provided
Part 3: Read Ch. 1 Key Issue 1: Define all bolded terms and answer questions

General Directions:

1. Some assignments should be handwritten on notebook paper, others typed, please read directions carefully. When handwriting it MUST be legible and NEAT.
2. Your responses should be written in your own words. If you plagiarize, you will automatically receive a zero.
3. All assignments are due the first day of class and considered late if not turned in.
4. Week one: Formative Grade-Project completed and ready for teacher feedback.
5. Week two-three: Summative Grade-Revised project due as major grade.
6. What do you need to bring to class on the first day that you attend class? Summer Assignment, something to write with, and a ready-to-work attitude!

If you have any questions, please do not hesitate to contact us at jvericker@littleelmisd.net or Mrs. Harkins at lharkin@littleelmisd.net we will be checking our school affiliated email throughout the summer. I am also available during the summer June 12th and 14th at 1pm or Aug. 7th at 4pm here at the school.

We look forward to meeting you in August. Have a great summer!

Sincerely, Mrs. Vericker and Mrs. Harkins
Directions for Part 1

Typed, printed copy of an analysis of six current events, ONE event from each of the following: Africa, Asia, Australia, Europe, North America, South America.

#1 CURRENT EVENTS ANALYSIS - Analyze six significant events reported in publications during the summer of 2018. Paying attention to what is happening in the news will help to illuminate the locations and concepts we will study.

• You may use any printed newspaper or reputable online news source. Excellent online sources include cnn.com, bbcnews.com, npr.com, nytimes.com, washingtonpost.com, and wsj.com. Click on World or International to find events outside of the country in which the publication is based. Include one each from Africa, Asia, Australia, Europe, North America, & South America.
• Copy & paste the article LINK into a document. (link only please)
• Use one of the 18 National Geographic Society’s education standards, included on pg. 3, to analyze your event from a spatial perspective.
• MLA format: 12 pt., Times New Roman font, Double spaced, 1 in margins, heading in top left corner, title centered)

First paragraph (this should be shorter than paragraph two, EVERYTHING MUST BE IN YOUR OWN WORDS):

• continent on which event took place
• sentence that states the name of the article, date published, author (if available), & publication
• summary of event using your own words

Second paragraph:

• the National Geographic Standard, such as the physical and human characteristics of places, you connected to your event
• an explanation of why you believe the event is an example of that standard; an event may fit more than one standard
• concluding sentence or two explaining why the event matters--What consequences/effects might the event have? What contrasting viewpoint could be offered? What cultural values are revealed by the event? What personal connection can you make to the event?

*See example below and National Geography Standards
EUROPE: The article “Paris Ends Relationship With ‘Love Locks’ ” was published on CNN.com on June 1, 2015. For several years, visitors to the Ponts des Arts (Bridge of the Arts in English) over the Seine River in Paris, France have attached locks to the bridge, a structure built during the time of Napoleon. Some have even thrown the keys into the Seine River to further mark their presence at the popular tourist attraction. Although the practice seemed initially innocuous and even charming, it has had negative effects. The weight of the locks creates a safety risk, and graffiti and structural damage to the bridge degrade the historic structure. The city of Paris decided to close the bridge for a week in order to remove all of the locks.

The practice of attaching “love locks” to the bridge, and the city’s subsequent desire to remove them, is an example of National Geographic Standard 6, How culture and experience influence people’s perception of places and regions. Paris, France is widely viewed by the western world as a romantic city. Many little girls’ dreams come true when their significant others propose marriage to them at the Eiffel Tower. Attaching a lock, and throwing the key into the river below, is a symbolic gesture of locking two hearts and leaving a permanent mark of the relationship on what many consider to be the most romantic city in the world. The practice is a great example of humans’ desire to leave their mark on the world’s landscapes. While the sentiment behind the practice is quite delightful, its effects on Paris’s historic Ponts des Arts and the Seine River could be quite disastrous.
The geographically informed person knows and understands:

**The World in Spatial Terms**
- Standard 1: How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information
- Standard 2: How to use mental maps to organize information about people, places, and environments in a spatial context
- Standard 3: How to analyze the spatial organization of people, places, and environments on Earth’s surface

**Places and Regions**
- Standard 4: The physical and human characteristics of places
- Standard 5: That people create regions to interpret Earth’s complexity
- Standard 6: How culture and experience influence people’s perceptions of places and regions

**Physical Systems**
- Standard 7: The physical processes that shape the patterns of Earth’s surface
- Standard 8: The characteristics and spatial distribution of ecosystems and biomes on Earth’s surface

**Human Systems**
- Standard 9: The characteristics, distribution, and migration of human populations on Earth’s surface
- Standard 10: The characteristics, distribution, and complexity of Earth’s cultural mosaics
- Standard 11: The patterns and networks of economic interdependence on Earth’s surface
- Standard 12: The processes, patterns, and functions of human settlement
- Standard 13: How the forces of cooperation and conflict among people influence the division and control of Earth’s surface

**Environment and Society**
- Standard 14: How human actions modify the physical environment
- Standard 15: How physical systems affect human systems
- Standard 16: The changes that occur in the meaning, use, distribution, and importance of resources

**The Uses of Geography**
- Standard 17: How to apply geography to interpret the past
- Standard 18: How to apply geography to interpret the present and plan for the future
Part 2:

- **First Map**: Label all countries listed and write the regions and sub-regions in correct places.
- **Regions Map**: Use as a guide to help you label the first map, color code it if you need or write a key.

Part 3:

Define all bolded terms from the reading Ch. 1 Key Issue 1, MUST be handwritten ONLY in blue or black ink.

Questions:

1. Explain how cartography is a science and identify contemporary mapping tools.
2. What are map scale and projection? What are the 4 different types of distortion?
3. Explain how latitude and longitude are used to locate points on Earth’s surface.
Directions: Use the following graphics to help you prepare for the upcoming AP Test.

Major Regions of the World

Sub-Regions of the World
Countries to Know: USA, Mexico, Canada, Brazil Chile, Cuba, Guatemala, Peru, Venezuela, Egypt, Sierra Leon, Chad, Madagascar, Iraq, Iran, Afghanistan, Pakistan, India, Syria, China, Japan, Vietnam, Russia, North and South Korea, Australia, New Zealand, England (UK), Spain, France, Germany, Italy, Austria, Bulgaria, Turkey, Iceland, Democratic Republic of Congo, Ethiopia, Somalia, Algeria, Mali, Niger, Nigeria, South Africa, Nepal, Philippines, Mongolia, Burman.
Why Is Geography a Science?

- Introducing Geography
- Cartography: The Science of Mapmaking
- Contemporary Geographic Tools
- Interpreting Maps
- The Geographic Grid

**LEARNING OUTCOME 1.1.1**
Summarize differences between geography and history.

Thinking geographically is one of the oldest human activities. Perhaps the first geographer was a prehistoric human who crossed a river or climbed a hill, observed what was on the other side, returned home to tell about it, and scratched the route in the dirt. The second geographer may have been a friend or relative who followed the dirt drawing to reach the other side.

The word *geography*, invented by the ancient Greek scholar Eratosthenes, is based on two Greek words. *Geo* means “Earth,” and *graphy* means “to write.” Geography is the study of where things are found on Earth’s surface and the reasons for the locations. Human geographers ask two simple questions: Where are people and activities found on Earth? Why are they found there?

In his framework of all scientific knowledge, the German philosopher Immanuel Kant (1724–1804) compared geography and history:

<table>
<thead>
<tr>
<th>Geographers . . .</th>
<th>Historians . . .</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify the location of important places and explain why human activities are located beside one another.</td>
<td>Identify the dates of important events and explain why human activities follow one another chronologically.</td>
</tr>
<tr>
<td>Ask where and why.</td>
<td>Ask when and why.</td>
</tr>
<tr>
<td>Organize material spatially.</td>
<td>Organize material chronologically.</td>
</tr>
<tr>
<td>Recognize that an action at one point on Earth can result from actions at another point, which can consequently affect conditions elsewhere.</td>
<td>Recognize that an action at one point in time can result from past actions that can in turn affect future ones.</td>
</tr>
</tbody>
</table>

History and geography differ in one especially important manner: A geographer can drive or fly to another place to study Earth’s surface, whereas a historian cannot travel to another time to study other eras firsthand. This ability to reach other places lends excitement to the discipline of geography—and geographic training raises the understanding of other spaces to a level above that of casual sightseeing.

**Introducing Geography**

To introduce human geography, we will concentrate on the main features of human behavior: culture and economy. The first half of the book explains why the most important cultural features, such as major languages, religions, and ethnicities, are arranged as they are across Earth. The second half of the book looks at the locations of the most important economic activities, including agriculture, manufacturing, and services.

This chapter introduces basic concepts that geographers employ to address their “where” and “why” questions. To explain where things are, one of geography’s most important tools is a map. Ancient and medieval geographers created maps to describe what they knew about Earth. Today, accurate maps are generated from electronic data.

Geographers employ several basic concepts to explain why every place on Earth is in some ways unique and in other ways related to other locations. Many of these concepts are commonly used English words, but they are given particular meaning by geographers.

To explain why every place is unique, geographers have two basic concepts:

- **A place** is a specific point on Earth, distinguished by a particular characteristic. Every place occupies a unique location, or position, on Earth’s surface.
- **A region** is an area of Earth defined by one or more distinctive characteristics. Geographers divide the world into a number of regions, such as North America and Latin America.

To explain why different places are interrelated, geographers have three basic concepts:

- **Scale** is the relationship between the portion of Earth being studied and Earth as a whole. Geographers study a variety of scales, from local to global. Many processes

\[ \text{\textbf{FIGURE 1-1 PLACE}} \] The place of the City of Luxembourg is atop a hill overlooking the Alzette River.
that affect humanity's occupation of Earth are
global in scale, such as climate change and depletion
of energy supplies. At the same time, local-scale
processes—such as preservation of distinctive cultural
and economic activities—are increasingly important.

- **Space** refers to the physical gap or interval between
two objects. Geographers observe that many objects
are distributed across space in a regular manner, for
discernible reasons.

- **Connection** refers to relationships among people
and objects across the barrier of space. Geographers
are concerned with the various means by which
connections occur.

Luxembourg can be used to illustrate the five concepts.
The City of Luxembourg is a place located on a hillside
perched above the Alzette River (Figure 1-1). The City of
Luxembourg is the capital of the country of Luxembourg,
located in the world region of Europe (Figure 1-2). Luxem-
bourg plays a major role at a global scale, as one of the prin-
cipal headquarters of the European Union, which unites
28 countries (Figure 1-3a). At the same time, Luxembourg, like
other places, has a distinctive local scale; one example is the
availability of distinctive local products not available elsewhere
(Figure 1-3b). The space occupied by Luxembourg has distinctive
features; for example, most people live in the south of
the country, whereas the north is sparsely inhabited (Figure
1-4). Connections between Luxembourg and other places
are provided by road, rail, and river (Figure 1-5).

**PAUSE & REFLECT 1.1.1**

What are the principal connections from your
hometown to other places?

**FIGURE 1-5 CONNECTION** Luxembourg is connected to other places
in Europe by train. European Union offices are in the background.
Cartography: The Science of Mapmaking

LEARNING OUTCOME 1.1.2
Understand how cartography developed as a science.

Geography's most important tool for thinking spatially about the distribution of features across Earth is a map. A map is a two-dimensional or flat-scale model of Earth's surface, or a portion of it. Geography is immediately distinguished from other disciplines by its reliance on maps to display and analyze information.

A map serves two purposes:

- **As a reference tool.** A map helps us to find the shortest route between two places and to avoid getting lost along the way. We consult maps to learn where in the world something is located, especially in relationship to a place we know, such as a town, body of water, or highway. The maps in an atlas or a smart phone app are especially useful for this purpose.

- **As a communications tool.** A map is often the best means for depicting the distribution of human activities or physical features, as well as for thinking about reasons underlying a distribution.

A map is a scale model of the real world, made small enough to work with on a desk or computer. It can be a hasty here's-how-to-get-to-the-party sketch, an elaborate work of art, or a precise computer-generated product. For centuries, geographers have worked to perfect the science of mapmaking, called cartography. Contemporary cartographers are assisted by computers and satellite imagery.

![FIGURE 1-6 EARLIEST SURVIVING MAP](image)

This map, dating from 6200 B.C., depicts the town of Çatalhöyük, located in present-day Turkey, and the eruption of the Hasan Dağ (Mount Hasan) twin-peaks volcano, which is actually located around 140 km northeast of the town. Archaeological evidence indicates that the volcano did erupt around the time that the map was made. The map is now in the Konya Archaeological Museum.

GEOPGRAPHY IN THE ANCIENT WORLD

The science of geography has prehistoric roots. The earliest surviving fully authenticated map, depicting the town of Çatalhöyük, located in present-day Turkey, dates from approximately 6200 B.C. (Figure 1-6). Archaeologists found the map on the wall of a house that was excavated during the 1960s. Major contributors to geographic thought in the ancient eastern Mediterranean included:

- Thales of Miletus (ca. 624-ca. 546 B.C.), who applied principles of geometry to measuring land area.

- Anaximander (ca. 610-ca. 546 B.C.), a student of Thales, who made a world map based on information from sailors and argued that the world was shaped like a cylinder.

- Pythagoras (ca. 570-ca. 495 B.C.), who may have been the first to propose a spherical world and argued that the sphere was the most perfect form.

- Hecateus (ca. 550-ca. 476 B.C.), who may have produced the first geography book, called *Geographia* (“Travels Around the Earth”).

- Aristotle (384-322 B.C.), who was the first to demonstrate that Earth was spherical on the basis of evidence.

- Eratosthenes (ca. 276-ca. 195 B.C.), the inventor of the word *geography*, who accepted that Earth was round (as few others did in his day), calculated its circumference within 0.5 percent accuracy, accurately divided Earth into five climatic regions, and described the known world in one of the first geography books.

- Strabo (ca. 63 B.C.-ca. A.D. 24), who described the known world in a 17-volume work titled *Geography*.

- Ptolemy (ca. A.D. 100-ca. 170), who wrote the eight-volume *Guide to Geography*, codified basic principles of mapmaking, and prepared numerous maps that were not improved upon for more than 1,000 years (Figure 1-7).

China was another center of early geographic thought. Ancient Chinese geographic contributions included:

- “Yu Gong” (“Tribute of Yu”), a chapter in a book called *Shu Jing* (“Classic of History”), which was the earliest surviving Chinese geographical writing, by an unknown author from the fifth century B.C., described the economic resources of the country’s different provinces.

- Pei Xiu, the “father of Chinese cartography,” who produced an elaborate map of the country in A.D. 267.

GEOPGRAPHY’S REVIVAL

After Ptolemy, little progress in mapmaking or geographic thought was made in Europe for several hundred years. Maps became less mathematical and more fanciful, showing
Earth as a flat disk surrounded by fierce animals and monsters. Geographic inquiry continued, though, outside Europe. Contributors outside of Europe included:

- Muhammad al-Idrisi (1100–ca. 1165), a Muslim geographer who prepared a world map and geography text in 1154, building on Ptolemy’s long-neglected work (Figure 1-8).
- Abu Abdullah Muhammad Ibn-Battuta (1304–ca. 1368), a Moroccan scholar, who wrote *Rihla* (“Travels”) based on three decades of journeys covering more than 120,000 kilometers (75,000 miles) through the Muslim world of northern Africa, southern Europe, and much of Asia.

Making maps as reference tools revived during the Age of Exploration and Discovery. Columbus, Magellan, and other explorers who sailed across the oceans in search of trade routes and resources in the fifteenth and sixteenth centuries required accurate maps to reach desired destinations without wrecking their ships. In turn, cartographers used information collected by the explorers to create more accurate maps. Influential European cartographers included:

- Martin Waldseemüller (ca. 1470–ca. 1521), a German cartographer who was credited with producing the first map to use the label “America”; he wrote on the map (translated from Latin) “from Amerigo the discoverer...as if it were the land of Americus, thus America.”
- Abraham Ortelius (1527–1598), a Flemish cartographer, who created the first modern atlas and was the first to hypothesize that the continents were once joined together before drifting apart (Figure 1-9).
- Bernhardus Varenius (1622–1650), who produced *Geographia Generalis*, which stood for more than a century as the standard treatise on systematic geography.

**PAUSE & REFLECT 1.1.2**

What is one main difference between the world maps of Ptolemy (Figure 1-7) and of Ortelius (Figure 1-9)?
Contemporary Geographic Tools

LEARNING OUTCOME 1.1.3
Identify geography’s contemporary analytic mapping tools.

Maps are not just paper documents in textbooks. They have become an essential tool for contemporary delivery of online services through smart phones, tablets, and computers.

PINPOINTING LOCATIONS: GPS
Our smart phones, tablets, and computers are equipped with Global Positioning System (GPS), which is a system that determines the precise position of something on Earth. The GPS in use in the United States includes three elements:
- Satellites placed in predetermined orbits by the U.S. military (24 in operation and 3 in reserve).
- Tracking stations to monitor and control the satellites.
- A receiver that can locate at least 4 satellites, figure out the distance to each, and use this information to pinpoint its own location.

GPS is most commonly used for navigation. Pilots of aircraft and ships stay on course with GPS. On land, GPS detects a vehicle’s current position, the motorist programs the desired destination into a GPS device, and the device provides instructions on how to reach the destination. GPS can also be used to find the precise location of a vehicle, enabling a motorist to summon help in an emergency or a customer to monitor the progress of a delivery truck or position of a bus or train.

Thanks to GPS, our electronic devices provide us with a wealth of information about the specific place on Earth we currently occupy. Cell phones equipped with GPS allow individuals to share their whereabouts with others. Geographers find GPS to be particularly useful in coding the precise location of objects collected in fieldwork. The locations of all the information we gather and photos we take with our electronic devices are recorded through

DOING GEOGRAPHY Data Collection & Mental Mapping

Most of the maps and other information fed into handheld electronic devices is provided by three companies. Google supplies Android devices, TomTom (formerly Tele Atlas) supplies Apple devices, and Nokia (formerly Navteq, now owned by Microsoft) supplies Microsoft products. These companies get their information from what they call “ground truthing.” Hundreds of field researchers drive around, building the database. One person drives, while the other feeds information into a notebook computer (Figure 1-10). Hundreds of attributes are recorded, such as crosswalks, turn restrictions, and name changes. Thus, electronic navigation systems ultimately depend on human observation.

What’s Your Geography?

A mental map is a personal representation of a portion of Earth’s surface. A mental map depicts what an individual knows about a place, and it contains personal impressions of what is in the place and where the place is located.

1. Draw a mental map depicting your route between two familiar places, such as between home and school or dorm room and geography class. Show the paths (roads or walkways) and important landmarks along the route, such as buildings or shops.
2. Compare your mental map to those made by others in your class. How detailed is your depiction of paths and landmarks compared to those of others? At school, for example, a senior is likely to have a more detailed map than a newcomer.
3. Compare your mental map to a map of the same area from Google Maps. How accurate is your map? Did you forget something important or put something in the wrong place?
4. At OpenStreetMap, see if your route has been mapped. If so, are important landmarks included? If your route has not been mapped, or if important landmarks are not included, you are free to place them on the map by following OpenStreetMap instructions.
**FIGURE 1-11 GIS** Geographic information systems involve two types of data: vector and raster. Vector data consists of points (for example, for cities) and lines (for example, for highways). Raster data consists of images such as landforms.

**ANALYZING DATA: GI-SCIENCE**

Geographic Information Science (GIScience) is analysis of data about Earth acquired through satellite and other electronic information technologies. A geographic information system (GIS) captures, stores, queries, and displays the geographic data. GIS produces maps (including those in this book) that are more accurate and attractive than those drawn by hand. A map is created by retrieving a number of stored objects and combining them to form an image. Each type of information is stored in a layer (Figure 1-11). For example, separate layers could be created for boundaries of countries, bodies of water, roads, and names of places. A single map might display only a single layer by itself, but most maps combine several layers, and GIS permits construction of much more complex maps than can be drawn by hand.

The acquisition of data about Earth's surface from a satellite orbiting Earth or from other long-distance methods is remote sensing. Remote-sensing satellites scan Earth's surface and transmit images in digital form to a receiving station on Earth's surface. At any moment, a satellite sensor records the image of a tiny area called a picture element, or pixel. Scanners detect the radiation being reflected from that tiny area. A map created by remote sensing is essentially a grid containing many rows of pixels. The smallest feature on Earth's surface that can be detected by a sensor depends on the resolution of the scanner. Geographers use the remote sensing to map the changing distribution of a wide variety of features, such as agriculture, drought, and sprawl.

GIScience helps geographers create more accurate and complex maps and measure changes over time in the characteristics of places. Layers of information acquired through remote sensing and produced through GIS can be described and analyzed. GIScience enables geographers to calculate whether relationships between objects on a map are significant or merely coincidental. For example, a map showing where life expectancy is low (such as in Figure 1-24) can be combined with layers showing the location of people with various incomes and the location of crimes.

**COLLECTING AND SHARING DATA: VGI**

Smart phones, tablets, and computers enable individuals to make maps and share them with others. **Volunteered geographic information (VGI)** is the creation and dissemination of geographic data contributed voluntarily and for free by individuals. VGI is part of the broader trends of citizen science, which is scientific research by amateur scientists, and participatory GIS (PGIS), which is community-based mapping. Citizen science and PGIS collect and disseminate local knowledge and information through electronic devices. For example, OpenStreetMap (OSM) is VGI intended to develop a free base map of the world. Individuals can contribute to OSM at OpenStreetMap.org (see Doing Geography and What's Your Geography? feature).

A **mashup** is a map that overlays data from one source on top of a map provided by a mapping service, such as Google Maps or Google Earth. The term mashup refers to the practice of overlaying data from one source on top of one of the mapping services; the term comes from the hip-hop practice of mixing two or more songs.

A mashup map can show the locations of nearby pizza restaurants, the locations of commercial airplanes currently in flight, or traffic conditions on highways. Individuals can create mashups on their personal computers because mapping services provide access to the application programming interface (API), which is the language that links a database such as an address list with software such as mapping software. An API for mapping software is available at such sites as developers.google.com/maps.

**PAUSE & REFLECT 1.1.3**

State a question you have about the area where you live. Describe a mashup that you could create using GIS that would answer your question.
Interpreting Maps

**LEARNING OUTCOME 1.1.4**

Understand the role of map scale and projection in reading maps.

To make any map, a cartographer must make two decisions:

- How much of Earth’s surface to depict on the map (map scale).
- How to transfer a spherical Earth to a flat map (projection).

For more details about cartography, see Appendix A.

**MAP SCALE**

The first decision a cartographer faces is how much of Earth’s surface to depict on the map. Is it necessary to show the entire globe, or just one continent, or a country, or a city? To make a scale model of the entire world, many details must be omitted because there simply is not enough space. Conversely, if a map shows only a small portion of Earth’s surface, such as a street map of a city, it can provide a wealth of detail about a particular place.

The level of detail and the amount of area covered on a map depend on its map scale. When specifically applied to a map, **map scale** refers to the relationship of a feature’s size on a map to its actual size on Earth. Map scale is presented in three ways (Figure 1-12):

- **Ratio.** A ratio or fraction shows the numerical ratio between distances on the map and Earth’s surface. A scale of 1:1,000,000 means that 1 unit (for example, inch, centimeter, foot, finger length) on the map represents 1 million of the same unit on the ground. The 1 on the left side of the ratio always refers to a unit of distance on the map, and the number on the right always refers to the same unit of distance on Earth’s surface.

- **Written.** A written scale describes the relationship between map and Earth distances in words. For example, in the statement “1 centimeter equals 10 kilometers,” the first number refers to map distance and the second to distance on Earth’s surface.

- **Graphic.** A graphic scale usually consists of a bar line marked to show distance on Earth’s surface. To use a bar line, first determine with a ruler the distance on the map in inches or centimeters. Then hold the ruler against the bar line and read the number on the bar line opposite the map distance on the ruler. The number on the bar line is the equivalent distance on Earth’s surface.

Maps often display scale in more than one of these three ways.

The appropriate scale for a map depends on the information being portrayed. A map of a neighborhood, such as Figure 1-12c, may have a scale of 1:10,000, whereas a map of a city (Figure 1-12a) may have a scale of 1:1,000,000. One inch represents about 1/6 mile on Figure 1-12c and 16 miles on Figure 1-12a.

At the scale of a small portion of Earth’s surface, such as a downtown area, a map provides a wealth of details about the place. At the scale of the entire globe, a map must omit many details because of lack of space, but it can effectively communicate processes and trends that affect everyone.

**PROJECTION**

Earth is very nearly a sphere and is therefore accurately represented with a globe. However, a globe is an extremely limited tool with which to communicate information about Earth’s surface. A small globe does not have enough space to display detailed information, whereas a large globe is too bulky and cumbersome to use. And a globe is difficult to write on, photocopy, display on a computer screen, or carry in the glove box of a car. Consequently, most maps—including those in this book—are flat. Three-dimensional maps can be made but are expensive and difficult to reproduce.

![FIGURE 1-12 MAP SCALE](The three images show the city of Dubai, in the United Arab Emirates, at three scales.)
Earth's spherical shape poses a challenge for cartographers because drawing Earth on a flat piece of paper unavoidably produces some distortion. Cartographers have invented hundreds of clever methods of producing flat maps, but none has produced perfect results. The scientific method of transferring locations on Earth's surface to a flat map is called projection (Figure 1-13).

The problem of distortion is especially severe for maps depicting the entire world. Four types of distortion can result:

1. The shape of an area can be distorted, so that it appears more elongated or squat than it is in reality.
2. The distance between two points may become increased or decreased.
3. The relative size of different areas may be altered, so that one area may appear larger than another on a map while it is in reality smaller.
4. The direction from one place to another can be distorted.

Most of the world maps in this book, such as Figure 1-13a, are equal area projections. The primary benefit of this type of projection is that the relative sizes of the landmasses on the map are the same as in reality. The projection minimizes distortion in the shapes of most landmasses. Areas toward the North and South poles—such as Greenland and Australia—become more distorted, but they are sparsely inhabited, so distorting their shapes usually is not important.

To largely preserve the size and shape of landmasses, however, the projection in Figure 1-13a forces other distortions:

- The Eastern and Western hemispheres are separated into two pieces, a characteristic known as interruption.
- The meridians (the vertical lines), which in reality converge at the North and South poles, do not converge at all on the map. Also, they do not form right angles with the parallels (the horizontal lines).

The Robinson projection (Figure 1-13b) is useful for displaying information across the oceans. Its major disadvantage is that by allocating space to the oceans, the land areas are much smaller than on interrupted maps of the same size.

The Mercator projection (Figure 1-13c) has several advantages: Shape is distorted very little, direction is consistent, and the map is rectangular. Its greatest disadvantage is that relative size is grossly distorted toward the poles, making high-latitude places look much larger than they actually are.

PAUSE & REFLECT 1.1.4

Compare the sizes of Greenland and South America on the three maps in Figure 1-13. Which of the two landmasses is actually larger? How do you know?
The Geographic Grid

LEARNING OUTCOME 1.1.5
Explain how latitude and longitude are used to locate points on Earth’s surface.

The geographic grid is a system of imaginary arcs drawn in a grid pattern on Earth’s surface. The geographic grid plays an important role in telling time.

LATITUDE AND LONGITUDE

The location of any place on Earth’s surface can be described precisely by meridians and parallels, two sets of imaginary arcs drawn in a grid pattern on Earth’s surface (Figure 1-14):

- A meridian is an arc drawn between the North and South poles. The location of each meridian is identified on Earth’s surface according to a numbering system known as longitude.
- A parallel is a circle drawn around the globe parallel to the equator and at right angles to the meridians. The numbering system to indicate the location of a parallel is called latitude.

The meridian that passes through the Royal Observatory at Greenwich, England, is 0° longitude, also called the prime meridian. The meridian on the opposite side of the globe from the prime meridian is 180° longitude. All other meridians have numbers between 0° and 180° east or west, depending on whether they are east or west of the prime meridian. For example, Belo Horizonte, Brazil, is located at 44° west longitude and Baghdad, Iraq, at 44° east longitude.

The equator is 0° latitude, the North Pole 90° north latitude, and the South Pole 90° south latitude. Nicosia, Cyprus, is located at 35° north latitude and Buenos Aires, Argentina, at 35° south latitude.

Latitude and longitude are used together to identify locations. For example, Denver, Colorado, is located at 40° north latitude and 105° west longitude. The mathematical location of a place can be designated more precisely by dividing each degree into 60 minutes (‘) and each minute into 60 seconds (”). For example, the official mathematical location of Denver, Colorado, is 39°44’ north latitude and 104°59’ west longitude. The state capitol building in Denver is located at 39°42’2” north latitude and 104°59’04” west longitude. GPS typically divide degrees into decimal fractions rather than minutes and seconds. The Colorado state capitol, for example, is located at 39.714444° north latitude and 84.984444° west longitude.

Measuring latitude and longitude is a good example of how geography is partly a natural science and partly a study of human behavior. Latitudes are scientifically derived via Earth’s shape and its rotation around the Sun. The equator (0° latitude) is the parallel with the largest circumference and is the place where every day has 12 hours of daylight. Even in ancient times, latitude could be accurately measured by the length of daylight and the position of the Sun and stars.

On the other hand, 0° longitude is a human creation. Any meridian could have been selected as 0° longitude because all meridians have the same length and all run between the poles. The 0° longitude runs through Greenwich because England was the world’s most powerful country when longitude was first accurately measured and the international agreement was made.

TELLING TIME

Longitude is the basis for calculating time. Earth as a sphere is divided into 360° of longitude (the degrees from 0° to 180° west longitude plus the degrees from 0° to 180° east longitude).

As Earth rotates daily, these 360 imaginary lines of longitude pass beneath the cascading sunshine. If we let every fifteen degree of longitude represent one time zone, and divide the 360° by 15°, we get 24 time zones, or one for each hour of the day. By international agreement, Greenwich Mean Time (GMT), or Universal Time (UT), which is the time at the prime meridian (0° longitude), is the master reference time for all points on Earth.

Each 15° band of longitude is assigned to a standard time zone (Figure 1-15). The eastern United States, which is near 75° west longitude, is therefore 5 hours earlier than GMT (the 75° difference between the prime meridian and 75° west longitude, divided by 15° per hour, equals 5 hours). Thus when the time in New York City in the winter is 1:32 p.m. (or 13:32 hours, using a 24-hour clock), it is 6:32 p.m. (or 18:32 hours) GMT. During the summer, many places in the world, including most of North America, move the clocks ahead one hour; so in the summer when it is 6:32 p.m. GMT, the time in New York City is 2:32 p.m.

When you cross the International Date Line, which, for the most part, follows 180° longitude, you move the clock back 24 hours, or one entire day, if you are heading eastward, toward America. You turn the clock ahead
24 hours if you are heading westward, toward Asia. To see the need for the International Date Line, try counting the hours around the world from the time zone in which you live. As you go from west to east, you add 1 hour for each time zone. When you return to your starting point, you will reach the absurd conclusion that it is 24 hours later in your locality than it really is. Therefore—if it is 6:32 a.m. Monday in Auckland, when you get to Honolulu, it will be 8:32 a.m. Sunday because the International Date Line lies between Auckland and Honolulu.

The International Date Line for the most part follows 180° longitude. However, several islands in the Pacific Ocean belonging to the countries of Kiribati and Samoa, as well as to New Zealand’s Tokelau territory, moved the International Date Line several thousand kilometers to the east. Samoa and Tokelau moved it in 2011 so that they could be on the same day as Australia and New Zealand, their major trading partners. Kiribati moved it in 1997 so that it would be the first country to see each day’s sunrise. Kiribati hoped that this feature would attract tourists to celebrate the start of the new millennium on January 1, 2000 (or January 1, 2001, when sticklers pointed out the new millennium really began). But it did not.

Inability to measure longitude was the greatest obstacle to exploration and discovery for many centuries. Ships ran aground or were lost at sea because no one on board could pinpoint longitude. In 1714, the British Parliament enacted the Longitude Act, which offered a prize equivalent to several million in today’s dollars to the person who could first measure longitude accurately.

Most eighteenth-century scientists were convinced that longitude could be determined only by the position of the stars. English clockmaker John Harrison won the prize by using the connection between longitude and time. He invented the first portable clock that could keep accurate time on a ship—because it did not have a pendulum. When the Sun was directly overhead of the ship—noon local time—Harrison’s portable clock set to Greenwich time could say it was 2 p.m. in Greenwich, for example, so the ship would be at 30° west longitude because each hour of difference was equivalent to traveling 15° longitude.

PAUSE & REFLECT 1.1.5
Where in the world, other than Newfoundland, is standard time on the half-hour rather than the hour? Why might that country prefer not to be on the hour?

CHECK-IN   KEY ISSUE 1

Why Is Geography a Science?

✓ Geography has ancient and medieval roots.
✓ Maps are tools of reference and increasingly tools of communication.
✓ Reading a map requires recognizing its scale and projection.
✓ Contemporary mapping utilizes electronic technologies, such as GPS and GIS.