Question			Answer	Marks	AO	Guidance	
11	(a)		**DR** $\tan\theta + \cot\theta = \frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta}$ $= \frac{\sin^2\theta + \cos^2\theta}{\cos\theta\sin\theta}$	**M1**	**3.1a**	Use identities for $\tan\theta$ and $\cot\theta$ and attempt to combine fractions into a single fraction	Allow **BOD** if order reversed when considering $\tan\theta + \cot\theta$ Could instead split into two fractions if starting with right-hand side (or using a proof that 'meets in the middle')
			$= \frac{1}{\cos\theta\sin\theta}$	**M1**	**3.1a**	Use at least one identity correctly	ie **use of** $\sin^2\theta + \cos^2\theta = 1$, or equivalent Pythagorean identity, in a proof and not just stated 2nd and 3rd **M marks** could be seen in either order, and possibly in a single step
			$= \frac{1}{\frac{1}{2}\sin 2\theta}$	**M1**	**1.1**	Use a second identity correctly	ie **use of** $\cos\theta\sin\theta = \frac{1}{2}\sin 2\theta$ and not just stated
			$= 2\text{cosec}2\theta$ **AG**	**A1**	**2.1**	Obtain given answer	Obtain given answer convincingly Condone missing θ within proof, as long as present in final answer
				[4]			**M** marks could be seen in any order, depending on the method used Starting with the LHS, the RHS or attempting a proof that 'meets in the middle' are all acceptable methods Attempting to manipulate the given identity can gain **M** marks up until the point where any term(s) change sides; after that there is no further credit

Question			Answer	Marks	AO	Guidance	
11	(b)		**DR** $\frac{2}{\sin 2\theta} = 4$ $\sin 2\theta = \frac{1}{2}$	**B1**	**3.1a**	Obtain $\sin 2\theta = \frac{1}{2}$ oe; any correct equation (possibly with $\sin 2\theta$ in the denominator)	Obtain correct equation in a single trig ratio, with like terms gathered, and no powers
			$2\theta = 30^o$ $\theta = 15^o$	**M1**	**1.1**	Attempt to find at least one solution, using correct order of operations Equation **must** involve $k\theta$, where $k \neq 1$	eg invsin and then divide by 2 Could be invcos or invtan, depending on equation being solved, and could be dividing by k and not 2
			$2\theta = 30°, 150°, 390°, 510°$ $\theta = 15°, 75°, 195°, 255°$	**A1**	**1.1**	Obtain at least two correct solutions	Condone solutions in radians Must come from solving algebraically and not **BC** eg correct solutions from $\sin\theta\cos\theta = 0.25$ is **M0**, and hence **A0**
				A1	**2.1**	Obtain all 4 correct solutions, and no others in given range	Must now be in degrees
				[4]		**NB** solution space is over 2 pages so **MUST** check both – needs **SEEN** on pg13	**DR** so method needed; no credit for answer(s) only **NB** The command word is 'hence' so there should be an attempt to use the result from part **(a)**, though **B0 M1** is possible if the equation was never correct. If there is never an attempt to use the part **(a)** result, but another algebraic method is instead attempted (eg quadratic in $\tan\theta$ or disguised quadratic in $\sin\theta$ or $\cos\theta$) then apply **SC B1** for 2 correct solutions or **B2** for all 4 correct and no extras

11	**(c)**		**DR** $\tan\frac{1}{2}\theta + \cot\frac{1}{2}\theta = 2\text{cosec}\theta$	**B1***	**3.1a**	State or use correct identity from part **(a)**	If used in the given equation, condone errors elsewhere as long as this identity is correct
			$\sin 2\theta(2\,\text{cosec}\,\theta) = 3$ $2\sin\theta\cos\theta\dfrac{2}{\sin\theta} = 3$	**M1dep***	**3.1a**	Valid attempt to rewrite in terms of $\sin\theta$ and/or $\cos\theta$ only	Using correct identities
			$4\cos\theta = 3$ $\cos\theta = \dfrac{3}{4}$	**A1**	**1.1**	Simplify to obtain correct value for $\cos\theta$	**A0** if additional solutions **ISW** any value given for θ Must have worked exactly throughout, so **A0** if 41.4° seen as part of solution
				[3]			