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INTERNATIONAL A LEVEL MATHEMATICS • PURE 1

Pure Mathematics 1

Exam Questions by Topic

Pearson Edexcel International Advanced Level (WMA11/01) • Calculator allowed

Multi-step exam questions at the difficulty of the real WMA11 paper, with a full mark scheme

Chapters (tap a chapter to jump to it)	Qs	Marks	Page	My score
1 Algebraic Expressions Indices, surds, expanding and factorising	10	57	own PDF	
2 Quadratics Completing the square, the discriminant, quadratic graphs	10	65	own PDF	
3 Equations and Inequalities Simultaneous equations, inequalities, regions	10	69	own PDF	
4 Graphs and Transformations Cubic and reciprocal graphs, intersections, transformations	10	68	own PDF	
5 Straight-line Graphs Gradients, equations of lines, parallel and perpendicular	10	68	own PDF	
6 Trigonometric Ratios Sine and cosine rules, area of a triangle, trig graphs	10	66	own PDF	
7 Radians Radian measure, arc length, sector and segment areas	10	71	2	
8 Differentiation Gradients, second derivatives, tangents and normals	10	71	own PDF	
9 Integration Integrating x^n , finding $y = f(x)$ from $f'(x)$	10	67	own PDF	

[Full mark scheme](#)

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CHAPTER 7 • KEY SKILLS

Radians

Specification P1: 3.2, 3.3 • 10 questions • 71 marks • about 85 minutes

1 Radians and exact values π radians = 180° .

e.g. $150^\circ = \frac{5\pi}{6}$, $\sin \frac{\pi}{3} = \frac{\sqrt{3}}{2}$,

$\cos \frac{\pi}{4} = \frac{\sqrt{2}}{2}$

2 Arc length $s = r\theta$, with θ in radians.

e.g. $r = 5$, $\theta = 1.2$: $s = 6$

3 Area of a sector $A = \frac{1}{2}r^2\theta$, with θ in radians.

e.g. $r = 4$, $\theta = \frac{\pi}{4}$: $A = 2\pi$

4 Area of a segment

Sector minus triangle:

$\frac{1}{2}r^2\theta - \frac{1}{2}r^2\sin\theta = \frac{1}{2}r^2(\theta - \sin\theta)$

5 Perimeters

Add every outside edge: arcs, radii and straight sides. Never include an internal line.

6 Triangles in radiansSine rule, cosine rule and $\frac{1}{2}ab\sin C$

work in radians: set your calculator to radian mode.

7 Equations from a sectorWrite the perimeter and area in r and θ , then eliminate one of them. Check $0 < \theta < 2\pi$.**8 Trig graphs in radians**sin, cos: period 2π . tan: period π .

$y = \sin\left(x + \frac{\pi}{3}\right)$: $\frac{\pi}{3}$ to the left.

9 Solutions from graphs

Rearrange so one side is a graph you know and the other a line you can draw; count intersections.

Skills map every skill above is tested at least once; interleaved skills come from GCSE or other chapters

Skill	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Marks	4	6	5	5	6	9	9	9	8	10
1 Radians and exact values	•		•	•					•	
2 Arc length	•	•			•	•	•	•		•
3 Area of a sector	•	•			•	•	•	•		•
4 Area of a segment					•					
5 Perimeters		•			•	•	•	•		•
6 Triangles in radians		•			•	•	•	•		
7 Equations from a sector		•				•				•
8 Trig graphs in radians			•	•					•	
9 Solutions from graphs				•						
Interleaved: sine rule, cosine rule, ambiguous case (Chapter 6)					•	•	•	•		
Interleaved: quadratics, completing the square (Chapter 2)										•
Interleaved: transformations, straight lines (Chapters 4, 5)			•	•					•	

Exam difficulty. Questions 1 to 5 check each skill on its own. Questions 6 to 10 are multi-step questions built like the last questions on a real WMA11 paper, where one part leads into the next and skills from different topics are combined.

Must learn. $s = r\theta$ and $A = \frac{1}{2}r^2\theta$ are *not* in the formula booklet. Stay in radians: a straight line is π , not 2π . Keep full accuracy until the final answer.



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1. In this question you must show all stages of your working.

Solutions relying on calculator technology are not acceptable.

(a) Write 150° in radians, giving your answer as an exact multiple of π .

(1)

The sector OAB of a circle has centre O , radius 6 cm and angle $AOB = 150^\circ$

(b) Find, in terms of π ,

- (i) the length of the arc AB ,
- (ii) the area of the sector OAB .

(3)

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(Total for Question 1 is 4 marks)



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2. The sector OAB of a circle has centre O and radius r cm. The angle AOB is 1.25 radians and the area of the sector is 40 cm^2

(a) Show that $r = 8$

(2)

(b) Find the perimeter of the sector.

(2)

(c) Find the length of the chord AB , giving your answer in cm to 3 significant figures.

(2)

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Question 2 continued

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(Total for Question 2 is 6 marks)



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3. (a) Sketch the graph of $y = \cos\left(x - \frac{\pi}{3}\right)$, $0 \leq x \leq 2\pi$

Show clearly the exact coordinates of the points where the graph meets the coordinate axes.

(3)

- (b) Write down the exact coordinates of the maximum point and the minimum point of the graph in this interval.

(2)

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Question 3 continued

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(Total for Question 3 is 5 marks)



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Question 4 continued

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(Total for Question 4 is 5 marks)



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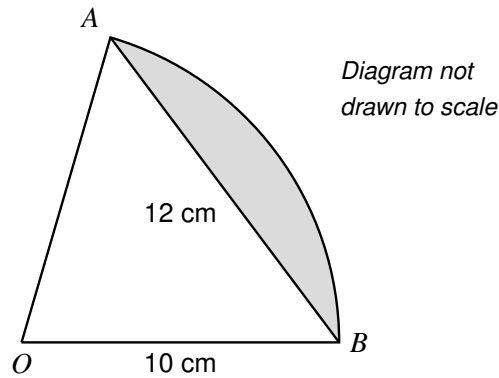


Figure 1

Figure 1 shows the sector OAB of a circle with centre O and radius 10 cm.

The chord AB has length 12 cm. The segment bounded by the arc AB and the chord AB is shown shaded.

- (a) Show that angle $AOB = 1.287$ radians, correct to 4 significant figures. (2)
- (b) Find the area of the shaded segment, giving your answer in cm^2 to 3 significant figures. (2)
- (c) Find the perimeter of the shaded segment, giving your answer in cm to 3 significant figures. (2)



Question 5 continued

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(Total for Question 5 is 6 marks)



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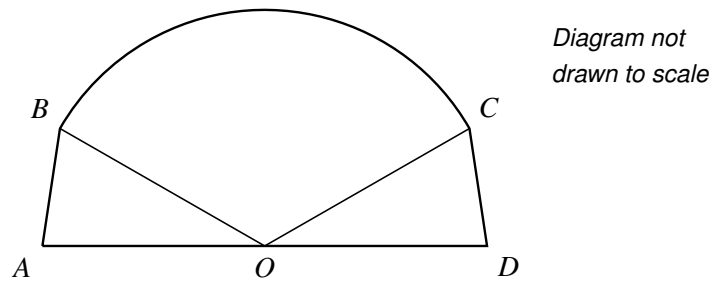
**Figure 2**

Figure 2 shows the plan of a stage. It consists of the sector OBC of a circle with centre O , joined to two congruent triangles OAB and ODC .

Given that

- angle $BOC = 2.1$ radians
- the area of the sector OBC is 58 m^2
- AOD is a straight line of length 14 m

(a) show that the radius of the sector is 7.43 m , correct to 3 significant figures, (2)

(b) find the size of angle AOB , in radians, to 3 significant figures. (1)

Hence find

(c) the total area of the stage, giving your answer in m^2 to 3 significant figures, (3)

(d) the total perimeter of the stage, giving your answer in m to 3 significant figures. (3)



Question 6 continued

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Question 6 continued

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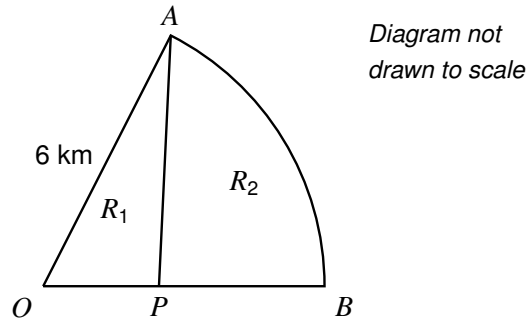
**Figure 3**

Figure 3 shows a plot of land in the shape of a sector OAB of a circle with centre O and radius 6 km. The angle AOB is 1.1 radians.

The point P lies on OB . A straight fence AP divides the plot into two regions: R_1 , the triangle OAP , and R_2 , the rest of the sector.

Given that the area of R_2 is twice the area of R_1 ,

- (a) find the perimeter of the sector OAB , (2)
- (b) show that the area of R_1 is 6.6 km^2 (3)
- (c) find the length OP , giving your answer in km to 3 significant figures, (2)
- (d) find the length of the fence AP , giving your answer to the nearest 100 m. (2)



Question 7 continued

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Question 7 continued

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(Total for Question 7 is 9 marks)



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Diagram not drawn to scale

Question 8 continued

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Question 8 continued

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(Total for Question 8 is 9 marks)



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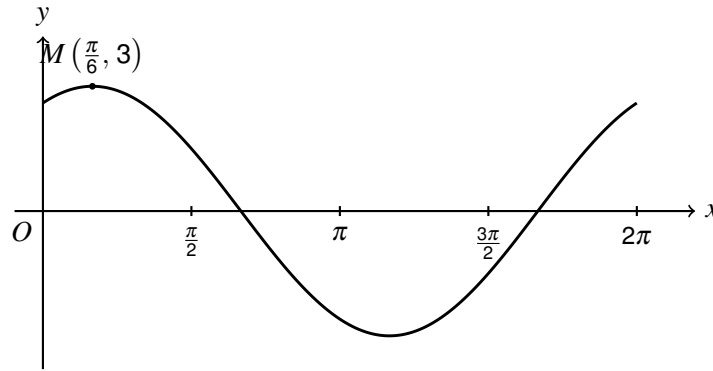


Figure 5

Figure 5 shows part of the curve with equation $y = a \sin(x + b)$, $0 \leq x \leq 2\pi$, where a and b are constants, $a > 0$ and $0 < b < \pi$

The curve has a maximum point at $M\left(\frac{\pi}{6}, 3\right)$.

(a) Write down the value of a and the value of b . (2)

(b) Find the exact coordinates of the point where the curve crosses the y -axis. (1)

(c) Find the exact x coordinates of the points where the curve crosses the x -axis. (2)

The same curve can also be written as $y = a \cos(x + c)$, where $-\pi < c < 0$

(d) Find the value of c . (2)

(e) Write down the exact coordinates of the minimum point of the curve for $0 \leq x \leq 2\pi$ (1)



Question 9 continued

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(Total for Question 9 is 8 marks)



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Solutions relying on calculator technology are not acceptable.

The perimeter of the sector is 20 cm and the area of the sector is 16 cm^2

- (b)** Find the value of r and the value of θ , explaining clearly why one solution of the equation in part (a) must be rejected. **(4)**

A second sector also has a perimeter of 20 cm.

- (c) Show that its area, $A \text{ cm}^2$, is given by $A = 10r - r^2$, and hence find the maximum possible area of the sector and the value of θ for which it occurs. (3)



Question 10 continued

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Question 10 continued

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(Total for Question 10 is 10 marks)

TOTAL FOR CHAPTER 7 IS 71 MARKS

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