Question	Scheme	Marks	AOs
9(a)	$e^{2i\theta}+e^{-2i\theta}=(\cos 2\theta+i\sin 2\theta)+(\cos(-2\theta)+i\sin(-2\theta))$ $=(\cos 2\theta+i\sin 2\theta)+(\cos 2\theta-i\sin 2\theta)=\ ...$	M1	2.1
	$=2\cos 2\theta$ *	A1*	1.1b
		(2)	
(b)	$C+iS=1+\frac{1}{4}e^{2i\theta}+\frac{1}{16}e^{4i\theta}+\ ...$	M1	2.1
	$C+iS=\dfrac{1}{1-\frac{1}{4}e^{2i\theta}}$	M1	1.1b
	$C+iS=\frac{4}{4-e^{2i\theta}}$	A1	1.1b
		(3)	
(c)	$C+iS=\dfrac{4}{4-e^{2i\theta}}\times\dfrac{4-e^{-2i\theta}}{4-e^{-2i\theta}}$	M1	2.1
	$=\dfrac{16-4e^{-2i\theta}}{17-4(e^{2i\theta}+e^{-2i\theta})}=\dfrac{16-4(\cos 2\theta-i\sin 2\theta)}{17-8\cos 2\theta}$	M1	1.1b
	$C=\mathrm{Re}\left(\dfrac{16-4(\cos 2\theta-i\sin 2\theta)}{17-8\cos 2\theta}\right)=\dfrac{16-4\cos(2\theta)}{17-8\cos(2\theta)}$ *	A1*	2.2a
		(3)	
(d)	$S=\mathrm{Im}\left(\dfrac{16-4(\cos 2\theta-i\sin 2\theta)}{17-8\cos 2\theta}\right)=\dfrac{4\sin(2\theta)}{17-8\cos(2\theta)}$	B1ft	2.2a
	$\frac{4\sin(2\theta)}{17-8\cos(2\theta)}=0\Rightarrow 4\sin(2\theta)=0\Rightarrow\theta=\cdots$	M1	3.1a
	$\theta=0,\ \frac{\pi}{2},\ \pi$	A1	1.1b
		(3)	
			(11 marks)

Notes:

(a)

M1: Uses the modulus-argument form (Euler's formula)

A1*: Achieves the printed answer, with no errors seen

(b)

M1: Writes $C+iS$ as a series $1+\alpha e^{2i\theta}+\beta e^{4i\theta}$

M1: Use the sum to infinity of a GP on their series

A1: Correct answer

(c)

M1: Multiplies top and bottom of the answer to (b) by $4-e^{-2i\theta}$

M1: Replaces $e^{-2i\theta}$ with $\cos 2\theta-i\sin 2\theta$ and $e^{2i\theta}+e^{-2i\theta}=2\cos 2\theta$

A1*: Achieves the printed answer, with no errors seen

A1: Deduces the correct expression for S

(d)

B1ft: Deduces the correct imaginary part from their $C + \mathrm{i}S$

M1: Sets $S = 0$ and uses trigonometry to find a value for θ

A1: All three correct values for θ