GCSE ONLINE TUTORING

GEOMETRY & MEASURES / TOPIC GUIDE 42

42

Perimeter and area

Shared GCSE core

Distinguish boundary length from surface coverage, derive familiar area formulas and solve compound-shape problems. Work with perpendicular heights, missing dimensions, algebraic lengths and practical purchase decisions.

Perimeter: length • Area: square units

Use perpendicular heights and count exposed edges.

UNDERSTAND THE IDEA. EXPLAIN THE METHOD.

Detailed teaching • Worked examples • Discussion • Original practice • Full solutions

Name: _____

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Your learning guide

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Independent educational resource

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Before you begin

Multiply lengths, rearrange simple formulae and convert square units.

Your route through this notebook

1. Perimeter and rectangles
2. Triangles and parallelograms
3. Trapezia, kites and compound shapes
4. Algebraic dimensions and practical coverage

How to use it

Read a lesson, cover the worked solutions and try the examples yourself. Complete its practice page before checking the answers at the back. Finish with the mixed review, then return to any method you could not explain.

YOUR PROGRESS

After each lesson, ask: Can I explain the idea? Can I choose a method? Can I check my result? Record any questions you want to revisit.

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LESSON 1 / UNDERSTAND

Perimeter and rectangles

Perimeter is the total length around a shape’s boundary. Area measures the two-dimensional region inside. A rectangle has perimeter 2(l + w) and area lw, but these formulas describe different quantities and have different units. A square of side s has perimeter 4s and area s^2.

For an irregular outline, trace every exposed edge once. Internal joins are not part of the outer perimeter. A rectangular missing side can often be found by subtracting parallel lengths, but check that the shape’s right-angle structure supports the subtraction. Two shapes can share an area and have different perimeters, or share a perimeter and have different areas.

A reliable method

1. Decide whether the question asks for boundary or coverage.

2. Label every needed length and trace the outer edge.

3. Give length units for perimeter and squared units for area.

Worked example 1

A rectangle is 8 cm by 5 cm. Find perimeter and area.

STEP-BY-STEP SOLUTION

Perimeter 2(8 + 5) = 26 cm. Area 8 × 5 = 40 cm^2.

Worked example 2

A rectangle has perimeter 34 m and width 6 m. Find length and area.

STEP-BY-STEP SOLUTION

l + 6 = 17, so l = 11 m. Area = 11 × 6 = 66 m^2.

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LESSON 1 / DISCUSS & PRACTISE

Explain it, then try it

DISCUSSION • TEST THE IDEA

For a square, doubling the side doubles the perimeter but quadruples the area. Length and area do not scale by the same factor.

Say it in your own words

Explain the key idea to someone else. Use a small example to support your explanation. If you disagree with a claim, show why it fails.

1.1 Find perimeter of a 12 cm by 7 cm rectangle.

1.2 Find area of a square with side 9 m.

1.3 A rectangle has area 72 cm^2 and width 8 cm. Find length.

1.4 Compare areas of rectangles 3 by 7 and 4 by 6, each with perimeter 20.

Check before turning to the answers: is the size sensible, is the notation clear, and have you included any required units?

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LESSON 2 / UNDERSTAND

Triangles and parallelograms

A parallelogram has area base × perpendicular height. The sloping side is not the height unless it is perpendicular to the chosen base. A triangle with the same base and height has half that area, so A = bh/2. These formulas follow by cutting and rearranging or pairing congruent triangles.

A height can lie outside an obtuse triangle, because it is measured to the extended base line. Choose a base-height pair that are perpendicular. If the area and one dimension are known, rearrange before calculating the missing dimension. The triangle formula does not require the triangle to be right-angled, only that its height is perpendicular to the selected base.

A reliable method

1. Choose a base and its perpendicular height.

2. Use bh for a parallelogram or bh/2 for a triangle.

3. Check whether a labelled sloping side is actually needed.

Worked example 1

A parallelogram has base 12 cm, perpendicular height 5 cm and sloping side 7 cm. Find area.

STEP-BY-STEP SOLUTION

Area = 12 × 5 = 60 cm². The 7 cm side is not the perpendicular height.

Worked example 2

A triangle has area 42 m² and base 12 m. Find perpendicular height.

STEP-BY-STEP SOLUTION

42 = 12h/2 = 6h, so h = 7 m.

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LESSON 2 / DISCUSS & PRACTISE

Explain it, then try it

DISCUSSION • TEST THE IDEA

Using the hypotenuse as a triangle’s height can overestimate its area. A right-angle mark identifies a valid base-height pair.

Say it in your own words

Explain the key idea to someone else. Use a small example to support your explanation. If you disagree with a claim, show why it fails.

2.1 Find area of a triangle with base 15 cm and height 8 cm.

2.2 Find area of a parallelogram with base 9 m and height 4.5 m.

2.3 A triangle has area 30 cm² and height 5 cm. Find base.

2.4 Why is the sloping side of a non-rectangular parallelogram not generally its height?

Check before turning to the answers: is the size sensible, is the notation clear, and have you included any required units?

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LESSON 3 / UNDERSTAND

Trapezia, kites and compound shapes

A trapezium with parallel sides a,b and perpendicular distance h has area (a + b)h/2. This averages the two parallel lengths and multiplies by the height. A kite with perpendicular diagonals d_1,d_2 has area $d_1d_2/2$. Do not use the trapezium formula on two arbitrary sides or a kite formula without the required diagonal geometry.

For a compound shape, split into familiar non-overlapping regions or subtract a missing region from a larger shape. Label the missing dimensions before calculating. Area joins are counted once, but for perimeter only the exposed edges matter. Add or subtract shapes in matching units.

A reliable method

1. Mark parallel sides, perpendicular heights or perpendicular diagonals.

2. Choose a non-overlapping split or a whole-minus-gap method.

3. Check dimensions and count only the intended region.

Worked example 1

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

STEP-BY-STEP SOLUTION

$A = (6 + 10) \times 4/2 = 32$ cm².

Worked example 2

An L-shape is a 10 m by 8 m rectangle with a 4 m by 3 m corner removed. Find area and outer perimeter.

STEP-BY-STEP SOLUTION

Area = 80 − 12 = 68 m². For a corner cut-out aligned with the sides, the removed outer lengths are replaced by equal inner step lengths, so perimeter remains 2(10 + 8) = 36 m.

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LESSON 3 / DISCUSS & PRACTISE

Explain it, then try it

DISCUSSION • TEST THE IDEA

Removing a corner reduces area but does not always reduce perimeter. Trace the new boundary rather than subtracting twice the cut-out dimensions blindly.

Say it in your own words

Explain the key idea to someone else. Use a small example to support your explanation. If you disagree with a claim, show why it fails.

3.1 Find trapezium area for parallel sides 9 m,15 m and height 6 m.

3.2 A kite has perpendicular diagonals 12 cm and 7 cm. Find area.

3.3 A 12 by 9 rectangle loses an interior 3 by 4 rectangular hole. Find remaining area.

3.4 For that interior hole, find total boundary length including the hole.

Check before turning to the answers: is the size sensible, is the notation clear, and have you included any required units?

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LESSON 4 / UNDERSTAND

Algebraic dimensions and practical coverage

If a side is expressed algebraically, apply the same geometry formula before simplifying. A rectangle with sides x and x + 4 has area $x(x + 4) = x^2 + 4x$ and perimeter 4x + 8. A stated area or perimeter can produce an equation; reject solutions that make lengths non-positive.

For paint, tiles or flooring, identify the usable coverage per pack or coat. Calculate total required coverage, divide by pack coverage and round up only when whole packs must be bought. Extra waste or overlap should be added only when specified. For paint, distinguish wall area from the total application area across several coats.

A reliable method

1. Build the geometric expression or equation first.

2. Solve and check length restrictions.

3. For purchases, include stated coats or waste before rounding whole packs.

Worked example 1

A rectangle has sides x and x + 3, perimeter 30 cm. Find area.

STEP-BY-STEP SOLUTION

$2x + 2(x + 3) = 30$ gives x = 6 cm; other side 9 cm. Area = 54 cm^2.

Worked example 2

A wall area is 27 m^2 and needs two coats. Paint covers 10 m^2 per litre per coat. Find litres and 2.5-litre tins required.

STEP-BY-STEP SOLUTION

Application area 54 m^2. Paint 54/10 = 5.4 litres. Tins 5.4/2.5 = 2.16, so buy 3 tins.

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LESSON 4 / DISCUSS & PRACTISE

Explain it, then try it

DISCUSSION • TEST THE IDEA

A coverage figure must be read with its unit and coat assumption. Doubling coats doubles paint use in a constant-coverage model, not the physical wall area.

Say it in your own words

Explain the key idea to someone else. Use a small example to support your explanation. If you disagree with a claim, show why it fails.

4.1 Write area of a rectangle with sides 2x and x + 5.

4.2 A square has perimeter 44 cm. Find area.

4.3 A 24 m² floor uses tiles covering 0.4 m² each. How many, ignoring waste?

4.4 Flooring covers 3 m² per pack. Required area is 26 m² plus 10% stated waste. Find packs.

Check before turning to the answers: is the size sensible, is the notation clear, and have you included any required units?

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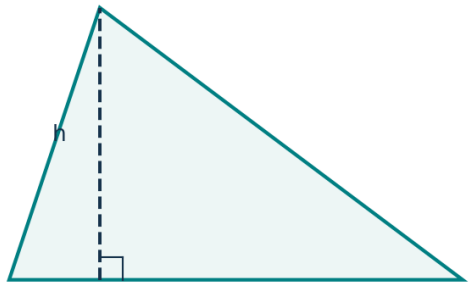
VISUAL EXPLAINER / RELATIONSHIPS, NOT GUESSWORK

Read the geometry

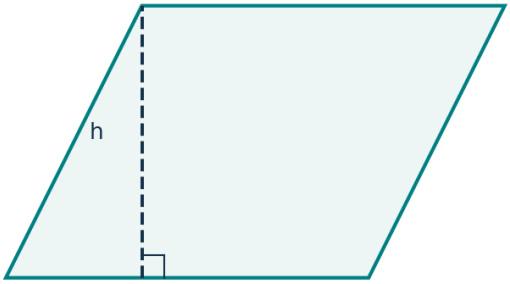
Separate boundary length from area and use true heights

Triangle



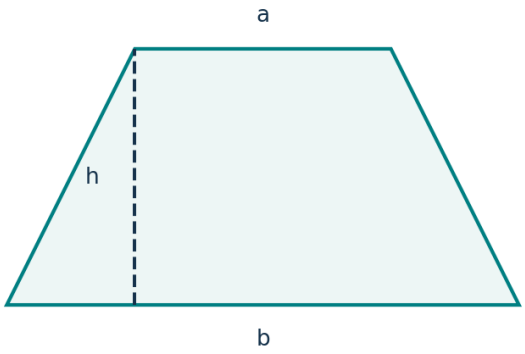
A = bh/2

Parallelogram



A = bh

Trapezium



A = (a + b)h/2

Corner cut-out



WHAT THE FIGURES ESTABLISH

The dashed heights in the first three panels are perpendicular to their bases. A sloping edge is not generally a height. The L-shape is a labelled 10 by 8 rectangle with a 4 by 3 corner removed: area is 68 m², while its outer perimeter remains 36 m. Illustrative lengths are not to scale in that panel.

Discuss: identify the given information, the geometric condition and the conclusion. Recalculate a labelled result or explain a theorem without measuring the sketch. Unless explicitly stated, diagrams are illustrative and are not measurement questions.

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MIXED REVIEW / ORIGINAL EXAM-STYLE PRACTICE

Apply your learning • 1

These questions are independently authored, not taken or adapted from past papers. Marks are suggested for self-assessment. Show your method and explain decisions. Use a calculator only where the arithmetic requires it.

R1. Find perimeter and area of an 11 cm by 6 cm rectangle. [2 marks]

R2. A triangle has base 14 m and perpendicular height 9 m. Find area. [2 marks]

R3. A parallelogram has base 16 cm and area 120 cm². Find height. [2 marks]

R4. Find trapezium area for parallel sides 8 cm,13 cm and height 6 cm. [2 marks]

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MIXED REVIEW / ORIGINAL EXAM-STYLE PRACTICE

Apply your learning • 2

These questions are independently authored, not taken or adapted from past papers. Marks are suggested for self-assessment. Show your method and explain decisions. Use a calculator only where the arithmetic requires it.

R5. A 15 m by 10 m rectangle loses a 4 m by 6 m corner. Find remaining area. [3 marks]

R6. A kite has perpendicular diagonals 18 cm and 11 cm. Find area. [2 marks]

R7. A rectangle has sides x and x + 2 and perimeter 28 cm. Find its area. [4 marks]

R8. A 32 m² floor requires 15% extra material. Packs cover 2.5 m². Find minimum packs. [3 marks]

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SOLUTIONS / LESSON PRACTICE

Check the reasoning

Your layout may differ. Compare the mathematical reasoning as well as the final answer. Correct any error, then reattempt the question without looking.

Lesson 1 • Perimeter and rectangles

1.1 Find perimeter of a 12 cm by 7 cm rectangle.

38 cm.

1.2 Find area of a square with side 9 m.

81 m².

1.3 A rectangle has area 72 cm² and width 8 cm. Find length.

9 cm.

1.4 Compare areas of rectangles 3 by 7 and 4 by 6, each with perimeter 20.

Areas 21 and 24 square units: equal perimeters do not force equal areas.

Lesson 2 • Triangles and parallelograms

2.1 Find area of a triangle with base 15 cm and height 8 cm.

60 cm².

2.2 Find area of a parallelogram with base 9 m and height 4.5 m.

40.5 m².

2.3 A triangle has area 30 cm² and height 5 cm. Find base.

b = 2 × 30/5 = 12 cm.

2.4 Why is the sloping side of a non-rectangular parallelogram not generally its height?

Height is the perpendicular distance between parallel bases; the sloping edge is not perpendicular.

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SOLUTIONS / LESSON PRACTICE

Check the reasoning • continued

Lesson 3 • Trapezia, kites and compound shapes

3.1 Find trapezium area for parallel sides 9 m,15 m and height 6 m.

72 m².

3.2 A kite has perpendicular diagonals 12 cm and 7 cm. Find area.

42 cm².

3.3 A 12 by 9 rectangle loses an interior 3 by 4 rectangular hole. Find remaining area.

108 − 12 = 96 square units.

3.4 For that interior hole, find total boundary length including the hole.

Outer 2(12 + 9) = 42; inner 2(3 + 4) = 14. Total boundary 56 units.

Lesson 4 • Algebraic dimensions and practical coverage

4.1 Write area of a rectangle with sides 2x and x + 5.

$2x^2 + 10x$.

4.2 A square has perimeter 44 cm. Find area.

Side 11 cm, area 121 cm².

4.3 A 24 m² floor uses tiles covering 0.4 m² each. How many, ignoring waste?

24/0.4 = 60 tiles.

4.4 Flooring covers 3 m² per pack. Required area is 26 m² plus 10% stated waste. Find packs.

26 × 1.1 = 28.6 m²; 28.6/3 ≈ 9.533, so 10 packs.

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SOLUTIONS / MIXED REVIEW

Answers and marking guidance

Award the suggested method marks for valid working, even where a later arithmetic slip occurs. Do not count the same step twice. These are independent teaching allocations, not official exam-board mark schemes.

R1. Find perimeter and area of an 11 cm by 6 cm rectangle. [2 marks]

34 cm and 66 cm². [1 each.]

R2. A triangle has base 14 m and perpendicular height 9 m. Find area. [2 marks]

14 × 9/2 = 63 m². [1 for formula; 1 for result.]

R3. A parallelogram has base 16 cm and area 120 cm². Find height. [2 marks]

120/16 = 7.5 cm. [1 for rearrangement; 1 for result.]

R4. Find trapezium area for parallel sides 8 cm,13 cm and height 6 cm. [2 marks]

(8 + 13) × 6/2 = 63 cm². [1 for formula; 1 for result.]

R5. A 15 m by 10 m rectangle loses a 4 m by 6 m corner. Find remaining area. [3 marks]

150 − 24 = 126 m². [1 for each rectangle; 1 for subtraction.]

R6. A kite has perpendicular diagonals 18 cm and 11 cm. Find area. [2 marks]

18 × 11/2 = 99 cm². [1 for formula; 1 for result.]

R7. A rectangle has sides x and x + 2 and perimeter 28 cm. Find its area. [4 marks]

4x + 4 = 28 gives x = 6; sides 6 and 8; area 48 cm². [1 for model; 1 for x; 1 for sides; 1 for area.]

R8. A 32 m² floor requires 15% extra material. Packs cover 2.5 m². Find minimum packs. [3 marks]

Required 36.8 m²; 36.8/2.5 = 14.72; buy 15 packs. [1 for waste; 1 for division; 1 for rounding.]

Reflect, repair and revisit

Record one secure method, one mistake you corrected and one question to retry. Reattempt the questions you missed in a few days. Explain why your new method works before you compare your answer.

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