

GCSE MATHS

Perimeter and area

Long workbook

Questions on GCSE Maths topics, including challenges beyond typical exam questions.

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Topic recap

Perimeter

Add the lengths around the outside. Internal dividing lines do not belong to the perimeter.

Straight-sided shapes

Rectangle area is length times width. Triangle area is half base times perpendicular height. Parallelogram area is base times perpendicular height.

Trapezia and circles

Trapezium area is half the sum of the parallel sides times their perpendicular separation. Circle area is πr^2 and circumference is $2\pi r$.

Units

Use matching length units before calculating. Areas use square units. For a missing length, rearrange the area formula.

A calculator may be used. Give exact answers unless rounding is requested.

Calculate from the given lengths; do not measure the diagrams.

1. Rectangles and triangles

Example Problem 1

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A rectangle has perimeter 30 cm and length 9 cm. Find its area.



The idea

1. Find the width from half the perimeter, then multiply.

Worked Solution

$$w = 30/2 - 9 = 6 \text{ cm}$$

$$A = 9(6) = 54 \text{ cm}^2$$

Half the perimeter is length plus width.

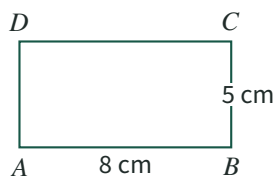
Multiply the dimensions.

1 Rectangles and triangles

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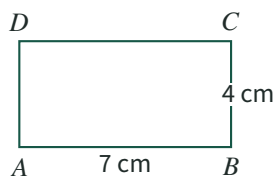
Q1 A rectangle measures 8 cm by 5 cm. Find its perimeter.

*



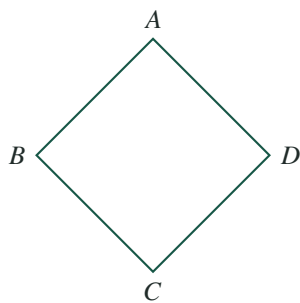
Q2 A rectangle measures 7 cm by 4 cm. Find its area.

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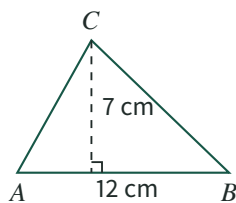


Q3 A square has perimeter 36 cm. Find its area.

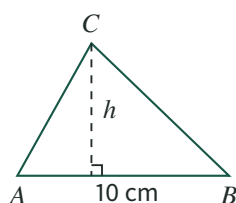
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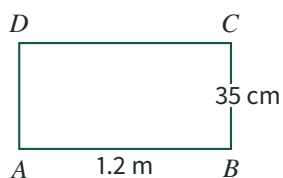
Q4 A triangle has base 12 cm and perpendicular height 7 cm. Find its area. *



Q5 A triangle has area 45 cm^2 and base 10 cm. Find its perpendicular height. **



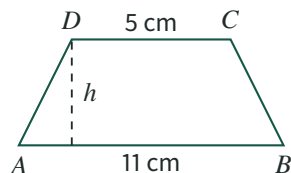
Q6 A rectangle is 1.2 m long and 35 cm wide. Find its area in square metres. **



2. Parallelograms and trapeziums

Example Problem 2

A trapezium has parallel sides 5 cm and 11 cm and area 48 cm^2 . Find its height.



The idea

1. Substitute into the trapezium formula and solve for the height.

Worked Solution

$$48 = \frac{1}{2}(5 + 11)h = 8h$$

Average the parallel sides.

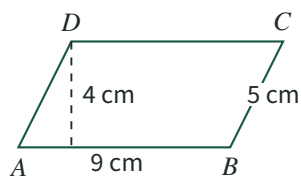
$$h = 6 \text{ cm}$$

Divide the area by eight.

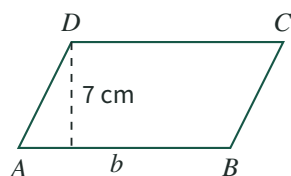
2 Parallelograms and trapeziums

Q7 Find the area of the parallelogram.

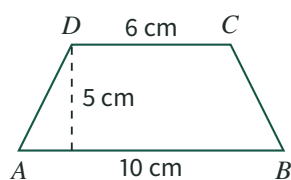
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**Q8** A parallelogram has area 63 cm^2 and perpendicular height 7 cm. Find its base.

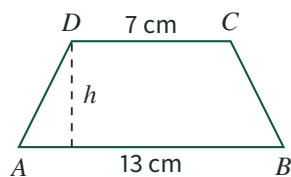
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**Q9** Find the area of the trapezium.

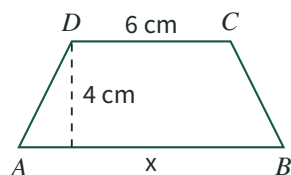
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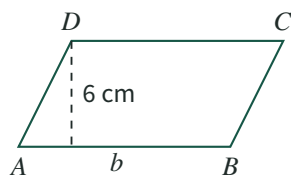
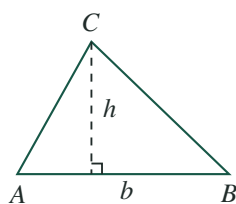
Q10 A trapezium has parallel sides 7 cm and 13 cm and area 60 cm^2 . Find its height.



Q11 A trapezium has height 4 cm, area 34 cm^2 and one parallel side 6 cm. Find the other parallel side.



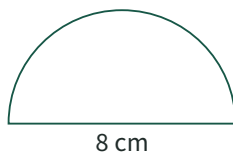
Q12 The triangle and parallelogram have the same base and area. The parallelogram height is 6 cm. Find the triangle height.



3. Circles and compound shapes

Example Problem 3

Find the perimeter of a semicircle with diameter 8 cm. Give an exact answer.



The idea

1. Add the curved edge and the straight diameter.

Worked Solution

$$r = 4 \text{ cm}$$

Halve the diameter.

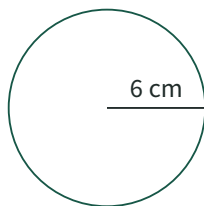
$$P = \pi(4) + 8 = 4\pi + 8 \text{ cm}$$

Half the circumference is π times the radius.

3 Circles and compound shapes

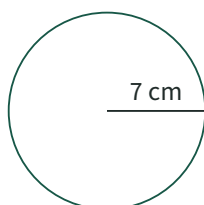
Q13 Find the area of a circle with radius 6 cm. Give your answer in terms of π .

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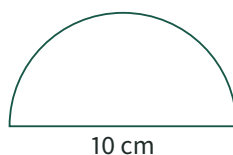


Q14 Find the circumference of a circle with diameter 14 cm. Give your answer in terms of π .

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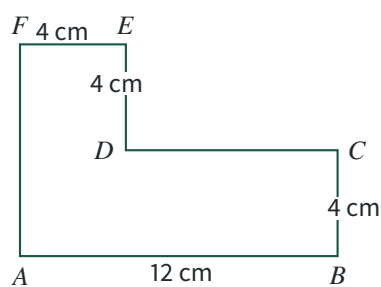
Q15 Find the perimeter of a semicircle of radius 5 cm, including its straight edge. Give an exact answer.



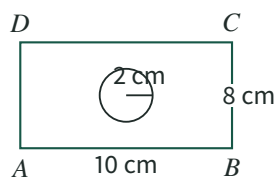
Q16 All corners of the L-shape are right angles.

(a) Find its area.

(b) Find its perimeter.



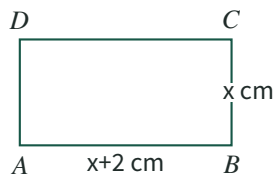
Q17 A 10 cm by 8 cm rectangle has a circular hole of radius 2 cm. Find the remaining area exactly.



4. Area equations and reasoning

Example Problem 4

A rectangle has length $x + 2$ cm, width x cm and area 48 cm^2 . Find x .



The idea

1. Form an area equation, factorise and reject an impossible length.

Worked Solution

$$x(x + 2) = 48$$

Multiply length by width.

$$(x + 8)(x - 6) = 0$$

Move all terms to one side and factorise.

$$x = 6 \text{ cm}$$

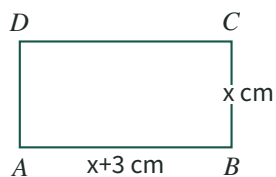
The other root is negative.

4 Area equations and reasoning

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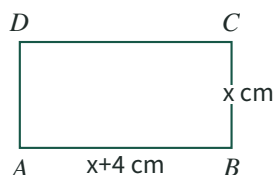
Q18 A rectangle has width x cm, length $x + 3$ cm and perimeter 34 cm. Find its area.

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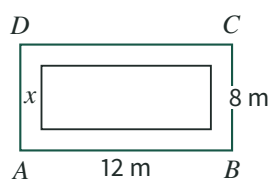


Q19 A rectangle has width x cm, length $x + 4$ cm and area 96 cm^2 . Find its perimeter.

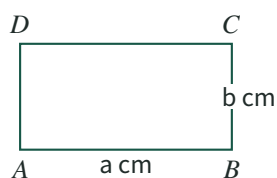
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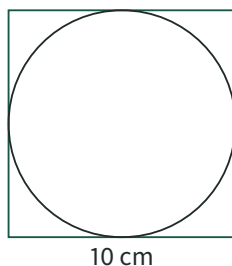
- Q20** A 12 m by 8 m garden has a path of uniform width x m inside all four edges. The remaining grass has area 60 m^2 . Find x .



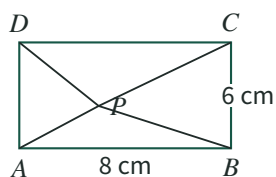
- Q21** A rectangle has perimeter 20 cm and positive integer side lengths. Find its greatest possible area.



- Q22** A square of side 10 cm contains an inscribed circle touching all four sides. Find the fraction of the square outside the circle exactly.



- Q23** A rectangle measures 8 cm by 6 cm. A point P is inside it. Prove that the sum of the areas of triangles PAB and PCD is 24 cm^2 , where AB and CD are opposite 8 cm sides.



Solving principles

1. Sketch the missing edges

Use equal total widths and heights to find an unlabelled boundary.

2. Split or subtract

Choose rectangles, triangles or circles that make the area easier.

3. Keep radius and diameter distinct

Halve the diameter before using a radius formula.

4. Check a length is possible

Reject negative lengths or roots that contradict the diagram.