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INTERNATIONAL A LEVEL MATHEMATICS • PURE 1

Pure Mathematics 1

Exam Questions by Topic: Mark Scheme

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

Every question in the booklet, marked line by line the way an examiner marks it

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	3	
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	

Question booklet

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How to use this mark scheme

The same marking rules Pearson examiners use for WMA11.

Mark every line, not just the answer. Method marks are given for a correct method even when the final answer is wrong. If you lost marks, find the *first* line where your working differs from the scheme. That is the thing to fix.

Code	Meaning
M1	Method mark: for knowing a correct method and attempting to apply it. Small slips in the working do not lose this mark.
dM1	Dependent method mark: can only be given if the method mark before it has been given.
A1	Accuracy mark: for a correct answer or line of working. It can only be given if the method mark it depends on has been given.
B1	Independent mark: for a correct result or statement, whatever method was used.
*	The answer is given in the question. Every step must be shown, and the answer must follow from correct working (cso).
cao	Correct answer only.
cso	Correct solution only: no errors anywhere in the working.
ft	Follow through: the mark can be given for correct work using your own earlier (wrong) answer.
oe	Or equivalent: any correct equivalent form is accepted.

“Solutions relying on calculator technology are not acceptable.” When a question says this, a correct final answer with no algebraic working scores **no marks**. The notes under each scheme line say when this applies.



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Chapter 7: Radians

Mark scheme. Marks are shown on the right of each line.

Question 1

4 marks

Part	Scheme	Marks
(a)	$\frac{5\pi}{6}$	B1 (1)
(b)	(i) $s = 6 \times \frac{5\pi}{6} = 5\pi \text{ cm}$ (ii) $A = \frac{1}{2} \times 6^2 \times \frac{5\pi}{6}$ $15\pi \text{ cm}^2$	B1 M1 A1 (3)
Total for Question 1: 4 marks		

Question 2

6 marks

Part	Scheme	Marks
(a)	$\frac{1}{2}r^2 \times 1.25 = 40 \Rightarrow r^2 = 64$ $r = 8$ *	M1 A1* (2)
(b)	$8 + 8 + 8 \times 1.25$ 26 cm	M1 A1 (2)
(c)	$AB^2 = 8^2 + 8^2 - 2 \times 8 \times 8 \cos 1.25$ (or $AB = 2 \times 8 \sin 0.625$) 9.36 cm <i>The angle must be used in radians: $\cos 1.25^\circ$ gives 0.17 cm and scores M1 A0.</i>	M1 A1 (2)
Total for Question 2: 6 marks		



Question 3

5 marks

Part	Scheme	Marks
(a)	Cosine curve translated $\frac{\pi}{3}$ to the right	B1
	$(0, \frac{1}{2})$	B1
	$(\frac{5\pi}{6}, 0)$ and $(\frac{11\pi}{6}, 0)$	B1
		(3)
(b)	Maximum $(\frac{\pi}{3}, 1)$	B1
	Minimum $(\frac{4\pi}{3}, -1)$	B1
		(2)
Total for Question 3: 5 marks		

Question 4

5 marks

Part	Scheme	Marks
(a)	π	B1 (1)
(b)	$3 \sin \frac{\pi}{3} = \frac{3\sqrt{3}}{2}$	B1 (1)
(c)	$2x = \frac{\pi}{2}$ or $\frac{5\pi}{2}$ $(\frac{\pi}{4}, 3)$ and $(\frac{5\pi}{4}, 3)$	M1 A1 (2)
(d)	4 <i>Two complete cycles, and $0 < 2 < 3$, so the line $y = 2$ crosses each cycle twice.</i>	B1 (1)
Total for Question 4: 5 marks		



Question 5

6 marks

Part	Scheme	Marks
(a)	$\cos(\angle AOB) = \frac{10^2 + 10^2 - 12^2}{2 \times 10 \times 10} = 0.28$ $\angle AOB = 1.2870\dots = 1.287 \text{ radians}^*$ Alternative: $\sin \frac{\theta}{2} = \frac{6}{10}$, so $\theta = 2 \arcsin 0.6$. The value must be seen to more than 4 s.f. (e.g. 1.28700) for A1*.	M1 A1* (2)
(b)	$\frac{1}{2} \times 10^2 (1.287\dots - \sin 1.287\dots)$ 16.4 cm²	M1 A1 (2)
(c)	$10 \times 1.287\dots + 12$ 24.9 cm	M1 A1 (2)
Total for Question 5: 6 marks		



Question 6

9 marks

Part	Scheme	Marks
(a)	$\frac{1}{2}r^2 \times 2.1 = 58 \Rightarrow r^2 = \frac{116}{2.1}$ $r = 7.432\dots = 7.43 \text{ m}^*$	M1 A1* (2)
(b)	$\frac{\pi - 2.1}{2} = \boxed{0.521}$ The common error is $\frac{2\pi - 2.1}{2}$: AOD is a straight line, so the angles at O add to π.	B1 (1)
(c)	Area of one triangle = $\frac{1}{2} \times 7 \times 7.432\dots \times \sin 0.5208\dots$ Total = $58 + 2 \times 12.94\dots$ $\boxed{83.9 \text{ m}^2}$	M1 M1 A1 (3)
(d)	$AB^2 = 7^2 + 7.432\dots^2 - 2 \times 7 \times 7.432\dots \cos 0.5208\dots, \text{ so } AB = 3.739\dots$ Arc BC = $7.432\dots \times 2.1 = 15.61\dots$ Perimeter = $15.61\dots + 2 \times 3.739\dots + 14 = \boxed{37.1 \text{ m}}$ The radii OB and OC are internal and are not part of the perimeter. The base AD = 14 m is.	M1 B1 A1 (3)
Total for Question 6: 9 marks		



Question 7

9 marks

Part	Scheme	Marks
(a)	$6 + 6 + 6 \times 1.1$ 18.6 km	M1 A1 (2)
(b)	Area of sector = $\frac{1}{2} \times 6^2 \times 1.1 = 19.8$ $R_1 + R_2 = 3R_1$, so $R_1 = \frac{19.8}{3}$ $= 6.6 \text{ km}^2$ * <i>A circular argument (using 6.6 to find OP and then the area again) scores 0.</i>	M1 M1 A1* (3)
(c)	$\frac{1}{2} \times 6 \times OP \times \sin 1.1 = 6.6$ $OP = 2.47 \text{ km}$	M1 A1 (2)
(d)	$AP^2 = 6^2 + 2.468\dots^2 - 2 \times 6 \times 2.468\dots \cos 1.1$ $AP = 5.35\dots$, so 5.4 km <i>Final A1 needs the answer to the nearest 100 m, with units. AP is not perpendicular to OB.</i>	M1 A1 (2)
Total for Question 7: 9 marks		



Question 8

9 marks

Part	Scheme	Marks
(a)	$\frac{\sin(\angle OBA)}{10} = \frac{\sin \frac{\pi}{6}}{7} \Rightarrow \sin(\angle OBA) = \frac{5}{7}, \text{ acute value } 0.7956 \dots$ Obtuse: $\pi - 0.7956 \dots = 2.3459 \dots = 2.346^*$	M1 A1* (2)
(b)	Angle $OAB = \pi - \frac{\pi}{6} - 2.3459 \dots = 0.2720 \dots$ and $OB = \frac{7 \sin 0.2720 \dots}{\sin \frac{\pi}{6}}$ 3.76 cm	M1 A1 (2)
(c)	Triangle = $\frac{1}{2} \times 10 \times 3.761 \dots \times \sin \frac{\pi}{6} = 9.40 \dots$ Sector = $\frac{1}{2} \times 3.761 \dots^2 \times 1.2 = 8.49 \dots$ 17.9 cm²	M1 M1 A1 (3)
(d)	$10 + 7 + 3.761 \dots \times 1.2 + 3.761 \dots$ 25.3 cm <i>OB is an internal line and must not be added. The boundary is OA, AB, the arc BC and CO.</i>	M1 A1 (2)
Total for Question 8: 9 marks		



Question 9

8 marks

Part	Scheme	Marks
(a)	$a = 3$	B1
	$\frac{\pi}{6} + b = \frac{\pi}{2}$, so $b = \frac{\pi}{3}$	B1
		(2)
(b)	$3 \sin \frac{\pi}{3}$: $\left(0, \frac{3\sqrt{3}}{2}\right)$	B1
		(1)
(c)	$x + \frac{\pi}{3} = \pi$ or 2π	M1
	$x = \frac{2\pi}{3}$ and $x = \frac{5\pi}{3}$	A1
		(2)
(d)	$y = 3 \cos(x + c)$ has its maximum where $x + c = 0$, so $\frac{\pi}{6} + c = 0$	M1
	$c = -\frac{\pi}{6}$	A1
	Equivalently, $\sin\left(x + \frac{\pi}{3}\right) = \cos\left(x + \frac{\pi}{3} - \frac{\pi}{2}\right)$. $c = \frac{11\pi}{6}$ is outside the given range.	(2)
(e)	$\left(\frac{7\pi}{6}, -3\right)$	B1
		(1)
Total for Question 9: 8 marks		



Question 10

10 marks

Part	Scheme	Marks
(a)	$2r + r\theta = 20$ and $\frac{1}{2}r^2\theta = 16$ Eliminates θ : $r\theta = 20 - 2r$, so $\frac{1}{2}r(20 - 2r) = 16$ $10r - r^2 = 16 \Rightarrow r^2 - 10r + 16 = 0$ *	B1 M1 A1* (3)
(b)	$(r - 2)(r - 8) = 0$, so $r = 2$ or $r = 8$ $r = 2$ gives $\theta = \frac{20 - 4}{2} = 8$ Rejects: $8 > 2\pi$, which is more than a full turn, so this is not a sector $r = 8, \theta = \frac{1}{2}$	M1 M1 A1 A1 (4)
(c)	$r\theta = 20 - 2r$, so $A = \frac{1}{2}r(20 - 2r) = 10r - r^2$ * $A = 25 - (r - 5)^2$, so the maximum area is 25 cm^2 when $r = 5$ $5\theta = 20 - 10$, so $\theta = 2$	B1* M1 A1 (3)
Total for Question 10: 10 marks		

