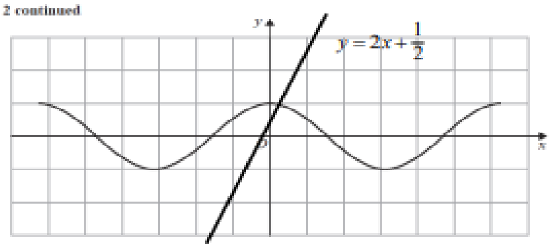
Radians- MS

June 2019 Mathematics Advanced Paper 1: Pure Mathematics 1

1.

Question	Scheme	Marks	AOs
2(a)	2 continued  Diagram 1	B1	3.1a
	For an allowable linear graph and explaining that there is only one intersection	B1	2.4
		(2)	
(b)	$\cos x - 2x - \frac{1}{2} = 0 \Rightarrow 1 - \frac{x^2}{2} - 2x - \frac{1}{2} = 0$	M1	1.1b
	Solves their $x^2 + 4x - 1 = 0$	dM1	1.1b
	Allow awrt 0.236 but accept $-2 + \sqrt{5}$	A1	1.1b
		(3)	
			(5 marks)

(a)

B1: Draws $y = 2x + \frac{1}{2}$ on Figure 1 or Diagram 1 with an attempt at the correct gradient and the correct intercept. Look for a straight line with an intercept at $\approx \frac{1}{2}$ and a further point at $\approx \left(\frac{1}{2}, 1\frac{1}{2}\right)$ Allow a tolerance of 0.25 of a square in either direction on these two points. It must appear in quadrants 1, 2 and 3.

B1: There must be an allowable linear graph on Figure 1 or Diagram1 for this to be awarded
Explains that as there is only one intersection so there is just one root.
This requires a reason and a minimal conclusion.
The question asks candidates to explain but as a bare minimum allow one "intersection"

Note: An allowable linear graph is one with intercept of $\pm\frac{1}{2}$ with one intersection with $\cos x$ **OR** gradient of ± 2 with one intersection with $\cos x$

(b)

M1: Attempts to use the small angle approximation $\cos x = 1 - \frac{x^2}{2}$ in the given equation.
The equation must be in a single variable but may be recovered later in the question.

dM1: Proceeds to a 3TQ in a single variable and attempts to solve. See General Principles
The previous M must have been scored. Allow completion of square or formula or calculator. Do not allow attempts via factorisation unless their equation does factorise. You may have to use your calculator to check if a calculator is used.

A1: Allow $-2 + \sqrt{5}$ or awrt 0.236.

Do not allow this where there is another root given and it is not obvious that 0.236 has been chosen.

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2.

Question	Scheme	Marks	AOs
1	Attempts either $\sin 3\theta \approx 3\theta$ or $\cos 4\theta \approx 1-\frac{(4\theta)^2}{2}$ in $\frac{1-\cos 4\theta}{2\theta \sin 3\theta}$	M1	1.1b
	Attempts both $\sin 3\theta \approx 3\theta$ and $\cos 4\theta \approx 1-\frac{(4\theta)^2}{2} \rightarrow \frac{1-\left(1-\frac{(4\theta)^2}{2}\right)}{2\theta \times 3\theta}$ and attempts to simplify	M1	2.1
	$=\frac{4}{3}$ oe	A1	1.1b
		(3)	
			(3 marks)

M1: Attempts either $\sin 3\theta \approx 3\theta$ or $\cos 4\theta \approx 1-\frac{(4\theta)^2}{2}$ in the given expression.

See below for description of marking of $\cos 4\theta$

M1: Attempts to substitute both $\sin 3\theta \approx 3\theta$ and $\cos 4\theta \approx 1-\frac{(4\theta)^2}{2}$

$\rightarrow \frac{1-\left(1-\frac{(4\theta)^2}{2}\right)}{2\theta \times 3\theta}$ and attempts to simplify.

Condone missing bracket on the 4θ so $\cos 4\theta \approx 1-\frac{4\theta^2}{2}$ would score the method

Expect to see it simplified to a single term which could be in terms of θ

Look for an answer of k but condone $k\theta$ following a slip

A1: Uses both identities and simplifies to $\frac{4}{3}$ or exact equivalent with no incorrect lines BUT allow recovery on missing bracket for $\cos 4\theta \approx 1-\frac{4\theta^2}{2}$.

Eg. $\frac{1-\left(1-\frac{(4\theta)^2}{2}\right)}{2\theta \times 3\theta}=\frac{8\theta^2}{6\theta}=\frac{4}{3}$ is M1 M1 A0

Condone awrt 1.33.

Alt: $\frac{1-\cos 4\theta}{2\theta \sin 3\theta}=\frac{1-\left(1-2\sin^2 2\theta\right)}{2\theta \sin 3\theta}=\frac{2\sin^2 2\theta}{2\theta \sin 3\theta}=\frac{2\times(2\theta)^2}{2\theta \times 3\theta}=\frac{4}{3}$

M1 For an attempt at $\sin 3\theta \approx 3\theta$ or the identity $\cos 4\theta = 1-2\sin^2 2\theta$ with $\sin 2\theta \approx 2\theta$

M1 For both of the above and attempts to simplify to a single term.

A1 $\frac{4}{3}$ oe

May 2017 Mathematics Advanced Paper 1: Pure Mathematics 2

3.

Question Number	Scheme	Marks
4. (a)	**Usually answered in radians: Uses** $BCD = 3.5 \times (angle)$, $= 3.5 \times 1.77 = 6.195$ (m) (accept awrt 6.20)	M1 A1 **(2)**
(b)	Area = $\frac{1}{2}(3.5)^2 \times 1.77 = 10.84$ (m^2)	M1 A1 **(2)**
(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 × "4.101"	M1
	= 19.04	A1cao **(4)** **[8]**

	Notes
(a)	M1: uses $s = 3.5 \times \theta$ with θ in radians or completely correct work in degrees A1: awrt 6.20 or just 6.2 (do not need to see units) Correct answer can imply the method.
(b)	M1 for attempt to use $A = \frac{1}{2} \times 3.5^2 \times \theta$ (Accept θ in degrees.) A1 for awrt 10.84 (do not need to see units) isw if correct answer is followed by 10.8. Correct answer can imply the method.
(c)	M1: Uses area of triangle $\frac{1}{2} \times 3.7 \times 3.5 \times \sin(\text{angle})$ Must be correct method for area of triangle but may be less direct. A1: Correct expression using correct angle i.e. $\frac{\pi}{2} - \frac{1.77}{2}$ or awrt 0.69 or awrt 39 degrees (need at least 2 sf if no other work seen, but may be implied by correct final answer) If correct expression is given then isw (so e.g. isw an answer of 0.0775 implying angle set to degrees on calculator) M1: Adds **twice** their **second calculated area** (even if rectangle or segment) to their sector area (may have been slips or errors in one or both formulae – such as missing ½ or mixture of degrees and radians or weak attempt at triangle area) so M0A0M1A0 is a possible mark distribution A1: 19.04 cao (common answer through insufficient accuracy is 19.08 which loses final mark) **Special Case**. The mark profile M1A0M1A0M1A0M1A0 can be given if the angle is misunderstood as 1.77π or as AFB for example If "10.84" + $3.5 \times 3.7 \sin(\text{angle})$ is used then this can gain both M marks and the A marks if correct. But use of $3.5 \times 3.7 \sin(\text{angle})$ and later doubled and added to "10.84" is 1st M0, 2nd M1.

May 2016 Mathematics Advanced Paper 1: Pure Mathematics 2

4.

Question Number	Scheme		Marks
9. (a)	$\text{Area}(FEA) = \frac{1}{2}x^2\left(\frac{2\pi}{3}\right); = \frac{\pi x^2}{3}$	$\frac{1}{2}x^2 \times \left(\frac{2\pi}{3}\right)$ or $\frac{120}{360} \times \pi x^2$ simplified or un-simplified	M1
		$\frac{\pi x^2}{3}$	A1
			[2]
	Parts (b) and (c) may be marked together		
(b)	$\{A =\}\ \frac{1}{2}x^2 \sin 60^\circ + \frac{1}{3}\pi x^2 + 2xy$	Attempt to sum 3 areas (at least one correct)	M1
		Correct expression for at least two terms of A	A1
	$1000 = \frac{\sqrt{3}x^2}{4} + \frac{\pi x^2}{3} + 2xy \Rightarrow y = \frac{500}{x} - \frac{\sqrt{3}x}{8} - \frac{\pi x}{6}$ $\Rightarrow y = \frac{500}{x} - \frac{x}{24}\left(4\pi + 3\sqrt{3}\right)$ *	Correct proof.	A1 *
			[3]
(c)	$\{P =\}\ x + x\theta + y + 2x + y\ \left\{= 3x + \frac{2\pi x}{3} + 2y\right\}$	Correct expression in x and y for their θ measured in rads	B1ft
	$...2y = \quad + 2\left(\frac{500}{x} - \frac{x}{24}\left(4\pi + 3\sqrt{3}\right)\right)$	Substitutes expression from (b) into y term.	M1
	$P = 3x + \frac{2\pi x}{3} + \frac{1000}{x} - \frac{\pi x}{3} - \frac{\sqrt{3}}{4}x \Rightarrow P = \frac{1000}{x} + 3x + \frac{\pi x}{3} - \frac{\sqrt{3}}{4}x$		
	$\Rightarrow P = \frac{1000}{x} + \frac{x}{12}\left(4\pi + 36 - 3\sqrt{3}\right)$ *	Correct proof.	A1 *
			[3]
	Parts (d) and (e) should be marked together		
(d)	$\frac{dP}{dx} = -1000x^{-2} + \frac{4\pi + 36 - 3\sqrt{3}}{12}; = 0$	$\frac{1000}{x} \to \frac{\pm\lambda}{x^2}$	M1
		Correct differentiation (need not be simplified).	A1;
		Their $P' = 0$	M1
	$\Rightarrow x = \sqrt{\frac{1000(12)}{4\pi + 36 - 3\sqrt{3}}}$ $(= 16.63392808...)$	$\sqrt{\frac{1000(12)}{4\pi + 36 - 3\sqrt{3}}}$ or awrt 17 (may be implied)	A1
	$\left\{P = \frac{1000}{(16.63...)} + \frac{(16.63...)}{12}\left(4\pi + 36 - 3\sqrt{3}\right)\right\} \Rightarrow P = 120.236..\ (\text{m})$	awrt 120	A1
			[5]
(e)	$\frac{d^2P}{dx^2} = \frac{2000}{x^3} > 0 \Rightarrow \text{Minimum}$	Finds P'' **and** considers sign.	M1
		$\frac{2000}{x^3}$ (need not be simplified) and > 0 and conclusion. Only follow through on a correct P'' and x in range $10 < x < 25$.	A1ft
			[2]
			15

		Question 9 Notes
(a)	M1	Attempts to use $\text{Area}(FEA) = \frac{1}{2}x^2 \times \frac{2\pi}{3}$ (using radian angle) or $\frac{120}{360} \times \pi x^2$ (using angle in degrees)
	A1	$\frac{\pi x^2}{3}$ cao (Must be simplified and be their answer in part (a)) Answer only implies M1A1. N.B. $\text{Area}(FEA) = \frac{1}{2}x^2 \times 120$ is awarded M0A0
(b)	M1	An attempt to sum 3 " areas" consisting of rectangle, triangle and sector (allow slips even in dimensions) but **one area** should be correct
	1st A1	Correct expression for **two** of the **three** areas listed above. Accept any correct equivalents e.g. two correct from $\frac{1}{2}x^2 \sin\left(\frac{\pi}{3}\right)$ or $\frac{1}{4}x^2\sqrt{3}$, $\frac{1}{2} \times \frac{2}{3}\pi x^2$, $2xy$
	2nd A1*	This is a given answer which should be stated and should be achieved without error so all three areas must have been correct and their sum put equal to 1000 and an intermediate step of rearrangement should be present.

(c)	B1ft	Correct expression for P from arc length, length AB and three sides of rectangle in terms of both x and y with $2y$ (or $y + y$), $3x$ (or $x + 2x$) (or $x + x + x$), and $x\theta$ clearly listed . Allow addition after substitution of y. NB $\theta = \frac{2\pi}{3}$ but allow use of their consistent θ in radians (usually $\theta = \frac{\pi}{3}$) from parts (a) and (b) for this mark. $120x$ or $60x$ do not get this mark.
	M1	Substitutes $y = \frac{500}{x} - \frac{x}{24}\left(4\pi + 3\sqrt{3}\right)$ or their unsimplified attempt at y from earlier (allow slips e.g. sign slips) into $2y$ term.
	A1*	This is a given answer which should be stated and should be achieved without error
(d)	1st M1	Need to see at least $\frac{1000}{x} \to \frac{\pm\lambda}{x^2}$
	1st A1	Correct differentiation of both terms (need not be simplified) Not follow through. Allow any correct equivalent. e.g. $\frac{dP}{dx} = -1000x^{-2} + \frac{\pi}{3} + 3 - \frac{\sqrt{3}}{4}$ Also allow $\frac{dP}{dx} = -1000x^{-2} + awrt\ 3.61$ Check carefully as there are many correct equivalents and some have two terms in $x\pi$ to differentiate obtaining for example $\frac{2\pi}{3} - \frac{8\pi}{24}$ instead of $\frac{\pi}{3}$
	2nd M1	Setting their $\frac{dP}{dx} = 0$. Do not need to find x, but if inequalities are used this mark cannot be gained until candidate states or uses a value of x without inequalities. May not be explicit but may be implied by correct working and value or expression for x . May result in $x^2 < 0$ so M1A0
	2nd A1	There is no requirement to write down a value for x, so this mark may be implied by a correct value for P. It may be given for a correct expression or value for x of 16.6, 16.7 or 17
	3rd A1	Allow answers wrt 120 but not 121

(e)	M1	Finds P'' **and** considers sign. Follow through **correct** differentiation of their P' (not just reduction of power)
	A1ft	Need $\frac{2000}{x^3}$ and > 0 (or positive value) and conclusion. Only follow through on a correct P'' and a value for x in the range $10 < x < 25$ (need not see x substituted but an x should have been found) If P is substituted then this is awarded M1 A0

	Special case	(d) Some candidates multiply P by 12 to "simplify" If they write $\frac{dP}{dx} = -12000x^{-2} + 4\pi + 36 - 3\sqrt{3}$; $= 0$ then solve they will get the correct x and P They should be awarded M1A0M1A1A1 in part (d). If they then do part (e) writing $\frac{d^2P}{dx^2} = \frac{24000}{x^3} > 0 \Rightarrow$ Minimum They should be awarded M1A0 (so lose 2 marks in all) If they wrote $\frac{d(12P)}{dx} = -12000x^{-2} + 4\pi + 36 - 3\sqrt{3}$; $= 0$ etc they could get full marks.

May 2015 Mathematics Advanced Paper 1: Pure Mathematics 2

5.

Question Number	Scheme	Marks
4.(a)	In triangle OCD **complete method** used to find angle COD so:	
	Either $\cos C\hat{O}D = \dfrac{8^2+8^2-7^2}{2\times8\times8}$ 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)
(b)	Uses $s = 8\theta$ for any θ in radians or $\dfrac{\theta}{360}\times2\pi\times8$ for any θ in degrees	M1
	$\theta = \dfrac{\pi - \text{"}COD\text{"}}{2}$ $(= awrt\ 1.12)$ or $2\theta(= awrt\ 2.24)$ and Perimeter = 23+(16 $\times\theta$)	M1
	accept awrt 40.9 (cm)	A1 (3)
(c)	Either Way 1: (Use of Area of two sectors + area of triangle)	
	Area of triangle = $\frac{1}{2}\times8\times8\times\sin0.906$ (or 25.1781155 accept awrt 25.2)or $\frac{1}{2}\times8\times7\times\sin1.118$ or $\frac{1}{2}\times7\times h$ after h calculated from correct Pythagoras or trig.	M1
	Area of sector = $\frac{1}{2}8^2\times\text{"}1.117979732\text{"}$ (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)
	Or Way 2: (Use of area of semicircle – area of segment)	
	Area of semi-circle = $\frac{1}{2}\times\pi\times8\times8$ (or 100.5)	M1
	Area of segment = $\frac{1}{2}8^2\times(\text{"}0.906\text{"}-\sin\text{"}0.906\text{"})$ (or 3.807)	M1
	So area required = awrt 96.7 or 96.8 or 96.9 (cm^2)	A1 (3) [8]

Notes

(a) **M1**: Either use correctly quoted cosine rule – may quote as $7^2 = 8^2+8^2-2\times8\times8\cos\alpha \Rightarrow \alpha = ...$
Or split isosceles triangle into two right angled triangles and use arcsin or longer methods using Pythagoras and arcos (i.e. $\pi - 2\times\arccos\frac{3.5}{8}$). **There are many ways of showing this result.**
Must conclude that $\angle COD =$

A1*: (NB this is a given answer) If any errors or over-approximation is seen this is A0. It needs correct work **leading to stated answer** of 0.906 or awrt 0.906 for A1. The cosine of COD is equal to 79/128 or awrt 0.617. Use of 0.62 (2sf) does not lead to printed answer. They may give 51.9 in degrees then convert to radians. This is fine.

The minimal solution $7^2 = 8^2+8^2-2\times8\times8\cos\alpha \Rightarrow \alpha = ...0.906$ (with no errors seen) can have M1A1 but errors rearranging result in M1A0

(b) **M1**: Uses formula for arc length with $r = 8$ and any angle i.e. $s = 8\theta$ if working in rads or $s = \dfrac{\theta}{360}\times2\pi\times8$ in degrees
(If the formula is quoted with r the 8 may be implied by the value of their $r\theta$)

M1: Uses angles on straight line (or other geometry) to find angle BOC or AOD and uses Perimeter = 23 + arc lengths BC and AD (may make a slip – in calculation or miscopying)

A1: correct work leading to awrt 40.9 not 40.8 (do not need to see cm) This answer implies M1M1A1

(c) Way 1: **M1**: Mark is given for **correct** statement of area of triangle $\frac{1}{2}\times8\times8\times\sin0.906$ (must use correct angle) or for correct answer (awrt 25.2) Accept alternative correct methods using Pythagoras and ½ base×height

M1: Mark is given for formula for area of sector $\frac{1}{2}8^2\times\text{"}1.117979732\text{"}$ with $r = 8$ and their angle BOC or AOD or (BOC + AOD) **not** COD. May use $A = \dfrac{\theta}{360}\times\pi\times8^2$ **if working in degrees**

A1: Correct work leading to awrt 96.7, 96.8 or 96.9 (This answer implies M1M1A1)

NB. Solution may combine the two sectors for part (b) and (c) and so might use $2\times\angle BOC$ rather than $\angle BOC$

Way 2: **M1**: Mark is given for **correct** statement of area of semicircle $\frac{1}{2}\times\pi\times8\times8$ or for correct answer 100.5

M1: Mark is given for formula for area of segment $\frac{1}{2}8^2\times(\text{"}0.906\text{"}-\sin\text{"}0.906\text{"})$ with $r = 8$ or 3.81 **A1**: As in Way 1

6.

Question Number	Scheme		Marks
5.(a)	Area $BDE = \frac{1}{2}(5)^2(1.4)$	M1: Use of the correct formula or method for the area of the sector	M1A1
	$= 17.5\ (\text{cm}^2)$	A1: 17.5 oe	
			[2]
(b)	**Parts (b) and (c) can be marked together**		
	$6.1^2 = 5^2 + 7.5^2 - (2\times5\times7.5\cos DBC)$ or $\cos DBC = \dfrac{5^2+7.5^2-6.1^2}{2\times5\times7.5}$ (or equivalent)		M1
	M1: A correct statement involving the angle DBC		
	Angle $DBC = 0.943201...$	awrt 0.943	A1
	Note that work for (b) may be seen on the diagram or in part (c)		
			[2]
(c)	**Note that candidates may work in degrees in (c)** (Angle $DBC = 54.04....\text{degrees}$)		
	Area $CBD = \frac{1}{2}5(7.5)\sin(0.943)$		
	Angle $EBA = \pi - 1.4 - "0.943"$ **(Maybe seen on the diagram)**	Area $CBD = \frac{1}{2}5(7.5)\sin(\text{their } 0.943)$ or awrt 15.2. (Note area of $CBD = 15.177...$) A correct method for the area of triangle CBD which can be implied by awrt 15.2	M1
	$\pi - 1.4 - "\text{their } 0.943"$ A value for angle EBA of awrt 0.8 (from 0.7985926536... or 0.7983916536...) or value for angle EBA of $(1.74159... - \text{their angle } DBC)$ would imply this mark.		M1
	$AB = 5\cos(\pi - 1.4 - "0.943")$ or $AE = 5\sin(\pi - 1.4 - "0.943")$		
		$AB = 5\cos(\pi - 1.4 - \text{their } 0.943)$ $AB = 5\cos(0.79859...) = 3.488577938...$ Allow M1 for $AB = \text{awrt } 3.49$ Or $AE = 5\sin(\pi - 1.4 - \text{their } 0.943)$ $AE = 5\sin(0.79859...) = 3.581874365688...$ Allow M1 for $AE = \text{awrt } 3.58$ **It must be clear that $\pi - 1.4 - "0.943"$ is being used for angle EBA.** **Note that some candidates use the sin rule here but it must be used correctly – do not allow mixing of degrees and radians.**	M1
	Area $EAB = \frac{1}{2}5\cos(\pi - 1.4 - "0.943") \times 5\sin(\pi - 1.4 - "0.943")$		
	<u>**This is dependent on the previous M1**</u> <u>**and there must be no other errors in finding the area of triangle EAB**</u>		dM1
	Allow M1 for area $EAB = \text{awrt } 6.2$		
	Area $ABCDE = 15.17... + 17.5 + 6.24... = 38.92...$		
		awrt 38.9	A1cso
			[5]
	Note that a sign error in (b) can give the obtuse angle (2.198....) and could lead to the correct answer in (c) – this would lose the final mark in (c)		**Total 9**

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7.

Question Number	Scheme	Marks
5. (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** $\frac{1}{2}(12)^2(\pi - 0.64)$ $\{= 82.41297091...$ **or** $180.1146711...\}$	A1
	Area $= \frac{1}{2}(23)(12)\sin 0.64 + \frac{1}{2}(12)^2(\pi - 0.64)$ $\{= 82.41297091... + 180.1146711...\}$	A1
	$\{\text{Area} = 262.527642...\}$ = awrt 262.5 (m^2) or 262.4(m^2) or 262.6 (m^2)	A1
		(4)
(b)	$CDE = 12 \times (angle)$, $= 12(\pi - 0.64)\{\Rightarrow CDE = 30.01911...\}$	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]**

	Notes for Question 5
(a)	M1: uses either area of triangle formula as given in mark scheme, or area of sector or both (may be implied by answer) A1: one correct area expression (with **correct angle** used) $\frac{1}{2}(23)(12)\sin 0.64$ or $\frac{1}{2}(12)^2(\pi - 0.64)$ or see awrt 82.4 **or** awrt 180 (180 may be split as 226.2(semicircle) minus 46.1(small sector)) A1: two correct area expressions (with correct angles) **added together** (allow 2.5 as implying $\pi - 0.64$) or see awrt 82.4 + awrt 180 (or 226 - 46) A1: answers which round to 262.5 or 262.4 or 262.6
(b)	1st M1 for attempt to use $s = r\,\theta$ (any angle) 1st A1 for $\pi - 0.64$ in the formula (or 2.5) 2nd M1: Uses correct cosine rule to obtain AE or AE^2(this may appear in part (a)) 3rd M1(**independent**): Perimeter = 23 + 12 + their AE + their CDE 2nd A1: awrt 80.2 (ignore units – even incorrect units)
Degrees (a)	Uses either $\frac{1}{2}ab\sin(\text{angle})$ **or** $\frac{\text{angle in degrees}}{360} \times \pi(12)^2$ or both for M1 Area $= \frac{1}{2}(23)(12)\sin 36.7$ **or** $\frac{(180-36.7)}{360} \times \pi(12)^2$ $\{= awrt\ 82.4...$ **or** $180\}$ A1 Area $= \frac{1}{2}(23)(12)\sin 36.7 + \frac{(180-36.7)}{360} \times \pi(12)^2$ $\{= awrt\ 82.4... + 180\}$ A1 Final mark as before
(b)	$CDE = \frac{\text{Angle in degrees}}{360} \times 24\pi, = \frac{180-36.7}{360} \times 24\pi \{\Rightarrow CDE = 30.01268...\}$ M1, A1 Final three marks as before

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8.

Question Number	Scheme		Marks
7.			
[redacted]	[redacted]	Correct use of cosine rule [redacted]	[redacted]

[redacted]

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Jan 2012 Mathematics Advanced Paper 1: Pure Mathematics 2

9.

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May 2011 Mathematics Advanced Paper 1: Pure Mathematics 2

10.

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Jun 2010 Mathematics Advanced Paper 1: Pure Mathematics 2

11.

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12.

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