# 27 Scale Diagrams

By studying this lesson you will be able to

- identify scale diagrams, and
- draw scale diagrams and calculate actual measurements using the scale.

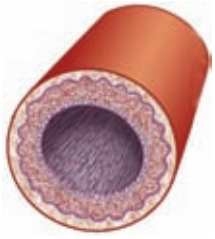
## 27.1 Scale Diagrams

When the shapes of various objects in the environment are being drawn, it is most often difficult to draw them to the actual measurements of the shape. In such situations, the shape is drawn by decreasing or increasing the measurements by a common ratio depending on the size of the shape.

Since the figure is drawn by increasing or decreasing all the measurements by a common ratio, the shape of the figure will be exactly the same as the original shape and only the size will be different. Figures drawn in this manner are called **scale diagrams**. A few such scale diagrams are shown below.


The plan of the floor area of a house; size has been decreased


The map of Sri Lanka; size has been decreased



The cross section of a blood vessel; size has been increased

## 27.2 The Scale of a Scale Diagram

Suppose you want to draw a scale diagram of a flower bed of length 6 m and breadth 2 m in your book. You need to first select a suitable scale.

Suppose 1 cm in the scale diagram represents a length of 1 m of the flower bed.

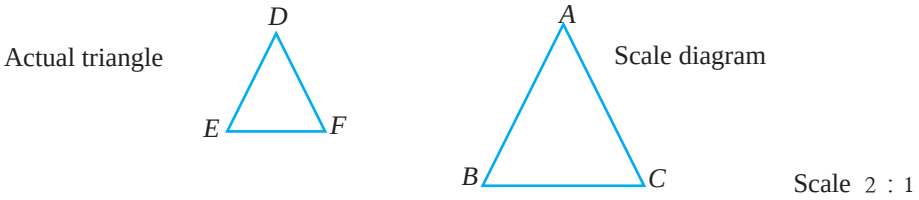
Since 1 m equals 100 cm, a length of 1 cm in the scale diagram represents 100 cm of actual length. As the same unit has been used, this can be expressed as a ratio as 1:100. This ratio is considered as **the scale** of the scale diagram.

Based on the selected scale, a scale diagram of the flower bed can be drawn, with the actual length of the flower bed which is 6 m represented by 6 cm and the actual breadth which is 2 m represented by 2 cm in the scale diagram.


The scale written as 1:100 in the figure expresses the fact that an actual length of 100 cm is represented by 1 cm in the scale diagram.

Observe carefully how the scales of various scale diagrams are indicated.

The scale diagram of the given triangle has been drawn to the scale 2:1.




**Example 1**

Express as a ratio, the scale of a scale diagram where 200 cm is represented by 1cm.

Since the same unit has been used, the scale can be expressed as a ratio as 1:200.

**Example 2**

Express as a ratio, the scale of a scale diagram where 9 m is represented by 2 cm.

Length represented by 2 cm = 9 m
Length represented by 2 cm = 900 cm
Length represented by 1 cm = 900 ÷ 2 cm
= 450 cm

The scale is 1 : 450

**Example 3**

Express as a ratio, the scale of a scale diagram where 2 mm is represented by 1 cm.

Length represented by 1cm = 2 mm
Length represented by 10 mm = 2 mm

The scale is 10 : 2 or 5 : 1
This scale is used to magnify a small object.

**Exercise 27.1**

(1) Express the scale as a ratio in each of the following cases.

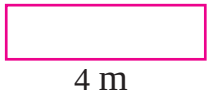
(i) Representing 20 cm by 1 cm (ii) Representing 8 m by 2 cm
(iii) Representing 1 m by 4 cm (iv) Representing 1 mm by 5 cm
(v) Representing 6 mm by 3 cm

## 27.3 Drawing scale diagrams

Let us gain an understanding of scale diagrams by considering the following examples.

Let us draw a scale diagram of the blackboard in the classroom.

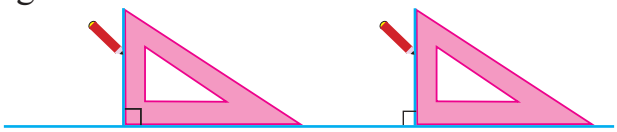
- The blackboard is rectangular in shape.
- Its length is 4 m and its breadth is 1 m.
- Let us consider that 1 m is represented by 1 cm as the scale. That means the scale is 1:100.
- So the scale diagram should be a rectangle of length 4 cm and breadth 1 cm.
- Let us mark the measurements in a sketch.



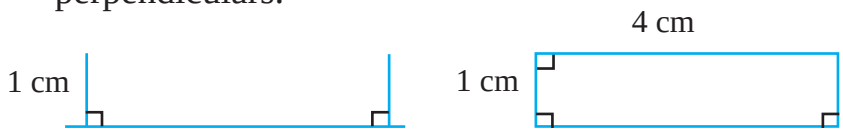
Follow the given steps to draw the scale diagram with this length and breadth.

**Step 1** - Draw a straight line segment of length 4 cm using the ruler and the pencil.


**Step 2** - Draw two perpendiculars of length 1 cm each at the two ends of the straight line segment using the set square as shown in the figure.




**Step 3** - Complete the rectangle by joining the end points of the two perpendiculars.




## Exercise 27.2

(1) The length of a hall in a particular school is 20 m and the width (breadth) is 8 m.
   (i) Select a suitable scale to draw the floor plan of the hall and write it as a ratio.
   (ii) Draw a scale diagram of the floor plan of the hall.

(2) The side length of a square shaped land is 24 m. Draw a scale diagram of the land using the scale 1:600.

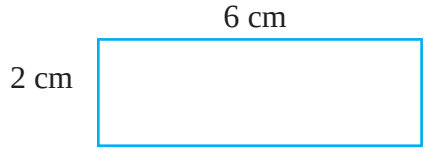
(3) The length of a rectangular building is 30 m and the width is 18 m.
   (i) Select a suitable scale to draw the scale diagram of the floor of the building.
   (ii) Draw the scale diagram of the floor of the building using the selected scale.

## 27.4 Obtaining actual measurements from scale diagrams

Let us see how the actual measurements can be obtained from a given scale diagram by considering a few examples.

A scale diagram of a land drawn to the scale 1:500 is shown in the figure. Let us find;

(i) the actual length of the land,
(ii) the actual width of the land,
(iii) the actual area of the land.




The scale 1:500 indicates that 500 cm or 5m of the actual length of the land is represented by 1 cm in the scale diagram.

Therefore;

(i) the actual length of the land = $6 \times 5$ m $= 30$ m
(ii) the actual width of the land = $2 \times 5$ m $= 10$ m
(iii) the actual area of the land = length $\times$ width $= 30 \times 10$ m$^2$
$= 300$ m$^2$

**Example 1**

A square shaped land is drawn to the scale 1: 400. The side length of the scale drawing is 2.5 cm. Calculate the side length of the land.

1 : 400 means that 400 cm or 4 m is represented by 1 cm in the scale diagram.

Therefore, side length of the land $= 2.5 \times 4$ m
$= 10$ m

**Example 2**

What length in a scale diagram drawn to the scale 1: 10 000 represents an actual length of 1 km?

1:10 000 means that 10 000 cm is represented by 1 cm in the scale diagram.
10 000 cm $= 100$ m $= 0.1$ km
That is, 0.1 km is represented by 1 cm in the scale diagram.
$\therefore$ 1 km is represented by 10 cm in the scale diagram.

## Exercise 27.3

(1) In a map drawn to the scale 1:200,

(i) find the actual length represented by 3 cm.

(ii) find the actual length represented by 5 cm.

(iii) what length in the map represents an actual length of 8 m?

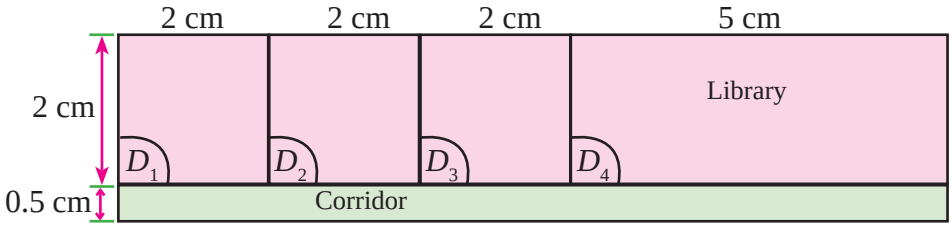
(2) In a map drawn to the scale 1:200 000,

(i) what is the actual distance between two cities indicated by a distance of 7 cm?

(ii) what length in the map represents a distance of 1 km?

(iii) If the distance from Colombo to Balangoda along the A4 road is 142 km, what is the distance between the two cities in the map?

(3) A scale diagram of the ground floor of a multi-storey building in a school is shown below. The floor plan consists of 3 classrooms, a library and a corridor. The scale is 1:200.




(i) Find the actual length and width of a classroom in metres.

(ii) Find the actual area of a classroom.

(iii) Find the actual area of the library.

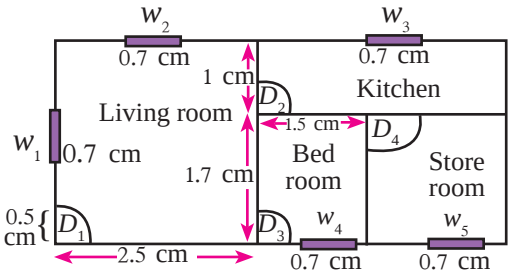
(iv) Find the actual area of the corridor.

(4) The floor plan of a house is shown in the figure. The scale is 1:200.

(i) Find the actual width of the door $D_1$.

(ii) Find the actual length of the window $w_1$.

(iii) Find the actual length and width of the bedroom and hence find the area of the bedroom.



(iv) Find the area of the living room.

(v) It is proposed to lay tiles in the living room. Estimate the number of square tiles of side length 50 cm required for this purpose.

## Summary

- When a scale diagram of a shape is being drawn, it has to be done by decreasing or increasing the measurements by a common ratio, depending on the size of the shape.
- The ratio of a unit length to the actual length represented by a unit length in a scale diagram is considered as the scale of the scale diagram.