Question Number	Scheme	Marks
1	$3\tan^2\theta+7\sec\theta-3=0\Rightarrow 3\left(\sec^2\theta-1\right)+7\sec\theta-3=0$	M1
	$3\sec^2\theta+7\sec\theta-6=0$	A1
	$(3\sec\theta-2)(\sec\theta+3)=0\Rightarrow\sec\theta=...\Rightarrow\cos\theta=...$	dM1
	$\theta=109.5°, 250.5°$	A1, A1
		(5)
		Total 5

Main method: Also allow if another variable is used e.g $x\leftrightarrow\theta$

M1: Attempts to set up a quadratic equation in $\sec\theta$ using $\tan^2\theta=\pm1\pm\sec^2\theta$

Condone bracketing slips, for example, where $3\tan^2\theta$ is replaced by $\pm3\sec^2\theta\pm1$

A1: Collects terms to form a correct 3TQ, $3\sec^2\theta+7\sec\theta-6=0$ o.e

Terms do not need to be all on one side of the equation and the $=0$ can be implied by subsequent work.

dM1: Dependent upon the previous M1, it is scored for the method of producing a solvable non zero solution for $\cos\theta$

Look for;

- A valid way of solving their quadratic equation in $\sec\theta$ using any allowable method including a calculator leading to $\sec\theta=...$
- Use of $\sec\theta=\dfrac{1}{\cos\theta}$ to produce a solution $\cos\theta=k$ where $-1<k<1, k\neq0$

E.g. $3\sec^2\theta+7\sec\theta-6=0\Rightarrow\sec\theta=-3\Rightarrow\cos\theta=-\dfrac{1}{3}$. You can ignore the 2nd solution

If the error had been $\tan^2\theta=\sec^2\theta+1$ look for $3\sec^2\theta+7\sec\theta=0\Rightarrow\sec\theta=-\dfrac{7}{3}\Rightarrow\cos\theta=-\dfrac{3}{7}$

A1: One of $\theta=$ awrt $109.5°$, awrt $250.5°$ following M1, A1, dM1

Allow either answer in radians here so score for awrt 1.91 or awrt 4.37

A1: CSO. Both $\theta=$ awrt $109.5°$ and awrt $250.5°$ and no extras in the range

……..

Other methods do exist but the same marking principles will apply

Alt method:

M1: For an attempt to set up a quadratic equation in a single trigonometric term, e.g. $\cos\theta$

Replaces $\tan^2\theta$ by $\dfrac{\sin^2\theta}{\cos^2\theta}$, $\sec\theta$ by $\dfrac{1}{\cos\theta}$ and then uses $\sin^2\theta=\pm1\pm\cos^2\theta\Rightarrow$ quadratic equation in $\cos\theta$ E.g. $3\tan^2\theta+7\sec\theta-3=0\Rightarrow3\dfrac{\sin^2\theta}{\cos^2\theta}+7\times\dfrac{1}{\cos\theta}-3=0\Rightarrow3\sin^2\theta+7\cos\theta-3\cos^2\theta=0$

and then uses $\sin^2\theta=\pm1\pm\cos^2\theta\Rightarrow3\left(1-\cos^2\theta\right)+7\cos\theta-3\cos^2\theta=0$.

Condone slips

A1: For a correct 3TQ in $\cos\theta$. FYI $6\cos^2\theta-7\cos\theta-3=0$. Terms do not have to be on one side

dM1: Solves the quadratic equation in $\cos\theta$ using an appropriate method including a calculator.

It must lead to a solution $\cos\theta=k$ where $-1<k<1, k\neq0$

If a calculator is used the solution must be correct for their equation.

E.g. $6\cos^2\theta - 7\cos\theta - 3 = 0 \Rightarrow \cos\theta = -\frac{1}{3}$

A1: One of $\theta =$ awrt 109.5°, awrt 250.5° following M1, A1, dM1

Allow either answer in radians here so score for awrt 1.91 or awrt 4.37

A1: CSO. Both $\theta =$ awrt 109.5° and awrt 250.5° and no extras in the range.

If both solutions to the quadratic were given then both must be correct

……..

Methods using calculator technology and not showing all stages of working as required by question:

Example 1:

$3\tan^2\theta + 7\sec\theta - 3 = 0 \Rightarrow \theta = 109.5°, 250.5°$

No marks

Example 2:

$3\tan^2\theta + 7\sec\theta - 3 = 0 \Rightarrow 3\left(\sec^2\theta - 1\right) + 7\sec\theta - 3 = 0$

$\Rightarrow 3\sec^2\theta + 7\sec\theta - 6 = 0 \Rightarrow \sec\theta = -3 \Rightarrow \theta = 109.5°, 250.5°$

Scores M1, A1, dM0, A0, A0

Example 3:

$3\tan^2\theta + 7\sec\theta - 3 = 0 \Rightarrow 6\cos^2\theta - 7\cos\theta - 3 = 0$ via identities followed by $\Rightarrow \theta = 109.5°, 250.5°$

Scores M1, A1, dM0, A0, A0

Methods using calculator technology and showing sufficient stages of working:

Example 4: $3\tan^2\theta + 7\sec\theta - 3 = 0 \Rightarrow 3\sec^2\theta + 7\sec\theta - 6 = 0$ via identity followed by

$\sec\theta = -3 \Rightarrow \cos\theta = -\frac{1}{3} \Rightarrow \theta = \pm 109.5°$

Scores M1, A1, dM1, A1, A0 (only one of the two solutions given)

Example 5: $3\tan^2\theta + 7\sec\theta - 3 = 0 \Rightarrow 6\cos^2\theta - 7\cos\theta - 3 = 0$ via identities followed by

$\cos\theta = -\frac{1}{3} \Rightarrow \theta = 109.5°, 250.5°$ M1, A1, dM1, A1, A1

Question Number	Scheme	Marks
2 (a)	$x = 2y^2 + 5y - 6$	
	$\frac{dx}{dy} = 4y + 5 \Rightarrow \frac{dy}{dx} = \frac{1}{4y+5}$	M1, A1
		(2)
(b)	Sets their $4y + 5 = 0 \Rightarrow y = -\frac{5}{4}$	M1
	Substitutes their $y = -\frac{5}{4}$ into $x = 2y^2 + 5y - 6$ to find x	dM1
	$\left(-\frac{73}{8}, -\frac{5}{4}\right)$	A1
		(3)
		Total 5

Mark as one complete question

Main method via differentiation in (a) and (b)

(a)

M1: Differentiates $2y^2 + 5y - 6$ to a linear term in y AND attempts to take the reciprocal.

Condone for this mark attempts such as $\frac{dx}{dy} = 4y + 5 \Rightarrow \frac{dy}{dx} = \frac{1}{4y} + \frac{1}{5}$

We may see other methods including implicit differentiation from WMA14.

Look for $x = 2y^2 + 5y - 6 \Rightarrow 1 = ay\frac{dy}{dx} + b\frac{dy}{dx}$ followed by an attempt to make $\frac{dy}{dx}$ the subject

A1: $\frac{dy}{dx} = \frac{1}{4y+5}$ ISW after a correct answer.

(b) **Marks in part (b) can only be awarded after sight of $\frac{dx}{dy} = \frac{ay+b}{k}$ or $\frac{dy}{dx} = \frac{k}{ay+b}$**

So full marks can only be awarded after sight of $\frac{dx}{dy} = 4y + 5$ or $\frac{dy}{dx} = \frac{1}{4y+5}$

M1: Sets $'ay + b' = 0 \Rightarrow y = \ldots$. following sight of $\frac{dx}{dy} = \frac{ay+b}{k}$ **or** $\frac{dy}{dx} = \frac{k}{ay+b}$

Ignore/condone incorrect statements such as $\frac{dy}{dx} = 0$ here

This can be implied. E.g $\frac{dy}{dx} = \frac{1}{4y+5}$ followed by $y = -\frac{5}{4}$

dM1: Substitutes their solution of their $4y + 5 = 0$ into $x = 2y^2 + 5y - 6$ to find x.

This is dependent upon the previous M

A1: $\left(-\frac{73}{8}, -\frac{5}{4}\right)$ following $\frac{dx}{dy} = 4y + 5$ **or** $\frac{dy}{dx} = \frac{1}{4y+5}$

The answer may be given separately, for example, as $x = -9.125$, $y = -1.25$

ISW after a correct answer.