Question	Scheme	Marks	AOs
13(a)	$7\sin^2\theta - 4\sin\theta\cos\theta = 4$ $\Rightarrow 7\tan^2\theta - 4\tan\theta = \dfrac{4}{\cos^2\theta}$	M1	1.1b
	$\Rightarrow 3\tan^2\theta - 4\tan\theta + \dfrac{4\sin^2\theta}{\cos^2\theta} - \dfrac{4}{\cos^2\theta} = 0$	dM1	1.1b
	$\dfrac{4\sin^2\theta - 4}{\cos^2\theta} = -4\dfrac{\cos^2\theta}{\cos^2\theta} = -4 \Rightarrow 3\tan^2\theta - 4\tan\theta - 4 = 0$ *	ddM1 A1*	2.1 1.1b
		(4)	
(b)	Roots: $-\dfrac{2}{3}$, 2	B1	1.1b
	$\tan^{-1}\left("-\dfrac{2}{3}"\right) = \ldots$ or $\tan^{-1}("2") = \ldots$	M1	1.1b
	Two of awrt 63, awrt 146, awrt 243, awrt 326	A1	1.1b
	All four of awrt 63.4, awrt 146.3, awrt 243.4, awrt 326.3	A1	1.1b
		(4)	
(c)	awrt 735.9	B1	2.2a
		(1)	
			(9 marks)

Notes

(a) There are various ways of proceeding to the given answer. May work in θ or another variable which is acceptable. Condone a mixture of θ and e.g. x in the same equation or expression within their working.

Condone poor notation e.g. $\cos\theta^2$, $\sin^2 + \cos^2 = 1$ provided the intention is clear.

You may see multiple attempts so score the attempt which is most complete

M1: Score for any one of the following (somewhere in their same attempt which may already have errors in their working)

- divides **all** terms by $\cos^2\theta$
- uses $\tan\theta = \dfrac{\sin\theta}{\cos\theta}$ (or $\sec\theta = \dfrac{1}{\cos\theta}$)
- uses the identity $\pm\sin^2\theta \pm \cos^2\theta = \pm 1$ (or $\pm 1 \pm \tan^2\theta = \pm\sec^2\theta$)

dM1: Score for any two of the following (somewhere in their same attempt which may already have errors in their working)

- divides **all** terms by $\cos^2\theta$
- uses $\tan\theta = \dfrac{\sin\theta}{\cos\theta}$ (or $\sec\theta = \dfrac{1}{\cos\theta}$)
- uses the identity $\pm\sin^2\theta \pm \cos^2\theta = \pm 1$ (or $\pm 1 \pm \tan^2\theta = \pm\sec^2\theta$)

It is dependent on the previous method mark.

ddM1: A full attempt to rearrange the equation to the form $a\tan^2\theta + b\tan\theta + c = 0$. It is dependent on the previous two method marks. When rearranging condone sign slips or a missing trailing bracket only.

A1*: Proceeds to the given answer with all steps shown and no errors other than what is condoned (see above). Condone a missing trailing bracket only.

The final answer must be in terms of θ and written using the correct notation.

Note they may work in reverse from $3\tan^2\theta - 4\tan\theta - 4 = 0$ to $7\sin^2\theta - 4\sin\theta\cos\theta = 4$ or meet somewhere in the middle. In these cases there must be some minimal conclusion e.g. QED or tick

The first two method marks should be applied in the same way as the main scheme.

The dM1 mark will be scored for reaching a form of $\sin\theta(d\sin\theta + e\cos\theta) = f$

(b) **Answers with no working scores 0 marks.**
Beware of correct angles following incorrect roots which cannot score the A marks

B1: Roots: $-\frac{2}{3}$, 2

M1: Attempts to find at least one of the angles for one of their roots. This may be implied by a correct answer. You may need to check this on your calculator.

A1: Two of awrt 63, awrt 146, awrt 243, awrt 326 (**must come from a correct root**)

A1: All four of awrt 63.4, awrt 146.3, awrt 243.4, awrt 326.3 and no others in the range
Withhold the final mark if they solve for 4α (and subsequently divide their angles by 4)

(c)

B1: awrt 735.9