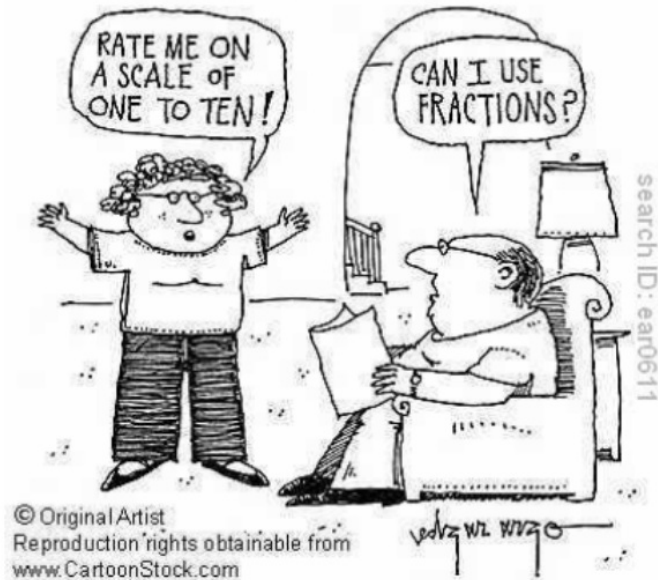


Scale Drawings and Models



Objective: Students will be able to find and use the scale factor to find new measurements for models and real life objects.

Scale Drawings and Models

Have you ever looked at a map, sewed a piece of clothing, built a model or assembled a piece of Ikea furniture? Then most likely you have had to use a scale drawing.

What is a scale drawing or a "to scale model"?

- It is a drawing or model that is the same shape but a bigger or smaller version of the original object.

When would you use a scale drawing?

- Drawing plans for a house, or building, making a model airplane, using a map, putting together a BBQ etc.

What type of jobs would use a scale drawing or model replica?

- engineer, construction worker, sculptor, cartographer, seamstress, architect

Review:

Proportional Reasoning - A proportion is a statement that compares 2 rates or 2 ratios.

- A ratio is a comparison between 2 numbers with the same units.

Examples of Ratio: $\frac{3 \text{ in}}{1 \text{ in}}$; $\frac{1 \text{ cup}}{5 \text{ cups}}$

- A rate is a comparison between 2 numbers with different units.

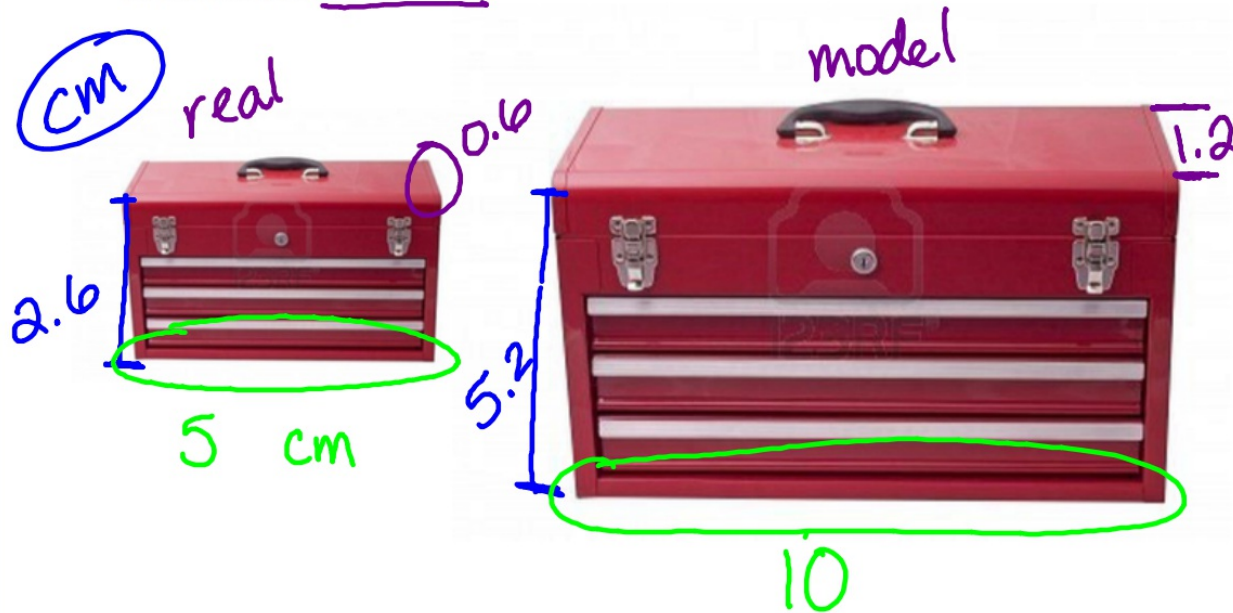
Examples of Rate: $\frac{3 \text{ in}}{100 \text{ km}}$, $\frac{\text{mi}}{\text{hr}}$, $\frac{\$}{\text{hr}}$, $\frac{\text{grams}}{\text{in}}$

If the numerator is 1, then your denominator is the scale factor. If the numerator is not 1, then we need to reduce the fraction into simplest terms.

When we get our numerator to 1, that fraction is our **Scale Factor**.

Scale Factor: is the number the dimensions are dilated by to give the dimensions of the other object. Recall: Enlargements and Reductions. This is usually a fraction.

Example 1: Measure the drawings below. What scale factor was used to find the dimensions of the enlargement?



Scale Factor = 2

Example 2: The ratio of the length to the width of a rectangle is **5:3**. If the rectangle is **24 cm** wide, how long is it?

Length:Width \Rightarrow 5:3 (we can also write it as a fraction)

$$\frac{\text{Length}}{\text{Width}} = \frac{5 \cdot 8 = x}{3 \cdot 8 = 24}$$

$$5 \cdot 8 = 40$$

Note: We always keep the top and bottom in the same units.

$$\frac{40}{24} = \frac{5}{3}$$

$$40\text{cm} = x$$

Proportional Reasoning Worksheet

1. Solve for x.

(a) $\frac{3}{8} = \frac{x}{168}$ $x=63$ (b)

~~$\frac{x}{13} = \frac{7}{91}$~~ $\frac{91}{91} = \frac{91x}{91}$

(c) ~~$\frac{x}{7} = \frac{30}{105}$~~ $\frac{105x}{105} = \frac{210}{105}$ $x=2$ (d)

~~$\frac{408}{x} = \frac{4}{9}$~~ $\frac{408 \cdot 9}{x} = \frac{4 \cdot 9}{9}$ $x=918$

2. Solve the following proportions to one decimal place.

(a) ~~$\frac{5}{6} = \frac{12}{x}$~~ $\frac{5x}{5} = \frac{72}{5}$ $x=14.4$

(b) ~~$\frac{7}{15} = \frac{9}{k}$~~ $\frac{7k}{7} = \frac{135}{7}$ $k=19.3$

(c) ~~$\frac{1.2}{4.9} = \frac{m}{7.3}$~~

(d) ~~$\frac{p}{85} = \frac{76}{39}$~~

$\frac{4.9m}{4.9} = \frac{8.76}{4.9}$ $m=1.8$

$\frac{39p}{39} = \frac{6460}{39}$ $165.6=p$

3. The ratio of Tom's age to Mary's is 3:4. If Tom is 15, how old is Mary?

4. If Georgina travels 355 km in 7 hours, how far will she travel in 8.5 hours at the same rate?

① $\frac{\text{model}}{\text{original}}$



$$\frac{5\text{cm}}{x\text{m}} = \frac{9.5\text{cm}}{30.5\text{m}}$$

$$\frac{9.5x}{9.5} = \frac{152.5}{9.5}$$

$$x = 16.1\text{m}$$

Scale Statements

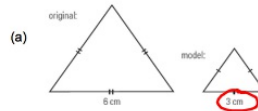
Scale Statement: is a ratio that compares the size of a model to the size of the real object.

Example 1: A model ship scale statement is 1:350. If the model is 1 m long, then how long is the real thing?
350 meters

- We can also write our scale statement as a fraction, which is the scale factor.

$$SF = \frac{\text{Model}}{\text{Real life}} = \frac{1}{350}$$

Example 2: Write a scale statement for the reduced or enlarged object, and calculate the scale factor used to create the reduced or enlarged object.



$$\frac{\text{model}}{\text{real life}} = \frac{3\text{cm}}{6\text{cm}}$$

$$SF = \frac{1}{2}$$

Scale Statement
is 1:2



$$\frac{\text{model}}{\text{real life}} = \frac{15\text{cm}}{3\text{cm}}$$

$$SF = \frac{5}{1} = 5$$

Scale Statement
is 5:1

When the model is smaller than the real life object, the numerator should be 1.

When the model is bigger than the real life object, the denominator will be 1.

(c) A man in a photograph is 2cm tall. His actual height is 1.8m. Write a scale statement and determine the scale factor.

$$\frac{\text{photo height}}{\text{actual height}} \rightarrow \frac{2\text{cm} \div 2}{1.8\text{m} \div 2} = \frac{1\text{cm}}{0.9\text{m}}$$

$$SF = \frac{1\text{cm}}{0.9\text{m}} = \frac{1\text{cm}}{90\text{cm}}$$

Scale Statement $\rightarrow 1:90$

$$\begin{array}{r} 100 \\ \times 0.9 \\ \hline 90.0 \end{array}$$

(d) The man in the photo is 172 cm tall in real life, in the photo graph he is 2.7 cm tall. If the height of the truck in the photograph measures 9.3 cm, what is the height of the actual truck in meters?



$$\frac{\text{model}}{\text{real life}} \rightarrow \frac{2.7 \text{ cm}}{172 \text{ cm}} = \frac{9.3 \text{ cm}}{x \text{ cm}}$$

$$\frac{2.7x}{2.7} = \frac{1599.6}{2.7}$$

$$x = 592.44 \text{ cm}$$

$$\frac{592.44 \text{ cm}}{1} \cdot \frac{1 \text{ m}}{100 \text{ cm}} = \frac{592.44}{100} \text{ m}$$

$$= 5.9244 \text{ m}$$

$$\text{truck height} = \boxed{5.92 \text{ m}}$$