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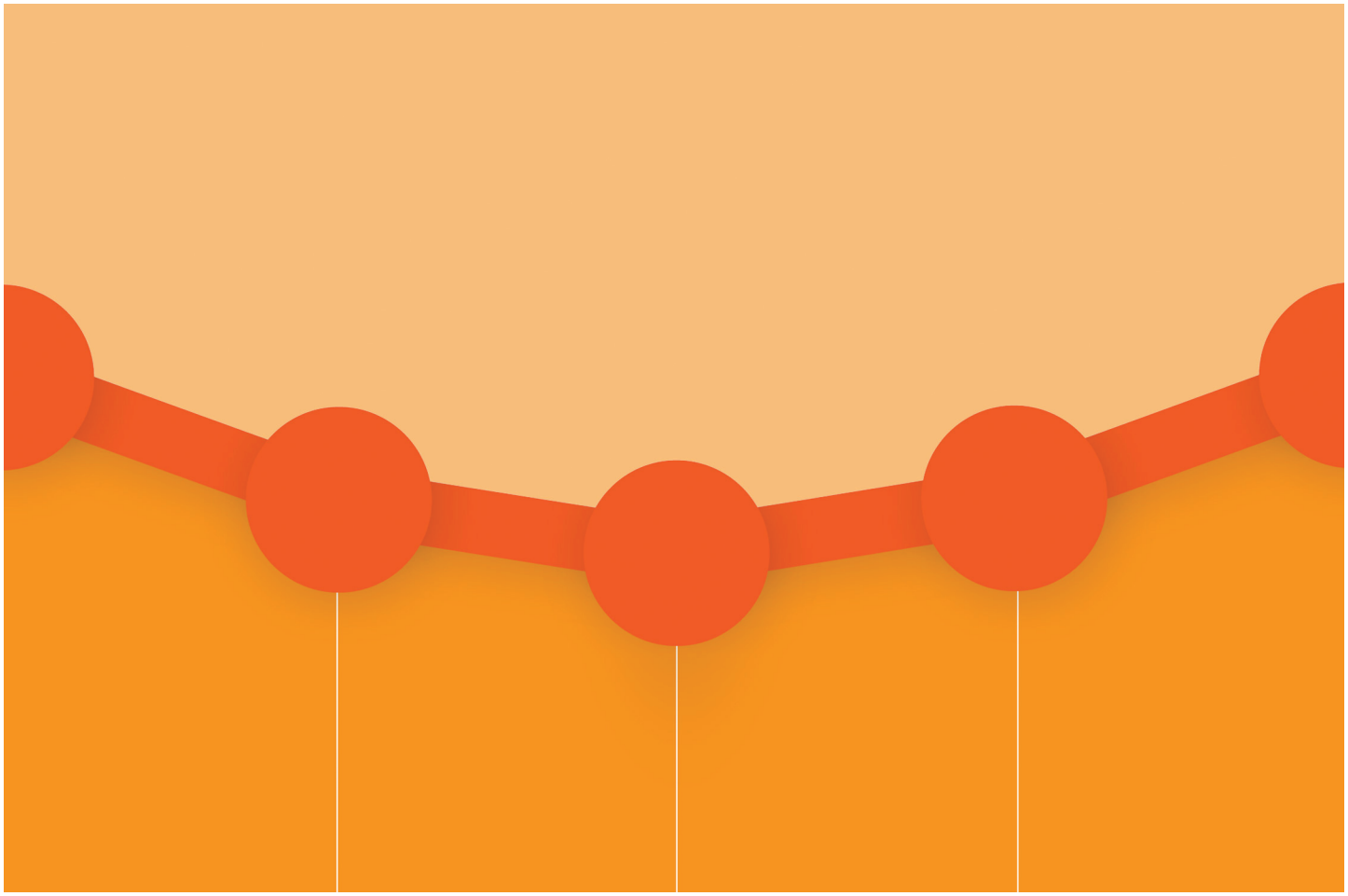
Diagrams, charts and graphs



About this free course

This free course provides a sample of level 1 study in Mathematics: www.open.ac.uk/courses/find/mathematics.

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You can experience this free course as it was originally designed on OpenLearn, the home of free learning from The Open University: www.open.edu/openlearn/science-maths-technology/mathematics-and-statistics/mathematics-education/diagrams-charts-and-graphs/content-section-0.

There you'll also be able to track your progress via your activity record, which you can use to demonstrate your learning.

Head of Intellectual Property, The Open University
Designed and edited by The Open University

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Introduction

This free course has two aims: firstly, to help you read and interpret information in the form of diagrams, charts and graphs, and secondly, to give you practice in producing such diagrams yourself.

To start you will deal with interpreting and drawing diagrams to a particular scale. You will then learn to extract information from tables and charts. Finally you will learn to draw graphs using coordinate axes, which is a very important mathematical technique.

This OpenLearn course provides a sample of level 1 study in Mathematics.

Learning Outcomes

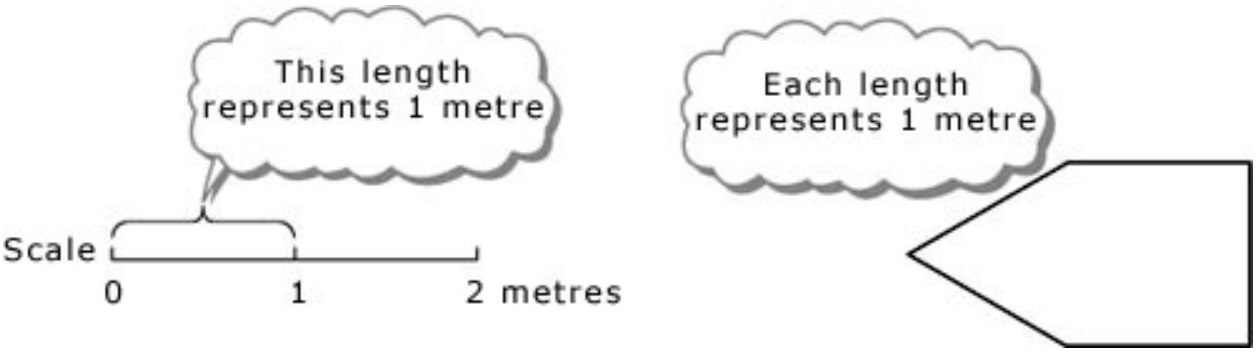
After studying this course, you should be able to:

- draw and interpret scale diagrams
- extract information from tables
- draw, interpret and compare pie charts, bar charts and frequency diagrams
- use and interpret coordinates
- plot points and draw graphs, using suitable axes and scales.

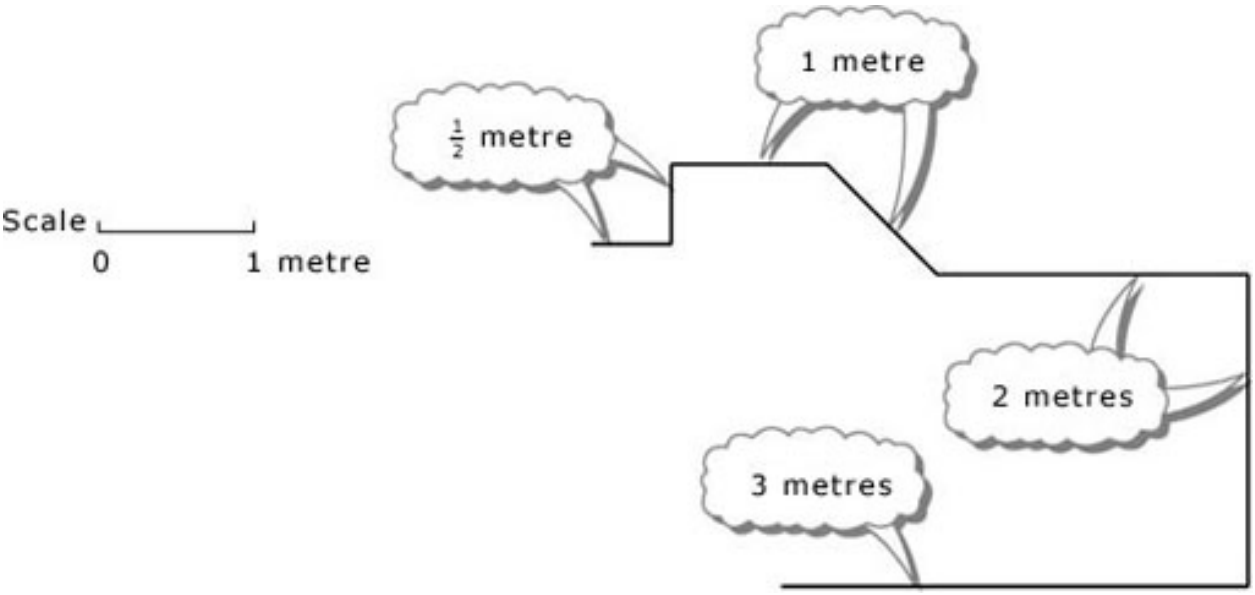
1 Scale diagrams

1.1 Understanding scale diagrams

Plans of houses and instructions for assembling shelves, etc., often come in the form of **scale diagrams**. Each length on the diagram represents a length relating to the real house, the real shelves, etc. Often a scale is given on the diagram so that you can see which length on the diagram represents a standard length, such as a metre, on the real object. This length always represents the *same* standard length, wherever it is on the diagram and in whatever direction.



Other lengths may represent fractions or multiples of this standard length. Thus, lengths which are half as long on the diagram represent lengths which are half as long in reality; lengths which are twice as long on the diagram represent lengths which are twice as long in reality; and so on.



Scale diagrams are often drawn on a square grid. It is then possible to count squares on the grid rather than measure lengths on the diagram. Care must be taken with either

method: the ends of a length may fall between the marks on the ruler, or the grid lines may not be equally spaced.

Example 1

Below is a scale plan of a bathroom. Answer the questions listed below the plan. You might want to show the ruler and then drag it to make your measurements.

The background squares show the length representing 1 m.

Interactive content is not available in this format.

Click on 'Reveal answer' for a detailed solution.

Answer

On the plan, the top and bottom walls are 3 squares wide, and so the bathroom is 3 m wide. The side walls in the diagram are 3 and a bit squares long. If you measure the 'bit', you will find that it is one-fifth of the length representing 1 m, and therefore it represents $\frac{1}{5}$ m or 0.2 m. It follows that the total length of each side wall is 3.2 m. Hence the bathroom measures 3 m by 3.2 m.

The shower in the plan is 1 square in each direction, so in reality it is 1 m by 1 m.

The bath in the plan is nearly 2 squares long. If you measure it on the plan, you will find it is 1 square plus $\frac{8}{10}$ (or 0.8) of a square long. It is also $\frac{8}{10}$ or 0.8 of a square wide on the plan. This means that in reality its dimensions are 1.8 m by 0.8 m.

As the doorframe is about 1 square wide on the plan, the actual door is about 1 m wide.

Example 2

(a) The scale on a diagram is such that 2 cm represent 1 m. What lengths do 6 cm, 0.2 cm, 3 cm, 3.6 cm and 0.5 cm represent?

(b) A window is 2.3 m wide and 1.4 m high. Draw a scale diagram of the window, using a scale in which 2 cm represent 1 m.

Answer

(a) Because you are being asked to convert lengths on the diagram into real lengths, it is easiest to work with a diagram length of 1 cm. As 2 cm represent 1 m, 1 cm will represent 0.5 m. Then

6 cm represent 0.5 × 6 m = 3 m,

0.2 cm represent 0.5 × 0.2 m = 0.1 m,

3 cm represent 0.5 × 3 m = 1.5 m,

3.6 cm represent 0.5 × 3.6 m = 1.8 m,

0.5 cm represent 0.5 × 0.5 m = 0.25 m.

(b) Here 1 m in reality is represented by 2 cm on the diagram. So

2.3 m are represented by 2.3 × 2 cm = 4.6 cm,

1.4 m are represented by 1.4 × 2 cm = 2.8 cm.

The rectangle should be 4.6 cm by 2.8 cm and the 1 metre scale should be represented by 2 cm.

1.1.1 Try some yourself

Activity 1

On the plan of the bathroom in Example 1, what is the width of the window and what are the dimensions of the wash basin?

Answer

The window in the diagram is 1.1 squares wide, so in reality it is 1.1 m wide.

The wash basin in the diagram is $\frac{7}{10}$ of a square deep by $\frac{9}{10}$ of a square wide, so in reality it is 0.7 m by 0.9 m.

Activity 2

On a scale diagram, 5 cm represent 1 m. What lengths do the following represent: 10 cm, 20 cm, 1 cm?

Answer

On the diagram, 5 cm represent 1 m.

As 10 cm are 2 × 5 cm, they represent 2 m.

As 20 cm are 4 × 5 cm, they represent 4 m.

As 1 cm is $\frac{1}{5 \times 5\ \text{cm}}$, it represents $\frac{1}{5}$ m or 0.2 m.

Activity 3

On a map of a new town, 2 cm represent 1 km. What lengths on the map represent the distances of 10 km, 5 km and 0.5 km in the town?

Answer

On the map, 1 km is represented by 2 cm.

Thus:

10 km are represented by 10 × 2 cm = 20 cm;

5 km are represented by 5 × 2 cm = 10 cm;

0.5 km is represented by 0.5 × 2 cm = 1 cm.

Activity 4

Draw a scale plan of the garden described below, using a scale in which 0.5 cm represents 1 m.

The garden is rectangular and measures 10 m by 20 m. It has flowerbeds that are 2 m wide along the whole of one of the long sides and along both of the short sides. A 1.5-m-wide path occupies the rest of the other long side. Another path, also 1.5 m in width, makes a T-junction with this path and leads straight to a sundial at the centre of the garden.

Answer

Your scale plan should look something like this: