Trigonometry 1 MS

Q1.

1 **(i)**	$3(2\sin x - \cos x) = 2(\sin x - 3\cos x)$ $\rightarrow 6s - 3c = 2s - 6c \rightarrow 4s = -3c$ $\rightarrow \tan x = -\frac{3}{4}$	M1 A1 [2]	Expanding, collecting, use of $t = s \div c$ Answer given. All correct.
(ii)	$x = 180 - 36.9 = 143.1°$ or $x = 360 - 36.9 = 323.1°$	B1 B1√ [2]	co For 180 + first answer.

Q2.

4 **(i)**	$2\sin x \tan x + 3 = 0$ $2\sin x \frac{\sin x}{\cos x} + 3 = 0$	M1	For using tan = sin ÷ cos
	$2\frac{(1-\cos^2 x)}{\cos x} + 3 = 0$	M1	For using $\sin^2 + \cos^2 = 1$ and everything correct
	$\rightarrow 2\cos^2 x - 3\cos x - 2 = 0$	[2]	Answer given – check.
(ii)	$2\cos^2 x - 3\cos x - 2 = 0$ $\rightarrow \cos x = -½$ or 2 $x = 120°$ or $240°$	M1 A1 B1√ [3]	Solution of quadratic. co. √ for 360 – his answer.

Q3.

4 **(i)**	$\frac{\sin x \tan x}{1-\cos x} = \frac{\sin^2 x}{\cos x(1-\cos x)}$	M1		Use of $\tan x = \sin x \div \cos x$
	$= \frac{1-\cos^2 x}{\cos x(1-\cos x)}$	M1		Use of $\sin^2 x = 1 - \cos^2 x$
	$= \frac{(1-\cos x)(1+\cos x)}{\cos x(1-\cos x)} = \frac{1}{\cos x} + 1$	M1	[3]	Realising the need to use difference of 2 squares. Answer given.
(ii)	$\frac{1}{\cos x} + 1 + 2 = 0$ $\rightarrow \cos x = -⅓$ $\rightarrow x = 109.5°$ or $250.5°$	M1 A1 A1√	[3]	Uses part **(i)** with cos x as subject. co. √ for $360° - 1^{st}$ answer.

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Q4.

2	**LHS** $= \sin^2x/\cos^2x - \sin^2x$ $\sin^2x(1 - \cos^2x)/\cos^2x$	M1 M1		Replace t^2 by s^2/c^2 or $\sec^2 - 1$ Use of $1 - \cos^2x = \sin^2x$
	$\frac{\sin^2 x \sin^2 x}{\cos^2 x}$ oe	M1		Valid overall method
	$\tan^2x\sin^2x$	A1		**AG**
	OR RHS $= \frac{\sin^2 x}{\cos^2 x}.\sin^2 x$	M1		Replace t^2 by s^2/c^2
	$\sin^2x(1 - \cos^2x)/\cos^2x$ $(\sin^2x/\cos^2x) - \sin^2x$ $\tan^2x - \sin^2x$	M1 M1 A1	[4]	Use of $1 - \cos^2x = \sin^2x$ Valid overall method **AG**

Q5.

5	**(i)**	$\frac{2\sin^2\theta\sin^2\theta}{1-\sin^2\theta} = 1$		M1	Equation as function of sin θ
		$2\sin^4\theta + \sin^2\theta - 1 = 0$	**AG**	A1 [2]	
	(ii)	$(2\sin^2\theta - 1)(\sin^2\theta + 1) = 0$		M1	Or use formula on quadratic in $\sin^2\theta$
		$\sin\theta = \frac{(\pm)1}{\sqrt{2}}$		A1	
		$\theta = 45°, 135°$		A1	
		$\theta = 225°, 315°$		A1 [4]	Provided no excess solutions in range

Q6.

8	**(i)**	$\left(\frac{1}{\sin\theta} - \frac{1}{\tan\theta}\right)^2 \equiv \frac{1-\cos\theta}{1+\cos\theta}$		
		$\left(\frac{1}{\sin\theta} - \frac{\cos\theta}{\sin\theta}\right)^2 = \frac{(1-\cos\theta)^2}{\sin^2\theta}$	M1	Use of tan = sin/cos
		$= \frac{(1-\cos\theta)(1-\cos\theta)}{1-\cos^2\theta} = \frac{1-\cos\theta}{1+\cos\theta}$	M1 A1 [3]	Use of $\sin^2 + \cos^2 = 1$. All correct. (NB ag. – ensure cancelling has been done)
	(ii)	$\left(\frac{1}{\sin\theta} - \frac{1}{\tan\theta}\right)^2 = \frac{2}{5}$		
		$\frac{1-\cos\theta}{1+\cos\theta} = \frac{2}{5}$	M1	Uses part **(i)** to obtain an eqn in cosθ
		$\cos\theta = \frac{3}{7}$	A1	co
		$\theta = 64.6°$ or $295.4°$	A1 A1 √ [4]	co. √ for 360 – "1st answer".

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Q7.

5	**(i)** $3\cos^2 x + 8\cos x + 4 = 0$ $(3\cos x + 2)(\cos x + 2) = 0$ $\cos x = -\frac{2}{3}$ **(ii)** $\cos(\theta + 70) = -\frac{2}{3}$, $\theta = 61.8$ $\theta + 70 = 131.8$ (or 228.2) $\theta = 158.2$	M1 M1 A1 [3] M1 A1 M1 A1 [4]	Use of $c^2 + s^2 = 1$ Factorising, formula or completing the square needed **AG** Ignore $\cos x = -2$ also offered SC B1 if –2/3 and –2 seen

Q8.

5	$\tan x + \frac{1}{\tan x} \equiv \frac{1}{\sin x \cos x}$ **(i)** LHS $= \frac{\sin x}{\cos x} + \frac{\cos x}{\sin x}$ $= \frac{\sin^2 x + \cos^2 x}{\sin x \cos x} = \frac{1}{\sin x \cos x}$ **(ii)** $\frac{2}{\sin x \cos x} = 3\tan x + 1$ Uses (i) $2(\tan x + \frac{1}{\tan x}) = 3\tan x + 1$ $\rightarrow \tan^2 x + \tan x - 2 = 0$ $\rightarrow \tan x = 1$ or -2 $\rightarrow x = 45°$ or $116.6°$	 M1 M1 [2] M1 DM1 B1 A1 [4]	 Use of tan = sin/cos twice Use of $s^2 + c^2 = 1$ appropriately – everything correct. Uses part (i) to obtain eqn in tan$x$ only Correct soln of quadratic eqn co. Must have correct quadratic co

Q9.

1	$\tan^2\theta - \sin^2\theta = \tan^2\theta \sin^2\theta$ **(i)** $\frac{s^2}{c^2} - s^2$ $\rightarrow \frac{s^2 - s^2c^2}{c^2} = \frac{s^2(1-c^2)}{c^2}$ $\rightarrow t^2s^2$ **(ii)** RHS $> 0 \rightarrow \tan^2\theta > \sin^2\theta$ QED $\tan\theta > \sin\theta$ if θ acute.	 M1 M1 A1 [3] B1 [1]	 Use of $s \div c = t$ Use of $s^2 + c^2 = 1$ All ok Realises RHS > 0

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Q10.

4 $\sin 2x + 3\cos 2x = 0$ **(i)** $\rightarrow$ $\tan 2x = -3$ $2x = 180 - 71.6$ or $360 - 71.6$ $x = 54.2^\circ$ or 144.2° Also 234.2° and 324.2°	M1 M1 A1A1√ A1√ [5]	Uses $\tan 2x = k$ and works with "$2x$". Finds "$2x$" before ÷ 2 co. co√ (both of these need 2nd M) for 180° + his answer(s)
(ii) 12 answers.	B1√ [1]	for 3 times the number of solns to (i).