Question Number	Scheme	Marks
7. (a)	$y\big\vert_{0.8} = 2\cos 2.4 - 2.4 + 4 = 0.13$ AND $y\big\vert_{0.9} = 2\cos 2.7 - 2.7 + 4 = -0.51$	M1
	States change of sign, continuous and hence root	A1
		(2)
(b) (i)	$\left(x_2\right) = \frac{1}{3}\arccos\left(1.5\times 0.8 - 2\right) = 0.8327$	M1 A1
(ii)	$x_5 = 0.8110$	A1
		(3)
(c)	$\frac{\mathrm{d}y}{\mathrm{d}x} = -6\sin 3x - 3$	M1 A1
	Attempts $\frac{\mathrm{d}y}{\mathrm{d}x} = 0 \Rightarrow \sin 3x = -\frac{1}{2} \Rightarrow x = ...$ via correct order of operations	dM1
	Achieves either $\frac{7\pi}{18}$ or $\frac{19\pi}{18}$	A1
	Correct attempt to find the third positive solution e.g. $x = \frac{\frac{\pi}{6} + 3\pi}{3}$	ddM1
	$\beta = \frac{7\pi}{18}$ and $\lambda = \frac{19\pi}{18}$	A1
		(6)
		11 marks

(a)

M1 Attempts the value of y at 0.8 **AND** 0.9 with at least one correct to 1 sf rounded or truncated.
Note that it is possible to choose a tighter interval containing the root but to score the A1 the conclusion must refer to the given interval.

A1 Both values correct to 1sf rounded or truncated, with reason (Sign change **and** continuous function) and minimal conclusion (root)
If the candidate chooses 0.8 and 0.9 the minimal conclusion does not need to mention the interval.
So e.g. $y\big\vert_{0.8} = 0.1 > 0$, $y\big\vert_{0.9} = -0.5 < 0$ and function is continuous, so ✓ would be acceptable

(b) (i)

M1 Attempts to substitute $x_1 = 0.8$ into the formula. Implied by sight of embedded values in expression or awrt 0.83

A1 AWRT 0.8327

(b)(ii)

A1 $x_5 = 0.8110$ CAO. This is not awrt and 0.811 is A0 unless preceded by 0.8110

If it is clearly marked (b)(ii) then you don't need the x_5

(c)

M1 For $\left(\frac{\mathrm{d}y}{\mathrm{d}x}\right) = A\sin 3x + B$

A1 $\left(\frac{\mathrm{d}y}{\mathrm{d}x}\right) = -6\sin 3x - 3$

dM1 Attempts $\frac{\mathrm{d}y}{\mathrm{d}x} = 0 \Rightarrow \sin 3x = a, \quad |a| < 1 \Rightarrow x = ...$ It is dependent upon the previous M

Look for correct order of operations, invsin*a* then ÷3 leading to a value for *x*.

When $\sin 3x = -\frac{1}{2}$ it is implied, for example, by $-\frac{\pi}{18}, \frac{7\pi}{18}, \frac{11\pi}{18}$ (2nd soln), $\frac{19\pi}{18}$ amongst others or if answers are given as decimals, for example, by awrt –0.17, awrt 1.2 , awrt 1.92 or awrt 3.32

For $\sin 3x = +\frac{1}{2}$ it would be implied, for example, by values such as $\frac{\pi}{18}, \frac{5\pi}{18}$ awrt 0.17 or awrt 0.87

The calculations must be using radians. If degrees are used initially they must be converted to radians

A1 For recognising that either $\frac{7\pi}{18}$ or $\frac{19\pi}{18}$ is a solution to $\sin 3x = -\frac{1}{2}$

ddM1 Attempts to find the solution for λ in the correct quadrant.

Look for the **3rd positive solution** for their $\sin 3x = k$

So for $k > 0$ it would be for $x = \frac{2\pi + \arcsin|k|}{3}$

And for $k < 0$ it would be for $x = \frac{3\pi + \arcsin|k|}{3}$

A1 States that $\beta = \frac{7\pi}{18}$ and $\lambda = \frac{19\pi}{18}$ Labels must be correct

Question Number	Scheme	Marks
8.(i)	$\int \frac{2}{3x-1}\,\mathrm{d}x = \frac{2}{3}\ln(3x-1)$	M1 A1
	$\int_3^{42} \frac{2}{3x-1}\,\mathrm{d}x = \frac{2}{3}\ln(125) - \frac{2}{3}\ln(8) = \ln\frac{25}{4}$	dM1 A1
		(4)
(ii)	$\frac{2x^3-7x^2+8x+1}{(x-1)^2} = 2x + B + \frac{C}{(x-1)^2}$	B1
	Full method to find values of A, B and C	M1
	$\frac{2x^3-7x^2+8x+1}{(x-1)^2} = 2x - 3 + \frac{4}{(x-1)^2}$	A1
	$\int \mathrm{h}(x)\,\mathrm{d}x = \int Ax + B + \frac{C}{(x-1)^2}\,\mathrm{d}x$	
	$= \frac{1}{2}Ax^2 + Bx - \frac{C}{(x-1)}$	M1 A1 ft
	$= x^2 - 3x - \frac{4}{(x-1)} \quad (+c)$	A1
		(6)
		10 marks
(ii) Alt I first 3 marks	$2x^3-7x^2+8x+1 = Ax(x-1)^2 + B(x-1)^2 + C$	
	Any of $A=2, B=-3$, or $C=4$	B1
	Either substitution or equating coefficients to get two values	M1
	All values correct $A=2, B=-3, C=4$	A1
		(3)
(ii) Alt II first 3 marks	$\begin{array}{r} 2x-3 \\ x^2-2x+1 \overline{\big)\, 2x^3-7x^2+8x+1} \\ \underline{} \\ 4 \end{array}$	
	Likely to be $2x$	B1
	For attempt at division	M1
	Correct quotient and remainder	A1
		(3)

(i)