

Exercise walk-through

3.1.4

Similarity Scale

AQA · GCSE · Mathematics

22. Scale drawings and maps · Foundation

Scale drawings and maps · Foundation

At 1:25,000, 4 cm represents $100,000 \text{ cm} = 1000 \text{ m} = 1 \text{ km}$. A real 1.5 km path is 150,000 cm, so it measures $150,000 / 25,000 = 6 \text{ cm}$ on the map. A room 6 m by 4 m drawn at 1:100 becomes 6 cm by 4 cm because each metre is 100 cm. Its drawing diagonal is $\sqrt{(6^2 + 4^2)} \approx 7.21 \text{ cm}$ and the real diagonal is about 7.21 m. Enlarging the printed map changes its numerical scale: doubling drawing lengths halves the scale denominator. A scale bar printed with the map enlarges with it.

48. Length, area and volume scale factors · Higher

Length, area and volume scale factors · Higher

For similar shapes with corresponding length factor k , area factor is k^2 and volume factor is k^3 . Name the direction of the comparison: model to real or real to model. Recover k from an area ratio by a square root and from a volume ratio by a cube root. A change in only one dimension does not create similar solids. Higher links corresponding sides to equal trigonometric ratios.

50. Length, area and volume scale factors · Higher

Length, area and volume scale factors · Higher

Enlarging a box from $2 \times 3 \times 4$ to $6 \times 9 \times 12$ multiplies lengths by 3. Its volume changes from 24 to 648, a factor of 27; a 2×3 face changes area from 6 to 54, a factor of 9. Length ratio 2:5 corresponds to area ratio 4:25 and volume ratio 8:125. If similar shapes have areas 20 and 80 cm^2 , the larger-to-smaller length factor is $\sqrt{(80/20)}=2$. If similar solids have volumes 16 and 128 cm^3 , $k=\sqrt[3]{8}=2$. Higher: triangles with the same acute angle have equal opposite/hypotenuse ratios; doubling both lengths leaves $\sin\theta$ unchanged.

Exercises 2.1·2.3

2.1 (Foundation) Find the area factor for length factor 3.

2.2 (Foundation) Find the volume factor for length factor 3.

2.3 (Foundation) Find the length factor when similar areas have ratio 20:80, smaller to larger.

Exercises 2.1·2.3

2.1 (Foundation) Find the area factor for length factor 3.

2.1 A face scales in two directions: $3^2=9$.

2.2 (Foundation) Find the volume factor for length factor 3.

2.2 A solid scales in three directions: $3^3=27$.

2.3 (Foundation) Find the length factor when similar areas have ratio 20:80, smaller to larger.

2.3 The area factor is $80/20=4$; its square root is 2.

Exercise 3.1

3.1 Decide whether this claim is true. Justify with a concrete calculation or counterexample: Doubling all lengths of a solid doubles its volume.

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3.1 False. A cube of side 1 has volume 1; side 2 gives volume 8. A length scale factor 2 gives volume scale factor $2^3=8$.

Local review guidance: show the chosen method; give the checked result; explain the condition or failed shortcut. This is authored classroom guidance.