Question Number	Scheme	Marks
1(a)	$\left(\frac{\mathrm{d}y}{\mathrm{d}x}=\right)2x\cos\left(\frac{1}{2}x\right)-\frac{1}{2}x^2\sin\left(\frac{1}{2}x\right)$	M1 A1
	Sets $\frac{\mathrm{d}y}{\mathrm{d}x}=0\Rightarrow\tan\left(\frac{1}{2}x\right)=\frac{4}{x}\Rightarrow x=2\arctan\left(\frac{4}{x}\right)$*	**d**M1 A1*
		(4)
(b)	$x_2=2\arctan\left(\frac{4}{2}\right)$	M1
	$x_2=$ awrt 2.214 $\qquad$ $x_6=2.155$ cao	A1, A1
		(3)
		(7 marks)

(a)

M1: Differentiates using the product rule to obtain an expression of the form $Ax\cos\left(\frac{1}{2}x\right)+Bx^2\sin\left(\frac{1}{2}x\right)$

If the product rule is quoted it must be correct.

A1: For a correct simplified or unsimplified derivative.

dM1: Sets their $\frac{\mathrm{d}y}{\mathrm{d}x}=0$ and proceeds to an equation involving $\tan\left(\frac{1}{2}x\right)$. This may be implied by their working.

The M1 must have been scored.

A1*: Correctly achieves the given answer of $x=2\arctan\left(\frac{4}{x}\right)$

An intermediate line of $\tan\left(\frac{1}{2}x\right)=\frac{4}{x}$ or $\frac{\sin\left(\frac{1}{2}x\right)}{\cos\left(\frac{1}{2}x\right)}=\frac{2x}{\frac{1}{2}x^2}$ must be seen

Note that some may work backwards having differentiated e.g.

$$x=2\arctan\left(\frac{4}{x}\right)\Rightarrow\frac{x}{2}=\arctan\left(\frac{4}{x}\right)\Rightarrow\tan\left(\frac{x}{2}\right)=\frac{4}{x}\Rightarrow\frac{x\sin\left(\frac{x}{2}\right)}{\cos\left(\frac{x}{2}\right)}=4\Rightarrow4\cos\left(\frac{x}{2}\right)=x\sin\left(\frac{x}{2}\right)$$

$$\Rightarrow2x\cos\left(\frac{x}{2}\right)=\frac{1}{2}x^2\sin\left(\frac{x}{2}\right)\Rightarrow2x\cos\left(\frac{x}{2}\right)-\frac{1}{2}x^2\sin\left(\frac{x}{2}\right)=0$$

Score M1 for a complete method to reach $\frac{\mathrm{d}y}{\mathrm{d}x}=0$ and A1 if correct with (minimal) conclusion.

(b)

M1: Attempts to use the given iteration formula. Award for $x_2=2\arctan\left(\frac{4}{2}\right)$ or awrt 2.21

Note that this mark may also be implied by awrt 127 if they are using degrees and no working is shown.

A1: x_2 = awrt 2.214

A1: x_6 = 2.155 (Note that this is not awrt)