Perimeter and area

Leaving Certificate · Ordinary Level

Understand the idea

How to start

Perimeter measures the distance around a shape. Area measures the space inside it.

1. Choose a formula for the shape and name each measurement.
2. Use a perpendicular height, measured at a right angle to the base.
3. Use square units for area, such as cm^2. Use length units for perimeter.

Key terms & definitions

Perimeter
The total length around a shape.

Perpendicular height
A distance measured at a right angle to the base.

Radius
The distance from the centre of a circle to its circumference.

Key ideas

• Perimeter is the distance around a boundary; area measures the surface enclosed.

• Rectangle: $A = lw$. Triangle: $A = \frac{1}{2}bh$ with perpendicular height h.

• Parallelogram: $A = bh$. Trapezium: $A = \frac{1}{2}(a + b)h$ where a and b are parallel sides.

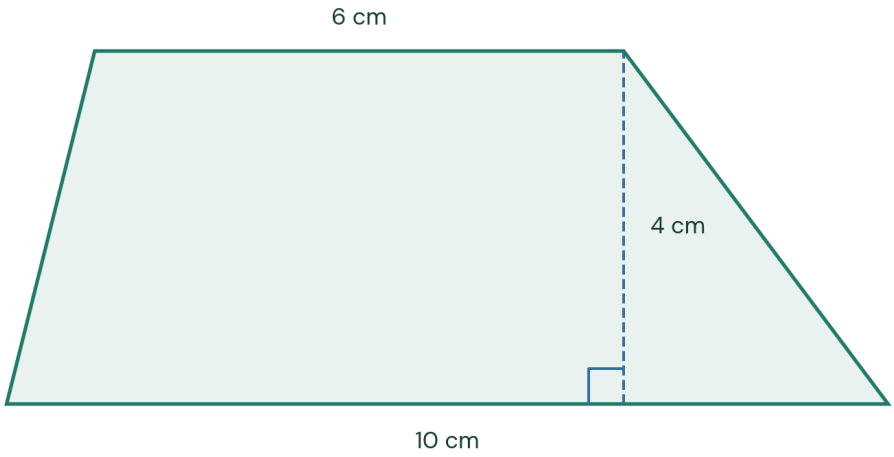
• Circle: $C = 2\pi r$ and $A = \pi r^2$. A diameter is twice the radius.

• Split a composite shape into familiar shapes or subtract a missing part. Count only the outside boundary for its perimeter.

• An arc is part of a circumference: $L = \frac{\theta}{360}2\pi r$ when θ is in degrees.

• A sector is part of a disc: $A = \frac{\theta}{360}\pi r^2$.

• For equally spaced ordinates, the trapezoidal rule estimates area:
$A \approx \frac{h}{2}[y_0 + y_n + 2(\text{sumofinteriorordinates})]$.



Trapezium: average the parallel sides 6 cm and 10 cm, then multiply by the perpendicular height 4 cm.

Quick reminder

• Perimeter: distance around. Area: surface inside.

• Use perpendicular height, not automatically a sloping side.

• Circle formulas use radius, not diameter.

Worked examples

Example 01 · Area and circumference

A circle has diameter 10 cm. Find its exact area and circumference.

Why this method?

Sketch and label the shape. Choose a formula using the perpendicular height or split the shape into familiar pieces.

$r = \frac{10}{2} = 5\text{cm}$	**Step 1** The circle formulas use the radius, which is half the given diameter.
$A = \pi(5)^2 = 25\pi\text{cm}^2$	**Step 2** Substitute the radius into the area formula. Squaring the radius gives square units for the area.

$C = 2\pi(5) = 10\pi\text{cm}$	**Step 3** Use twice the radius in the circumference formula. The answer is a length, so use ordinary length units.

Example 02 · A trapezium

A trapezium has parallel sides 6 cm and 10 cm and perpendicular height 4 cm. Find its area.

Why this method?

Sketch and label the shape. Choose a formula using the perpendicular height or split the shape into familiar pieces.

$A = \frac{1}{2}(a + b)h$	**Step 1** Choose the formula
$A = \frac{1}{2}(6 + 10)(4)$	**Step 2** Substitute
$A = 32\text{cm}^2$	**Step 3** The parallel sides add to 16. Half of 16×4 is 32, with square centimetres for area.

Example 03 · A composite L-shape

$A10$ cm by 8 cm rectangle has $a4$ cm by 3 cm corner removed. Find the remaining area.

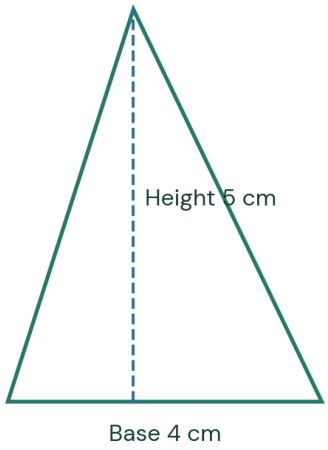
Why this method?

Sketch and label the shape. Choose a formula using the perpendicular height or split the shape into familiar pieces.

$10 \times 8 = 80\text{cm}^2$	**Step 1** Find the whole rectangle
$4 \times 3 = 12\text{cm}^2$	**Step 2** Find the removed part
$80 - 12 = 68\text{cm}^2$	**Step 3** Subtract the removed area from the area of the whole shape. This leaves the area that is still present.

Example 04 · Area of a triangle and of an L-shape

A triangle has a base of 4 cm and a perpendicular height of 5 cm. What is its area?



Triangle with base 4 cm and perpendicular height 5 cm.

Why this method?

Sketch and label the shape. Choose a formula using the perpendicular height or split the shape into familiar pieces.

$\frac{1}{2} \times 4 \times 5$	**Step 1** Area of a triangle $= \frac{1}{2} \times$ base $\times$ height
$= 10 \text{ cm}^2$	**Step 2** Four times five is 20. A triangle is half the corresponding rectangle, so divide 20 by 2.

Think about it: Before moving on: why is the area of a triangle half of base $\times$ height?

Example 05 · A quarter-circle sector

Find the sector area and arc length for radius 4 cm and angle 90°.

Why this method?

Choose the shape formula or approximation first, then substitute measurements with consistent units.

$\frac{90}{360} = \frac{1}{4}$	**Step 1** The angle is one quarter of a full turn.
$A = \frac{1}{4}\pi(4)^2 = 4\pi \text{cm}^2$	**Step 2** Take one quarter of the full disc area.

$L = \frac{1}{4}(2\pi)(4) = 2\pi\text{cm}$	**Step 3** Take one quarter of the full circumference.

Example 06 · Trapezoidal rule: two strips

Three heights are $2m, 4m$ and $3m$, measured $5m$ apart. Estimate the area under the boundary.

Why this method?

Choose the shape formula or approximation first, then substitute measurements with consistent units.

$A \approx \frac{5}{2}[2 + 3 + 2(4)]$	**Step 1** There are two strips, each $5m$ wide. The middle height belongs to both trapezia, so count it twice.
$A \approx \frac{5}{2}(13) = 32.5\text{m}^2$	**Step 2** Add the heights inside the bracket, then multiply. The curved boundary makes this an estimate.

Example 07 · Use the trapezoidal rule

Widths at equal $4m$ intervals are $5, 7, 8$ and $6m$. Estimate the area.

$A \approx \frac{4}{2}[5 + 2(7 + 8) + 6]$	**Step 1** Count the two endpoint widths once and each interior width twice.
$A \approx 82\ \text{m}^2$	**Final step** Multiply the bracket by half the interval width.

Common mistake

Using a sloping side as the height. In $A = \frac{1}{2}bh$, h must meet the chosen base at a right angle. A sloping side can be used as height only if it is perpendicular to that base.

Exam technique

Sketch and mark missing lengths before choosing an area formula.

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 circle has diameter 12 cm. Find its exact area and circumference.

Question 2

A trapezium has parallel sides 8 cm and 14 cm and perpendicular height 5 cm. Find its area.

Watch an explanation

Cognito — Area Formulas - Rectangle, Parallelogram, Triangle & Trapezium

Cognito — Circles - Area & Circumference

Open the website chapter to load the embedded players. Use the rates and rules in your question for financial examples.

Self-check answers

Question 1

$r = 6\text{cm};\ A = 36\pi\text{cm}^2;\ C = 12\pi\text{cm}.$

Halve the diameter first. Area uses the square of the radius; circumference uses the radius once.

Question 2

$A = \frac{1}{2}(8 + 14)(5) = 55\text{cm}^2.$

Average the two parallel lengths, then multiply by the perpendicular height.

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