Question number	Scheme	Marks
10 (a)	$f\left(\frac{3}{4}\right)=16\left(\frac{3}{4}\right)^3+11\left(\frac{3}{4}\right)-15$	M1
	$\left(\frac{27}{4}+\frac{33}{4}-15\right)=0$ *	A1cso [2]
(b)(i)	$\left[\sin 2\theta=\sin(\theta+\theta)\right]=\sin\theta\cos\theta+\sin\theta\cos\theta$	M1
	$(\sin 2\theta=)2\sin\theta\cos\theta$ *	A1cso [2]
(b)(ii)	$\left[\cos 2\theta=\cos(\theta+\theta)=\right]\cos\theta\cos\theta-\sin\theta\sin\theta=\cos^2\theta-\sin^2\theta$	M1
	$=\cos^2\theta-(1-\cos^2\theta)=2\cos^2\theta-1$ *	M1 A1cso [3]
(c)	$27\cos\theta(2\cos^2\theta-1)+19\sin\theta(2\sin\theta\cos\theta)-15(=0)$	M1
	$54\cos^3\theta-27\cos\theta+38(1-\cos^2\theta)\cos\theta-15(=0)$	M1
	$54\cos^3\theta-27\cos\theta+38\cos\theta-38\cos^3\theta-15(=0)$ $\left(16\cos^3\theta+11\cos\theta-15=0\right)$ oe	A1
	(When $x=\cos\theta$) $16x^3+11x-15=0$ *	A1cso [4]
(d)	$\left(16x^3+11x-15=0\Rightarrow(4x-3)(4x^2+3x+5)=0\right)\rightarrow 4x^2+3x+5$	M1
	$b^2-4ac=9-80<0$ (So no real roots)	M1 A1
	(Only solution is) $4x-3=0$ or $4\cos\theta-3=0$ so $\cos\theta=\frac{3}{4}$ *	A1cso [4]
		Total 15 marks

Part	**Marks**	**Notes**
(a)	**M1**	For $f\left(\frac{3}{4}\right)=16\left(\frac{3}{4}\right)^3+11\left(\frac{3}{4}\right)-15$
	A1*cso	For a fully correct solution, with = 0 stated, with no errors seen
(b)(i)	**M1**	For sight of $\sin\theta\cos\theta+\sin\theta\cos\theta$
	A1*cso	For obtaining the given expression, with no errors seen
(b)(ii)	**M1**	For $\cos\theta\cos\theta-\sin\theta\sin\theta=\cos^2\theta-\sin^2\theta$
	M1	For correctly using $\sin^2\theta=1-\cos^2\theta$
	A1*cso	For obtaining the given expression with no errors seen
(c)	**M1**	For correctly substituting $\sin 2\theta=2\sin\theta\cos\theta$ and $\cos 2\theta=2\cos^2\theta-1$
	M1	For expanding the first set of brackets (allow one error only in expansion) and correct use of $\sin^2\theta=1-\cos^2\theta$,
	A1	$54\cos^3\theta-27\cos\theta+38\cos\theta-38\cos^3\theta-15(=0)$ oe all brackets expanded
	A1*cso	For obtaining the given equation
(d)	**M1**	For any valid, complete method to find the quadratic factor which must be of the form $4x^2+ax\pm5$
	M1	For use of the discriminant from their quadratic factor
	A1	For $b^2-4ac=9-80<0$

Question number	Scheme	Marks
11 (a)(i)	$(a=)-8$	B1 [1]
(a)(ii)	$e^{2x}=9 \Rightarrow 2x=\ln 9$	M1
	$x=\frac{1}{2}\ln 9=\ln 3$ *	A1cso [2]
ALT	$e^{2x}=9 \Rightarrow \left[\left(e^{x}\right)^{2}=3^{2}\right] \Rightarrow e^{x}=3$	M1
	$x=\ln 3$ *	A1cso
(b)	$\pi\int_{0}^{\ln 3}\left(e^{2x}-9\right)^{2}\,dx$	M1
	$\pi\int_{0}^{\ln 3}\left(e^{4x}-18e^{2x}+81\right)dx$	A1
	$(\pi)\left[\frac{1}{4}e^{4x}-9e^{2x}+81x\right]_{(0)}^{(\text{"}\ln 3\text{"})}$ oe	M1 A1ft
	$(\pi)\left[\left(\frac{81}{4}-81+81\ln 3\right)-\left(\frac{1}{4}-9\right)\right]$	M1
	$\pi(81\ln 3-52)$	A1 [6]
		Total 9 marks

	A1*cso	For a fully correct solution.

Part	Mark	Notes
(a)(i)	**B1**	For $(a=)-8$
(a)(ii)	**M1**	For substituting y = 0 and rearranging to $2x=\ln 9$ or $x=\frac{1}{2}\ln 9$
	A1*cso	For a fully correct solution with no errors – must see $x=\frac{1}{2}\ln 9$ *or* $2x=2\ln 3$
ALT	**M1**	For substituting y = 0 and manipulating to give $e^{x}=3$
	A1*cso	For a fully correct solution with no errors
(b)	**M1**	For $\pi\int_{0}^{\ln 3}\left(e^{2x}-9\right)^{2}\,dx$
	A1	For $\pi\int_{0}^{\ln 3}\left(e^{4x}-18e^{2x}+81\right)dx$ oe. If π seen for first M1, can be omitted.
	M1	For minimally acceptable attempt to integrate two terms of their expression (at least one term integrated correctly). π and limits can be omitted.
	A1ft	For $\frac{1}{4}e^{4x}-9e^{2x}+81x$ Ft their expression of the form $e^{4x}+ce^{2x}+d$ π and limits can be omitted
	M1	For correct substitution of 0 and their *b* into a changed expression. The substitution must be fully shown for this mark. π can be omitted. This mark can be implied by a correct final answer.
	A1	For obtaining the correct expression

π must only be present for the final A1 mark and the first M1 mark (can be implied by first or final A1)

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