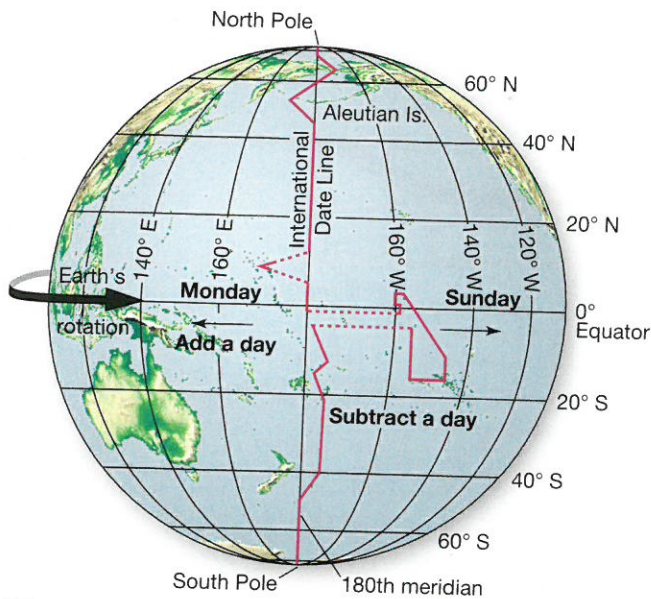




▲ **Figure 1.16 International Date Line.** The IDL location is approximately along the 180th meridian (see the IDL location on Figure 1.15). The dotted lines on the map show where island countries have set their own time zones, but their political control extends only 3.5 nautical miles (4 mi) offshore. Officially, you gain one day crossing the IDL from east to west.

characteristic of a place or area, such as rainfall, airline routes, or political features such as state boundaries and place names. **Cartography** is the science and art of map-making, often blending aspects of geography, engineering, mathematics, computer science, and art. It is similar in ways to architecture, in which aesthetics and utility combine to produce a useful product.

We all use maps to visualize our location in relation to other places, or maybe to plan a trip, or to understand a news story or current event. Maps are wonderful tools! Understanding a few basics about maps is essential to our study of physical geography.

The Scale of Maps

Architects, toy designers, and mapmakers have something in common: They all represent real things and places with the convenience of a model; examples are a drawing; a pretend car, train, or plane; a diagram; and a map. In most cases, the model is smaller than the reality. For example, an architect renders a blueprint of a structure to guide the building contractors, preparing the drawing so that a centimeter (or inch) on the blueprint represents so many meters (or feet) on the proposed building. Often, the drawing is 1/50 or 1/100 real size.

The cartographer does the same thing in preparing a map. The ratio of the image on a map to the real world is the map's **scale**; it relates the size of a unit on the map to the size of a similar unit on the ground. A 1:1 scale means that any unit (for example, a centimeter) on the map represents that same unit (a centimeter) on the ground, although this is an impractical map scale, since the map

is as large as the area mapped! A more appropriate scale for a local map is 1:24,000, in which 1 unit on the map represents 24,000 identical units on the ground.

Cartographers express map scale as a representative fraction, a graphic scale, or a written scale (**Figure 1.17**). A *representative fraction (RF, or fractional scale)* is expressed with either a colon or a slash, as in 1:125,000 or 1/125,000. No actual units of measurement are mentioned because any unit is applicable as long as both parts of the fraction are in the same unit: 1 cm to 125,000 cm, 1 in. to 125,000 in., or even 1 arm length to 125,000 arm lengths.

A *graphic scale, or bar scale*, is a bar graph with units to allow measurement of distances on the map. An important advantage of a graphic scale is that, if the map is enlarged or reduced, the graphic scale enlarges or reduces along with the map. In contrast, written and fractional scales become incorrect with enlargement or reduction. As an example, if you shrink a map from 1:24,000 to 1:63,360, the written scale "1 in. to 2000 ft" is no longer correct. The new correct written scale is "1 in. to 5280 ft (1 mi)."

Scales are *small* or *large*, depending on the ratio described. In relative terms, a scale of 1:24,000 is a large scale, whereas a scale of 1:50,000,000 is a small scale. The greater the denominator in a fractional scale (or the number on the right in a ratio expression), the smaller the scale of the map. Small-scale maps show a greater area in less detail; a small-scale map of the world is little help in finding an exact location, but works well for illustrating global wind patterns or ocean currents. Large-scale maps show a smaller area in more detail and are useful for applications needing precise location or navigation over short distances.

Map Projections

A globe is not always a helpful map representation of Earth. When you go on a trip, you need more-detailed information than a globe can provide. To provide local

CRITICAL thinking 1.4

Find and Calculate Map Scales

Find globes or maps in the library or geography department, and check the scales at which they were drawn. See if you can find examples of fractional, graphic, and written scales on wall maps, on highway maps, and in atlases. Find some examples of small- and large-scale maps, and note the different subject matter they portray.

Look at a world globe that is 61 cm (24 in.) in diameter (or adapt the following values to whatever globe you are using). We know that Earth has an equatorial diameter of 12,756 km (7926 mi), so the scale of such a globe is the ratio of 61 cm to 12,756 km. To calculate the representative fraction for the globe in centimeters, divide Earth's actual diameter by the globe's diameter (12,756 km ÷ 61 cm). (*Hint:* 1 km = 1000 m, and 1 m = 100 cm; therefore, Earth's diameter of 12,756 km represents 1,275,600,000 cm, and the globe's diameter is 61 cm.) In general, do you think a world globe is a small- or a large-scale map of Earth's surface?