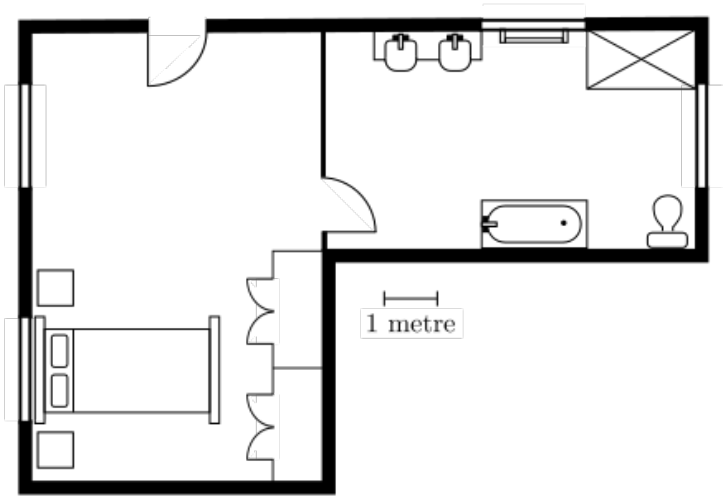
SCALE DIAGRAMS

A DEFINITIONS

Discover: When designing a house, an architect doesn't draw the house at its actual size. That would be far too big to fit on paper! Instead, the architect draws a smaller version of the house where every measurement is reduced by the same amount, called the **scale**. For house plans, a scale of 1:100 is often used, meaning the house is drawn 100 times smaller than it really is.



These smaller versions are called **scale diagrams**.

Definition Scale Diagram

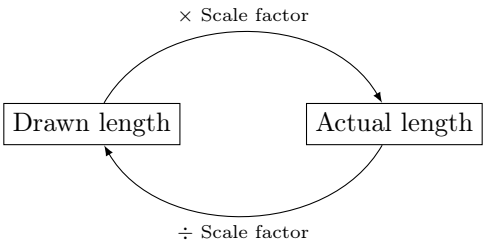
A **scale diagram** is a way of representing an object at a different proportion to its real-world size using a **scale**, which is a ratio expressed as 1:scale factor or 1/scale factor.

$$\frac{1}{\text{Scale factor}} = \frac{\text{Drawn length}}{\text{Actual length}}$$

B FORMULAE

Proposition Formulae

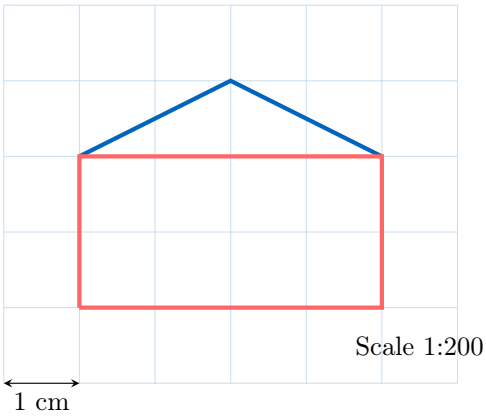
$$\text{Actual length} = \text{Drawn length} \times \text{Scale factor}$$
$$\text{Drawn length} = \text{Actual length} \div \text{Scale factor}$$
$$\text{Scale factor} = \frac{\text{Actual length}}{\text{Drawn length}}$$



Proof

$$\frac{1}{\text{Scale factor}} = \frac{\text{Drawn length}}{\text{Actual length}}$$
$$1 \times \text{Actual length} = \text{Drawn length} \times \text{Scale factor} \quad \text{(cross multiplication)}$$
$$\text{Actual length} = \text{Drawn length} \times \text{Scale factor} \quad \text{(simplification)}$$

Ex: Find the width of this house:



Answer: The drawn width of the house is 4 cm.

$$\begin{aligned}\text{Actual width} &= \text{Drawn width} \times \text{Scale factor}\\ &= 4\,\text{cm} \times 200\\ &= 800\,\text{cm}\\ &= 8\,\text{m}\end{aligned}$$

The actual width of the house is 8 meters.

Ex: For the scale 1:200, find the drawn length corresponding to an actual length of 6 m.

Answer:

$$\begin{aligned}\text{Drawn length} &= \frac{\text{Actual length}}{\text{Scale factor}}\\ &= \frac{6\,\text{m}}{200}\\ &= \frac{600\,\text{cm}}{200} \qquad \text{(unit conversion)}\\ &= 3\,\text{cm}\end{aligned}$$

So, 6 m of actual length represents 3 cm of drawn length.

Ex: 2 cm of drawn length represents 5 m of actual length.
Find the scale factor.

Answer:

$$\begin{aligned}\text{Scale factor} &= \frac{\text{Actual length}}{\text{Drawn length}}\\ &= \frac{5\,\text{m}}{2\,\text{cm}}\\ &= \frac{500\,\text{cm}}{2\,\text{cm}} \qquad \text{(converting to the same units)}\\ &= 250\end{aligned}$$

So, the scale factor is 250.