Question	Scheme	Marks	AOs
4(a)	$$\mathrm{f}'(x)=2x+\frac{4x-4}{2x^2-4x+5}$$	M1 A1	1.1b 1.1b
	$$2x+\frac{4x-4}{2x^2-4x+5}=0\Rightarrow 2x\left(2x^2-4x+5\right)+4x-4=0$$	dM1	1.1b
	$$2x^3-4x^2+7x-2=0\,*$$	A1*	2.1
		(4)	
(b)	(i) $$x_2=\frac{1}{7}\left(2+4(0.3)^2-2(0.3)^3\right)$$	M1	1.1b
	$$x_2=0.3294$$	A1	1.1b
	(ii) $$x_4=0.3398$$	A1	1.1b
		(3)	
(c)	$$\mathrm{h}(x)=2x^3-4x^2+7x-2$$ $$\mathrm{h}(0.3415)=0.00366\ldots \qquad \mathrm{h}(0.3405)=-0.00130\ldots$$	M1	3.1a
	States: • there is a change of sign • $\mathrm{f}'(x)$ is continuous • $\alpha=0.341$ to 3dp	A1	2.4
		(2)	
			(9 marks)

Notes

(a)

M1: Differentiates $\ln\left(2x^2-4x+5\right)$ to obtain $\dfrac{g(x)}{2x^2-4x+5}$ where g(x) could be 1

A1: For $f'(x)=2x+\dfrac{4x-4}{2x^2-4x+5}$

dM1: Sets their f′(x) $=ax+\dfrac{g(x)}{2x^2-4x+5}=0$ and uses "**correct**" algebra, condoning slips, to obtain a cubic equation. E.g Look for $ax\left(2x^2-4x+5\right)\pm g(x)=0$ o.e. , condoning slips, followed by some attempt to simplify

A1*: Achieves $2x^3-4x^2+7x-2=0$ with no errors. (The dM1 mark must have been awarded)

(b)(i)

M1: Attempts to use the iterative formula with $x_1=0.3$. If no method is shown award for $x_2=\text{awrt } 0.33$

A1: $x_2=\text{awrt } 0.3294$ Note that $\dfrac{1153}{3500}$ is correct

Condone an incorrect suffix if it is clear that a correct value has been found

(b)(ii)

A1: $x_4=\text{awrt } 0.3398$ Condone an incorrect suffix if it is clear that a correct value has been found

(c)

M1: Attempts to substitute x = 0.3415 and x = 0.3405 into a suitable function and gets one value correct (rounded or truncated to 1 sf). It is allowable to use a tighter interval that contains the root 0.340762654

Examples of suitable functions are $2x^3-4x^2+7x-2,\ x-\dfrac{1}{7}\left(4x^2-2x^3+2\right)$ and f '(x) as this has been found in part (a) with f '(0.3405)= - 0.00067.., f '(0.3415)= (+) 0.0018

There must be sufficient evidence for the function, which would be for example, a statement such as $h(x)=2x^3-4x^2+7x-2$ or sight of embedded values that imply the function, not just a value or values even if both are correct. Condone $h(x)$ being mislabelled as f

$h(0.3415)=2\times0.3415^3-4\times0.3415^2+7\times0.3415-2$

A1: Requires

- both calculations correct (rounded or truncated to 1sf)
- a statement that there is a change in sign and that the function is continuous
- a minimal conclusion e.g. ✓, proven, α = 0.341, root