Enlargements and scale factors

Leaving Certificate · Ordinary Level

Understand the idea

How to start

An enlargement multiplies every distance from a stated centre by the same scale factor.

1. Write down the scale factor k.
2. Multiply a length by k, an area by k squared or a volume by k cubed.
3. Check the corresponding units.

Key terms & definitions

Scale factor
New corresponding length divided by original length.

Centre of enlargement
The point from which all distances scale.

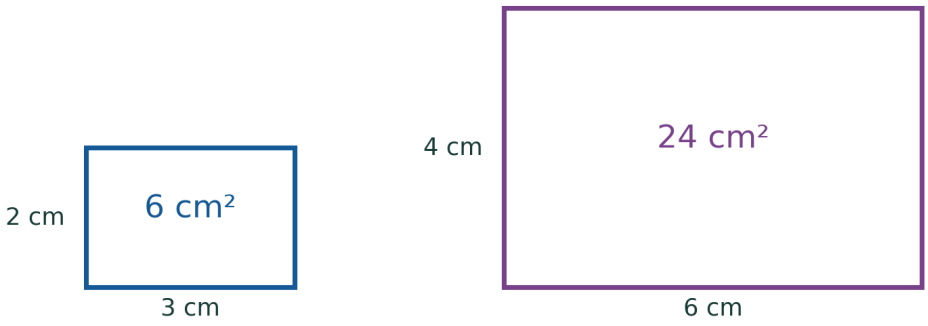
Key ideas

• A scale factor of 2 doubles every length. A factor of one half halves every length.

• Lengths scale by k; areas by k^2 and volumes by k^3 for similar solids.

• Corresponding angles stay the same.

• Use matching lengths to find the scale factor, then use the correct power for area or volume.



A 3 cm by 2 cm rectangle has area 6 cm^2. Doubling both lengths makes a 6 cm by 4 cm rectangle with area 24 cm^2: four times as large.

Quick reminder

- A scale factor of 2 doubles every length. A factor of one half halves every length.
- Lengths scale by k; areas by k^2 and volumes by k^3 for similar solids.

Worked examples

Example 01 · Start here: a length changes by the scale factor

A drawing enlarges a 4 cm length by scale factor 3. Find its new length.

Why this method?

A length is multiplied by the scale factor once. Area and volume use different powers.

$\text{New length} = 3(4)$	**Step 1** Multiply the original length by 3.
$\text{New length} = 12\text{cm}$	**Step 2** The answer is a length, so use cm.

Example 02 · Scale a length

A side is 3 cm. Enlarge it by scale factor 2.

Why this method?

Identify whether the question asks for length, area or volume before choosing a power of the scale factor.

$3(2) = 6\text{cm}$	**Step 1** Multiply the old length by 2.

Example 03 · Scale an area

A similar shape has length scale factor 2. Its original area is 6cm^2. Find the new area.

Why this method?

Identify whether the question asks for length, area or volume before choosing a power of the scale factor.

$k^2 = 2^2 = 4$	**Step 1** Area uses the square of the length scale factor.
$A = 6(4) = 24\text{cm}^2$	**Step 2** Multiply the old area by 4.

Example 04 · Enlarge a point from the origin

Enlarge $(2, 3)$ by scale factor 3 with centre $(0, 0)$.

Why this method?

Identify whether the question asks for length, area or volume before choosing a power of the scale factor.

$(x', y') = (3(2), 3(3))$	**Step 1** With centre at the origin, multiply both coordinates by 3.
$(6, 9)$	**Step 2** State the new point.

Example 05 · Shrink an area

An enlargement has scale factor 0.6. The original area is $50\ \text{cm}^2$. Find the image area.

$0.6^2 = 0.36$	**Step 1** Square the linear scale factor for area.
$50(0.36) = 18\ \text{cm}^2$	**Final step** Multiply the original area by the area factor.

Common mistake

Multiplying area by the length scale factor only once. If all lengths double, the area multiplies by $2^2 = 4$ and the volume by $2^3 = 8$.

Exam technique

Name the centre as well as the scale factor when describing an enlargement.

Try it yourself

Work on paper before checking the answers at the end. These questions are for self-checking, not submitted homework.

Question 1

A length is 10 cm. Reduce it with scale factor 0.4.

Question 2

$A5$ cm length is enlarged by scale factor 4. Find its new length.

Question 3

A solid of volume 10cm^3 is enlarged by scale factor 2. Find its new volume.

Self-check answers

Question 1

4cm

Question 2

20cm.

Lengths use the factor once.

Question 3

80cm^3.

Volume multiplies by 2 cubed, which is 8.

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