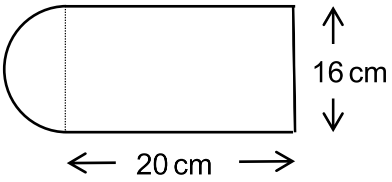
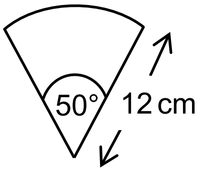
GCSE (9–1) MATHEMATICS

Higher Check In - 10.03 Area calculations

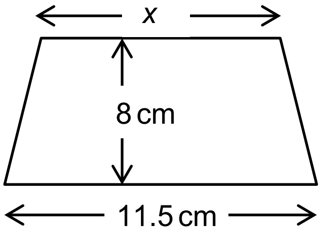
1. Calculate the total area of the shape below.



2. Calculate the area of the sector, giving your answer in terms of π.

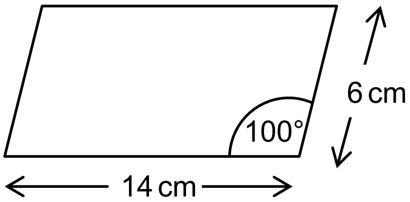


3. The area of the trapezium is 75 cm^2. Work out the length of x.

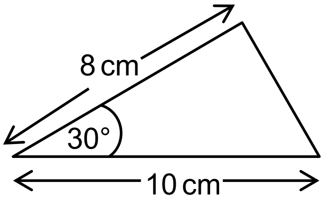


4. A semicircle has an area of $\frac{25}{32}\pi$ cm^2. What is the length of its diameter?

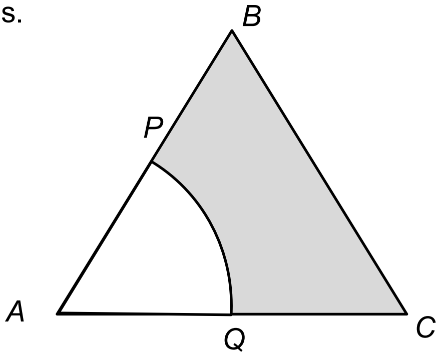
5. Calculate the area of this parallelogram.



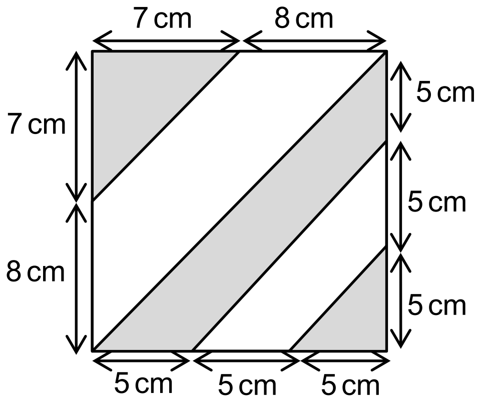
6. Ali says that the area of the triangle below can be worked out by calculating $\frac{8\times10}{2}$ giving 40 cm^2. Petra says that the area is 20 cm^2. Show that Petra is correct.



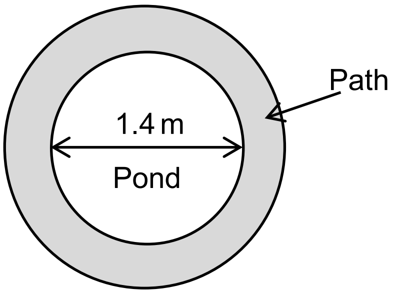
7. The diagram shows an equilateral triangle *ABC* with side length 12 cm. *P* is the midpoint of *AB* and *Q* is the midpoint of *AC*. Show that the shaded area is 43.5 cm^2 to 3 significant figures.



8. Show that the total shaded area is 99.5 cm^2.



9. The diagram represents a circular pond with a path that is 75 cm wide around it. Mr Smith is going to cover the path in gravel. One bag of gravel covers 2 m^2. How many bags of gravel will Mr Smith need to buy?



10. Calculate the area of a regular hexagon with sides of length 8 cm.

Extension

A rectangular paddock is to be made using 120 m of fencing.

Plot a graph with length (m) on the horizontal axis and area (m^2) on the vertical axis.

What is the largest possible area for the paddock? Explain how you worked this out from your graph. What values of length and width give the largest possible area for the paddock?

Answers

1. $420.5\,\text{cm}^2$

2. $20\pi\,\text{cm}^2$

3. $7.25\,\text{cm}$

4. $2.5\,\text{cm}$

5. $82.7\,\text{cm}^2$

6. 8 cm is the slant height not the perpendicular height. The formula $\frac{8\times 10}{2}$ can only be used if you know the base and perpendicular height.
   Using Area $=\frac{1}{2}ab\sin C$ gives Area $=\frac{1}{2}\times 8\times 10\times \sin 30^\circ = 20\,\text{cm}^2$, so Petra is correct.

7. Shaded area $=$ area of triangle – area of sector
   Shaded area $=\left(\frac{1}{2}\times 12\times\sqrt{108}\right)-\left(\frac{1}{6}\times\pi\times 6^2\right)=43.5042$, so $43.5\,\text{cm}^2$ to 3 sf.

8. Area of top left-hand grey triangle $=\frac{7\times 7}{2}=24.5\,\text{cm}^2$.

   Area of bottom right-hand grey triangle $=\frac{5\times 5}{2}=12.5\,\text{cm}^2$.

   Total area of central grey stripe $=\frac{15\times 15}{2}-\frac{10\times 10}{2}=62.5\,\text{cm}^2$.

   Therefore the area of the quadrilateral is $62.5+12.5+24.5=99.5\,\text{cm}^2$.

9. The area of the path is given by $\pi\times 1.45^2-\pi\times 0.7^2=5.07\,\text{m}^2$, so he needs 3 bags of gravel.

10. Divide the hexagon into 6 equilateral triangles.
    Area of one triangle $=\frac{1}{2}\times 8\times 8\times\sin 60^\circ = 27.71281292\,\text{cm}^2$
    Total area $=6\times 27.71281292=166\,\text{cm}^2$ (3 sf)

Extension

Length (m)	5	10	15	20	25	30	35	40	45	50	55
Width (m)	55	50	45	40	35	30	25	20	15	10	5
Area (m^2)	275	500	675	800	875	900	875	800	675	500	275

The greatest area is 900 m^2 as the graph of area against length is a curve which has a maximum at (30, 900).

The greatest area is achieved when the length and width are both 30 m, that is, when the paddock is square.

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Assessment Objective	Qu.	Topic	R	A	G
AO1	1	Apply area formulae to find the area of a composite 2D shape			
AO1	2	Find the area of a sector			
AO1	3	Use the area formula for a trapezium			
AO1	4	Find the diameter of a semicircle given the area			
AO1	5	Find the area of a parallelogram using the area sine rule			
AO2	6	Apply the sine rule to find the area of a triangle			
AO2	7	Find a shaded area using area formulae			
AO2	8	Find the area of a composite shape using area formulae			
AO3	9	Solve a real life problem involving area of a circle			
AO3	10	Find the area of a regular polygon by splitting it into triangles			

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