

Length, Area and Volume Scale Factors

Starter

1. A square of length 5 units is enlarged by a length factor of 3.
 - (a) Find the area:
 - (i) before and
 - (ii) after the enlargement.
 - (b) State the area factor from the small square to the big square.
 - (c) What is the connection between the length factor of 3 and the area factor you calculated?

Notes

Area factors

As can be seen by question 1 from the starter, if the length factor is 3, then the area factor is $3^2 = 9$.

In general, if the length factor is k , then the area factor is k^2 .

$$\text{Area factor} = \text{Length factor}^2$$

E.g. 1 Two triangles, P and Q, are similar. Triangle P has base length 2 cm and area 7 cm², while Q has base length 8 cm. Find the area of triangle Q.

Working: Length factor *from P to Q* = $\frac{8}{2} = 4$ *small to big so Lf > 1*
Area factor = Length factor² = $4^2 = 16$
Area of triangle Q = Area factor × Area of P
= 16×7
= 112 cm²

E.g. 2 Cylinders A and B are similar shapes and their radii are 5 cm and 4 cm respectively. Given that cylinder A has surface area 100 cm², find the surface area of B.

Volume factors

E.g. 3 We know that if the length factor is k , the **area** factor is k^2 .
What would be the **volume** factor?

Working: The volume factor would be k^3 .

$$\text{Volume factor} = \text{Length factor}^3$$

E.g. 4 The heights of two similar cuboids are 3 m and 6 m respectively. The smaller cuboid has a volume of 45 m³. Calculate the volume of the larger cuboid.

Working: Length factor *from small to big* = $\frac{6}{3} = 2$ *small to big so Lf > 1*
Volume factor = Length factor³ = $2^3 = 8$
Volume of big cuboid = volume factor × volume of small cuboid
= 45×8
= 360 m³

E.g. 5 The diameters of the bases of two similar cones are 8 cm and 20 cm. Given that the smaller cone has volume 56 cm^3 , find the volume of the other cone.

Video: [Similar shapes - areas](#)
Video: [Similar solids - volumes](#)

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

Exercise

p145 Ex 19.3 Qu 4-10

Summary

Area factor = Length factor²

Volume factor = Length factor³

<https://www.mathspanda.com/Y8/WES/Length Area and Volume Scale Factors WES.pdf>