5		**(a)**	**DR** $(\cot\theta+\text{cosec}\,\theta)^2=\left(\frac{\cos\theta}{\sin\theta}+\frac{1}{\sin\theta}\right)^2$ or $\cot^2\theta+2\cot\theta\,\text{cosec}\,\theta+\text{cosec}^2\theta=$ $\frac{\cos^2\theta}{\sin^2\theta}+2\left(\frac{\cos\theta}{\sin\theta}\right)\left(\frac{1}{\sin\theta}\right)+\frac{1}{\sin^2\theta}$ $=\left(\frac{1+\cos\theta}{\sin\theta}\right)^2=\frac{(1+\cos\theta)^2}{\sin^2\theta}=\frac{(1+\cos\theta)^2}{1-\cos^2\theta}$ or $\frac{1+2\cos\theta+\cos^2\theta}{\sin^2\theta}=\frac{1+2\cos\theta+\cos^2\theta}{1-\cos^2\theta}$ $=\frac{(1+\cos\theta)(1+\cos\theta)}{(1+\cos\theta)(1-\cos\theta)}$ or $\frac{1+2\cos\theta+\cos^2\theta}{(1-\cos\theta)(1+\cos\theta)}$ $=\frac{1+\cos\theta}{1-\cos\theta}$	**M1*** **M1dep*** **M1dep*** **A1** **[4]**	**2.1** **2.1** **1.1** **2.2a**	Replace both cot and cosec correctly in terms of cos and sin **or** expands brackets and replaces all terms with correct expressions in terms of sin and cos Combine terms and using $\sin^2\theta=1-\cos^2\theta$ correctly in denominator Re-writes $1-\cos^2\theta=(1+\cos\theta)(1-\cos\theta)$ **AG -** correct proof - no notational or other errors such as missing $\theta's$ or inconsistent variables – must see $(1+\cos\theta)(1+\cos\theta)$ or $(1+\cos\theta)^2$ in numerator before **AG**	Allow omission of 2 if brackets expanded but must contain a $\cot\theta\,\text{cosec}\,\theta$ term Ignore terms in numerator for this mark Dependent on both previous M marks
		ALT	$\frac{1+\cos\theta}{1-\cos\theta}=\frac{(1+\cos\theta)(1+\cos\theta)}{(1-\cos\theta)(1+\cos\theta)}$	M1*		Multiplying numerator and denominator by $(1+\cos\theta)$	
			$\frac{(1+\cos\theta)^2}{1-\cos^2\theta}=\frac{(1+\cos\theta)^2}{\sin^2\theta}$	M1dep*		Expanding and using $\sin^2\theta=1-\cos^2\theta$ correctly in denominator	Ignore numerator for this mark
			$\left(\frac{1+\cos\theta}{\sin\theta}\right)^2=\left(\frac{1}{\sin\theta}+\frac{\cos\theta}{\sin\theta}\right)^2$	M1dep*		Rewrite as a single squared term and split up into two terms	Dependent on both previous M marks
			$=(\cot\theta+\text{cosec}\,\theta)^2$	A1 [4]		**AG –** allow candidates to 'meet in the middle' but for the A1 mark they must give a conclusion (e.g. 'LHS = RHS' or 'proved')	

5	(b)		**DR**			**If 3 and/or 2 missing then M1M1M1A0B0 max. (so do not treat as a MR)**	
			$3(\cos\theta+\text{cosec}\,\theta)^2=2\sec\theta\Rightarrow 3\left(\frac{1+\cos\theta}{1-\cos\theta}\right)=\frac{2}{\cos\theta}$	**M1***	**2.1**	Using the result from part **(i)** and re-placing sec with 1/cos	Allow omission or errors with the placement of the 3 and or the 2
			$3\cos\theta(1+\cos\theta)=2(1-\cos\theta)\Rightarrow 3\cos^2\theta+5\cos\theta-2=0$	**M1dep***	**1.1**	Removing fractions and form three term quadratic in cos	Condone not = 0
			$(3\cos\theta-1)(\cos\theta+2)=0$	**M1dep***	**1.1**	Solving their three-term quadratic in cosine provided discriminant is non-negative. Use of correct quadratic equation formula (if formula is quoted correctly then only one sign slip is permitted, if the formula is quoted incorrectly M0, if not quoted at all substitution must be completely correct to earn the M1) or factorising (giving their $\cos^2\theta$ term and one other term when factors multiplied out) or comp. the square (must get to the square root stage involving ± and arithmetical errors may be condoned provided their $3\left(\cos\theta+\frac{5}{6}\right)^2$ seen or implied)	Dependent on both previous M marks – as DR required if answers stated with no working then this mark cannot be awarded
			$\cos\theta\neq -2\because \lvert\cos\theta\rvert\leq 1$	**A1**	**2.3**	Explicit rejection of -2 seen - allow $\cos\theta\neq -2$	No reason for rejection required
			$\cos\theta=\frac{1}{3}\Rightarrow\theta=1.23,\ 5.05$	**B1**	**2.2a**	awrt 1.23 and 5.05 (ignore any extra answers outside of the range of $0<\theta<2\pi$) but withhold this mark if there are any extra values in range (B0 if given in degrees)	1.230 959 … 5.052 225 …
				[5]			