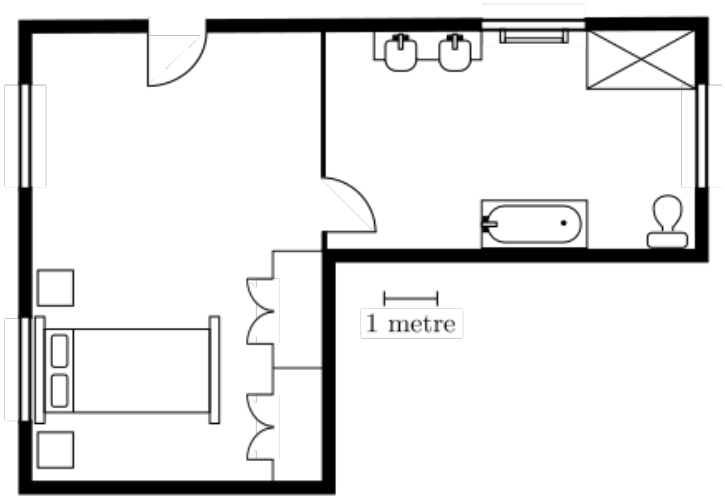
SCALE DIAGRAMS

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 method 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

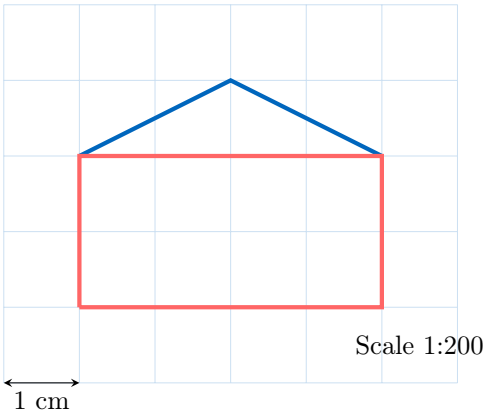
Proposition **Formulae**

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

Proof

$$\begin{aligned} \frac{1}{\text{Scale factor}} &= \frac{\text{Drawn length}}{\text{Actual length}} \\ 1 \times \text{Actual length} &= \text{Drawn length} \times \text{Scale factor} && \text{(cross multiplication)} \\ \text{Actual length} &= \text{Drawn length} \times \text{Scale factor} && \text{(simplification)} \end{aligned}$$

Ex: Find the width of this house:



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

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

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 6m.

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

Ex: 2cm of drawn length represents 5m 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.