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
	$\Rightarrow \left(4\cos x - 1\right)\left(\cos x + 3\right) = 0 \Rightarrow \cos x = \dfrac{1}{4} \Rightarrow x = 1.318,\ 4.965$	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

(i)

M1: States or uses $\tan x = \dfrac{\sin x}{\cos x}$ o.e.

dM1: Uses $\tan x = \dfrac{\sin x}{\cos x}$, attempts to multiply by $\cos x$ and then uses $\sin^2 x = \pm 1 \pm \cos^2 x$ to set up a 3 TQ equation in $\cos x$

A1: Correct simplified quadratic equation in $\cos x$. Terms can be on either side of the equation. The '= 0' can be implied by a subsequent attempt to solve.

dM1: Solves a quadratic equation in $\cos x$ by any allowable method (including a calculator) to find $\cos x$ and proceeds to a value for x (in degrees or radians) via arccos. Dependent upon the first M only

Minimum working required would be $4\cos^2 x + 11\cos x - 3 = 0 \Rightarrow \cos x = 0.25 \Rightarrow x = 1.3$

Note that

- $\cos x = \dfrac{1}{4} \Rightarrow x = 0.2527$ is dM0 as it is $\arcsin\left(\dfrac{1}{4}\right)$ not $\arccos\left(\dfrac{1}{4}\right)$
- $\cos x = \dfrac{1}{4} \Rightarrow x = 0.9689$ is dM0 as it is $\cos\left(\dfrac{1}{4}\right)$ not $\arccos\left(\dfrac{1}{4}\right)$

A1: $x =$ awrt $1.318,\ 4.965$ following the award of all previous marks.

Ignore any extra solutions outside the range, but withhold this mark for any extra solutions within it.

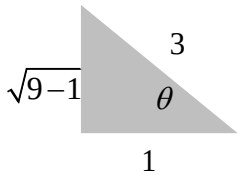
Notes: Condone notation such as $\tan = \dfrac{\sin}{\cos}$ and $\cos x^2$ for $\cos^2 x$. This is not a proof.

(ii)

M1: Full method of finding a value for $\tan\theta$. The value for $\sin\theta$ cannot just appear.

Other methods will be seen but most will include Pythagoras at some point. ($1+\tan^2\theta=\sec^2\theta=\frac{1}{\cos^2\theta}$)

E.g.



Allow sight of $\tan\theta=\sqrt{9-1}$ o.e without any other supporting evidence

A1: $\tan\theta=2\sqrt{2}$ following the award of M1

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Answers without working:

In both parts candidates are able to use calculators to solve the whole of the question. This does not score any marks due to the demand of the question. All method marks must be awarded before accuracy marks are given.

If in doubt then please send to review.

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

(i)(a)

B1: A correct expression for S_n (but allow S) with a minimum of three terms including the first and last terms **WITH** no incorrect terms. Note that an incorrect order does not imply an incorrect term
So, you may see $S_n = a + (a+d) + ... + (a+(n-1)d) + (a+(n-2)d)$ which is B1

M1: A correct method to find an expression for S_n in terms of a, n and d. Look for

- a sum with correct first and last terms
- the sum reversed (with at least first and last terms) and an attempt made to add the two series

This mark is usually scored when the candidate works with the sum $S_n = a + ... + a + (n-1)d$
Condone attempts with incorrect terms. (See below).

E.g. $S_n = a + (a+d) + ... + a + nd + (a+(n-1)d)$
$S_n = (a+(n-1)d) + a + nd + ... (a+d) + a$
$2S_n = 2a + (n-1)d ..... 2a + (n-1)d$

A1*: Correct proof that has previous lines scoring both B1 and M1 as well as a line equivalent to $2S_n = n(2a+(n-1)d)$ or equivalent before the given answer.

You may see alternative proofs which define $l = a + (n-1)d$.
This is acceptable and the same marking scheme can be applied.