

Y2P6 XMQs and MS

(Total: 8 marks)

1. P1_2020 Q12. 8 marks - Y2P6 Trigonometric functions

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

(a) **Condone a full proof in x (or other variable) instead of θ 's here**

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

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

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

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 θ '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 $x = 3x - 50^\circ$.

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

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: $x = 25^\circ$

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

A1: $x = 115^\circ$ 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 $\cos x = 0 \Rightarrow x = 90^\circ$. Ignore additional values here.

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

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

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

Alt 1- Right hand side to left hand side

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

Alt 2- Works on both sides

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

Alt (b)

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