Question Number	Scheme	Marks
9 (a)	Uses $\tan\theta = \dfrac{\sin\theta}{\cos\theta} \rightarrow$ $\cos\theta - 1 = 4\sin\theta \dfrac{\sin\theta}{\cos\theta}$	M1
	$\cos^2\theta - \cos\theta = 4\sin^2\theta$ oe	A1
	Uses $\sin^2\theta = 1 - \cos^2\theta \rightarrow$ $\cos^2\theta - \cos\theta = 4\left(1 - \cos^2\theta\right)$	M1
	$5\cos^2\theta - \cos\theta - 4 = 0$ *	A1 *
		(4)
(b)	$(5\cos 2x + 4)(\cos 2x - 1) = 0$	M1
	Critical values of $-\dfrac{4}{5}, 1$	A1
	Correct method to find x from their $\cos 2x = -\dfrac{4}{5}$	dM1
	$x = 0, 1.25$	A1
		(4)
		(8 marks)

Question Number	Scheme	Marks
	$8\tan\theta = 3\cos\theta$	
7 (a)	Uses $\tan\theta = \dfrac{\sin\theta}{\cos\theta} \rightarrow$ $8\dfrac{\sin\theta}{\cos\theta} = 3\cos\theta$	M1
	$8\sin\theta = 3\cos^2\theta$ oe	
	Uses $\cos^2\theta = 1 - \sin^2\theta \rightarrow$ $8\sin\theta = 3\left(1 - \sin^2\theta\right)$	M1
	$3\sin^2\theta + 8\sin\theta - 3 = 0$ *	A1 *
		(3)
(b)	$(3\sin 2x - 1)(\sin 2x + 3) = 0$	M1
	Critical value(s) of $\dfrac{1}{3}, (-3)$	A1
	Correct method to find x from their $\sin 2x = \dfrac{1}{3}$	dM1
	$x =$ awrt $9.74°, 80.26°$	A1
		(4)
		(7 marks)

Question Number	Scheme	Marks
6 (i) (a)	Uses $\sin^2\theta+\cos^2\theta=1$ with $\cos\theta=\frac{1}{\sqrt{5}}\Rightarrow\sin^2\theta=\frac{4}{5}$	M1
	$\Rightarrow\sin\theta=-\frac{2}{\sqrt{5}}$	A1
(b)	Uses $\tan\theta=\frac{\sin\theta}{\cos\theta}$ with $\cos\theta=\frac{1}{\sqrt{5}}$ and their $\sin\theta=-\frac{2}{\sqrt{5}}$	M1
	$\Rightarrow\tan\theta=-2$	A1 **(4)**
(ii) (a)	1 (m)	B1 **(1)**
(b)	$30t-40=180\Rightarrow t=7.33$ Hence 7:20 **am**	M1, A1, A1 **(3)**
(c)	$4+3\cos(30T-40)^\circ=3.5\Rightarrow\cos(30T-40)^\circ=-\frac{1}{6}$	M1
	$\Rightarrow 30T-40=99.6,\ 260.4,\ \underline{\underline{459.6}}$	A1
	$\Rightarrow T=\frac{"459.6"+40}{30}=16.65$	dM1, A1 **(4)** **(12 marks)**

Question	Answer	Marks	Guidance
5(a)	Substitute $x=4$, equate to zero and attempt solution	M1	
	Obtain $a=-7$	A1	
	Divide by $x-4$ at least as far as the x term	M1	or use of identity or by inspection
	Obtain $2x^2+x+1$ and conclude $(x-4)(2x^2+x+1)$	A1	
	Alternative method for question 5(a)		
	Divide by $x-4$ at least as far as the x term	M1	
	Equate the remainder to zero	M1	
	Obtain $a=-7$	A1	
	Obtain $2x^2+x+1$ and conclude $(x-4)(2x^2+x+1)$	A1	
		4	

Question	Answer	Marks	Guidance
5(b)	Apply logarithms and use power law for $e^{3y}=4$	M1	
	Obtain $\frac{1}{3}\ln 4$ or exact equivalent	A1	
	Use discriminant $[=1-8=-7]$ or equivalent to show no other roots	B1	AG – necessary detail needed
		3	

Question Number	Scheme	Marks
3 (a)	$2\tan\theta+3\sin\theta=0$	
	States or uses $\tan\theta=\dfrac{\sin\theta}{\cos\theta}\rightarrow 2\dfrac{\sin\theta}{\cos\theta}+3\sin\theta=0$	M1
	$\sin\theta(2+3\cos\theta)=0$	
	$2+3\cos\theta=0$	dM1
	$\cos\theta=-\dfrac{2}{3}\Rightarrow\theta=$ awrt 132° or awrt 228°	A1
	$\cos\theta=-\dfrac{2}{3}\Rightarrow\theta=$ awrt 131.8° and awrt 228.2°	A1
	$\sin\theta=0\Rightarrow\theta=180°,360°$	B1
		(5)
(b)	Sets $2x+40°=$ their $131.8°\Rightarrow x=\ldots$	M1
	$x=$ awrt 45.9°	A1
		(2)
		(7 marks)

Question Number	Scheme	Marks
9 (i)	States or uses $\tan x = \dfrac{\sin x}{\cos x}$	B1
	$\sin x \tan x = 5 \Rightarrow \sin^2 x = 5\cos x \Rightarrow 1 - \cos^2 x = 5\cos x$	M1A1
	$\cos^2 x + 5\cos x - 1 = 0 \Rightarrow \left(\cos x = \right) \dfrac{-5 \pm \sqrt{29}}{2} \Rightarrow x = \text{awrt } 78.9°, 281.1°$	M1dM1A1
		(6)
(ii)	(a) $A = 5$	B1
		(1)
	(b) $2\theta - \dfrac{3\pi}{8} = \dfrac{3\pi}{2} \Rightarrow \theta = ...$	M1
	$\theta = \dfrac{15\pi}{16}$	A1
	y coordinate $Q = -3$ (or $2 - "A"$)	B1ft
		(3)
	(c) Sets $0 = "5"\sin\left(2\theta - \dfrac{3\pi}{8}\right) + 2 \Rightarrow \sin\left(2\theta - \dfrac{3\pi}{8}\right) = \pm\dfrac{2}{"5"}$	M1
	$\sin\left(2\theta - \dfrac{3\pi}{8}\right) = \pm\dfrac{2}{5} \Rightarrow \left(2\theta - \dfrac{3\pi}{8}\right) = \arcsin\left(\pm\dfrac{2}{5}\right) = ...$	dM1
	One of $\theta = 0.38,\ 2.4,\ 3.5,\ 5.5,\ 6.7,\ 8.6,\ 9.8....$	A1
	$\theta = \text{awrt } 5.51$	A1
		(4)
		Total 14

Question Number	Scheme	Marks
8(i)	$5\sin(3x+0.1)+2=0$ $\Rightarrow 5\sin(3x+0.1)=-2$ $\Rightarrow \sin(3x+0.1)=-\frac{2}{5}$	M1
	$\sin(3x+0.1)=-\frac{2}{5}$ $\Rightarrow 3x+0.1=\sin^{-1}\left(-\frac{2}{5}\right)$ $\Rightarrow x=\frac{\sin^{-1}\left(-\frac{2}{5}\right)-0.1}{3}$	dM1
	$x=-0.94,\ -0.17,\ \ 1.15,\ 1.92$	A1A1
		(4)
(ii)	$2\tan\theta\sin\theta=\cos\theta+5$ $\Rightarrow 2\sin^2\theta=\cos^2\theta+5\cos\theta$	M1
	$\Rightarrow 2\left(1-\cos^2\theta\right)=\cos^2\theta+5\cos\theta$	M1
	$\Rightarrow 3\cos^2\theta+5\cos\theta-2=0$	A1
	$\cos\theta=\frac{1}{3}(,-2)$ $\Rightarrow \theta=\cos^{-1}\left(\frac{1}{3}\right)=\ldots$	M1
	$(\theta=)\ 70.5°,\ 289.5°$	A1
		(5)
		Total 9

Question Number	Scheme	Marks
7 (i)	$(2\theta=)\arctan\left(\frac{5}{7}\right)$	M1A1
	$(\theta=)$ awrt $17.8°, 107.8°$	dM1A1
		(4)
(ii)	$24\tan x=5\cos x\Rightarrow 24\sin x=5\cos^2 x$ oe	M1
	$\Rightarrow 24\sin x=5\left(1-\sin^2 x\right)$	dM1
	$\Rightarrow 5\sin^2 x+24\sin x-5=0$	A1
	$\Rightarrow \sin x=\frac{1}{5}$	ddM1
	$\Rightarrow (x=)$ awrt $0.201, 2.940$	A1
		(5)
		(9 marks)

Question Number	Scheme	Marks
7 (i)	States or uses $\tan x = \dfrac{\sin x}{\cos x}$	M1
	$3\sin x\tan x = 11+\cos x \Rightarrow 3\sin^2 x = 11\cos x+\cos^2 x$ $\Rightarrow 3\left(1-\cos^2 x\right) = 11\cos x+\cos^2 x \Rightarrow 4\cos^2 x+11\cos x-3=0$	dM1, A1
	$\Rightarrow (4\cos x-1)(\cos x+3)=0 \Rightarrow \cos x = \dfrac{1}{4} \Rightarrow x = 1.318, 4.965$	dM1 A1
		(5)
(ii)	$\cos\theta = \dfrac{1}{3} \Rightarrow \sin^2\theta = 1-\dfrac{1}{3^2} \Rightarrow \tan\theta = \dfrac{\sin\theta}{\cos\theta} = \dfrac{\sqrt{1-\frac{1}{3^2}}}{\frac{1}{3}}$	M1
	$\Rightarrow \tan\theta = 2\sqrt{2}$	A1
		(2)
		Total 7

Question Number	Scheme	Marks
8 (i)	(a) $S_n = a+(a+d)+.....+\left(a+(n-1)d\right)$ (1)	B1
	$S_n = \left(a+(n-1)d\right)+.....(a+d)+a$ (2)	M1
	(1) + (2) $2S_n = \left(2a+(n-1)d\right)+\left(2a+(n-1)d\right).....+\left(2a+(n-1)d\right)$	
	$2S_n = n\left(2a+(n-1)d\right) \Rightarrow S_n = \dfrac{n}{2}\left(2a+(n-1)d\right)$ *	A1*
		(3)
	(b) States or uses two of $a=900$, $d=-8$ and $n=51$ Or alternatively states or uses two of $a=500$, $d=8$ and $n=51$	B1
	Complete method E.g $n = \dfrac{900-500}{8}+1$ and $S = \dfrac{51}{2}\{2\times 900+50\times -8\}$	M1
	35700	A1
		(3)
(ii)	(a) $\dfrac{11-k}{k-2} = \dfrac{k-2}{k+4}$	M1
	$44-k^2+7k = k^2-4k+4$	dM1
	$2k^2-11k-40=0$ *	A1*
		(3)
	(b) $2k^2-11k-40=0 \Rightarrow k = \left(-\dfrac{5}{2}\right), 8$	B1
	Uses either k value and attempts to find both a and r. E.g. with $k=8 \Rightarrow a = 8+4, r = \dfrac{8-2}{8+4}$	M1
	Uses $S_\infty = \dfrac{a}{1-r} = \dfrac{12}{1-\frac{1}{2}} = 24$	dM1, A1
		(4)
		Total 13

Question Number	Scheme	Marks
9.(i)	$3\sin(2\theta-10°)=1 \Rightarrow (2\theta-10°)=\arcsin\left(\frac{1}{3}\right)$	M1
	$\theta=\frac{19.47+10}{2}, \frac{160.53+10}{2}$	dM1
	$\theta=$ awrt $14.7°, 85.3°$	A1, A1 **(4)**
(ii) (a)	Writes $\frac{1}{\tan\alpha}-\sin\alpha=2\sin\alpha-\frac{1}{\tan\alpha}$ oe	M1
	$\frac{2}{\tan\alpha}=3\sin\alpha \Rightarrow \frac{2\cos\alpha}{\sin\alpha}=3\sin\alpha \Rightarrow 2\cos\alpha=3\sin^2\alpha$ *	dM1 A1* **(3)**
(b)	$2\cos\alpha=3\sin^2\alpha \Rightarrow 2\cos\alpha=3(1-\cos^2\alpha)$	M1
	$3\cos^2\alpha+2\cos\alpha-3=0$	A1
	Attempts to solve $3\cos^2\alpha+2\cos\alpha-3=0 \Rightarrow \cos\alpha=\frac{-2\pm\sqrt{40}}{6}$ oe	dM1 A1
	$\alpha=5.517$ radians	A1 **(5)** **(12 marks)**

Question Number	Scheme	Marks
5(i)	$4\tan\theta+5\sin\theta=0$	
	States or uses $\tan\theta=\frac{\sin\theta}{\cos\theta} \rightarrow 4\frac{\sin\theta}{\cos\theta}+5\sin\theta=0$	M1
	$\sin\theta(4+5\cos\theta)=0$	
	$\cos\theta=-\frac{4}{5}$	dM1
	$\cos\theta=-\frac{4}{5} \Rightarrow \theta=$ awrt $143°$ or awrt $217°$	A1
	$\cos\theta=-\frac{4}{5} \Rightarrow \theta=$ awrt $143.1°$ and awrt $216.9°$	A1
	$\sin\theta=0 \Rightarrow \theta=180°, 360°$	B1 **(5)**
(ii)	$\frac{\sin x}{\cos x}+\frac{\cos x}{\sin x}=\frac{5}{\cos x} \overset{\times\sin x\cos x}{\Rightarrow} \sin^2 x+\cos^2 x=5\sin x$	
	$5\sin x=1$	M1, A1
	$x=$ awrt $0.201, 2.94$	dM1, A1 **(4)** **(9 marks)**

Question Number	Scheme	Marks
6 (i) (a)	Uses $\sin^2\theta+\cos^2\theta=1$ with $\cos\theta=\frac{1}{\sqrt{5}}\Rightarrow\sin^2\theta=\frac{4}{5}$	M1
	$\Rightarrow\sin\theta=-\frac{2}{\sqrt{5}}$	A1
(b)	Uses $\tan\theta=\frac{\sin\theta}{\cos\theta}$ with $\cos\theta=\frac{1}{\sqrt{5}}$ and their $\sin\theta=-\frac{2}{\sqrt{5}}$	M1
	$\Rightarrow\tan\theta=-2$	A1 **(4)**
(ii) (a)	1 (m)	B1 **(1)**
(b)	$30t-40=180\Rightarrow t=7.33$ Hence 7:20 **am**	M1, A1, A1 **(3)**
(c)	$4+3\cos(30T-40)°=3.5\Rightarrow\cos(30T-40)°=-\frac{1}{6}$	M1
	$\Rightarrow 30T-40=99.6, 260.4, \underline{\underline{459.6}}$	A1
	$\Rightarrow T=\frac{"459.6"+40}{30}=16.65$	dM1, A1 **(4)** **(12 marks)**