Question Number	Scheme	Notes	Marks
1	$\mathrm{f}(x)=\frac{2}{3}x^3-3x^2+5x+\mathrm{e}^{2x}(1-2x),\qquad x=\frac{2x^2+5}{4\mathrm{e}^{2x}+6}$		
(a)	$\mathrm{f}'(x)=Ax^2\pm Bx+5\ \{+...\}\ \ A,B>0\ \ \{=2x^2-6x+5+...\}$ M1: Differentiates the first three terms to achieve $Ax^2\pm Bx+5\ \ A,B>0$ May be unsimplified but indices must be processed		**M1**
	$\mathrm{e}^{2x}(1-2x)\to 2\mathrm{e}^{2x}(1-2x)-2\mathrm{e}^{2x}$ or $\mathrm{e}^{2x}-2x\mathrm{e}^{2x}\to 2\mathrm{e}^{2x}-2\mathrm{e}^{2x}-4x\mathrm{e}^{2x}$ M1: Obtains one of the following forms for the product: $\mathrm{e}^{2x}(1-2x)\to \pm C\mathrm{e}^{2x}(1-2x)\pm D\mathrm{e}^{2x}$ or $\mathrm{e}^{2x}-2x\mathrm{e}^{2x}\to \pm E\mathrm{e}^{2x}\pm F\mathrm{e}^{2x}\pm Gx\mathrm{e}^{2x}$ All coefficients non-zero. Condone if an incorrect rule is stated/used. **The product must produce all the appropriate terms so do not allow equivalents** e.g., $\mathrm{e}^{2x}-2x\mathrm{e}^{2x}\to 2\mathrm{e}^{2x}-4x\mathrm{e}^{2x}$ is M0 If only the $x\mathrm{e}^{2x}$ term is seen it must be the correct $-4x\mathrm{e}^{2x}$ from correct work for the product A1: $\left(\mathrm{f}'(x)=\right)\ 2x^2-6x+5-4x\mathrm{e}^{2x}$ This answer only. Terms in any order. Not $5x^0$. May be partially factorised but Isw.		**M1** **A1**
			(3)
(b)	$\mathrm{f}'(0)=2(0)^2-6(0)+5-4(0)\mathrm{e}^{2(0)}=...\ \ \{5\}$ **and** $\mathrm{f}'(1)=2(1)^2-6(1)+5-4(1)\mathrm{e}^{2(1)}=...\ \ \{-28.556...\}$ Obtains values for both $\mathrm{f}'(0)$ and $\mathrm{f}'(1)$ with at least one correct f '(1) = awrt -29 or -28. Allow ft on their f '(x) correct to 2 sf (allowing if truncated) provided it is of the form: $\pm Hx^2\pm Ix\pm J\pm$ at least one term of the form $\pm K\mathrm{e}^{2x}$ or $\pm Lx\mathrm{e}^{2x}$ oe with no other forms of terms but allow the J to be missing. No substitution needs to be seen. M0 for clear use of f(x) instead of f '(x) but condone mislabelling i.e., sight of "f(0) = " and/or "f(1) =" provided there is no conclusive evidence that f(x) has actually been used. Note that f(0) =1 (but note that this could be the same as their f '(0)) and f(1) = - 4.722...		**M1**
	$\mathrm{f}'(0)=5$ and $\mathrm{f}'(1)=-28.556...$ $\Rightarrow$ There is a **sign change** and $\mathrm{f}'(x)$ is **continuous** over the interval hence **root** (in the interval $[0,1]$)	Both correct values from a correct f '(x), correct reason, mention of continuity and conclusion. An acceptable minimum in bold but allow equivalents e.g., "f '(0)>0, f '(1)<0" for "sign change" and condone e.g., "x/root/graph is continuous/continual". This is not a ft mark.	**A1**
			(2)

(c)(i)	$\{x_1 = 0 \Rightarrow x_2 =\} \frac{5}{10} = \frac{1}{2} \Rightarrow x_3 = \frac{2(0.5)^2 + 5}{4e^{2(0.5)} + 6} = ...$ $= 0.3259620992$ M1: Substitutes $x = 0$ into the iterative formula and then substitutes the answer into the formula and achieves a value. Condone slips if there is working but if just a value/values is/are given we must see awrt 0.326 (3sf) A1: Awrt 0.3260 (4sf) and accept "0.326" May just give answer only. Accept if unlabelled/mislabelled but mark their final answer to (i) in such cases (but isw if clearly followed by just rounding)	**M1** **A1**
(c)(ii)	$\{\alpha =\}$ 0.3675 $\{0.3674712656\}$ Awrt 0.3675. **Treat as a B mark** so 001 is a possible mark profile. Accept if unlabelled/mislabelled but mark their final answer to (ii) in such cases (but isw if followed by rounding)	**A1**
		(3)
		(Total 8 marks)