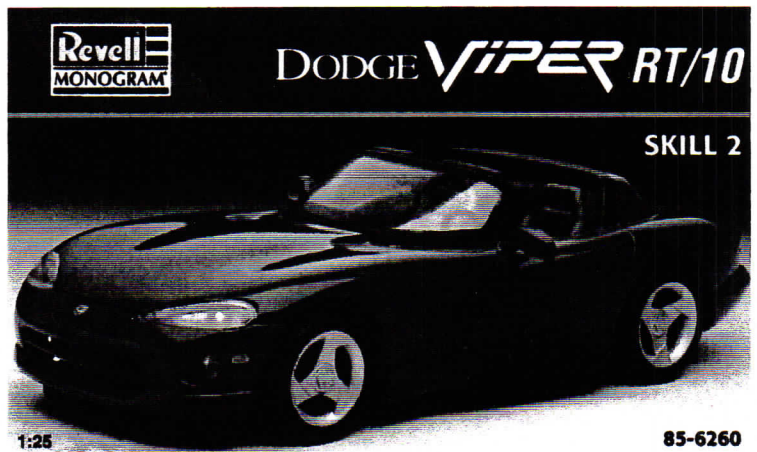## Key Ideas

This chapter helps you investigate these questions:
- What is a map scale?
- How can I use map scales effectively?

Key Terms

scale

direct statement scale

line scale

representative fraction scale

Have you ever made a model of something like an airplane or a building? Every part of the model is in true proportion to the life-size object (Fig. 4-1). This reduction in size is the basic idea of scale. In Chapter 2, you saw that a map must have a scale. The **scale** shows the relationship between the distance on a map and the actual distance on Earth's surface. A small distance on the map represents a much larger distance on Earth's surface. Scale can be represented in three different ways: direct statement, line scale, and representative fraction scale.

▼ **Fig. 4-1** Every part of this model car (right) is in true proportion to the life-size object that it represents. Note that the scale of the model is 1:25. What does this mean?

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Direct Statement Scale

A **direct statement scale** uses words to describe the relationship between a distance on a map and a specific distance on Earth's surface, for example, 1 cm to 10 km. This means if the distance between two towns on a map is one centimetre, the actual distance between the towns is 10 kilometres.
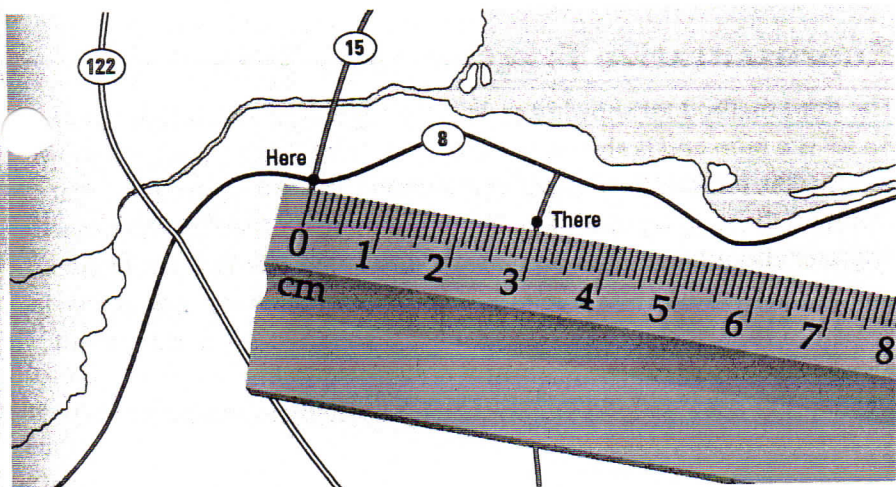
On the map in Fig. 4-2, the distance between *Here* and *There* is measured and found to be three centimetres. If the scale is 1 cm to 10 km, then the distance on Earth's surface is calculated as follows:

Since 1 cm = 10 km

(3 × 1) cm = (3 × 10) km

3 cm = 30 km

Therefore, the actual distance between *Here* and *There* is 30 kilometres.

◄ **Fig. 4-2** To determine the distance on a map with a direct statement scale, measure the distance between two places. Calculate the distance using the scale.

Line Scale

A **line scale** is like a special kind of ruler that is divided into units of distance. Use a line scale to find the distance between Kingston and Cornwall, following the five steps illustrated in Fig. 4-3.

A line scale is also called a linear scale.

◄ **Fig. 4-3** Follow these steps to find the actual distance between places using a line scale.
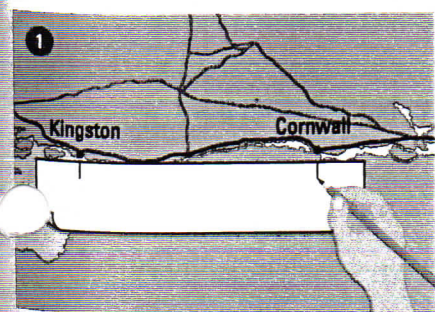
Mark the locations of the two cities on the edge of a sheet of paper.
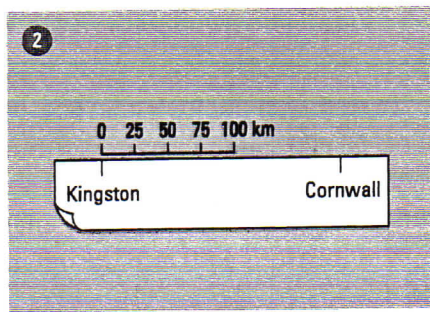
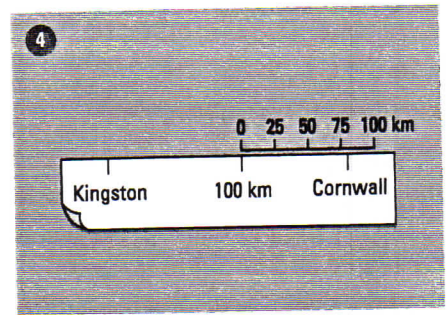Place the edge of the paper against the line scale on the map, with the first mark at 0.

Fig. 4-3 continued ▶
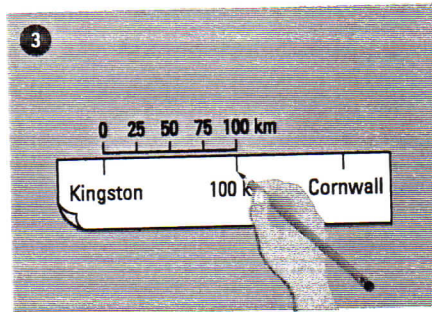
Make a mark on your paper at the right end of the line scale.

Move the mark from step three to 0 on the line scale and measure the remaining distance.

5 Calculate the total distance between Kingston and Cornwall by adding together the distances you measured (100 + 80).

The distance between Kingston and Cornwall is 180 km.

Representative Fraction (RF) Scale

> A representative fraction was used to show the scale of the model car in Fig. 4-1.

The third method for showing scale is the **representative fraction scale**. An RF is a ratio and is shown as follows: 1:50 000. (It could also be shown as 1/50 000, but this form is not as common.) This RF scale means that 1 unit on the map represents 50 000 of the *same units* on Earth's surface. The user chooses the units. In Canada, this would often be centimetres, and inches in the United States. This is very useful, because all people in the world can use this scale regardless of their language or the units of measurement used in their country.

There are a few properties about this ratio that you should know:

1:50 000

The first term of the ratio
- is always 1
- represents the distance on the map in the units of your choice

The second term of the ratio
- represents the distance on Earth's surface
- must be in the same unit of measurement as the first term of the ratio

> **INTERNET**
> To see examples of different scales, check www.pearsoned.ca/ makingconnections2.

Therefore, if the RF is 1:50 000, then 1 centimetre on the map represents 50 000 centimetres on Earth's surface.

We usually want to know distances in kilometres. To change the centimetres used in the RF into kilometres, we must know how to convert one unit of measurement into the other. Continue reading to find out how to do this.

Scale Conversion

The RF scale is practical because it can be used by everyone all over the world. It is not very useful, however, when we want to indicate an actual distance between places. For example, if the RF is 1:50 000 we know that one centimetre on the map represents 50 000 centimetres on Earth's surface. What we really want to know, however, is how many kilometres on Earth's surface are represented by one centimetre on the map. For this reason, it is important that we know how to convert from one scale to another.

Converting an RF Scale to a Direct Statement Scale

To convert an RF scale to a direct statement scale, divide the right side of the equation by 100 000, to change centimetres into kilometres.

Since
1 km = 1000 m and
1 m =100 cm,
1 km = (1000 x 100) cm
     = 100 000 cm

Therefore, in order to convert a 1:50 000 RF into a direct statement, you would use the following process:

1 cm = 50 000 cm

1 cm = (50 000/100 000) km

1 cm = 0.5 km or 1 cm to 500 m

Converting a Direct Statement Scale to an RF Scale

To convert from a direct statement scale back to an RF scale, multiply the right side of the equation by 100 000, to change kilometres into centimetres.

In order to convert the direct statement 1 cm to 2.5 km into a representative fraction, you would use the following process:

1 cm = 2.5 km

1 cm = (2.5 × 100 000) cm

1 cm = 250 000 cm or 1:250 000

When constructing a map, use the scale that is best suited to the purpose of the map. Make sure that there is a scale shown on all your maps.

QUESTIONS

KNOWLEDGE AND UNDERSTANDING

1. In your own words, what is an RF scale?
2. a) What does 1:250 000 mean?
   b) What does 1:3 000 000 mean?

APPLICATION

3. a) What does 1 cm to 0.5 km mean?
   b) Use this scale to recalculate the distance, in both kilometres and metres, between *Here* and *There* in Fig. 4-2.
4. The direct statement scale of a map is 1 cm to 35 km. If the map distance between points A and B is 9 cm, what is the actual distance?
5. The direct statement scale of a map is 1 cm to 250 km. If two places are 17 cm apart on the map, what is the actual distance between them?
6. Using the scale of 1 cm to 30 km, calculate the road distances between towns X and Y in Fig. 4-4.

▼ **Fig. 4-4**

a)

b)

c)
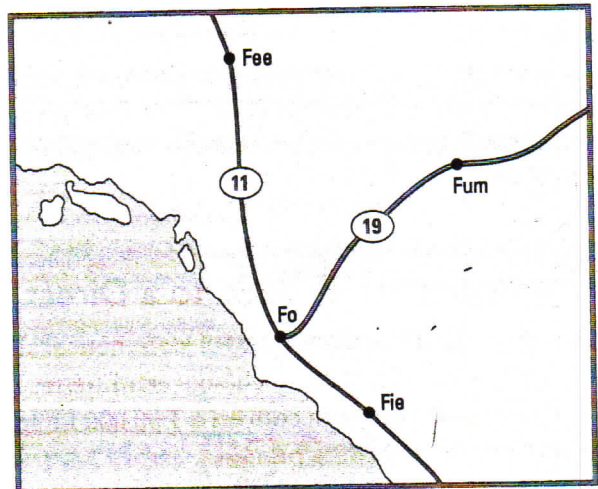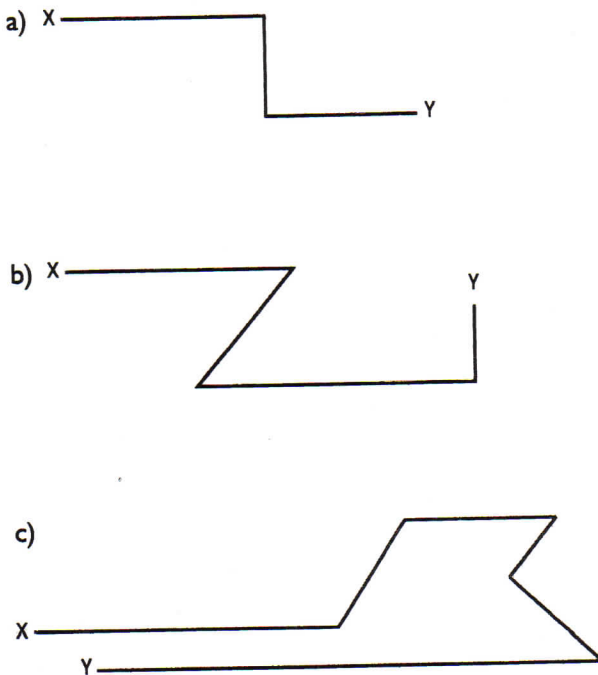
▲ **Fig. 4-5** The scale of this map is 1 cm to 12 km.

7. Refer to Fig. 4-5 to calculate the road distance between *Fee* and *Fie* and between *Fo* and *Fum*.
8. Here is a list of distances between Canadian cities. Draw straight lines in your notebook to show how each distance would appear on a map. Use a scale of 1 cm to 100 km.
   a) Calgary to Edmonton   299 km
   b) Fredericton to Montreal   834 km
   c) Regina to Winnipeg   571 km
9. a) In an atlas, find a map of a part of Canada that has a line scale.
   b) Use the line scale method to calculate the actual distance between two cities on that map.
   c) Select another pair of cities and repeat the activity.
10. Convert the following representative fractions to direct statements.
    a) 1:250 000
    b) 1:1 500 000
    c) 1:63 000 000

11. Use an atlas to find the straight-line distance between the locations listed below. Use the direct statement scale found in the atlas. (Answers will vary slightly depending on the atlas.)

a) Wiarton, Ontario (in the Bruce Peninsula) and Port Dover, Ontario (on Lake Erie)

b) Gananoque, Ontario (near Kingston on the St. Lawrence River) and Aylmer, Quebec (near Ottawa on the Ottawa River)

c) Sault Ste. Marie, Ontario (between Lake Superior and Lake Huron) and Timmins, Ontario (northeast of Sault Ste. Marie)

12. Find the maps in your atlas that show the following pairs of cities. Measure the straight-line distances between the two cities. Use the RF scale shown on the map to calculate the distance in kilometres.

a) London, England, and Rome, Italy (map of Europe)

b) Havana, Cuba, and Miami, Florida (map of the Caribbean)

c) Prince Rupert and Bella Coola, British Columbia (map of western Canada)

d) Yarmouth, Nova Scotia, and Bathurst, New Brunswick (map of eastern Canada)

13. Convert the following direct statement scales to RF scales.

a) 1 cm to 5 km

b) 1 cm to 25 km

c) 1 cm to 160 km

14. The line scale on a map indicates that 4 cm represents 20 km. What is the RF?

15. The line scale on a map indicates that 1.5 cm represents 50 km. What is the RF?