

Maps and Scale Models

Starter

- (Review of last lesson)** Convert these units to the ones stated:
(a) 0.056 m^3 to cm^3 (b) 290000 mm^2 to m^2
- (Review of previous material)** Simplify these ratios so that they are in the form $1 : n$.
(a) $4 : 20$ (b) $0.5 : 7$ (c) $4 \text{ cm} : 10 \text{ m}$
- (Review of previous material)** Given that the length factor is 5, write down the:
(a) area factor (b) volume factor

Notes

Map Scales

To convert distances on maps:

Either Map distance to real distance: multiply by the map ratio
...or... Real distance to map distance: divide by the map ratio
Then Convert the units, moving up or down by one unit at a time (it is best not to go straight from km to cm).

E.g. 1 The scale of a map is $1 : 6000$. What actual distance, in metres, does 3 cm represent on the map?

Working: Actual distance in cm = $3 \times 6000 = 18000 \text{ cm}$
Actual distance in m = $18000 \div 100 = 180 \text{ m}$

E.g. 2 The scale of a map is $1 : 50000$. Calculate the distance on the map, in cm, when the actual distance between two places is 800 m?

Hint: convert to metres and then kilometres.

E.g. 3 The scale of a map is $1 : 250000$. What actual distance (in km) does 5 cm represent on the map?

Map Ratios

The scale on a map is the length ratio.

Length ratio: $1 : n$

Length ratio to Area ratio: square both numbers $1^2 : n^2 \equiv 1 : n^2$
Length ratio to Volume ratio: cube both numbers $1^3 : n^3 \equiv 1 : n^3$

E.g. 4 Given that the length ratio is $1 : 4$, write down the:

(a) area ratio (b) volume ratio

Working: (a) Square both numbers: $1^2 : 4^2 \equiv 1 : 16$

The area or volume ratio can be used to calculate the the map or actual

E.g. 5 On a map with a scale of 1 : 200, a garden has an area of 6 cm². Calculate the actual area of the garden in m².

Working: Length ratio is 1 : 200
Area ratio is 1² : 200² \equiv 1 : 40000
Actual area of the garden in **cm**² = 6 × 40000 = 240000 cm²
To convert from **cm** to **m** we **divide** by 100.
So to convert from **cm**² to **m**² we **divide** by 100².
 \therefore 240000 cm² \equiv 240000 ÷ 100² m²
 $=$ 240000 ÷ 10000 m²
 $=$ 24 m²

The actual area of the garden is 24 m².

Alternatively:

Map: 6 cm² = 6 cm × 1 cm

Actual (multiply by map ratio): (6 × 200) cm × (1 × 200) cm
1200 cm × 200 cm

Convert to m: 12 m × 2 m = 24 m²

The actual area of the garden is 24 m².

E.g. 6 A map has a scale of 1 : 500. A public playground on the map has an area of 14 cm². Calculate the actual area, in m², of the playground.

E.g. 7 A standard football pitch has area 7140 m². What would the area of the pitch be, in cm, on a scale drawing whose scale is 1 : 90? Give your answer to 3 s.f..

E.g. 8 A diagram of a cuboid has lengths 2 cm, 3 cm and 5 cm. It is scaled up using the ratio 1 : 80. Calculate the actual volume of the cube in m³.

Video: [Maps scales](#)

[Solutions to Starter and E.g.s](#)

Exercise

p149 Ex 19.4 Qu 1-10

Summary

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...or... Real distance to map distance: divide by the map ratio
Then Convert the units, moving up or down by one unit at a time (it is best not to go straight from km to cm).

Map Ratios

The scale on a map is the length ratio.

Length ratio: 1 : n

Length ratio to Area ratio: square both numbers 1 : n^2

Length ratio to Volume ratio: cube both numbers 1 : n^3