Topic 1.1

Introduction to Maps

You will learn to:

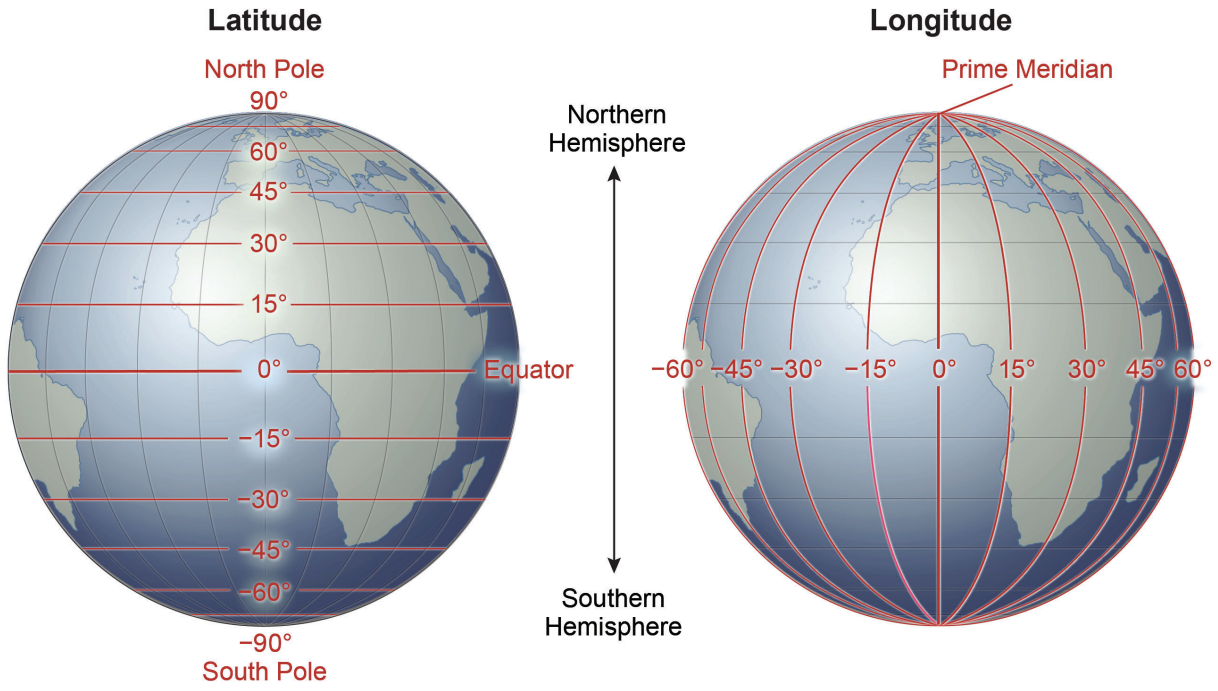
- Identify the different types of maps and how information is illustrated in maps.
- Identify what spatial relationships are.
- Identify the various types of map projections that distort spatial relationships.

Location

Location, which refers to the position of a point or object on the Earth's surface, is a central concern of geographers. Location may be communicated in terms of absolute location or relative location.

Absolute location

Absolute location is the position of a fixed point on Earth's surface, determined by latitude and longitude. Lines of latitude run north and south of the equator, while longitude lines run east and west of the prime meridian.



Longitude and latitude form a grid over Earth, and absolute location refers to a precise position on that grid. For example, the Washington Monument is located at 38.8895° N, 77.0353° W.

Relative location

Relative location is the position of one place in relation to other places. For example, in Central America, Costa Rica is south of Nicaragua. Unlike absolute location, relative location conveys information regarding direction, distance, accessibility, and connectivity.

The relative location of Costa Rica is south of Nicaragua.

Spatial relationships

The relationship between locations is also central to the study of geography. Geographers primarily use direction, distance, and elevation to discuss the spatial relationship between the Earth's physical features. They also look at spatial patterns on a map to study how groups of locations are broadly arranged.

Direction

Direction refers to one object's physical location in space relative to another object; it is essential to define the spatial relationship between locations. On a compass or map, the basis for direction is north—one of the four cardinal directions along with south, west, and east. Magnetic north is the polar location on Earth to which all compasses point.

Source: Jacek Halicki, CC BY-SA 4.0 (tinyurl.com/3v368hpu)

Because a compass always points north, the other cardinal directions can be determined in relation to north. The compass is circular, so its directions are measured in degrees:

- North, representing 0° or 360°
- South, representing 180°
- West, representing 270°
- East, representing 90°

Geographers use direction in exact terms, such as describing a location as 20° NW of another location. Direction can also be used in general terms, such as saying that one place is north of another.

Distance

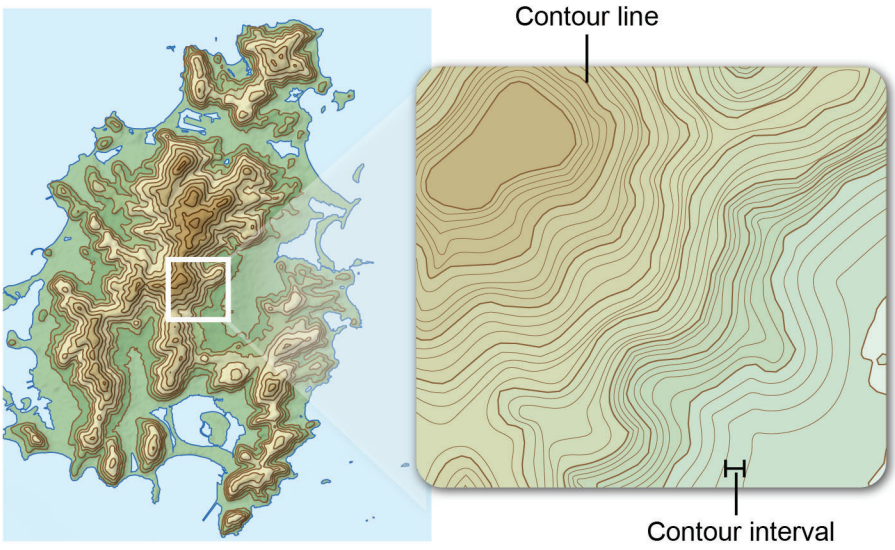
Distance—another way to determine the spatial relationship between locations—refers to the amount of horizontal physical space between them. Geographers can use many different types of units of measure to gauge distance.

Street signs showing the distance to other locations (shown in kilometers)

For example, distance can be expressed in exact terms, such as the driving distance from one city to another or the distance between tourist locations in Ireland. Distance can also be described generally as the time it takes to travel from one location to another.

Elevation

Elevation measures the vertical physical space between a point on Earth and sea level. Data is mapped to illustrate the contours of the physical landscape, known as topography.



Pattern

A **clustered pattern** shows things organized in groups or concentrated in a particular area.

A **dispersed pattern** shows things spread over a large area.

Geographers are also interested in the spatial pattern indicated by the arrangement of objects on a map. The two basic types of patterns are clustering and dispersal.

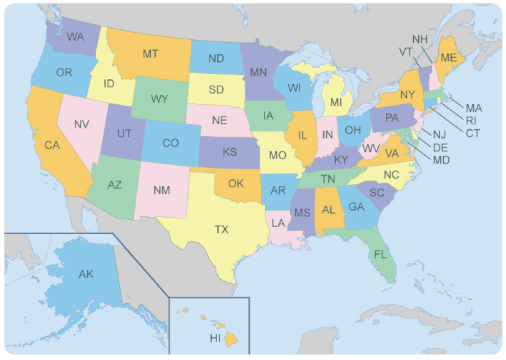
Types of maps

Maps are two-dimensional representations of a geographic area that show the spatial relationships between locations or reveal patterns in the distribution of phenomena. There are two general categories of maps: reference and thematic maps.

Reference maps

By using longitude and latitude, reference maps focus on the absolute location of objects. There are four common types of reference maps: political, physical, road, and plat.

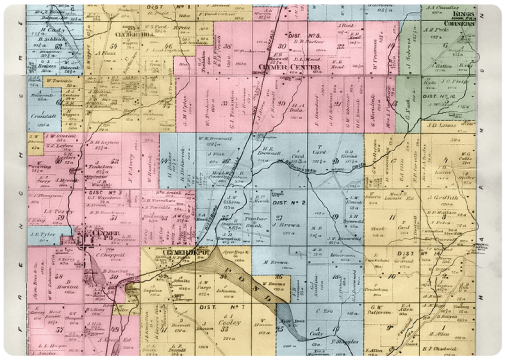
Political maps display formal boundaries that denote countries, states, and capitals.



Physical maps show natural features such as bodies of water, deserts, and mountains.

Road maps display road systems, including highways and streets.

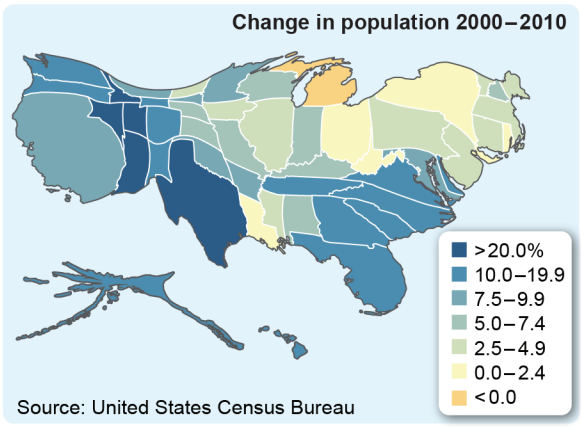
Plat maps display divisions of a piece of land, often showing property lines.



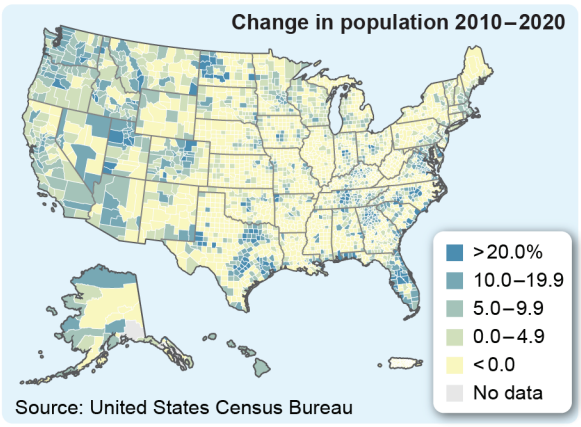
Thematic maps

Thematic maps show the movement and degree of some attribute or phenomenon within a geographic location. There are five common types of thematic maps: cartogram, choropleth, dot distribution, graduated symbol, and isoline.

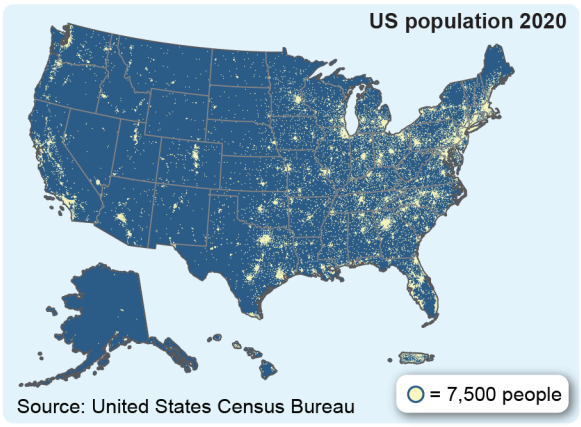
Cartograms distort land area to show changes in value.



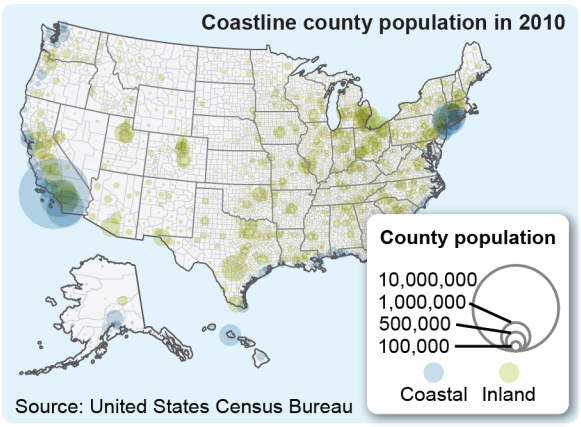
Choropleths use different shades to show the variations of the values.



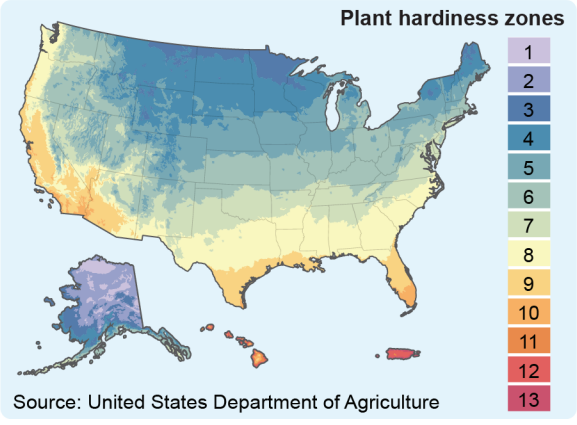
Dot maps use dots to show variations in values.



Graduated symbol maps use different sized symbols to represent variations in value.



Isoline maps present numerical data using lines drawn on maps connecting data points of the same value.



Map scale

Map scales communicate the relationship between a unit of measure on a map and the Earth. All map scales have this function; however, a map scale can express the relationship in two main ways: graphically and fractionally.

Graphic scales

A graphic scale typically uses a bar graph that defines the relationship between a distance on a map and that same distance on Earth.

Fractional scales

A fractional scale uses ratios to define the relationship between a distance on a map and that same distance on Earth. A fractional scale communicates how many units of a measure of distance on Earth are equal to 1 unit of that measure on the map.

Fractional scales are expressed as ratios, such as 1:100,000, a ratio indicating that 1 unit of a measure (inches, feet, or miles) on the map equals 100,000 units of that measure on Earth. For example, 1 inch on the map equals 100,000 inches—about 1.6 miles.

Small- and large-scale maps

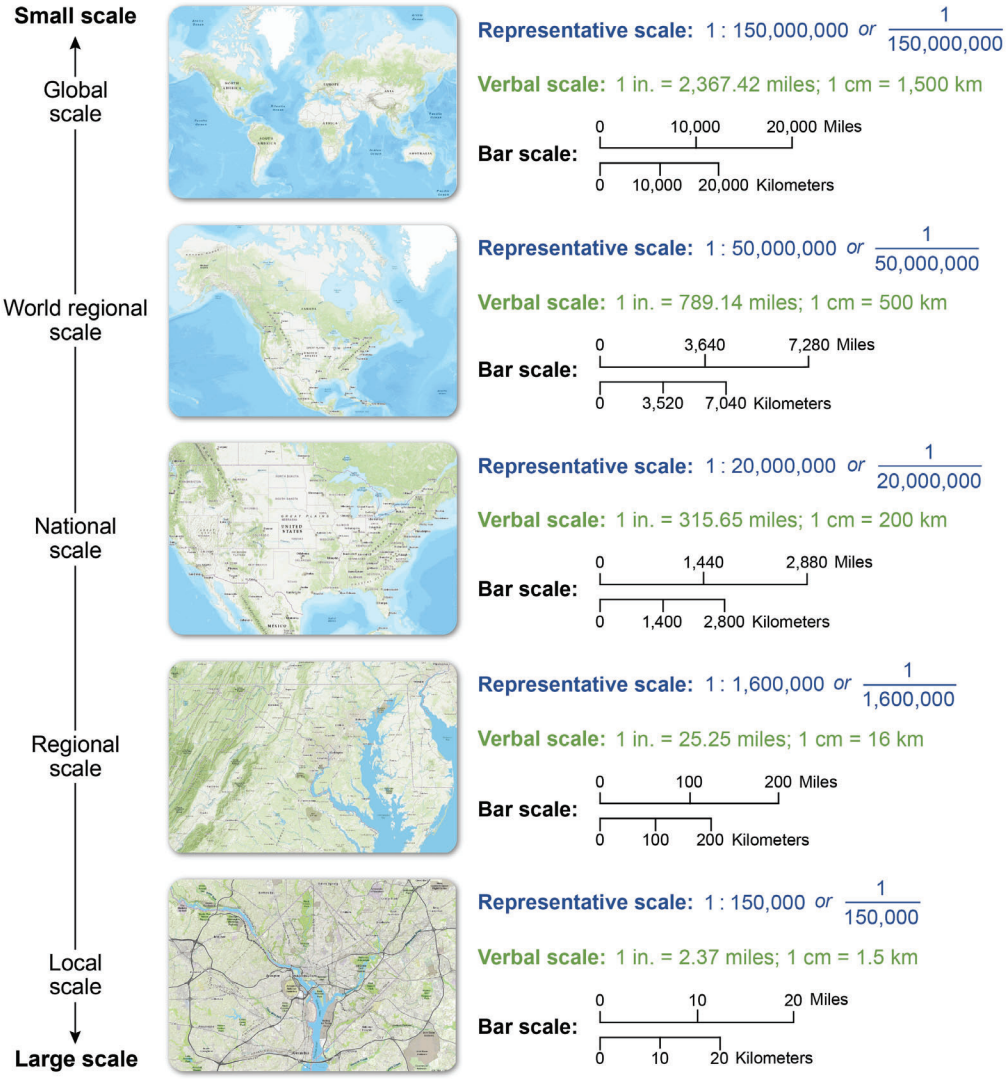
Scale allows maps to be "zoomed" in or out, revealing different levels of detail. It is important to be able to distinguish between small- and large-scale maps and to recognize that each scale size has different potential uses.

Geographers use the fractional scale's representative fraction (RF) to move from small to large. The larger the second number of the RF, the smaller the scale. The table below shows examples of the RF for small and large scales.

Size of scale	Representative fraction
Small	1:1,000,000
Large	1:10,000

Small-scale maps

A small-scale map shows a zoomed-out view of Earth. Global and world regional maps typically have a larger RF, such as 1:1,000,000. Small-scale maps are good for revealing broad geographic patterns, such as ocean currents or deserts.



Large-scale maps

A large-scale map depicts a zoomed-in view of Earth. For example, a map of a national park would be a large-scale map. To see the details of a capital city, a fractional scale could be 1:24,000.

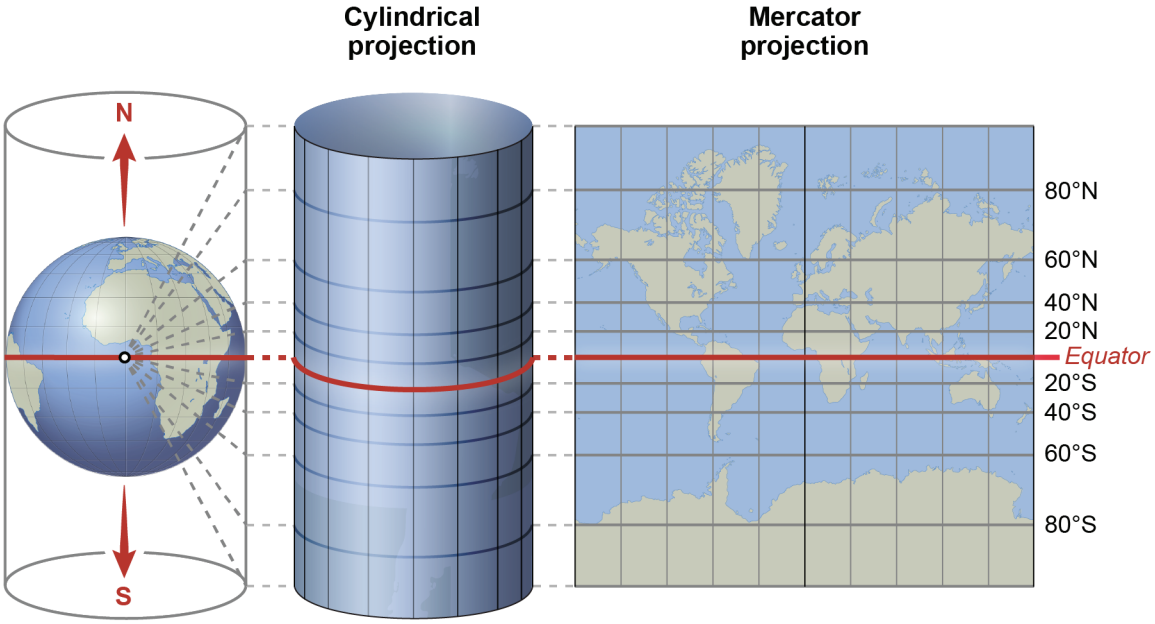
Map projections

In cartography, a projection refers to how the Earth's curvature is displayed on the flat surface of a map. Since the Earth is not flat, all projections distort spatial relationships in shape, area, distance, and direction.

For a projection method to preserve a map's accuracy in one aspect of spatial relationships, it must allow distortions in other aspects. Let's look at three types of world map projections and where aspects are preserved or distorted on the maps.

Mercator

Mercator maps are produced through cylindrical projection. Imagine wrapping a piece of paper around a globe at the equator. Think about where the paper touches the globe. On a Mercator map, the area around the equator has the least distortion. However, as you move north and south, the size of the landmasses gets distorted.

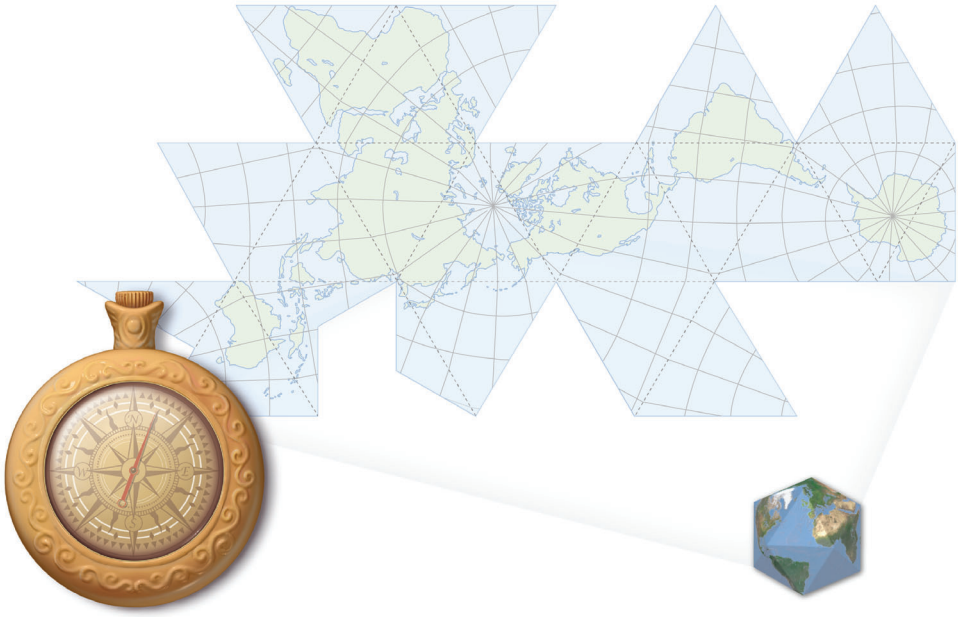


Mercator maps are great for navigation because they preserve distance, direction, longitude, and latitude. However, landmasses in the northernmost and southernmost portions look far bigger than they really are. For example, Mercator maps show Greenland and Africa as similar sizes, while Africa is about 15 times larger than Greenland.

The true size of Greenland compared to Africa

Fuller, or Dymaxion, projection

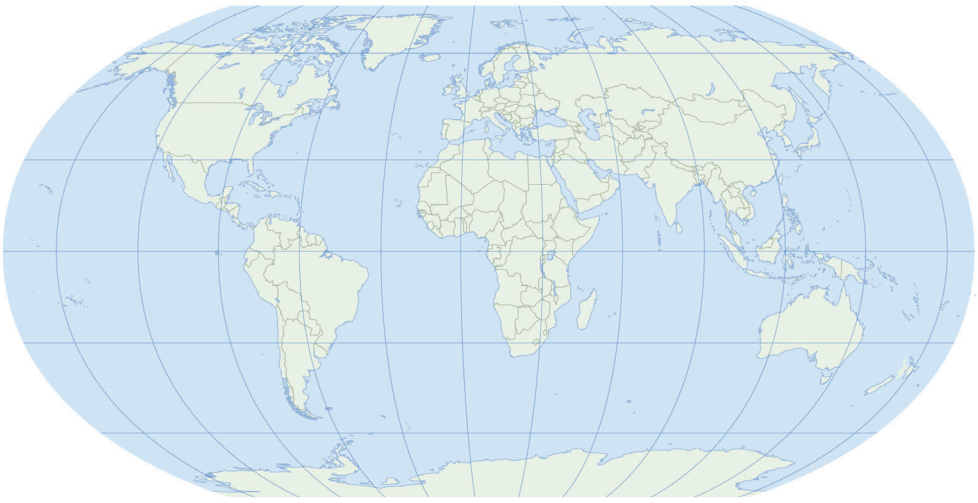
The Fuller projection uses an icosahedron (20-sided shape) as its developable surface. Imagine folding a piece of paper to make 20 equal-sized triangles, then wrapping it over a globe, allowing more flattened paper to touch the globe than in a cylindrical projection. When unraveled and laid flat, the Fuller projection becomes an interrupted map, meaning there are gaps between its sections.



Fuller projections preserve size, shape, and distance. However, they do not preserve direction or longitude and latitude.

Robinson projection

Computer simulations create the Robinson projection, which reduces distortion from the Earth's curvature. Notice that there is little distortion in size, shape, distance, or direction through most of the map's interior.



Nonetheless, there is a degree of distortion at the edges and the North and South Poles.

1.1 Vocabulary

Absolute location	The position of a fixed point on Earth's surface is determined by latitude (north or south of the equator) and longitude (east or west of the prime meridian).
Accessibility	A measurable indicator of how easy it is to reach one specific location from other locations.
Cartogram	A thematic map that distorts land area to show changes in value.
Cartography	The science of map-making includes compiling, formatting, and visually presenting data at varying scales and on various types of map projections.
Choropleth map	A thematic map that uses different shades of color for the various values represented.
Connectivity	The degree to which one point in a network is linked or related to another point in a network. Often taken into consideration are the factors that influence those connections.
Direction	The position in space toward which one person or thing must move in order to reach another person or thing.
Distance	The amount of physical space between two locations.
Dot distribution map	A thematic map that uses dots to show variation in values.
Elevation	The measure of vertical physical space between mean sea level and a point on Earth.
Fractional map scale	A map scale communicates how many units of a measure of distance on Earth are equal to one unit of that measure on the map. These scales are expressed as ratios, such as 1:100,000.
Graduated symbol map	A thematic map that uses different-sized symbols to represent variations in value.
Graphic map scale	A map scale using a bar graph to define the relationship between a distance on the map and that same distance on Earth.
Isoline map	A thematic map that presents numerical data, with lines drawn on the map to connect data points of the same value.
Latitude	A geographic coordinate that measures a distance north or south from Earth's equator. Represented by parallel lines that range from 0° at the equator to 90° at the North and South Poles.
Location	The position of an object or point on Earth's surface.

Longitude	A geographic coordinate that determines the location east or west of the prime meridian. Represented by vertical lines that run through Earth's poles on a globe.
Map scale	The size of a feature's relationship on the Earth to its size on a map.
Pattern	A property of distribution that concerns the arrangement of objects across space (such as dispersed or linear). The distribution of some objects may possess predictable arrangements while others may be distributed at irregular intervals.
Physical maps	Reference maps that show natural features such as bodies of water, deserts, and mountains.
Plat maps	Reference maps that depict a piece of land's divisions, often showing property lines.
Political maps	Reference maps that include formal boundaries denoting countries, states, and capitals.
Road maps	Reference maps that show road systems, including highways and streets.

1.1 Check for Understanding

1. **Is the South Side of Chicago an example of an absolute location?**

   A. True

   B. False

2. **The shape and features of the physical landscape are best described by which term?**

   A. Cartography

   B. Topography

   C. Map projection

3. **This type of map reveals stories, typically showing the movement and degree of some attribute or phenomenon in a geographic location.**

   A. Reference

   B. Thematic

   C. Political

4. **A Cartogram can be best described as which of the following?**

   A. A map that uses different shades to show the variations in value

   B. A map that uses dots to show variations in values

   C. A map that distorts land area to show changes in value

5. **All map projections have some areas of distortion in the direction, distance, or shape and size of landmasses.**

   A. True

   B. False

6. **What is a characteristic of the Mercator map?**

   A. The projection preserves longitude, latitude, and direction

   B. The projection does not distort the shape of landmasses

   C. The projection reduces the distortion from the Earth's arc