Question			Answer	Marks	Guidance
1			$\cos 2\theta = 1 - 2\sin^2\theta$	M1*	$\cos 2\theta = \pm 1 \pm 2\sin^2\theta$ (maybe implied in substitution)
			$(6\cos 2\theta + \sin\theta =)\ 6 - 12\sin^2\theta + \sin\theta$	A1	
			$6\cos 2\theta + \sin\theta = 0$ $\Rightarrow\ 12\sin^2\theta - \sin\theta - 6 = 0$ $\Rightarrow\ (4\sin\theta - 3)(3\sin\theta + 2) = 0$	M1dep*	Use of correct quadratic equation formula or factorising or comp. the square on their three term quadratic in $\sin\theta$ (see guidance in question 1 for awarding this method mark) provided $b^2 - 4ac \geq 0$
			$\Rightarrow\ \sin\theta = 3/4$ or $-2/3$	A1	www
				B1	First correct solution to 1 dp or better (eg 48.59° etc)
				B1	Three correct solutions
			$\Rightarrow\ \sin\theta = 3/4$, $\theta = 48.6°, 131.4°$ $\sin\theta = -2/3$, $\theta = 221.8°, 318.2°$	B1	All four correct solutions and no others in the range Ignore solutions outside the range **SC** Award max B1B1B0 for answers in radians (0.85, 2.29, 3.87, 5.55 or better – so one correct B1, three correct B1). Award max B1 if there are extra solutions in the range with radians **SC** If M1M1 awarded and both values of $\lvert\sin\theta\rvert \leq 1$ but B0B0B0 then award B1 only for evidence of using $\sin\theta \equiv \sin(180 - \theta)$
				[7]	

Question			Answer	Marks	Guidance
2	**(i)**		EITHER Use of cos = 1/sec (or sin= 1/cosec) From RHS $\frac{1-\tan\alpha\tan\beta}{\sec\alpha\sec\beta}$ $=\frac{1-\sin\alpha/\cos\alpha.\sin\beta/\cos\beta}{1/\cos\alpha.1/\cos\beta}$ $=\cos\alpha\cos\beta(1-\frac{\sin\alpha\sin\beta}{\cos\alpha\cos\beta})$ $=\cos\alpha\cos\beta-\sin\alpha\sin\beta$ $=\cos(\alpha+\beta)$	B1 M1 A1	Must be **used** Substituting and simplifying as far as having no fractions within a fraction [need more than $\frac{1-tt}{\sec\sec}=cc-ss$ ie an intermediate step that can lead to cc–ss] Convincing simplification and correct use of $\cos(\alpha+\beta)$ Answer given
			OR From LHS, cos = 1/sec or sin = 1/cosec **used** $\cos(\alpha+\beta)$ $=\cos\alpha\cos\beta-\sin\alpha\sin\beta$ $=\frac{1}{\sec\alpha\sec\beta}-\sin\alpha\sin\beta$ $=\frac{1-\sec\alpha\sin\alpha\sec\beta\sin\beta}{\sec\alpha\sec\beta}$ $=\frac{1-\tan\alpha\tan\beta}{\sec\alpha\sec\beta}$	B1 M1 A1 **[3]**	Correct angle formula and substitution and simplification to one term OR eg $\cos\alpha\cos\beta-\sin\alpha\sin\beta$ $=\cos\alpha\cos\beta(1-\tan\alpha\tan\beta)$ Simplifying to final answer www **Answer given** Or any equivalent work but must have more than cc–ss = answer.

Question			Answer	Marks	Guidance
2	(ii)		$\beta = \alpha$ $\cos 2\alpha = \dfrac{1-\tan^2\alpha}{\sec^2\alpha}$ $= \dfrac{1-\tan^2\alpha}{1+\tan^2\alpha}$.	M1 A1	$\beta = \alpha$ used , Need to see sec²α Use of $\sec^2\alpha = 1 + \tan^2\alpha$ to give required result Answer Given
			OR, without Hence, $\cos 2\alpha = \cos^2\alpha(1-\dfrac{\sin^2\alpha}{\cos^2\alpha})$ $= \dfrac{1}{\sec^2\alpha}(1-\tan^2\alpha)$ $= \dfrac{1-\tan^2\alpha}{1+\tan^2\alpha}$	M1 **[2]**	Use of $\cos 2\alpha = \cos^2\alpha - \sin^2\alpha$ soi Simplifying and using $\sec^2\alpha = 1+ \tan^2\alpha$ to final answer Answer Given Accept working in reverse to show RHS=LHS, or showing equivalent
2	(iii)		$\cos 2\theta = ½$ $2\theta = 60°, 300°$ $\theta = 30°, 150°$	M1 A1 A1 **[3]**	Soi or from $\tan^2\theta = 1/3$ oe from $\sin^2\theta$ or $\cos^2\theta$ First correct solution Second correct solution and no others in the range SC B1 for π/6and 5π/6 and no others in the range

Question			Answer	Marks	Guidance
3			$\sin(x + 45°) = \sin x \cos 45° + \cos x \sin 45°$ $= \sin x .1/\sqrt{2} + \cos x . 1/\sqrt{2}$ $= (1/\sqrt{2})(\sin x + \cos x) = 2\cos x$ $\Rightarrow \quad \sin x + \cos x = 2\sqrt{2}\cos x$ * $\Rightarrow \quad \sin x = (2\sqrt{2} - 1) \cos x$ $\Rightarrow \quad \tan x = 2\sqrt{2} - 1$ $\Rightarrow \quad x = 61.32°$, 241.32°	M1 A1 A1 M1 A1 A1 **[6]**	Use of **correct** compound angle formula **Since AG ,** $\sin x \cos 45^{o} + \cos x \sin 45^{o} = 2\cos x$ $\sin x + \cos x = 2\sqrt{2} \cos x$ only gets M1 need the second line or statement of $\cos 45^{o} = \sin 45^{o} = 1/\sqrt{2}$ oe as an intermediate step to get A1 A1 terms collected and $\tan x = \sin x /\cos x$ used for first correct solution for second correct solution and no others in the range 2dp but allow overspecification ignore solutions outside the range SC A1 for both 61.3º and 241.3º SC A1 for both 1.07 and 4.21 radians (or better) SC A1 for incorrect answers that round to 61.3° and 180° + their ans eg 61.33° and 241.33° Do not award SC marks if there are extra solutions in the range.

4 $\tan(\theta+45)=\dfrac{\tan\theta+\tan 45}{1-\tan\theta\tan 45}$	M1	oe using sin/cos
$=\dfrac{\tan\theta+1}{1-\tan\theta}$	A1	
$\Rightarrow$ $\dfrac{\tan\theta+1}{1-\tan\theta}=1-2\tan\theta$		
$\Rightarrow$ $1+\tan\theta=(1-2\tan\theta)(1-\tan\theta)$	M1	multiplying up and expanding
$=1-3\tan\theta+2\tan^2\theta$	A1	any correct one line equation
$\Rightarrow$ $0=2\tan^2\theta-4\tan\theta=2\tan\theta(\tan\theta-2)$	M1	solving quadratic for $\tan\theta$ oe
$\Rightarrow$ $\tan\theta=0$ or 2		
$\Rightarrow$ $\theta=0$ or 63.43	A1A1	www
	[7]	-1 extra solutions in the range

5 $\sin(\theta+\alpha)=2\sin\theta$		Using correct Compound angle formula
$\Rightarrow$ $\sin\theta\cos\alpha+\cos\theta\sin\alpha=2\sin\theta$	M1	in a valid equation
$\Rightarrow$ $\tan\theta\cos\alpha+\sin\alpha=2\tan\theta$	M1	dividing by $\cos\theta$
$\Rightarrow$ $\sin\alpha=2\tan\theta-\tan\theta\cos\alpha$		
$=\tan\theta\,(2-\cos\alpha)$	M1	collecting terms in $\tan\theta$ or $\sin\theta$ or dividing by $\tan\theta$ oe
$\Rightarrow$ $\tan\theta=\dfrac{\sin\alpha}{2-\cos\alpha}$ *	E1	www (can be all achieved for the method in reverse)
$\sin(\theta+40°)=2\sin\theta$		
$\Rightarrow$ $\tan\theta=\dfrac{\sin 40}{2-\cos 40}=0.5209$	M1	$\tan\theta=\dfrac{\sin 40}{2-\cos 40}$
$\Rightarrow$ $\theta=27.5°, 207.5°$	A1 A1	-1 if given in radian
	[7]	-1 extra solutions in the rang

6 $2\cos 2x=2(2\cos^2x-1)=4\cos^2x-2$	**M1**	Any double angle formula used
$\Rightarrow$ $4\cos^2x-2=1+\cos x$		
$\Rightarrow$ $4\cos^2x-\cos x-3=0$	**M1**	*getting a quadratic in cos x*
$\Rightarrow$ $(4\cos x+3)(\cos x-1)=0$	**M1dep**	attempt to solve
$\Rightarrow$ $\cos x=-3/4$ or 1	**A1**	for -3/4 and 1
$\Rightarrow$ $x=138.6°$ or $221.4°$	**B1 B1**	139,221 or better
or 0	**B1**	www
	[7]	-1 extra solutions in range