

A level Mathematics Practice Paper – Geometric sequences and series – Mark scheme

Question	Scheme	Marks
1(a)	$11^2 = 8^2 + 7^2 - (2 \times 8 \times 7 \cos C)$	M1
	$\cos C = \frac{8^2 + 7^2 - 11^2}{2 \times 8 \times 7}$ (or equivalent)	A1
	$\{\hat{C} = 1.64228...\} \Rightarrow \hat{C} = \text{awrt } 1.64$	A1 cso
		(3)
1(b)	Use of Area $\Delta ABC = \frac{1}{2}ab \sin(\text{their } C)$, where a, b are any of 7, 8 or 11	M1
	$= \frac{1}{2}(7 \times 8) \sin C$ using the value of their C from part (a)	A1 ft
	$\{= 27.92848... \text{ or } 27.93297...\} = \text{awrt } 27.9$ (from angle of either 1.64° or 94.1°)	A1 cso
		(3)
		(6 marks)
2(a)	In triangle OCD complete method used to find angle COD so: Either $\cos \angle COD = \frac{8^2 + 8^2 - 7^2}{2 \times 8 \times 8}$ or uses $\angle COD = 2 \times \arcsin \frac{3.5}{8}$ oe so $\angle COD =$	M1
	$(\angle COD = 0.9056(331894)) = 0.906$ (3sf) * accept awrt 0.906	A1 *
		(2)
2(b)	Uses $s = 8\theta$ for any θ in radians or $\frac{\theta}{360} \times 2\pi \times 8$ for any θ in degrees	M1
	$\theta = \frac{\pi - \angle COD}{2}$ (= awrt 1.12) or 2θ (= awrt 2.24) and Perimeter = $23 + (16 \times \theta)$	M1
	accept awrt 40.9 (cm)	A1
		(3)
2(c)	Either Way 1: (Use of Area of two sectors + area of triangle)	
	Area of triangle = $\frac{1}{2} \times 8 \times 8 \times \sin 0.906$ (or 25.1781155 accept awrt 25.2) or $\frac{1}{2} \times 8 \times 7 \times \sin 1.118$ or $\frac{1}{2} \times 7 \times h$ after h calculated from correct Pythagoras or trig.	M1
	Area of sector = $\frac{1}{2} 8^2 \times 1.117979732$ (or 35.77535142 accept awrt 35.8)	M1
	Total Area = Area of two sectors + area of triangle = awrt 96.7 or 96.8 or 96.9 (cm ²)	A1
		(3)
		(8 marks)

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Question	Scheme	Marks
3(a)	Usually answered in radians: Uses $BCD = 3.5 \times (\text{angle}), = 3.5 \times 1.77 = 6.195 \text{ (m)}$ (accept awrt 6.20)	M1 A1
		(2)
3(b)	Area = $\frac{1}{2}(3.5)^2 \times 1.77 = 10.84 \text{ (m}^2\text{)}$	M1 A1
		(2)
3(c)	Area of triangle = $\frac{1}{2} \times 3.7 \times 3.5 \times \sin(\text{angle}), = \frac{1}{2} \times 3.7 \times 3.5 \times \sin(\frac{\pi}{2} - \frac{1.77}{2})$ (=awrt 4.1)	M1 A1
	Total area = "10.84" + $2 \times$ "4.101"	M1
	= 19.04	A1cao
		(4)
		(8 marks)
4(a)	Length $DEA = 7(2.1) = 14.7$	M1A1
		(2)
4(b)	Angle $CBD = \pi - 2.1$	M1
	Both $7 \cos(\pi - 2.1)$ and $7 \sin(\pi - 2.1)$ or Both $7 \cos(\pi - 2.1)$ and $\sqrt{7^2 - (7 \cos(\pi - 2.1))^2}$ or Both $7 \sin(\pi - 2.1)$ and $\sqrt{7^2 - (7 \sin(\pi - 2.1))^2}$ Or equivalents to these	dM1
	$P = 7 \cos(\pi - 2.1) + 7 \sin(\pi - 2.1) + 7 + 14.7$	ddM1
	= 31.2764...	A1
	Awrt 31.3	
		(4)
		(6 marks)

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Question	Scheme		Marks
5(a)	$\text{Area } BDE = \frac{1}{2}(5)^2(1.4)$		M1
	$= 17.5 \text{ (cm}^2\text{)}$		A1
			(2)
	Parts (b) and (c) can be marked together		
5(b)	$6.1^2 = 5^2 + 7.5^2 - (2 \times 5 \times 7.5 \cos DBC)$ or $\cos DBC = \frac{5^2 + 7.5^2 - 6.1^2}{2 \times 5 \times 7.5}$ (or equivalent)		M1
	Angle $DBC = 0.943201\dots$	awrt 0.943	A1
			(2)
5(c)	Note that candidates may work in degrees in (c) (Angle $DBC = 54.04\dots$ degrees)		
	$\text{Area } CBD = \frac{1}{2}5(7.5)\sin(0.943)$		
	Angle $EBA = \pi - 1.4 - "0.943"$ (Maybe seen on the diagram)	$\text{Area } CBD = \frac{1}{2}5(7.5)\sin(\text{their } 0.943)$ or awrt 15.2. (Note area of $CBD = 15.177\dots$) A correct method for the area of triangle CBD which can be implied by awrt 15.2	M1
	$\pi - 1.4 - \text{"their } 0.943"$		M1
	$AB = 5 \cos(\pi - 1.4 - "0.943")$ or $AE = 5 \sin(\pi - 1.4 - "0.943")$		
	$AB = 5 \cos(\pi - 1.4 - \text{their } 0.943)$ $AB = 5 \cos(0.79859\dots) = 3.488577938\dots$ Or $AE = 5 \sin(\pi - 1.4 - \text{their } 0.943)$ $AE = 5 \sin(0.79859\dots) = 3.581874365688\dots$		M1
	$\text{Area } EAB = \frac{1}{2}5 \cos(\pi - 1.4 - "0.943") \times 5 \sin(\pi - 1.4 - "0.943")$		dM1
	$\text{Area } ABCDE = 15.17\dots + 17.5 + 6.24\dots = 38.92\dots$		
	awrt 38.9		A1 cso
			(5)
			(9 marks)

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Question	Scheme		Marks
6(a)	$9^2 = 4^2 + 6^2 - 2 \times 4 \times 6 \cos \alpha \Rightarrow \cos \alpha = \dots$	Correct use of cosine rule leading to a value for $\cos \alpha$	M1
	$\cos \alpha = \frac{4^2 + 6^2 - 9^2}{2 \times 4 \times 6} \left(= -\frac{29}{48} = -0.604.. \right)$		
	$\alpha = 2.22$ *	Cso (2.22 must be seen here)	A1
	(NB $\alpha = 2.219516005$)		
			(2)
6(b)	$2\pi - 2.22 (= 4.06366\dots)$	$2\pi - 2.22$ or awrt 4.06	B1
	$\frac{1}{2} \times 4^2 \times "4.06"$	Correct method for major sector area.	M1
	32.5	Awrt 32.5	A1
			(3)
6(c)	Area of triangle = $\frac{1}{2} \times 4 \times 6 \times \sin 2.22 (= 9.56)$	Correct expression for the area of triangle XYZ	B1
	So area required = "9.56" + "32.5"	Their triangle XYZ + (part (b) answer or correct attempt at major sector)	M1
	= 42.1 cm ² or 42.0 cm ²	Awrt 42.1 or 42.0 (Or <u>just</u> 42)	A1
			(3)
6(d)	Arc length = $4 \times 4.06 (= 16.24)$ Or $8\pi - 4 \times 2.22$	M1: $4 \times \text{their}(2\pi - 2.22)$ Or circumference – minor arc	M1A1ft
		A1: Correct ft expression	
	Perimeter = ZY + WY + Arc Length	9 + 2 + Any Arc	M1
	Perimeter = 27.2 or 27.3	Awrt 27.2 or awrt 27.3	A1
			(4)
			(12 marks)

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Question	Scheme	Marks
7(a)	$r\theta = 6 \times 0.95, = 5.7 \quad (\text{cm})$	M1 A1
		(2)
7(b)	$\frac{1}{2}r^2\theta = \frac{1}{2} \times 6^2 \times 0.95, = 17.1 \quad (\text{cm}^2)$	M1 A1
		(2)
7(c)	Let $AD = x$ then $\frac{x}{\sin 0.95} = \frac{6}{\sin 1.24}$ so $x = 5.16$ * OR $x = 3 / \cos 0.95$ OR so $x = 3 / \sin 0.62$ so $x = 5.16$ * OR $x^2 = 6^2 + x^2 - 12x \cos 0.95$ leading to $x =$, so $x = 5.16$ *	M1 A1
		(2)
7(d)	Perimeter = '5.7'+5.16 +6 – 5.16= "11.7" or 6 + their 5.7	M1A1 ft
		(2)
7(e)	Area of triangle $ABD = \frac{1}{2} \times 6 \times 5.16 \times \sin 0.95 = 12.6$ or $\frac{1}{2} \times 6 \times 3 \times \tan 0.95 = 12.6$ ($\frac{1}{2}$ base x height) or $\frac{1}{2} \times 5.16 \times 5.16 \times \sin 1.24 = 12.6$	M1 A1
	So Area of $R = '17.1' - '12.6' = 4.5$	M1 A1
		(4)
		(12 marks)

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Question	Scheme	Marks
8(a)	Mark (a) and (b) together.	
	Usually answered in radians: Uses either $\frac{1}{2}ab\sin(\text{angle})$ or $\frac{1}{2}(12)^2(\text{angle})$ or both	M1
	Area = $\frac{1}{2}(23)(12)\sin 0.64$ or $\frac{1}{2}(12)^2(\pi - 0.64)$ $\{= 82.41297091... \text{ or } 180.1147...$	A1
	Area = $\frac{1}{2}(23)(12)\sin 0.64 + \frac{1}{2}(12)^2(\pi - 0.64)$ $\{= 82.41297091... + 180.11467...$	A1
	$\{\text{Area} = 262.527642...\}$ = awrt 262.5 (m ²) or 262.4(m ²) or 262.6 (m ²)	A1
		(4)
8(b)	$CDE = 12 \times (\text{angle}), = 12(\pi - 0.64) \{ \Rightarrow CDE = 30.01911... \}$	M1 A1
	$AE^2 = 23^2 + 12^2 - 2(23)(12)\cos(0.64) \Rightarrow AE^2 =$ or $AE =$ $\{AE = 15.17376...$	M1
	Perimeter = $23 + 12 + 15.17376... + 30.01911...$	M1
	$= 80.19287... =$ awrt 80.2 (m)	A1
		(5)
		(9 marks)

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	Source paper	Question number	New spec references	Question description	New AOs
1	C2 Jan 2011	2	5.1	Trigonometry	1.1b
2	C2 2015	4	5.1	Trigonometry of triangle and circle	1.1b, 2.1, 3.1a
3	C2 2017	4	5.1	Trigonometry - arc length and area of sector, Area of triangle	1.1b, 3.1b and 3.4
4	C2 June 2014R	5	5.1	Arc length and sector area	1.1b, 2.2a
5	C2 2014	5	5.1	Arc length and sector area	1.1b, 2.2a, 3.1
6	C2 Jan 2013	7	5.1,	Trigonometry	1.1b, 2.2a, 3.1a
7	C2 Jan 2012	7	5.1	Trigonometry	1.1b
8	C2 2013	5	5.1	Trigonometry	1.1b, 3.1b