

3.1.4 Similarity Scale

Name: _____ Class: _____ Date: _____

KEY WORDS area scale factor

<!-- Session 2 native-skill companion -->

Objective

Practise similarity scale within the labelled native lessons. Public original tasks; locally authored answer guidance.

1 Key knowledge and worked examples

■ Length, area and volume scale factors · Foundation

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.

$$\frac{A_2}{A_1} = k^2, \quad \frac{V_2}{V_1} = k^3$$

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 , $k=\sqrt[3]{8}=2$.

Areas do not scale by k , and volumes do not scale by k^2 . Similarity needs every corresponding length to share the same factor. Reversing a ratio requires the reciprocal factor.

AQA R12 Foundation includes ratios and scale factors for lengths, areas and volumes. Higher adds links to similarity including trigonometric ratios. Check dimensions and compare a simple box or rectangle before applying the general factor.

■ 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.

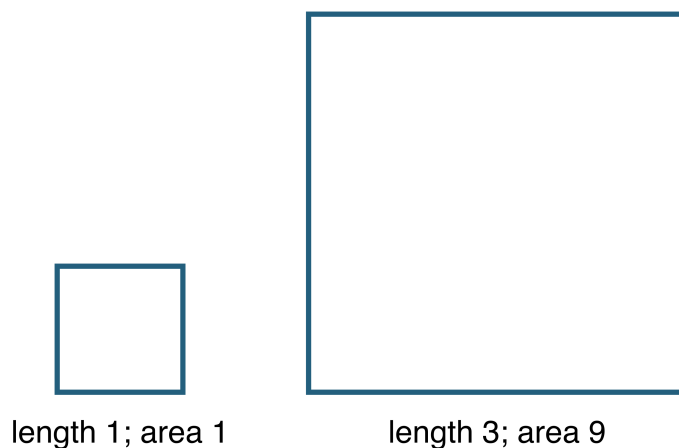
$$\frac{A_2}{A_1} = k^2, \quad \frac{V_2}{V_1} = k^3$$

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.

Areas do not scale by k , and volumes do not scale by k^2 . Similarity needs every corresponding length to share the same factor. Reversing a ratio requires the reciprocal factor.

AQA R12 Foundation includes ratios and scale factors for lengths, areas and volumes. Higher adds links to similarity including trigonometric ratios. Check dimensions and compare a simple box or rectangle before applying the general factor.

A length factor of 3 acts in both area dimensions



Original native-lesson illustration; labels belong to its worked example.

2 Practice

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.

3 Exam-style questions

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

Solutions

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

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

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

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.