

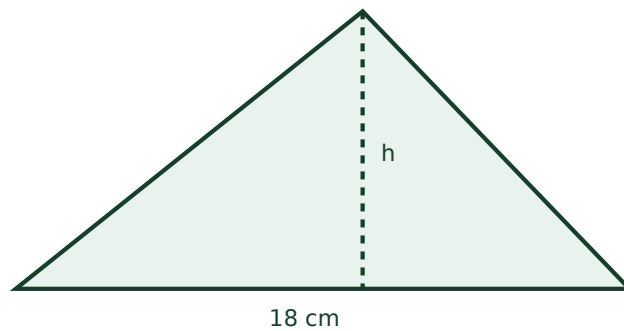
Chapter 12 | Supplementary Practice

Secondary 1 Mathematics • Perimeter and Area of Plane Figures • Thinkel

Original textbook-level questions with diagrams and complete worked solutions. Show equations, units and reasoning.
Use $\pi = 3.142$ unless otherwise stated.

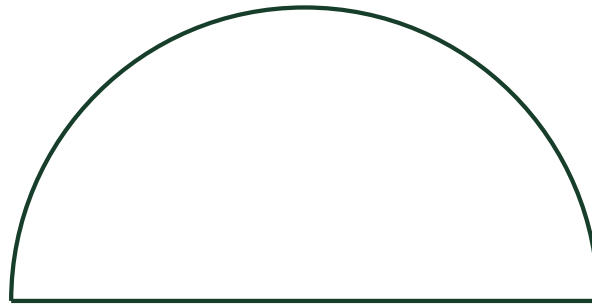
Section A | Units and Basic Figures

1. A rectangular poster measures 1.35 m by 84 cm. Find its area in (a) cm^2 and (b) m^2 .
2. A square courtyard has an area of 0.0025 km^2 . Find its side length in metres and its perimeter.
3. A rectangle has perimeter 86 cm. Its length is 7 cm more than twice its width. Find the dimensions and area.
4. A triangle has area 117 cm^2 and base 18 cm. Find its perpendicular height. If its other two sides measure 17 cm and 19 cm, find its perimeter.



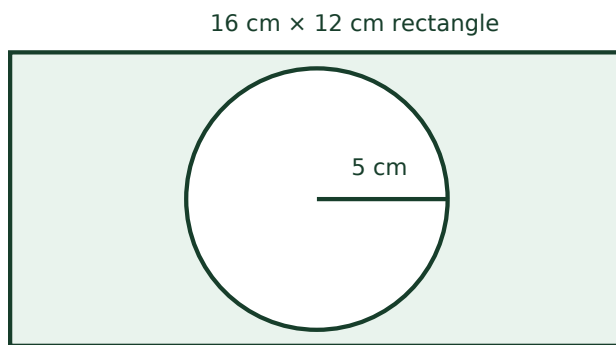
Section B | Circles and Compound Figures

5. A semicircular window has diameter 14 cm. Find (a) its area and (b) its complete perimeter, including the straight edge. Give answers to 3 significant figures.

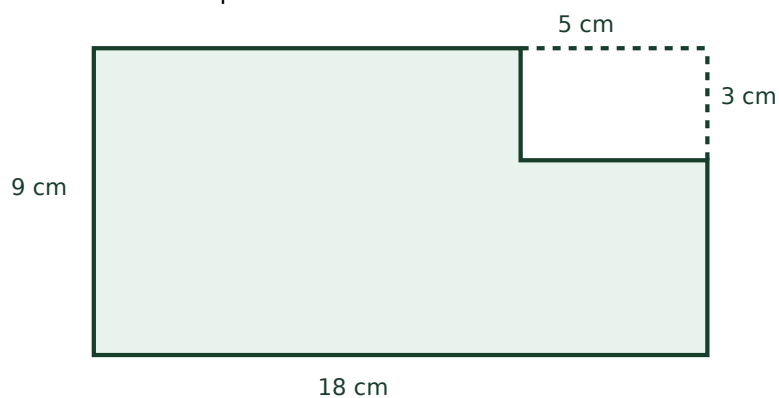


Diameter = 14 cm

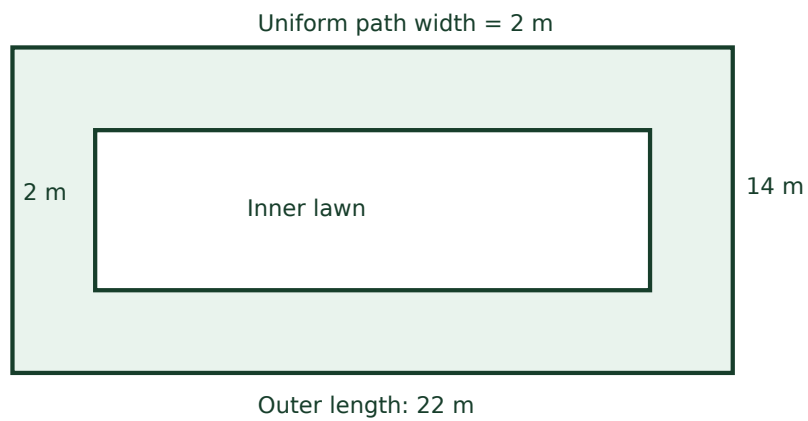
6. A circular pond of radius 5 cm is drawn inside a 16 cm by 12 cm rectangle. Find the area of the region outside the circle but inside the rectangle, to 3 significant figures.



7. An 18 cm by 9 cm rectangle has a 5 cm by 3 cm rectangle removed from the top-right corner. Find the remaining area and the outer perimeter.

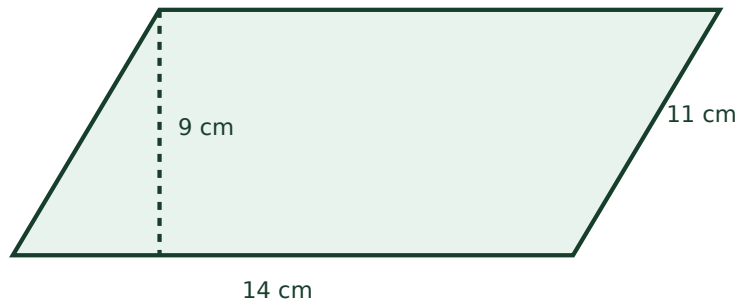


8. A 22 m by 14 m rectangular site contains a uniform 2 m-wide path along its inside boundary. Calculate the path's area.

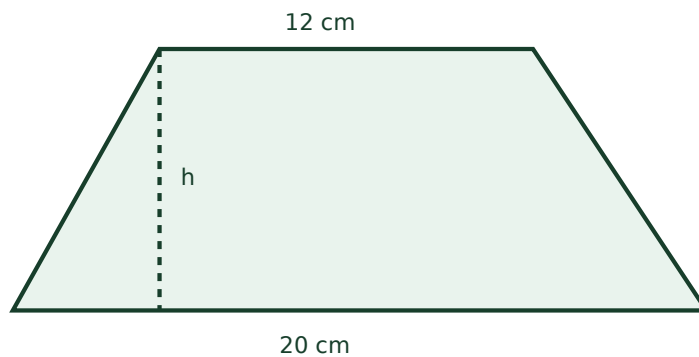


Section C | Parallelograms and Trapeziums

9. A parallelogram has base 14 cm, perpendicular height 9 cm and adjacent sloping side 11 cm. Find its area and perimeter. Then find the perpendicular height corresponding to the 11 cm side.



10. A trapezium has parallel sides 12 cm and 20 cm and area 192 cm^2 . Find its perpendicular height.

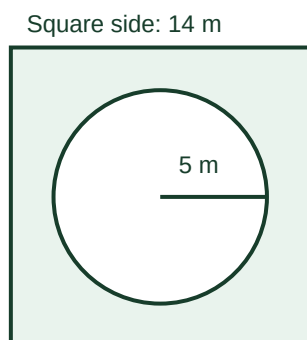


11. The parallel sides of a trapezium are in the ratio 3 : 5. Its area is 144 cm^2 and its perpendicular height is 9 cm. Find both parallel sides.

12. A parallelogram and a triangle have equal areas. The parallelogram has base 16 cm and perpendicular height 7.5 cm. The triangle's base is 20 cm. Find its perpendicular height.

Section D | Mixed Challenge

13. A square garden of side 14 m contains a circular flowerbed of radius 5 m. Calculate the uncovered garden area to 3 significant figures.



14. A rectangular swimming pool is 18 m long and 10 m wide. A uniform path of width x m is built around the outside. The total area, including the path, is 308 m^2 . Form an equation and find x .

15. A trapezium has height 8 cm. One parallel side is 6 cm longer than the other. Its area is 104 cm^2 . Find the lengths of the two parallel sides.

16. A square metal plate of side 20 cm has a circular hole of diameter 12 cm. Find (a) the remaining area and (b) the total boundary length, including the circular hole. Give answers to 3 significant figures.

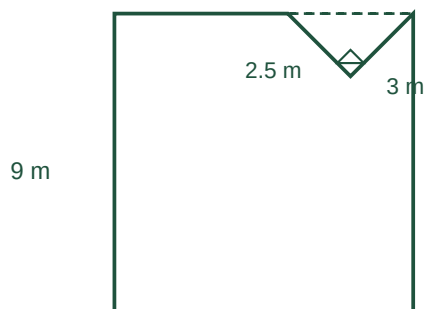
Additional textbook-style exercises | Q17-Q21

Q17 Triangle removed from a square

A square has side 9 m. A right-angled triangular notch is removed from its top edge.

The two perpendicular sides of the removed triangle are 2.5 m and 3 m.

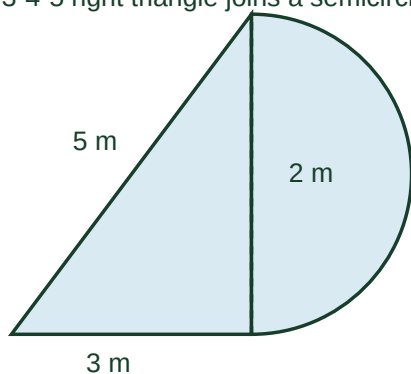
(a) Find the removed area. (b) Find the remaining area.



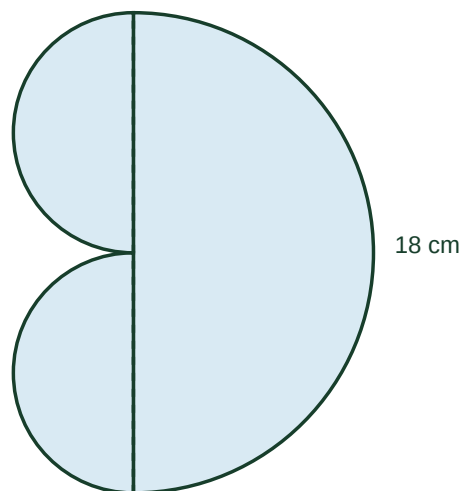
Q18 Semicircular compound figures

Find the complete perimeter and area of each shaded figure. Use $\pi = 3.142$.

(a) A 3-4-5 right triangle joins a semicircle of radius 2 m.



(b) One large semicircle of diameter 18 cm is joined to two smaller semicircles, each with diameter 9 cm.



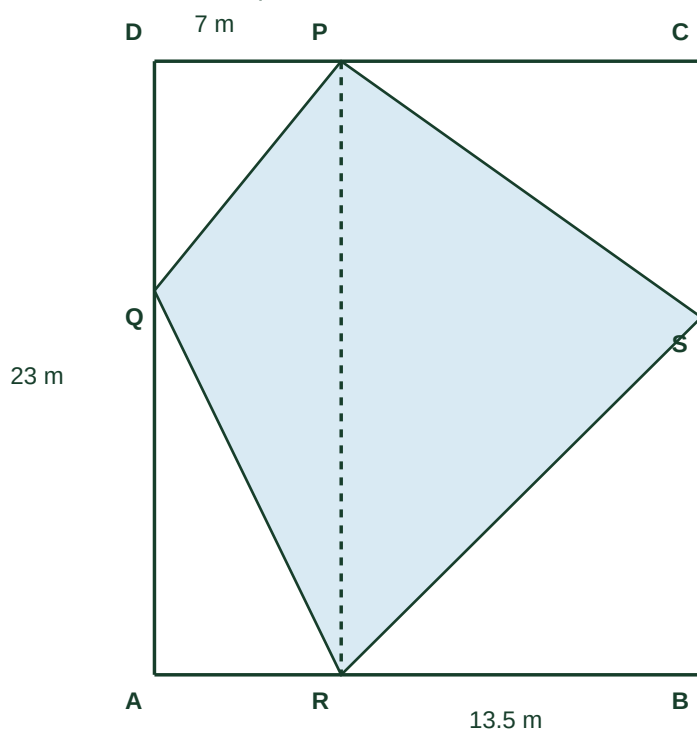
Additional textbook-style exercises | Q19-Q21

Q19 Shaded quadrilateral

ABCD is a rectangle. $AD = 23\text{ m}$, $DP = 7\text{ m}$ and $BR = 13.5\text{ m}$.

P is directly above R. Points Q and S lie on AD and BC respectively.

Find the area of shaded quadrilateral PQRS.

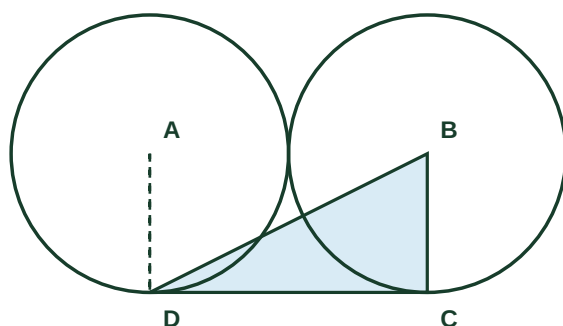


Q20 Two identical circles

Two identical circles, touching externally, have area 0.785 cm^2 each.

Their centres are A and B. A is vertically above D, B is vertically above C, and DC is horizontal. Find the area of shaded triangle DCB.

Give the answer to 3 significant figures.



Q21 Goat grazing

A goat is tied to a stake in an open field with a rope 1.5 m long.

It eats 1 m^2 of grass in 14 minutes. How long to eat all grass within its reach? Use $\pi = 3.142$. Round your answer to the nearest minute.

Worked Solutions | Section A

Question 1

$1.35 \text{ m} = 135 \text{ cm}$. $\text{Area} = 135 \times 84 = 11\,340 \text{ cm}^2$. Since $10\,000 \text{ cm}^2 = 1 \text{ m}^2$, $\text{area} = 11\,340 \div 10\,000 = 1.134 \text{ m}^2$.

Question 2

$0.0025 \text{ km}^2 = 0.0025 \times 1\,000\,000 = 2500 \text{ m}^2$. $\text{Side} = \sqrt{2500} = 50 \text{ m}$. $\text{Perimeter} = 4 \times 50 = 200 \text{ m}$.

Question 3

Let width be $w \text{ cm}$. $\text{Length} = 2w + 7$. Then $2(w + 2w + 7) = 86 \Rightarrow 6w + 14 = 86 \Rightarrow w = 12$. $\text{Length} = 31$. $\text{Area} = 12 \times 31 = 372 \text{ cm}^2$.

Question 4

$117 = \frac{1}{2} \times 18 \times h = 9h \Rightarrow h = 13 \text{ cm}$. $\text{Perimeter} = 18 + 17 + 19 = 54 \text{ cm}$.

Worked Solutions | Section B

Question 5

Radius = 7 cm. Area = $\frac{1}{2} \times 3.142 \times 7^2 = 76.979 \approx 77.0 \text{ cm}^2$. Complete perimeter = $\pi r + 2r = 3.142 \times 7 + 14 = 35.994 \approx 36.0 \text{ cm}$.

Question 6

Rectangle area = $16 \times 12 = 192 \text{ cm}^2$. Circle area = $3.142 \times 5^2 = 78.55 \text{ cm}^2$. Remaining area = $192 - 78.55 = 113 \text{ cm}^2$ (3 s.f.).

Question 7

Remaining area = $18 \times 9 - 5 \times 3 = 162 - 15 = 147 \text{ cm}^2$. The removed outer lengths are replaced by equal inner lengths, so perimeter = $2(18 + 9) = 54 \text{ cm}$.

Question 8

Inner rectangle: $(22 - 4) \times (14 - 4) = 18 \times 10 = 180 \text{ m}^2$. Whole site area = $22 \times 14 = 308 \text{ m}^2$. Path area = $308 - 180 = 128 \text{ m}^2$.

Worked Solutions | Section C

Question 9

Area = $14 \times 9 = 126 \text{ cm}^2$. Perimeter = $2(14 + 11) = 50 \text{ cm}$. With 11 cm as base, $126 = 11h \Rightarrow h = 126/11 \text{ cm} \approx 11.45 \text{ cm}$.

Question 10

$192 = \frac{1}{2} \times (12 + 20) \times h = 16h \Rightarrow h = 12 \text{ cm}$.

Question 11

Let the parallel sides be $3x$ and $5x$. Then $144 = \frac{1}{2} \times 8x \times 9 = 36x \Rightarrow x = 4$. Sides are 12 cm and 20 cm.

Question 12

Parallelogram area = $16 \times 7.5 = 120 \text{ cm}^2$. Triangle area = $\frac{1}{2} \times 20 \times h = 10h$. Hence $10h = 120 \Rightarrow h = 12 \text{ cm}$.

Worked Solutions | Section D

Question 13

Square area = $14^2 = 196 \text{ m}^2$. Flowerbed area = $3.142 \times 5^2 = 78.55 \text{ m}^2$. Uncovered area = $196 - 78.55 = 117.45 \text{ m}^2$ (3 s.f.).

Question 14

Outer dimensions are $(18 + 2x) \text{ m}$ and $(10 + 2x) \text{ m}$. $(18 + 2x)(10 + 2x) = 308 \Rightarrow 4x^2 + 56x + 180 = 308 \Rightarrow x^2 + 14x - 32 = 0 \Rightarrow (x + 16)(x - 2) = 0$. Reject negative width -16 ; $x = 2 \text{ m}$.

Question 15

Let shorter side = $x \text{ cm}$, longer side = $x + 6 \text{ cm}$. $104 = \frac{1}{2}(x + x + 6) \times 8 = 8x + 24 \Rightarrow 8x = 80 \Rightarrow x = 10$. Sides are 10 cm and 16 cm .

Question 16

Radius = 6 cm . Remaining area = $20^2 - 3.142 \times 6^2 = 400 - 113.112 = 286.888 \approx 287 \text{ cm}^2$. Total boundary = $4 \times 20 + 2 \times 3.142 \times 6 = 117.704 \approx 118 \text{ cm}$ (3 s.f.).

End of Supplementary Practice • All solutions include the essential mathematical working.

Worked solutions | Additional Q17-Q21

Q17 Removed triangular section

$$\text{Area} = \frac{1}{2} \times 2.5 \times 3 = 3.75 \text{ m}^2.$$

$$\text{Remaining square area} = 9 \times 9 - 3.75 = 77.25 \text{ m}^2.$$

Q18(a) Triangle and semicircle

$$\text{Right triangle height} = \sqrt{5^2 - 3^2} = 4 \text{ m}.$$

$$\text{Area} = \frac{1}{2} \times 3 \times 4 + \frac{1}{2} \times 3.142 \times 2^2 = 12.284 \text{ m}^2.$$

$$\text{Perimeter} = 3 + 5 + 3.142 \times 2 = 14.284 \text{ m}.$$

Q18(b) Three semicircular arcs

$$\text{Large radius} = 9 \text{ cm}; \text{ two small radii} = 4.5 \text{ cm each}.$$

$$\text{Area} = \frac{1}{2} \times 3.142 \times (9^2 + 2 \times 4.5^2) = 190.8765 \text{ cm}^2.$$

$$\text{Perimeter} = 3.142 \times (9 + 4.5 + 4.5) = 56.556 \text{ cm}.$$

Q19 Quadrilateral PQRS

PR = AD = 23 m. Horizontal distances from Q and S to PR are DP = 7 m and BR = 13.5 m respectively.

$$\text{Area} = \frac{1}{2} \times 23 \times 7 + \frac{1}{2} \times 23 \times 13.5 = 235.75 \text{ m}^2.$$

Q20 Area of shaded triangle DCB

$$\text{Each circle has radius } r = \sqrt{0.785 / 3.142} = 0.5 \text{ cm}.$$

$$\text{Since the circles touch, } DC = 2r = 1 \text{ cm}.$$

$$BC = r = 0.5 \text{ cm and is perpendicular to DC}.$$

$$\text{Area of shaded triangle DCB} = \frac{1}{2} \times 1 \times 0.5 = 0.25 \text{ cm}^2.$$

$$\text{Answer: } 0.250 \text{ cm}^2 \text{ (3 significant figures).}$$

Q21 Goat grazing

$$\text{Area reachable} = 3.142 \times 1.5^2 = 7.0695 \text{ m}^2.$$

$$\text{Time} = 7.0695 \times 14 = 98.973 \text{ minutes} = 99 \text{ minutes (nearest minute).}$$