Question Number	Scheme	Marks
1. (a)	$f(x) = 2\sec x + 6x - 3$ $f(0.1) = -0.39 \quad f(0.2) = 0.24$ States change of sign, continuous and hence root	M1 A1 **(2)**
(b)	Sets $f(x) = 0$, uses $\sec x = \frac{1}{\cos x}$ and makes x of $6x$ the subject $\Rightarrow 6x = 3 - \frac{2}{\cos x} \Rightarrow x = \frac{1}{2} - \frac{1}{3\cos x}$ *	B1* **(1)**
(c)	(i) $x_2 = \frac{1}{2} - \frac{1}{3\cos 0.15} = 0.16..$ $x_2 = \text{awrt } 0.1629$ (ii) $\alpha = 0.1622$	M1 A1 A1 **(3)** **(6 marks)**

Note: If the student uses degrees mode they will get values -0.39999 and 0.200001 in (a) and 0.1666… in (c). An answer in (c) of 0.16666… would be an indicator of the mode used for part (a) if rounded values are given see notes below.

(a)

M1: Attempts the value of f (x) at 0.1 and 0.2 with one **correct** to at least 1 sf rounded or truncated. Note that degrees mode gives -0.39999 and 0.200001 and these can be accepted for the M mark.

A1: Both values correct to at least 1sf (but see warning), rounded or truncated with reason (Sign change **and** continuous function) and minimal conclusion (root). For "sign change" accept f(0.1) < 0, f(0.2) > 0 shown, or f(0.1)f(0.2) < 0

Warning: Degrees mode answers should score A0, so if the values -0.39999 and 0.200001 are used score A0. However, if just f(0.1) = −0.4 and f(0.2) = 0.2 are used with no contrary evidence – see note above – the A1 will be scored if reason and conclusion are given.

Note: Use of a narrower interval is possible. You may need to check values, but score as per the main scheme with their end points as long as their interval contains the root.

(b)

B1*: Shows all necessary steps to show given result. Allow if α is used in place of x.

Sets $f(x) = 0$, uses $\sec x = \frac{1}{\cos x}$ and makes the x of the $6x$ the subject. The "=0" must be seen at some stage.

(c) (i)

M1: Uses iterative formula and $x_1 = 0.15$ to find $x_2 = 0.16..$ There must be some evidence of use of the iterative formula, either substitution seen or awrt 0.16 **other than** just 0.1622(315…), which may be from a calculator solve. If all that is seen is 0.1622(315…) with no other evidence then M0A0A0 will be scored.

A1: $(x_2 =)$ awrt 0.1629 Allow if the x_2 is omitted, so just awrt 0.1629 can score M1A1

(c)(ii) A1: $(\alpha =)$ 0.1622 following the award of the M mark (see note).

An answer of 0.1666… may score the first M in (c) as long as there is evidence of the iterative formula used but the value only will be M0 (calculator solve gives this value).