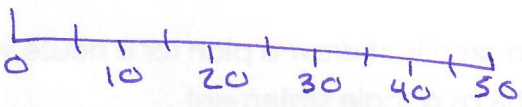
# Lesson #8.3 – Scale Drawings & Models

A **scale drawing** is used to represents objects that are either too large or too small to be drawn to their actual size. In a scale drawing, all parts are in the same proportion of their true size (i.e. **similar**).

A **scale statement** is a ratio of the length of the drawing or model to the length of the actual object. The scale statement can be represented in the four (4) ways:

1. As a Statement (1cm = 50km)
2. As a Rate ($\frac{1\text{cm}}{50\text{km}}$)
3. As a Ratio (1:5,000,000)
4. As a Scale




The **scale factor** is the number used to calculate the dimensions of the actual figure when the dimensions of the model are known, and vice versa.

To write a scale statement, set up a fraction ratio as follows:

$$\textbf{Scale Factor} = \frac{\textbf{model}}{\textbf{actual}} \quad \text{or} \quad \textbf{Scale Factor} = \textbf{model} : \textbf{actual}$$

Where the "model" represents the item being reproduced and the "actual" represents the original or starting item. When calculating Scale Factor your model and actual dimensions ***must have the same units!***

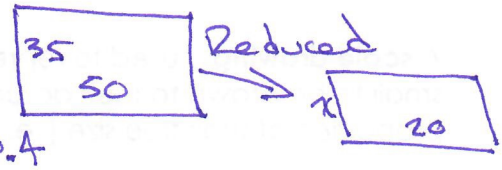
If the scale factor is **greater than 1**, we have an **enlargement** and if less than 1, we have a **reduction**.

**Example 1:** Complete the table.

| Object Length | Image Length | Scale Factor | Enlargement or Reduction |
|---|---|---|---|
| 7cm | 14cm | $\frac{14}{7} = 2$ | Enlargement |
| 15" | 5in | $\frac{5}{15} = \frac{1}{3}$ | Reduction |
| 4m | 6m | $\frac{6}{4} = 1.5$ | Enlargement |
| 8ft | 3.2ft | $\frac{3.2}{8} = 0.4$ | Reduction |

* Backwards $\frac{6}{x} = \frac{1.5}{1} \Rightarrow x = 4$

**Example 2:** A portrait measures 50 cm by 35 cm. The larger side of a reduction of its measures 20 cm.




**a)** What is the scale factor of the reduction?

$SF = \frac{Model}{Actual} = \frac{20cm}{50cm} = \frac{2}{5}$ or $0.4$

**b)** What is the length of the shorter side of the reduction?

$\frac{model}{Actual} = \frac{2}{5} \Rightarrow \frac{x}{35} = \frac{2}{5} \Rightarrow x = 14cm$

**Important:** Scale statements and scale factors ***cannot have decimal numbers or fractions as part of the final answer***. If this occurs, you must multiply or divide to eliminate them.

**Example 3:** An architect drew a plan for a house where ¼ inch represents 1 foot.

**a)** Write this as a scale statement

$SF = \frac{model}{actual} = \frac{1/4"}{12"}$ or $4 \times \frac{1}{4} : 12 \times 4 \Rightarrow 1:48$

1ft = 12"

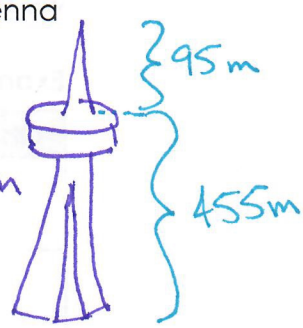
**b)** Write this as a scale factor in the form $\frac{1}{x}$

$SF = \frac{1}{48}$

**c)** If a room has a length of 5 ¼ inches on the plan, how big is it actually?

$\frac{model}{Actual} = \frac{1}{48}$ $\xrightarrow{5.25}$ $\frac{5.25}{x} = \frac{1}{48} \Rightarrow x = 252"$ or $21ft$

**Example 4:** For 34 years, the CN Tower in Toronto was the tallest free-standing structure in the world. It measures approximately 455 metres tall with an antenna that extends another 95 meters. A souvenir model of the tower without the antenna is 9.1 cm tall.




**a)** What is the scale factor used to make the model?

$SF = \frac{model}{Actual} = \frac{0.091m}{455m} = 0.0002$ $9.1cm = 0.091m$

$\frac{2}{10000}$ or $\frac{1}{5000} \Rightarrow 1:5000$

**b)** How long would the antenna be on this model at this scale factor? Express your answer in cm, rounded to 1 decimal place.

$\frac{model}{actual} = \frac{1}{5000} \Rightarrow \frac{x}{95m} = \frac{1}{5000}$ $x = 0.019m$ or $1.9cm$

**Practice Questions: Page 479 #:1 – 4, 6 – 8, 12*, 14***