Question Number	Scheme	Notes	Marks
7(a)	Condone use of e.g. $C + iS$ for $\cos x + i\sin x$ if the intention is clear.		
	$(\cos 5x \equiv)\,\mathrm{Re}(\cos x + i\sin x)^5 \equiv \cos^5 x + \binom{5}{2}\cos^3 x(i\sin x)^2 + \binom{5}{4}\cos x(i\sin x)^4$ Identifies the correct terms of the binomial expansion of $(\cos x + i\sin x)^5$ They may expand $(\cos x + i\sin x)^5$ completely but there must be an attempt to extract the real terms which must have the correct binomial coefficients combined with the correct powers of sin *x* and cos *x*. Condone use of a different variable e.g. θ.		M1
	$(\cos 5x \equiv)\cos^5 x - 10\cos^3 x\sin^2 x + 5\cos x\sin^4 x$ Correct simplified expression. Condone use of a different variable e.g. θ.		A1
	$\equiv \cos x(\cos^4 x - 10\cos^2 x\sin^2 x + 5\sin^4 x)$ $\equiv \cos x\left((1-\sin^2 x)^2 - 10(1-\sin^2 x)\sin^2 x + 5\sin^4 x\right)$ Applies $\cos^2 x = 1 - \sin^2 x$ to obtain an expression in terms of sin *x* inside the bracket. Condone use of a different variable e.g. θ.		M1
	$\equiv \cos x(16\sin^4 x - 12\sin^2 x + 1)$	Correct expression. Must be in terms of *x* now. The "cos5*x* =" is not required.	A1
			(4)
(b)	Allow use of a different variable in (b) e.g. *x* for <u>all</u> marks.		
	$\cos 5\theta = \sin 2\theta\sin\theta - \cos\theta$ $\Rightarrow \cos\theta(16\sin^4\theta - 12\sin^2\theta + 1) = 2\sin^2\theta\cos\theta - \cos\theta$ $\Rightarrow \cos\theta(16\sin^4\theta - 14\sin^2\theta + 2) = 0$ Uses the result from part (a) with $\sin 2\theta = 2\sin\theta\cos\theta$ and collects terms		M1
	$16\sin^4\theta - 14\sin^2\theta + 2 = 0$ $\Rightarrow \sin^2\theta = \frac{7 \pm \sqrt{17}}{16} \Rightarrow \sin\theta = ...$ Solves for $\sin^2\theta$ by any method including calculator and takes square root to obtain at least one value for $\sin\theta$. Depends on the first mark. May be implied by their values of $\sin\theta$ or θ. NB $\frac{7 \pm \sqrt{17}}{16} = 0.69519..., 0.17980...$		dM1
	$\sin\theta = \sqrt{\frac{7 \pm \sqrt{17}}{16}} \Rightarrow \theta = ...$ NB $\sqrt{\frac{7 \pm \sqrt{17}}{16}} = 0.833783..., \ 0.424035...$ A full method to reach at least one value for θ. Depends on the previous mark. May be implied by their values of θ		ddM1
	$(\theta =) 0.986, \ 0.438$	Correct values and no others in range. Allow awrt these values.	A1
			(4)
			Total 8

Note that it is possible to do 7(b) by changing to cos θ e.g.

$$\cos\theta\left(16\sin^4\theta-12\sin^2\theta+1\right)=\cos\theta\left(16\left(1-\cos^2\theta\right)^2-12\left(1-\cos^2\theta\right)+1\right)$$

$$\cos\theta\left(16\left(1-\cos^2\theta\right)^2-12\left(1-\cos^2\theta\right)+1\right)=2\sin^2\theta\cos\theta-\cos\theta$$

$$16\cos^4\theta-18\cos^2\theta+4=0$$

$$\cos^2\theta=\frac{9\pm\sqrt{17}}{16}\Rightarrow\cos\theta=\sqrt{\frac{9\pm\sqrt{17}}{16}}$$

$$(\theta=)0.986,\ 0.438$$

This is acceptable as they used part (a) and can be scored as:

M1: Uses part (a) with $\sin^2\theta=1-\cos^2\theta$ and $\sin 2\theta=2\sin\theta\cos\theta$ and collects terms.

dM1: Solves for $\cos^2\theta$ by any method including calculator and takes square root to obtain at least one value for $\cos\theta$. Depends on the first mark. May be implied by their values of $\cos\theta$ or θ.

$$\text{NB } \frac{9\pm\sqrt{17}}{16}=0.82019...,\ 0.30480...$$

dM1: A full method to reach at least one value for θ.
Depends on the previous mark. May be implied by their values of θ

$$\text{NB } \sqrt{\frac{9\pm\sqrt{17}}{16}}=0.905645...,\ \ 0.552092...$$

A1: $(\theta=)0.986,\ 0.438$