M1 Maths

G2-1 Maps and Scales

- maps and plans with legends and scales

Summary Learn Solve Revise Answers

Summary

A map or plan is a diagrammatic view of an area from directly above. They show the features of interest to the person using it.

Maps and plans are often accompanied by legends (or keys) showing what symbols are used for different objects.

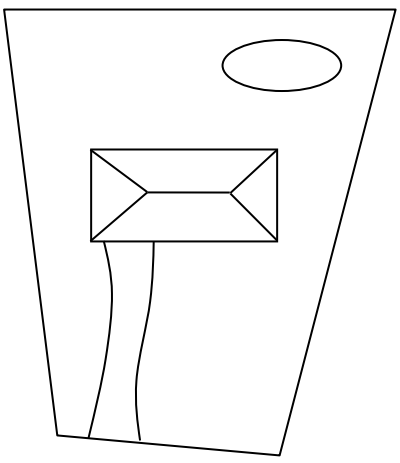
Maps and plans are often drawn to scale and, generally, the scale is shown. The scale shows what distance on the map corresponds to what distance in real life. It may be expressed as a ratio with units, as a ratio without units or as a bar.

Learn

Maps and Plans

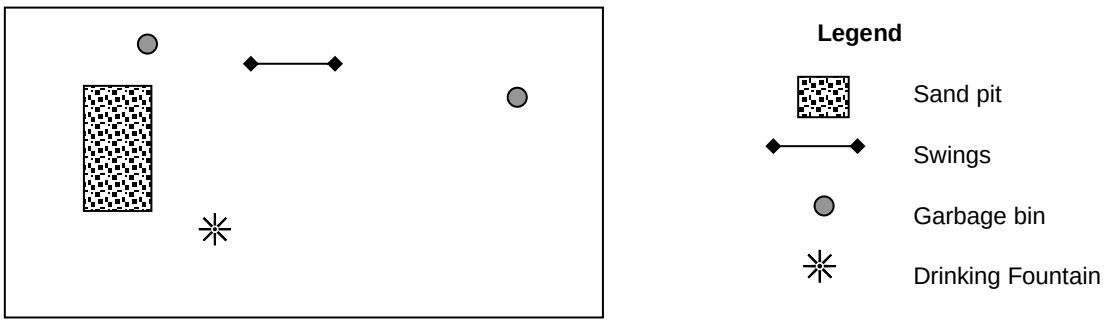
A map and a plan are really pretty much the same thing. We tend to talk about a map of a large area like a city, a country or the world. We talk about a plan of something smaller like a building or a garden. They work the same way though. They are both diagrammatic views from directly above. They show just the features of interest to the person using them.

The plan below is of a block of land, showing the house, drive and pool.



Where different types of objects are shown, sometimes symbols are used for the different objects. A legend (sometimes called a key) is then used so that the reader knows what the different symbols mean. The legend is usually placed somewhere around the edge of the map or plan.

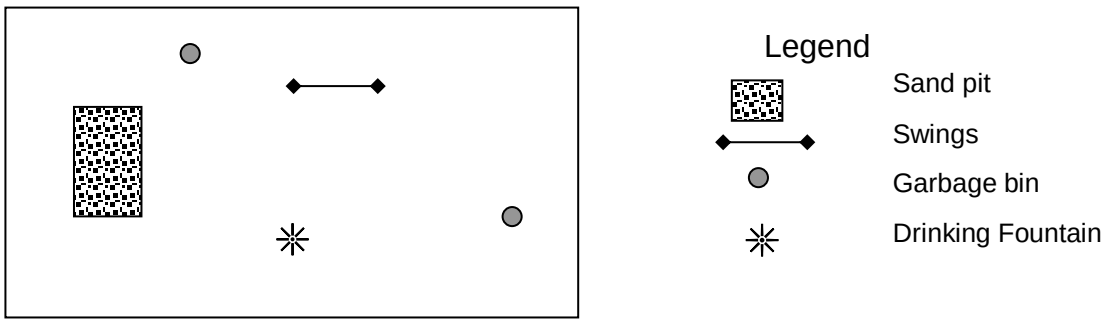
An example is shown below. Look at it until you understand exactly what it is showing.



The best way to get good at interpreting and producing maps and plans is to find some and look at them to see how they work and to draw some plans of things like your classroom, house or garden.

Practice

Q1 Look at the plan of the playground below.



(a) What is the largest object shown in the playground?

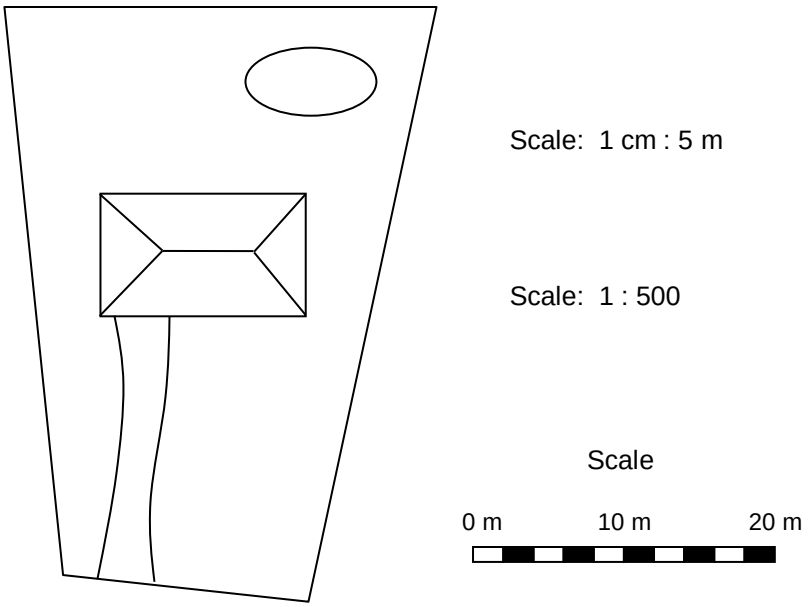
(b) What other object is closest to the swings?

(c) How many drinking fountains are there?

(d) How many garbage bins are there?

Scales

The plan below is of a block of land showing the house, drive and pool.



Maps and plans do not have to be drawn to scale, but most are. If they are to scale, the scale is generally indicated somewhere on the map. This is so the reader can work out the actual distance between the objects shown. The scale can be given in three forms. Each form is shown on the plan above.

Scales with ratios with units

The first scale on the plan is a ratio with units. It shows the length in real life that corresponds to a given length on the plan. This scale shows that 1 cm on the plan represents 5 m in real life.

Something shown as 3 cm on the map will be 15 m in real life. Something shown as 11.2 cm on the map will be 56 m in real life and so on. Every centimetre is 5 m. The length of the pool in the plan is 1.8 cm. That's 1.8 lots of 1 cm. So in real life, the length of the pool is 1.8 lots of 5 m, which is 9 m.

When drawing a plan at a scale of say 1 cm : 2 m, we have to work the other way. So an object 8 m long will show as 4 cm on the plan. This is because 8 m is 4 lots of 2 m and therefore on the plan it will be 4 lots of 1 cm.

Scales as ratios without units

The second scale on the map is given as a ratio without units. It is 1 : 500. This shows that any length on the map corresponds to 500 times the length in real life. In other words real life is 500 times bigger than the map.

To use these scales, it is usually easiest to change them to scales with units. A scale of 1 : 500 means 1 cm : 500 cm or 1 m : 500 m or 1 of any unit to 500 of the same unit. If we use centimetres, then it is 1 cm : 500 cm, which means 1 cm to 5 m. So we now have the scale with units.

Bar scales

The third scale on the plan is a bar scale. The length of the bar represents 20 m in real life. As there are 10 stripes on the bar, the length of each stripe represents 2 m.

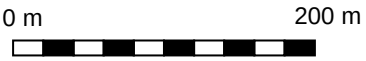
This type of scale is useful for working out roughly how big things are without doing any calculations. If we spaced two fingers at roughly the length of the house, then moved the fingers to the bar scale, we could read off the real-life length.

Practice

Q2 Express the following scales as ratios with units.
(a) 1: 2000 (b) 1: 400 (c) 1: 1000 000 (d) 1:50

Q3 Express the following scales without units.
(a) 1 cm : 1 m (b) 1 cm : 20 cm (c) 1 cm : 200 m
(d) 1 cm : 10 km

Q4 Use a ruler to express this bar scale as a ratio with units and as a ratio without units. [If viewing this on a computer screen, the scale will be different depending on the magnification used.]

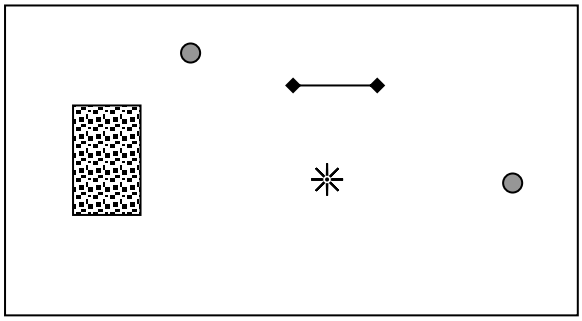


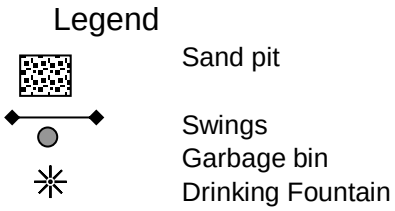
Q5 The scale on a map is 1 cm : 500 m.
(a) Find the real length of something which is 4 cm long on the map.
(b) How long would a 10 km road be on the map?

Q6 The scale on a map is 1:20 000 000.
(a) Find the real distance between two cities which are 3.2 cm apart on the map.
(b) How long would a 170 km river be on the map?

Q7 A 20 km canal is 4 cm long on a map. Give the scale of the map
(a) as a ratio with units
(b) as a ratio without units
(c) as a bar

Q8 The plan below is of a playground.





Scale: 1 cm : 5 m

(a) How long is the sand pit?
(b) How far apart are the garbage bins?
(c) How far is the drinking fountain from the swings?
(d) What is the perimeter of the playground?

Q9 (a) If you drew a plan of a rectangular building 20 m by 8 m at a scale of 1 cm : 2 m, what would its dimensions be on the paper?
(b) A map at a scale of 1 cm : 5 km shows two towns which are 42 km apart in real life. How far apart are they on the map?

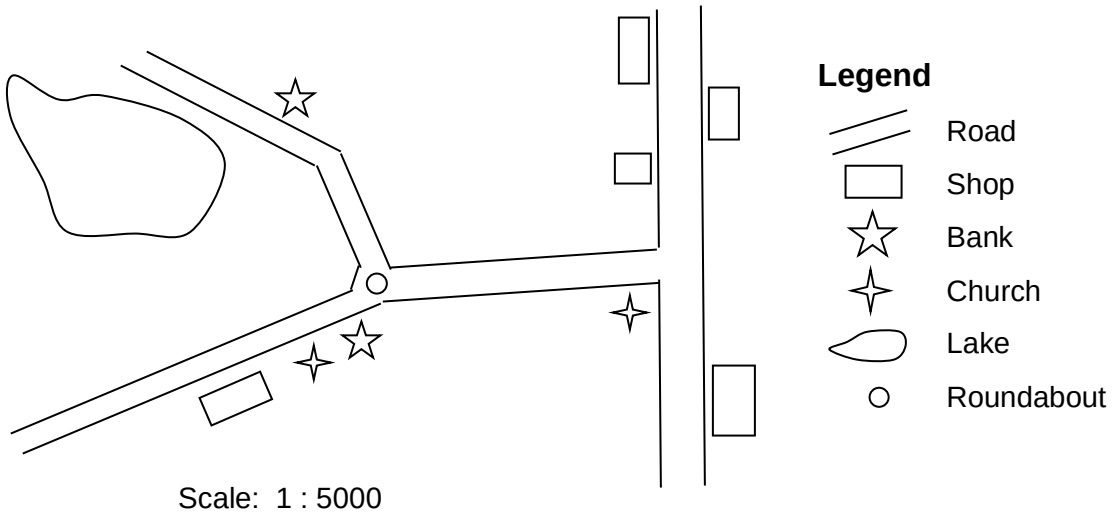
Solve

Q51 A plan of a rectangular circuit board is drawn at a scale of 1:10.

(a) If the board is 5 cm by 4 cm on the plan, what are its dimensions in real life?
(b) What is its area on the plan in square centimetres?
(c) What is its area in real life in square centimetres?
(d) What is the ratio of the areas?
(e) Explain why this ratio is different from the 1:10 ratio of the plan.

Q52 Find your home on Google maps. Set it to show a few streets around your home. Make a map of this area, showing a few interesting features like your house. Give a legend for the features and give the scale in all three forms.

Revision Set 1



Q61 Use the map above of part of a small town to answer these questions.

(a) How many shops are there on the main street that runs up and down the right side of the map?

(b) What is the building across the road from the lake?

(c) How many churches are there?

(d) What is the closet building to the roundabout?

(e) There is a bank next door to one of the churches. What is on the other side of the church?

(f) How long is the lake?

(g) How far apart are the churches?

Q62 Express 1 : 5000 as a ratio with units.

Q63 Express 1 cm : 2 km as a scale without units.

Q64 The scale on a map is 1 cm : 20 km.

(a) Find the real length of something which is 5 cm long on the map.

(b) How long would a 10 km road be on the map?

Q65 The scale on a plan is 1:200.

(a) Find the real distance between two points which are 5.4 cm apart on the plan.

(b) How long would a 170 m long wall be on the plan?

Q66 A 32 km canal is 8 cm long on a map. Give the scale of the map

(a) as a ratio with units

(b) as a ratio without units

(c) as a bar

Q67 If you drew a plan of a rectangular building 15 m by 8 m at a scale of 1:50, what would its dimensions be on the paper?

Q68 A map at a scale of 1 cm : 20 km shows two towns which are 42 km apart in real life. How far apart are they on the map?

Answers

Q1 (a) sand pit (b) garbage bin (c) 1 (d) 2

Q2 (a) 1 cm : 20 m (b) 1 cm : 4 m (c) 1 cm : 10 km (d) 1 cm : 50 cm

Q3 (a) 1: 100 (b) 1: 20 (c) 1: 20 000 (d) 1: 1 000 000

Q5 (a) 2 km (b) 20 cm

Q6 (a) 64 km (b) 8.5 cm

Q7 (a) 1 cm : 5 km (b) 1: 500 000

Q8 (a) 7 m (b) 22.5 m – 26 m (c) 8 m – 9 m (d) 115 m – 120 m

Q9 (a) 10 cm by 4 cm (b) 8.4 cm

Q51 (a) 50 cm by 40 cm (b) 20 cm2 (c) 2000 cm2 (d) 1:100

(e) The scale applies to lengths only. If the scale is 1:10, the length will be 10 times larger making the object 10 times larger, but then the width will also be 10 times larger, making the area 100 times larger. The ratio for areas is the square of the ratio for lengths.

Q61 (a) 4 (b) bank (c) 2 (d) bank (e) shop (f) 150 – 156 m (g) 205 – 215 m

Q62 1 cm : 50 m

Q63 1 : 200 000

Q64 (a) 100 km (b) 5 mm

Q65 (a) 10.8 m (b) 85 cm

Q66 (a) 1 cm : 4 km (b) 1 : 400 000

Q67 30 cm by 16 cm

Q68 2.1 cm