Question	Answer	Marks
8(a)	$r=\cos^2\theta$ SOI	M1
	$S_\infty=\dfrac{\sin^2\theta}{1-\cos^2\theta}$	M1
	1	A1
		3
8(b)(i)	$d=\sin^2\theta\cos^2\theta-\sin^2\theta$	M1
	$\sin^2\theta\left(\cos^2\theta-1\right)$	M1
	$-\sin^4\theta$	A1
		3

Question	Answer	Marks
8(b)(ii)	Use of $S_{16}=\dfrac{16}{2}[2a+15d]$	M1
	With both $a=\dfrac{3}{4}$ and $d=-\dfrac{9}{16}$	A1
	$S_{16}=-55\dfrac{1}{2}$	A1
		3

Question	Answer	Marks	Guidance
3(a)	State $2r+r\theta=65$ and $\frac{1}{2}r^2\theta=225$	B1	
	Form a 3-term quadratic or cubic in r or θ or $r\theta$ from correct arc and sector formula	*M1	Condone sign errors.
	Solve *their* 3 term quadratic or cubic to obtain values of r or θ	DM1	Expect $2r^2-65r+450=(2r-45)(r-10)$ or $18\theta^2-97\theta+72=(9\theta-8)(2\theta-9)$.
	$r=10$ and $\theta=4.5$ ignore $r=22.5$ and $\theta=\dfrac{8}{9}$, do not ignore $r=0$	A1	**B1 SC** if no quadratic or cubic solution. If $r=0$ included A0 or B0 SC.
		4	
3(b)	Use correct formula for area of triangle with clear use of angle being $2\pi-$their θ	M1	Expect 1.783 or 102.2°, *their* θ must be reflex.
	48.9	A1	AWRT, WWW or a second answer. Or greater accuracy; condone absence of units.
		2	

Question	Answer	Marks	Guidance
8(a)	$[\text{fg}(x)=]1/(2x+1)^2-1$	B1	SOI
	$1/(2x+1)^2-1=3$ leading to $4(2x+1)^2=1$ or $\dfrac{1}{(2x+1)}=[\pm]2$ or $16x^2+16x+3=0$	M1	Setting $\text{fg}(x)=3$ and reaching a stage before $2x+1=\pm½$ or reaching a 3 term quadratic in x
	$2x+1=\pm½$ or $2x+1=-½$ or $(4x+1)(4x+3)[=0]$	A1	Or formula or completing square on quadratic
	$x=-\dfrac{3}{4}$ only	A1	
	Alternative method for Question 8(a)		
	$x^2-1=3$	M1	
	$\text{g}(x)=-2$	A1	
	$\dfrac{1}{(2x+1)}=-2$	M1	
	$x=-\dfrac{3}{4}$ only	A1	
		4	

Question	Answer	Marks	Guidance
8(b)	$y=\frac{1}{(2x+1)^2}-1$ leading to $(2x+1)^2=\frac{1}{y+1}$ leading to $2x+1=[\pm]\frac{1}{\sqrt{y+1}}$	*M1	Obtain $2x+1$ or $2y+1$ as the subject
	$x=[\pm]\frac{1}{2\sqrt{y+1}}-\frac{1}{2}$	DM1	Make x (or y) the subject
	$-\frac{1}{2\sqrt{x+1}}-\frac{1}{2}$	A1	OE e.g. $-\frac{\sqrt{x+1}}{2x+2}-\frac{1}{2}$, $-\left(\sqrt{\frac{-x}{4x+4}}+\frac{1}{4}+\frac{1}{2}\right)$
		3	

Question	Answer	Marks	Guidance
5	Replace $\tan\theta$ with $\frac{\sin\theta}{\cos\theta}$	M1	
	Replace $\sin^2\theta$ with $1-\cos^2\theta$ leading to a 3-term quadratic	*M1	To obtain a 3-term quadratic in $\cos\theta$. Accept a cubic that has a common factor of $\cos\theta$. Condone +/–sign errors during simplification.
	$9\cos^2\theta+\cos\theta-4\ [=0]$	A1	OE
	Attempt to solve (*their* quadratic in $\cos\theta$) using a valid method	DM1	Only available for solution of a three-term quadratic. Correct values of $\cos\theta$ are 0.6134 and -0.7245.
	Any two of $\pm52.2,\ \pm136.4$	A1	AWRT as final answers. Any two correct answers between $-180°$ and $180°$ as *their* final answers.
	All four values	A1	Condone other answers outside the range but no others between $-180°$ and $180°$. **SC** after M1 *M1 A1 DM0, correct answers can score B1 B1.
		6	

Question	Scheme	Marks
5(a)	$\frac{1}{2}\times6^2\times1.3=\ldots$	M1
	$=23.4\,(\text{m}^2)$	A1
		(2)
(b)	$12.2^2=6^2+10.8^2-2\times6\times10.8\cos(ABE)$	M1
	$\cos(ABE)=\frac{6^2+10.8^2-12.2^2}{2\times6\times10.8}\left(=\frac{19}{648}\right)$ $ABE=1.54$	A1
		(2)
(c)	Area $ABE=\frac{1}{2}\times10.8\times6\sin(ABE)$	M1
	Area $BCD=\frac{1}{2}\times6\cos(\pi-1.3-"1.54")\times6\sin(\pi-1.3-"1.54")$ or e.g. Area $BCD=\frac{1}{2}\times6\sin(\pi-1.3-"1.54")\times\sqrt{6^2-(6\sin(\pi-1.3-"1.54"))^2}$	M1
	Total area $=60.9\text{m}^2$	A1
		(3)
		Total 7

Question	Answer	Marks	Guidance
5(b)	Differentiate *their* first derivative, substitute *their* x value. Substitution may be implied by a correct inequality or correct value,	**M1**	Must differentiate one term correctly. Expect $4-x^{-3}=12$ at $x=\frac{-1}{2}$ Alternative: substitute values of x into $\frac{dy}{dx}$. One value $x<-\frac{1}{2}$ and one value $-\frac{1}{2}<x<0$.
	conclude minimum	**A1**	Following correct work only
		2	
5(c)	State increasing …	**B1**	
	… with clear reference to first derivative always being positive [for $x>0$]	**B1**	Dependent on first derivative being correct. It is not sufficient to substitute values of x.
		2	

Question	Answer	Marks	Guidance
5	$\left[7C1a^6b(x)\right]$, $\left[7C2a^5b^2\left(x^2\right)\right]$, $[7C4a^3b^4\left(x^4\right)]$	**B2, 1, 0**	SOI, can be seen in an expansion.
	$\frac{7C2a^5b^2\left(x^2\right)}{7C1a^6b(x)}=\frac{7C4a^3b^4\left(x^4\right)}{7C2a^5b^2\left(x^2\right)}\rightarrow\frac{21a^5b^2}{7a^6b}=\frac{35a^3b^4}{21a^5b^2}$	**M1 A1**	M1 for a correct relationship OE (Ft from *their* 3 terms). For A1 binomial coefficients must be correct & evaluated.
	$\frac{a}{b}=\frac{5}{9}$	**A1**	OE
		5	

Question	Answer	Marks	Guidance
8(a)	$r=\frac{a}{a+2}$	**B1**	OE SOI
	$\frac{a}{1-\frac{a}{a+2}}=264$	**M1**	Use of S∞ formula.
	$\frac{a(a+2)}{a+2-a}=264$ leading to $\frac{a(a+2)}{2}=264$ leading to $a^2+2a-528$ $[=0]$	**M1***	Process to a 3 term quadratic or a 3 term cubic. May contain terms on LHS and RHS.
	$(a-22)(a+24)$ $[=0]$	**DM1**	Attempt to solve.
	$a=22$ (only)	**A1**	22 without working **SC DB1** (dep on 2nd M1).
		5	
8(b)	$d=\frac{6^2}{6+2}-6=-\frac{3}{2}$	**B1**	
	$\frac{n}{2}\left\{12+(n-1)\left(\frac{-3}{2}\right)\right\}[<]-480$	**M1***	Forming an inequation with *their* numerical d. May use an equality.
	$[3]\left(n^2-9n-640\right)$ $[>0]$	**A1**	OE May contain terms on LHS and RHS.
	$[n=]$ $\frac{9\pm\sqrt{81+2560}}{2}$	**DM1**	OE. Expect 30.19 . Working for solution must be shown.
	31 only	**A1**	Must come from a correct first inequality (or an equality). 31 no working **SC DB1** (dep on correct quadratic and correct inequality/equality).
		5	

Question	Answer	Marks	Guidance
5(a)	Angle $XYC = \sin^{-1}\left(\frac{9}{11}\right) = 0.9582$ or $\sin XYC = \frac{9}{11}$ leading to $XYC = 0.9582$	B1	AG. OE using cosine rule.
		1	
5(b)	$XY = \sqrt{11^2 - 9^2} = \sqrt{40}$ or using 0.9582 and trigonometry	*M1 A1	
	$AB = 9 + 11 - \textit{their}XY$	B1 FT	OE e.g. $20 - 2\sqrt{10}$, $2 + 9 - 2\sqrt{10} + 11 - 2\sqrt{10}$
	Arc $AC = 11 \times 0.9582$	M1	
	Arc $BC = 9 \times \frac{\pi}{2}$	M1	
	Perimeter = [13.6(8) + 10.5(4) + 14.1(4) =] 38.4	A1	AWRT. Answer must be evaluated as a single decimal.
		6	

Question	Answer	Marks
3(a)	$(y) = \mathrm{f}(-x)$	B1
		1
3(b)	$(y) = 2\mathrm{f}(x)$	B1
		1
3(c)	$(y) = \mathrm{f}(x+4) - 3$	B1 B1
		2