Question	Scheme	Marks	AOs
12 (a)	States or uses $\operatorname{cosec}\theta = \dfrac{1}{\sin\theta}$	B1	1.2
	$\operatorname{cosec}\theta - \sin\theta = \dfrac{1}{\sin\theta} - \sin\theta = \dfrac{1-\sin^2\theta}{\sin\theta}$	M1	2.1
	$= \dfrac{\cos^2\theta}{\sin\theta} = \cos\theta \times \dfrac{\cos\theta}{\sin\theta} = \cos\theta\cot\theta$ $\quad$ *	A1*	2.1
		(3)	
(b)	$\operatorname{cosec} x - \sin x = \cos x \cot(3x-50°)$ $\Rightarrow \cos x \cot x = \cos x \cot(3x-50°)$		
	$\cot x = \cot(3x-50°) \Rightarrow x = 3x-50°$	M1	3.1a
	$x = 25°$	A1	1.1b
	Also $\cot x = \cot(3x-50°) \Rightarrow x+180° = 3x-50°$	M1	2.1
	$x = 115°$	A1	1.1b
	Deduces $x = 90°$	B1	2.2a
		(5)	
		(8 marks)	
Notes:			

(a) Condone a full proof in x (or other variable) instead of $\theta's$ here

B1: States or uses $\operatorname{cosec}\theta = \dfrac{1}{\sin\theta}$ $\quad$ Do not accept $\operatorname{cosec}\theta = \dfrac{1}{\sin}$ with the θ missing

M1: For the key step in forming a single fraction/common denominator

$\quad$ E.g. $\operatorname{cosec}\theta - \sin\theta = \dfrac{1}{\sin\theta} - \sin\theta = \dfrac{1-\sin^2\theta}{\sin\theta}$. Allow if written separately $\dfrac{1}{\sin\theta} - \sin\theta = \dfrac{1}{\sin\theta} - \dfrac{\sin^2\theta}{\sin\theta}$

$\quad$ Condone missing variables for this M mark

A1*: Shows careful work with all necessary steps shown leading to given answer. See scheme for necessary steps. There should not be any notational or bracketing errors.

(b) Condone $\theta's$ instead of $x's$ here

M1: Uses part (a), cancels or factorises out the $\cos x$ term, to establish that one solution is found when $x = 3x-50°$.

$\quad$ You may see solutions where $\cot A - \cot B = 0 \Rightarrow \cot(A-B) = 0$ or $\tan A - \tan B = 0 \Rightarrow \tan(A-B) = 0$.

$\quad$ As long as they don't state $\cot A - \cot B = \cot(A-B)$ or $\tan A - \tan B = \tan(A-B)$ this is acceptable

A1: $x = 25°$

M1: For the key step in realising that $\cot x$ has a period of $180°$ and a second solution can be found by solving $x+180° = 3x-50°$. The sight of $x = 115°$ can imply this mark provided the step $x = 3x-50°$ has been seen. Using reciprocal functions it is for realising that $\tan x$ has a period of $180°$

A1: $x = 115°$ Withhold this mark if there are additional values in the range $(0,180)$ but ignore values outside.

B1: Deduces that a solution can be found from $\cos x = 0 \Rightarrow x = 90°$. Ignore additional values here.

....

Solutions with limited working. The question demands that candidates show all stages of working.

SC: $\cos x \cot x = \cos x \cot(3x-50°) \Rightarrow \cot x = \cot(3x-50°) \Rightarrow x = 25°, 115°$

They have shown some working so can score B1, B1 marked on epen as 11000

Alt 1- Right hand side to left hand side

Question	Scheme	Marks	AOs
12 (a)	States or uses $\quad \cot\theta = \dfrac{\cos\theta}{\sin\theta}$	B1	1.2
	$\cos\theta\cot\theta = \dfrac{\cos^2\theta}{\sin\theta} = \dfrac{1-\sin^2\theta}{\sin\theta}$	M1	2.1
	$= \dfrac{1}{\sin\theta} - \sin\theta = \operatorname{cosec}\theta - \sin\theta \qquad *$	A1*	2.1
		(3)	

Alt 2- Works on both sides

Question	Scheme	Marks	AOs
12 (a)	States or uses $\quad \cot\theta = \dfrac{\cos\theta}{\sin\theta}\quad$ or $\operatorname{cosec}\theta = \dfrac{1}{\sin\theta}$	B1	1.2
	$LHS = \dfrac{1}{\sin\theta} - \sin\theta = \dfrac{1-\sin^2\theta}{\sin\theta} = \dfrac{\cos^2\theta}{\sin\theta}$ $RHS = \cos\theta\cot\theta = \dfrac{\cos^2\theta}{\sin\theta}$	M1	2.1
	States a conclusion E.g. "HENCE TRUE", "QED" or $\operatorname{cosec}\theta - \sin\theta \equiv \cos\theta\cot\theta$ o.e. (condone = for ≡)	A1*	2.1
		(3)	

Alt (b)

Question	Scheme	Marks	AOs
	$\cot x = \cot(3x-50°) \Rightarrow \dfrac{\cos x}{\sin x} = \dfrac{\cos(3x-50°)}{\sin(3x-50°)}$ $\sin(3x-50°)\cos x - \cos(3x-50°)\sin x = 0$ $\sin\big((3x-50°)-x\big) = 0$ $2x-50° = 0$	M1	3.1a
	$x = 25°$	A1	1.1b
	Also $2x-50° = 180°$	M1	2.1
	$x = 115°$	A1	1.1b
	Deduces $\cos x = 0 \Rightarrow x = 90°$	B1	2.2a
		(5)	