

WA8MMGTW2

Two-dimensional space and structures

Core + Challenge

Semicircles, Quadrants and Composites — Marking Key

I can find the perimeter and area of semicircles, quadrants and sectors, and of composite shapes and shaded regions made with them.

For tutors and parents. Award method marks for correct working even if the final answer is wrong.

Marks summary

Section A Fluency: 16 Section B Core: 22 Section C Reasoning: 9 Section D Challenge: 11 **Total: 58**

Fluency: 1 mark each; accept an equivalent unsimplified answer for half credit at tutor's discretion.

A Fluency *answers and working*

/ 16 marks

Q	Answer	Working
1	157 cm ²	$3.14 \times 100 \div 2$
2	78.5 cm ²	$3.14 \times 100 \div 4$
3	31.4 cm	$2 \times 3.14 \times 10 \div 2$
4	51.4 cm	$31.4 + 20$ (the diameter)
5	6.28 m	$2 \times 3.14 \times 4 \div 4$
6	14.28 m	$6.28 + 4 + 4$
7	56.52 m ²	$r = 6: 3.14 \times 36 \div 2$
8	$\frac{1}{6}$	$\frac{60}{360}$
9	28.3 cm ²	$\pi \times 36 \div 4 = 28.27\dots$
10	31.8 m ²	$\pi \times 4.5^2 \div 2 = 31.80\dots$
11	23.1 m	$\pi \times 9 \div 2 + 9 = 23.13\dots$
12	25.0 cm	$2\pi \times 7 \div 4 + 14 = 24.99\dots$
13	75.4 cm ²	$\frac{1}{6} \times \pi \times 144 = 75.39\dots$
14	18.8 m	$\frac{1}{3} \times 2\pi \times 9 = 18.84\dots$
15	9.4 m ²	$\frac{3}{4} \times \pi \times 4 = 9.42\dots$
16	25.1 cm ²	$\frac{1}{8} \times \pi \times 64 = 25.13\dots$

B

Core *answers, working and marks*

/ 22 marks

Q	Answer	Working / sample response	Marks
1	$A = 77.0 \text{ cm}^2$; $P = 36.0 \text{ cm}$	$r = 7$: $A = \pi \times 49 \div 2 = 76.96\dots$ $P = \pi \times 14 \div 2 + 14 = 35.99\dots$ <i>1 mark each</i>	2
2	$A = 50.24 \text{ m}^2$; $P = 28.56 \text{ m}$	$A = 3.14 \times 64 \div 4 = 50.24$ $\text{Arc} = 2 \times 3.14 \times 8 \div 4 = 12.56$; $P = 12.56 + 8 + 8 = 28.56$ <i>1 mark each</i>	2
3	(a) 401.1 m (b) 9617 m^2	(a) Two ends make one circle of diameter 64: $\pi \times 64 = 201.06\dots$; $200 + 201.06\dots = 401.06\dots$ (b) Rectangle $100 \times 64 = 6400$; circle $\pi \times 32^2 = 3216.99\dots$ $6400 + 3216.99\dots = 9616.99\dots \approx 9617 \text{ m}^2$ <i>1 mark: 401.1 m</i> <i>1 mark: rectangle + circle</i> <i>1 mark: 9617 m²</i>	3
4	2.37 m^2	Rectangle: $1.2 \times 1.5 = 1.8$ Semicircle: $r = 0.6$: $\pi \times 0.36 \div 2 = 0.565\dots$ $1.8 + 0.565\dots = 2.365\dots \approx 2.37 \text{ m}^2$ <i>1 mark: rectangle</i> <i>1 mark: semicircle</i> <i>1 mark: 2.37 m²</i>	3
5	37.7 m^2	$\pi \times 4.9^2 \div 2 = 37.71\dots$ <i>1 mark: working</i> <i>1 mark: 37.7 m²</i>	2
6	21.5 cm^2	Square 100 ; quadrant $3.14 \times 100 \div 4 = 78.5$ $100 - 78.5 = 21.5$ <i>1 mark: quadrant</i> <i>1 mark: 21.5 cm²</i>	2
7	100.5 cm^2 ; 12.6 cm	Area: $\pi \times 16^2 \div 8 = 100.53\dots$ Crust: $\pi \times 32 \div 8 = 12.56\dots$ <i>1 mark each</i>	2
8	5.5 m	$\frac{1}{4} \times 2 \times \pi \times 3.5 = 5.49\dots$ <i>1 mark: $\frac{1}{4}$ of $2\pi r$</i> <i>1 mark: 5.5 m</i>	2
9	70.9 cm^2	Rectangle 96 ; semicircle $r = 4$: $\pi \times 16 \div 2 = 25.13\dots$ $96 - 25.13\dots = 70.86\dots$ <i>1 mark: semicircle</i> <i>1 mark: 70.9 cm²</i>	2
10	62.8 cm^2 ; 32.56 cm	$\frac{72}{360} = \frac{1}{5}$; $A = \frac{1}{5} \times 314 = 62.8$ $\text{Arc} = \frac{1}{5} \times 62.8 = 12.56$; $P = 12.56 + 10 + 10 = 32.56$ <i>1 mark each</i>	2

C

Reasoning *sample answers and marking criteria*

/ 9 marks

Q	Answer	Working / sample response	Marks
1	The diameter is also an edge	Half the circumference is only the curved part. The straight edge (the diameter) must be added: $P = \frac{1}{2}\pi d + d$. <i>1 mark: curve only</i> <i>1 mark: add d</i>	2
2	Two semicircles make one circle	Each end is a semicircle with the same diameter (the track's width). Two halves of the same circle make a whole circle, so $A = \text{rectangle} + \pi r^2$. <i>1 mark each</i>	2
3	21.4 cm	She only found the arc; she forgot the two straight radii. $9.42... + 6 + 6 = 21.42... \approx 21.4 \text{ cm}$ <i>1 mark: error</i> <i>1 mark: 21.4 cm</i>	2
4	False: the semicircle is twice as big	Semicircle: $\frac{1}{2} \times \pi \times 100 = 50\pi$ Circle: $\pi \times 25 = 25\pi$ $50\pi = 2 \times 25\pi$, so the semicircle is double. <i>1 mark: 50π</i> <i>1 mark: 25π</i> <i>1 mark: conclusion</i>	3

D

Challenge *solutions and marking criteria*

/ 11 marks

Q	Answer	Working / sample response	Marks
1	57.1 cm ²	The two quadrants cover the square, overlapping on the leaf: $2 \times 78.53... - 100$ $= 57.07... \approx 57.1 \text{ cm}^2$ <i>1 mark: 2 quadrants – square</i> <i>1 mark: 57.1 cm²</i>	2
2	3410 m ²	Straights: $2 \times 100 \times 8 = 1600$ Ends: a ring with $R = 40$ and $r = 32$: $\pi(40^2 - 32^2) = 576\pi = 1809.5...$ $1600 + 1809.5... = 3409.5... \approx 3410 \text{ m}^2$ <i>1 mark: straights</i> <i>1 mark: ring</i> <i>1 mark: 3410 m²</i>	3
3	25.1 cm ² ; 37.7 cm	Area: $\frac{1}{2}\pi(6^2 - 2^2 - 4^2) = \frac{1}{2}\pi \times 16 = 8\pi = 25.13...$ Perimeter: three arcs: $\frac{1}{2}\pi(12 + 4 + 8) = 12\pi = 37.69...$ (The perimeter equals the full circumference of the 12 cm circle.) <i>1 mark: area</i> <i>1 mark: three arcs</i> <i>1 mark: 37.7 cm</i>	3

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Q	Answer	Working / sample response	Marks
4	95.0 m ²	$\frac{3}{4}$ of a circle of radius 6: 27π Around the 4 m side, 2 m of rope is left: $\frac{1}{4} \times \pi \times 2^2 = \pi$; around the 3 m side, 3 m is left: $\frac{1}{4} \times \pi \times 3^2 = 2.25\pi$ Total $30.25\pi = 95.03... \approx 95.0 \text{ m}^2$ <i>1 mark: 27π</i> <i>1 mark: both small quadrants</i> <i>1 mark: 95.0 m^2</i>	3