Question Number	Scheme	Mark
2(a)	$\frac{1}{2}$	B1
		(1)
(b)	$\left\{\frac{dy}{dx}=\right\}\quad (3+2x)\ln 2x+\frac{1}{x}(3x+x^2)$ o.e.	M1A1
	$(3+2x)\ln 2x+\frac{1}{x}(3x+x^2)=0\Rightarrow \ln 2x=...$	dM1
	$\ln 2x=-\frac{3+x}{3+2x}\Rightarrow x=\frac{1}{2}e^{-\left(\frac{x+3}{2x+3}\right)}$ *	A1*
		(4)
(c)(i)	$\{x_2=\}\ \frac{1}{2}e^{-\frac{0.5+3}{2\times 0.5+3}}=0.2084310...$	M1
	awrt 0.2084	A1
(ii)	0.1948	A1
		(3)
		(8 marks)

(a)

B1: cao $\frac{1}{2}$ or 0.5. Condone (0.5, 0). There is no need to see $x = \ldots$ Ignore any solutions for $x \leqslant 0$

Must be clear that this is their answer to part (a) and not just $\frac{1}{2}$ or 0.5 seen anywhere.

(b)

M1: Attempts to use the product rule achieving $(A+Bx)\ln 2x+\frac{C}{x}(3x+x^2)$, A, B and C non-zero.

You may see e.g. $(3+x)\ln 2x+x\ln 2x+\frac{1}{x}x(3+x)$ if they do not expand the brackets before differentiating. Condone invisible brackets for this mark even if they are not recovered.

A1: $(3+2x)\ln 2x+3+x$ or unsimplified equivalent e.g. $(3+2x)\ln 2x+\frac{2}{2x}(3x+x^2)$

There is no need to see a LHS. Allow invisible brackets provided they are recovered.

dM1: Sets an expression of the form $(A+Bx)\ln 2x+\frac{C}{x}(3x+x^2)$ o.e. = 0, with A, B and C non-zero, and isolates $\ln 2x$ or $\ln x$ on one side. Dependent on the previous method mark.

A1*: Proceeds to the given answer with no errors seen.
Invisible brackets earlier in their work are penalised here.

Must be in this form but condone $x=\frac{1}{2}\mathrm{e}^{-\frac{x+3}{2x+3}}$ or $x=\frac{1}{2}\mathrm{e}^{-\frac{3+x}{3+2x}}$ or $x=\frac{1}{2}\mathrm{e}^{\frac{-(x+3)}{2x+3}}$

Do not accept e.g. $x=\frac{1}{2}\mathrm{e}^{\frac{-x-3}{2x+3}}$

Note that you may see some that work backwards from the given result $x=\frac{1}{2}\mathrm{e}^{-\left(\frac{x+3}{2x+3}\right)}$ to $(3+2x)\ln 2x+3+x=0$. This approach scores no marks unless there is clear evidence of differentiating the given equation $y=x(3+x)\ln 2x$ and must have a conclusion to score the final A1*. If unsure, send to review.

(c)(i)

M1: Substitutes 0.5 into the iterative formula. May be implied by awrt 0.208 or awrt 0.196

A1: awrt 0.2084

(c)(ii)

A1: cao 0.1948 following award of M1. This is not scored for awrt 0.1948

Question Number	Scheme	Mark
3(a)	$\left\{\frac{dx}{dy}=\right\}\ \frac{2(y-1)^2-2(2y-1)(y-1)}{(y-1)^4}$	M1
	$=\frac{-2y^2+2y}{(y-1)^4}$ **or** $=\frac{2(y-1)-2(2y-1)}{(y-1)^3}$	M1
	$=-\frac{2y}{(y-1)^3}$	A1
		(3)
(b)	e.g. $\frac{dy}{dx}="-\frac{(2-1)^3}{2\times 2}"=\ldots\left\{-\frac{1}{4}\right\}$ **and** $x=\frac{2\times 2-1}{1}=\ldots\{3\}$	M1
	$y-2="-\frac{1}{4}"(x-"3")$	dM1
	$x+4y-11=0$	A1
		(3)
		(6 marks)

(a)

M1: Attempts the quotient rule (or product rule) – see below for the required forms.

Allow for $\left\{\frac{dx}{dy}=\right\}\ \frac{\alpha(y-1)^2-\beta(2y-1)(y-1)}{(y-1)^4}$ or $\left\{\frac{dx}{dy}=\right\}\ \alpha(y-1)^{-2}-\beta(2y-1)(y-1)^{-3}$ o.e.

where $\alpha,\beta>0$ but condone $\left\{\frac{dx}{dy}=\right\}\ \frac{\alpha(y-1)^2-\beta(2y-1)(y-1)}{(y-1)^2}$ where $\alpha,\beta>0$

Note the correct differentiation using the product rule is $\left\{\frac{dx}{dy}=\right\}\ 2(y-1)^{-2}-2(2y-1)(y-1)^{-3}$

Attempts using implicit differentiation or partial fractions should be sent to review.

M1: Attempts to expand and simplify their numerator to a quadratic expression with brackets removed **or** cancels a factor of $(y-1)$ correctly and simplifies to a linear numerator, which *would* simplify to $ay+b$ where a **or** b may be 0 (there is no need to expand the brackets for this mark in this approach).

Using the product rule, they must attempt to factor out $(y-1)^{-3}$ and have a linear expression as their other factor (as above) **or** create a common denominator of $(y-1)^3$ with a linear numerator (as above).

e.g. $2(y-1)^{-2}-2(2y-1)(y-1)^{-3}\rightarrow(y-1)^{-3}\left[2(y-1)-2(2y-1)\right]$ **or** $\frac{2(y-1)-2(2y-1)}{(y-1)^3}$

Dependent on a reasonable attempt to use the quotient rule or product rule but condone slips in applying these so that the forms specified above might not be achieved e.g. sign errors or miscopied terms.

A1: $-\frac{2y}{(y-1)^3}$ or simplified equivalent. FYI $-\frac{2y}{y^3-3y^2+3y-1}$ is also acceptable.