§8-2 to §8-4 Scale Diagrams / Scale factors / Similar Objects

$$\text{scale factor } (k) = \frac{\text{diagram measurement}}{\text{actual measurement}}.$$

expressed as a fraction $\frac{3}{4}$

ratio 3:4

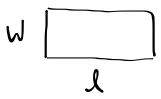
decimal 0.75

% 75%

If $k < 1$, the diagram is a reduction.

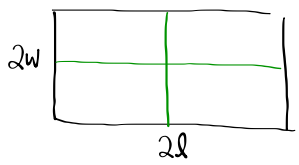
If $k > 1$, the diagram is an enlargement.

How does a scale factor affect the area?



Area = lw

If we double all the dimensions:



Scale factor is 2

New Area = $(2l)(2w)$

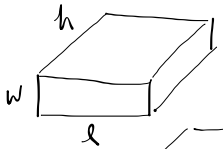
New Area = $2^2 lw$

New Area = 2^2 (old area)

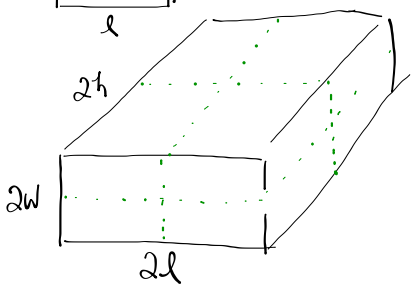
new area = k^2 (old area)

$$k^2 = \frac{\text{new area (diagram)}}{\text{old area (actual object)}}$$

What about volume?



Old Volume = lwh



new volume = $(2l)(2w)(2h)$

new volume = $2^3(lwh)$

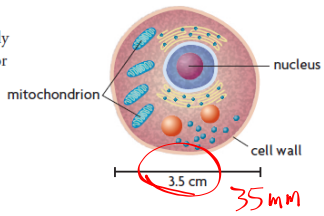
(old volume)

$$k^3 = \frac{\text{new volume}}{\text{old volume}}.$$

p478

EXAMPLE 3 Determining scale factor

The diameter of the animal cell that is represented by this scale diagram is actually 0.25 mm. What scale factor was used to draw this scale diagram?



35 mm

Hannah's Solution

scale factor → $k = \frac{\text{diagram measurement}}{\text{actual measurement}}$

$k = \frac{35\text{ mm}}{0.25\text{ mm}}$

$k = 140$ ← $k > 1$ (enlargement)

The diagram is 140 times bigger than the original object.

Example 1 (p484)

2:25 scale diagram

↑ diagram ↑ object

reduction

area of scale diagram is 20 cm^2

how much fabric is needed for the actual kite?

$k^2 = \frac{\text{area in diagram}}{\text{actual area}}$

$\left(\frac{2}{25}\right)^2 = \frac{20\text{ cm}^2}{A}$

$0.0064 = \frac{20\text{ cm}^2}{A}$

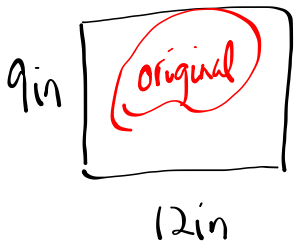
$0.0064A = 20\text{ cm}^2$

$A = \frac{20\text{ cm}^2}{0.0064}$

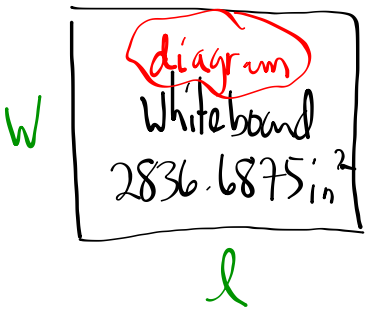
$A = 3125\text{ cm}^2$

Example 2 (p 485)

a) scale factor?



$A = 108 in^2$



$k^2 = \frac{\text{area in diagram}}{\text{area of original}}$

$k^2 = \frac{2836.6875 in^2}{108 in^2}$

$k^2 = 26.265625$

$k = 5.125$

b) The dimensions of the white board will 5.125 times the original laptop:

$W = 5.125 \times 9 in = 46.125 in$

$L = 5.125 \times 12 in = 61.44 in$

} dimensions of white board.

Example 1 (p492)

Are the frying similar?

$$\frac{\text{bottom of large pan}}{\text{bottom of small pan}} = \frac{30\text{ cm}}{20\text{ cm}} = \frac{3}{2}$$

$$\frac{\text{depth of large pan}}{\text{depth of small pan}} = \frac{6\text{ cm}}{4\text{ cm}} = \frac{3}{2}$$

$$\frac{\text{length of handle on large pan}}{\text{length of handle on small pan}} = \frac{24\text{cm}}{16\text{ cm}} = \frac{3}{2}$$

Since all the scale factors are the same for different parts of the objects, we can say that the pans are similar in shape.

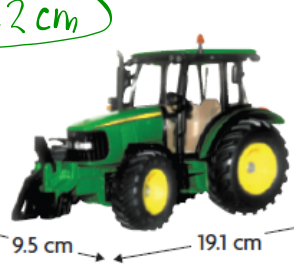
Example 2 (p493)

Scale factor is 1:16

$k = \frac{\text{model dimensions}}{\text{actual dimensions}}$.

we use this eq

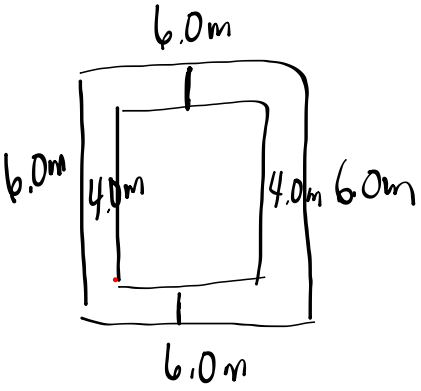
OR



203.2 cm
x16
305.6 cm
x16
x16
152cm
(1.52m)
3.056 m

1:16 means the actual tractor is 16x bigger than the model.

Example 2 (p505)



$h = 3.5$ m restriction

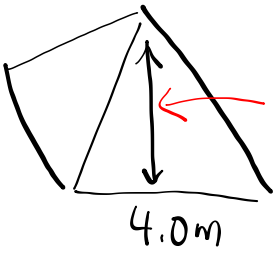
scale factor for base: $k = \frac{4.0\text{m}}{230.4\text{m}}$

use this scale factor → $k = 0.0174$

scale factor for height: $k = \frac{3.5\text{m}}{146.6\text{m}}$

$k = 0.0239$

model height $= 0.0174(146.6\text{m}) = 2.5$ m



$0.0174(186.4\text{m}) = 3.24$ m

Area of 1 triangle $= \frac{1}{2}(4.0\text{m})(3.24\text{m})$
$= 6.486\text{m}^2$

Total Area of $\triangle$ faces $= 4(6.486\text{m}^2)$
$= 26\text{m}^2$

+ Area of Base $= (4.0\text{m})^2$
$= 16\text{m}^2$

42m^2