

4

Using Map Scales

modified

Key Ideas

This chapter helps you investigate these questions:

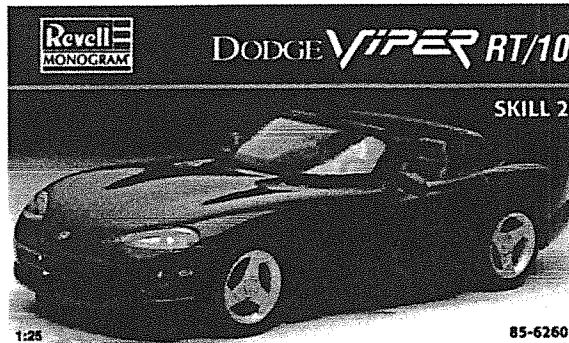
- What is a map scale?
- How can I use map scales effectively?

Key Terms

scale
direct statement
scale
line scale
representative
fraction scale

▼ 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?

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.



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.

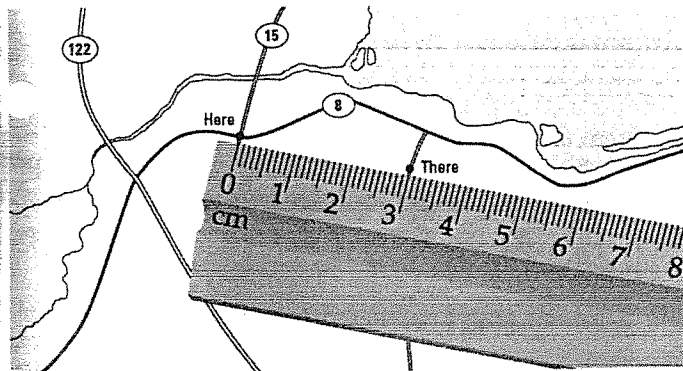
On the map in Fig. 4-2, the distance between *Here* and *There* is measured and found to be three centimetres. If the scale is 1 cm to 10 km, then the distance on Earth's surface is calculated as follows:

Since 1 cm = 10 km

$(3 \times 1) \text{ cm} = (3 \times 10) \text{ km}$

3 cm = 30 km

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

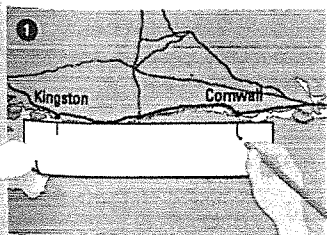


A **direct statement scale** is also called a **verbal statement**.

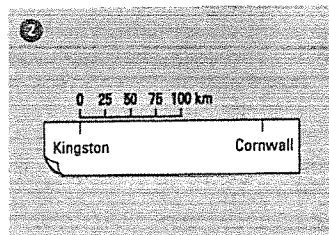
◀ Fig. 4-2 To determine the distance on a map with a direct statement scale, measure the distance between two places. Calculate the distance using the scale.

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.



1 Mark the locations of the two cities on the edge of a sheet of paper.

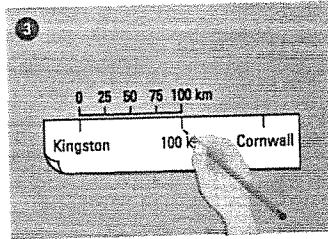


2 Place the edge of the paper against the line scale on the map, with the first mark at 0.

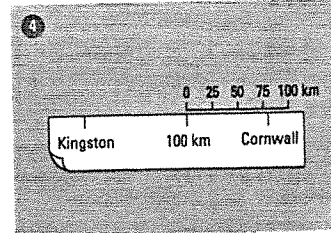
A **line scale** is also called a **linear scale**.

◀ Fig. 4-3 Follow these steps to find the actual distance between places using a line scale.

Fig. 4-3 continued ▶



Make a mark on your paper at the right end of the scale.



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

- 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.

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

Representative Fraction (RF) Scale

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

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.

INTERNET

To see examples of different scales, check www.parsoned.ca/makingconnections2.

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.

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

$$1 \text{ cm} = 50\,000 \text{ cm}$$

$$1 \text{ cm} = (50\,000/100\,000) \text{ km}$$

$$1 \text{ cm} = 0.5 \text{ km or } 1 \text{ cm to } 500 \text{ m}$$

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:

$$1 \text{ cm} = 2.5 \text{ km}$$

$$1 \text{ cm} = (2.5 \times 100\,000) \text{ cm}$$

$$1 \text{ cm} = 250\,000 \text{ cm or } 1:250\,000$$

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.

Since

$$1 \text{ km} = 1000 \text{ m and}$$

$$1 \text{ m} = 100 \text{ cm,}$$

$$1 \text{ km} = (1000 \times 100) \text{ cm} \\ = 100\,000 \text{ cm}$$

QUESTIONS

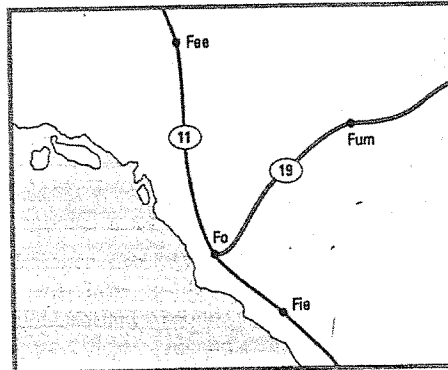
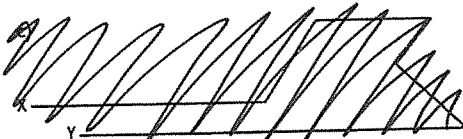
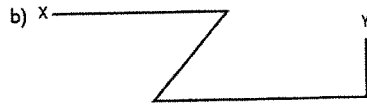
KNOWLEDGE AND UNDERSTANDING

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



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

~~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 Vancouver 571 km~~

~~From 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) ~~1:500 000~~
- c) ~~1:3 000 000~~

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.)
- Warton, Ontario (in the Bruce Peninsula) and Port Dover, Ontario (on Lake Erie)
 - Gananoque, Ontario (near Kingston on the St. Lawrence River) and Aylmer, Quebec (near Ottawa on the Ottawa River)
 - 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.
- London, England and Rome, Italy (map of Europe)
 - Havana, Cuba, and Miami, Florida (map of the Caribbean)
 - Prince Rupert and Bella Coola, British Columbia (map of western Canada)
 - Harmouth, Nova Scotia, and Bathurst, New Brunswick (map of eastern Canada)
13. Convert the following direct statement scales to RF scales.
- 1 cm to 5 km
 - 1 cm to 25 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 1.8 cm represents 50 km. What is the RF?

Geolab 2

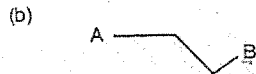
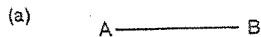
INTRODUCTION TO MAP SCALES

One of the basic map requirements, for any map, is a scale. A map scale is a way of reducing, or shortening, actual distance on the earth's surface so that it fits on the map. The reduction ratio is calculated carefully. This ratio between the actual distance on the earth's surface and the same distance on the map is known as the map scale.

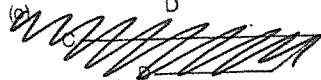
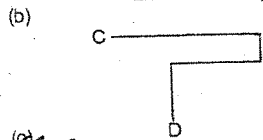
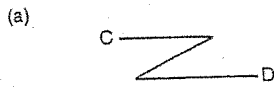
For example, most Canadian topographic maps show with 1 cm a distance of 0.5 km on the earth's surface. The reduction ratio in this case is 50 000 times (there are 50 000 cm in 0.5 km). This reduction ratio is written as a scale of 1:50 000.

Geolab 2 - Exercise

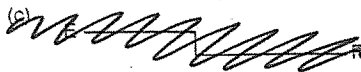
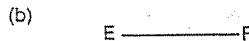
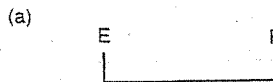
1. Imagine that the following diagrams show the roads between towns. Using the scale of 1 cm to 100 km find the road distances between towns A and B.



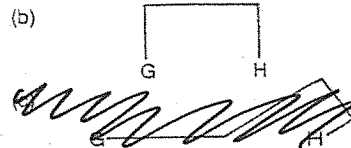
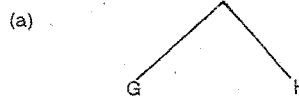
2. Using the scale of 1 cm to 25 km calculate the road distances between towns C and D.



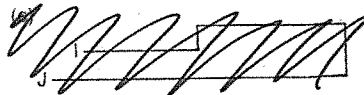
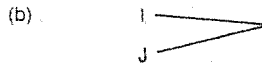
3. Using the scale of 1:250 000 (1 cm to 250 000 cm or 1 cm to 2.5 km) find the distance between the towns E and F.



4. Using the scale provided below find the distance between towns G and H on the three diagrams.



5. Using the scale provided below find the distance between towns I and J on the three diagrams.



Geolab 3

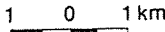
MAP SCALE CONVERSION

By looking back to Geolab 2 you will see that three different ways were used to write map scales. Can you identify the three different methods?

The three types of map scales are:

DIRECT STATEMENT—This scale is written in words: 1 cm to 1 km, or 1 cm represents 1 km. This means that 1 cm on the map represents 1 km on the earth's surface.

REPRESENTATIVE FRACTION—This scale is written in numbers as a ratio: 1:100 000 or $\frac{1}{100\,000}$. This means that 1 cm on the map represents 1 km on the earth's surface.

LINEAR SCALE—This scale is shown as a divided line.  1 0 1 km

Use your ruler to measure this linear scale. You will see that 1 cm represents 1 km on the earth's surface.


In other words, each of the three scales above, although appearing to be different, actually has the same meaning. Changing one type of scale to another type is called scale conversion.

Geolab 3 - Exercise

1. Draw a linear scale to show each of the following scales.

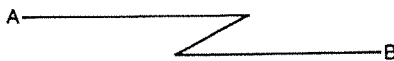
- (a) 1 cm: 12 km
(b) 1:6 000 000

2. Change the following scales to direct statements.

- (a) 1:1 500 000
(b)  0 20 km

3. Using the following scales calculate the distance from A to B along the line.


- (a) 1 cm: 7 km
(b) 1:12 500 000



4. Change the following linear scales to representative fractions.

(a)  0 3 km

(b)  0 80 km

(c)  0 5 km

5. The following diagram represents the shoreline of a small lake. It is drawn to a scale of 1:50 000



- (a) Draw this lake to a scale of 1:100 000.
(b) Draw the lake to a scale of 1:25 000.
(c) What is the relationship between the sizes of the lake and the scales at which they are drawn?

6. (a) Which scale do you think would show most detail?

(b) Which scale shows least detail?

7. Using the three maps on the following page answer the following questions.

(a) Which map shows the greatest area?

(b) What is its scale?

(c) Which map shows the smallest area?

(d) What is its scale?

(e) Which map shows the greatest detail?

(f) Explain why you have chosen this map.

8. (a) Find the shopping centre on Map 3.

Calculate its length in metres.

(b) Find the shopping centre on Map 2.

Calculate its length in metres.

(c) Should your answers to 8(a) and 8(b) be the same? If they are not the same, explain why.

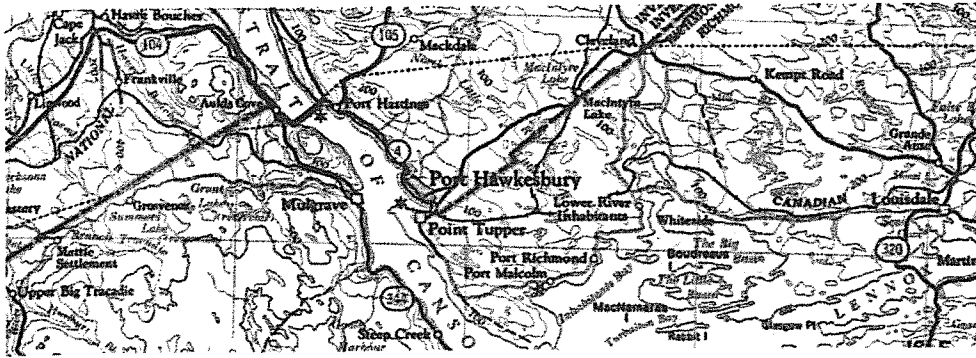
(d) You won't be able to find the shopping centre on Map 1. Why not?

9. The map scale 1:50 000 is one of the most commonly used for Canadian topographic maps. By examining Maps 1, 2, and 3 explain the advantages of the 1:50 000 map over the other two scales.

Map 1

Port Hawkesbury — Nova Scotia

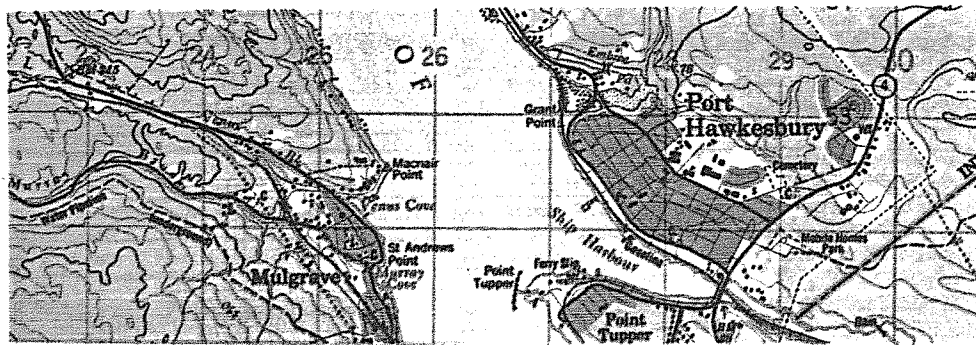
Scale 1:100 000



Map 2

Port Hawkesbury — Nova Scotia

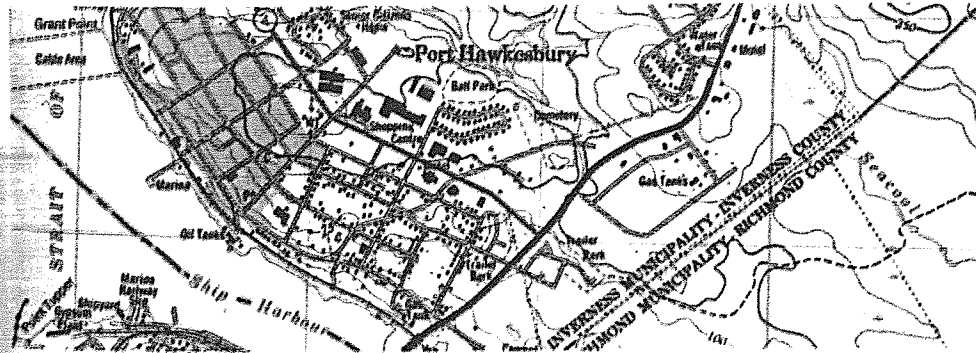
Scale 1:50 000

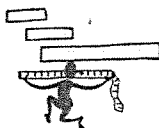


Map 3

Port Hawkesbury — Nova Scotia

Scale 1:25 000





Scales and Conversions - A

Two maps are drawn of a play park and a garage using the Scale 1:200 and 1:50

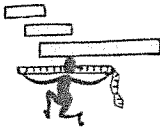
Here are some measurements and real life sizes of objects on the plans.
Fill in the boxes to complete the table:

Scale 1:200 (every 1cm on map = 200cm in real life size)

	DRAWING SIZE	REAL LIFE SIZE
Slide	1.7cm	
Table	0.8cm	
Bench		1.2m
Flower bed	1.1cm	
Youth club building	7.5cm	
Football pitch		8.9m
Soft play area	4.2cm	
Running track		12m
Swings	1.4cm	
Roundabout	2.3cm	

Scale 1:50 (every 1cm on plan = 50cm in real life size)

OBJECT	DRAWING SIZE	REAL LIFE SIZE
Car ramp 1	5.7cm	
Office	15cm	
Work Bench		1.2m
Car ramp 2	1.1cm	
Tyre Area	6.5cm	
MOT Area		5.9m



Scales and Conversions - B

1. A map scale is 1:1500
If the distance on the map is 500cm, what is the actual distance?

2.

A

B

A-B measures 16cm and the scale is 4:4000.
What is the total length in metres?

3. A man walks 1500 metres.
On a map this is shown as 3cm.
What is the scale on the map?

4. The following distances were recorded for a sponsored walk.

NAME	DISTANCE	TIME hrs
J Knowes	2200m	2.5
P Lokin	1600m	2.1
R Fotergill	1400m	2.3
P Willis	2900m	2.5
N Moilk	2400m	2.6

What is the total distance walked in kilometres?

