A1	For awrt both $x = 1.82$ and 0.549

Question	Scheme	Marks
7(a)	$y = \sqrt{\dfrac{e^{4x}}{2x-3}} = e^{2x}(2x-3)^{-\frac{1}{2}}$	B1
	$y = \dfrac{e^{2x}}{\sqrt{2x-3}} \Rightarrow \dfrac{dy}{dx} = \dfrac{2(2x-3)^{\frac{1}{2}}e^{2x} - 2\times\frac{1}{2}\times e^{2x}(2x-3)^{-\frac{1}{2}}}{\left[(2x-3)^{\frac{1}{2}}\right]^2}$	M1A1A1
	$\dfrac{dy}{dx} = \dfrac{\dfrac{2(2x-3)e^{2x} - 2\times\frac{1}{2}\times e^{2x}}{(2x-3)^{\frac{1}{2}}}}{2x-3} = \dfrac{2(2x-3)e^{2x} - 2\times\frac{1}{2}\times e^{2x}}{(2x-3)^{\frac{3}{2}}}$	M1
	$= \dfrac{e^{2x}(4x-7)}{(2x-3)^{\frac{3}{2}}}$	A1
	$\Rightarrow \delta y \approx \dfrac{e^{2x}(4x-7)}{(2x-3)^{\frac{3}{2}}}\delta x$*	A1cso [7]
(b)	When $x = 2.5$, $\delta x = \dfrac{0.2}{100}\times 2.5 = 0.005$	B1
	$\delta y \approx \dfrac{e^{2\times 2.5}(4\times 2.5-7)}{(2\times 2.5-3)^{\frac{3}{2}}}\times 0.005$	M1
	$\Rightarrow \delta y \approx 0.79$	A1 [3]
		Total 10 marks

Part	Mark	Notes
(a)	**If any candidate attempts part (a) using Chain Rule – please send to Review.**	
	B1	Simplifies the equation into a form which can be differentiated. For example, Award this mark for correct subsequent use in differentiation. $y = \sqrt{\dfrac{e^{4x}}{2x-3}} = e^{2x}(2x-3)^{-\frac{1}{2}}$ or $\dfrac{e^{2x}}{(2x-3)^{\frac{1}{2}}}$ or even $\dfrac{\left(e^{4x}\right)^{\frac{1}{2}}}{(2x-3)^{\frac{1}{2}}}$ or $\dfrac{\left(e^{4x}\right)^{\frac{1}{2}}}{\sqrt{(2x-3)}}$
	Uses Quotient rule. – **NB – This is a 'show' question. Check every line of working.**	
	M1	• The denominator must be correct and squared. • There must be an attempt to differentiate both terms • The two terms in the numerator must be subtracted either way around. Minimally acceptable differentiation is as follows: $e^{2x} \to 2e^{2x}$, $(2x-3)^{\frac{1}{2}} \to k(2x-3)^{-\frac{1}{2}}$ Allow $\left(e^{4x}\right)^{\frac{1}{2}} \to 4e^{4x}\times\frac{1}{2}\times\left(e^{4x}\right)^{-\frac{1}{2}}$

	A1	One term must be fully correct Either $2(2x-3)^{\frac{1}{2}}e^{2x}$ or $-2\times\frac{1}{2}\times e^{2x}(2x-3)^{-\frac{1}{2}}$
	A1	$\frac{dy}{dx}$ fully correct. Ignore poor notation and erroneous subsequent simplification. $'\frac{dy}{dx}'=\frac{2(2x-3)^{\frac{1}{2}}e^{2x}-2\times\frac{1}{2}\times e^{2x}(2x-3)^{-\frac{1}{2}}}{2x-3}$ **OR** $'\frac{dy}{dx}'=\frac{(2x-3)^{\frac{1}{2}}\times 4e^{4x}\times\frac{1}{2}\times(e^{4x})^{-\frac{1}{2}}-2\times\frac{1}{2}\times(e^{4x})^{\frac{1}{2}}(2x-3)^{-\frac{1}{2}}}{2x-3}$
	Uses Product Rule **NB – This is a 'show' question. Check every line of working.**	
	M1	The correct formula must be used. • $\frac{dy}{dx}=uv'+vu'$ • There must be an attempt to differentiate both terms $e^{2x}\to 2e^{2x}$, $(2x-3)^{-\frac{1}{2}}\to k(2x-3)^{-\frac{3}{2}}$ Allow $(e^{4x})^{\frac{1}{2}}\to 4e^{4x}\times\frac{1}{2}\times(e^{4x})^{-\frac{1}{2}}$
	A1	One term must be fully correct Either $(2x-3)^{-\frac{1}{2}}\times 2e^{2x}$ or $\left(-\frac{1}{2}\times 2\times(2x-3)^{-\frac{3}{2}}\right)e^{2x}$
	A1	$\frac{dy}{dx}$ fully correct. Ignore poor notation and erroneous subsequent simplification. $'\frac{dy}{dx}'=(2x-3)^{-\frac{1}{2}}\times 2e^{2x}+\left(-\frac{1}{2}\times 2\times(2x-3)^{-\frac{3}{2}}\right)e^{2x}$ **OR** $'\frac{dy}{dx}'=(2x-3)^{-\frac{1}{2}}\times 4e^{4x}\times\frac{1}{2}\times(e^{4x})^{-\frac{1}{2}}+\left(-\frac{1}{2}\times 2\times(2x-3)^{-\frac{3}{2}}\right)(e^{4x})^{\frac{1}{2}}$
	Simplification – Check their work carefully here.	
	M1	Quotient Rule A correct attempt to simplify the numerator by forming a fraction over $(2x-3)^{\frac{1}{2}}$ Product Rule A correct attempt to simplify by forming a fraction over $(2x-3)^{\frac{3}{2}}$
	A1	For $'\frac{dy}{dx}'=\frac{e^{2x}(4x-7)}{(2x-3)^{\frac{3}{2}}}$
	A1 cso	For the expression exactly as given $\delta y\approx\frac{e^{2x}(4x-7)}{(2x-3)^{\frac{3}{2}}}\delta x$
(b)	**B1**	For finding the change in x
	M1	For using the given expression to substitute the values and evaluate the expression.

		Do not accept a substitution of 0.2 or 0.2% for δx
	A1	For $'\delta y' \approx 0.79$ accept awrt 0.79 Do not penalise poor notation here. Allow dy = 0.79

	ALT 2	**Uses Chain Rule**
	B1	This mark is scored when they divide through later by e^{2x} and $(2x-3)^{\frac{1}{2}}$
	M1	The correct form must be used. $y = u^{\frac{1}{2}} \quad u' = \dfrac{4(2x-3)e^{4x} - 2e^{4x}}{(2x-3)^2} = \left[\dfrac{e^{4x}(8x-14)}{(2x-3)^2}\right] \quad y' = \dfrac{1}{2}\left(\dfrac{e^{4x}}{2x-3}\right)^{-\frac{1}{2}}$ $\Rightarrow \dfrac{dy}{dx} = \dfrac{1}{2}\left(\dfrac{e^{4x}}{2x-3}\right)^{-\frac{1}{2}} \times \left(\dfrac{4(2x-3)e^{4x} - 2e^{4x}}{(2x-3)^2}\right)$ Both terms must be differentiated correctly $e^{4x} \to 4e^{4x}$, $(2x-3) \to k$
	A2	For the correct derivative in unsimplified form. We must see this in full to determine if they simplify further correctly as it is a show question. Please award **both** A marks for the correct derivative seen.
	B1	This mark is awarded at this point. Simplifies $\left(\dfrac{e^{4x}}{2x-3}\right)^{-\frac{1}{2}}$ to e^{2x} and $(2x-3)^{\frac{1}{2}}$ accept inverted or not.
	M1	Simplifies e^{2x} and $(2x-3)^{\frac{1}{2}}$ to obtain a denominator of $(2x-3)^{\frac{3}{2}}$ $\dfrac{dy}{dx} = \dfrac{1}{2}\left(\dfrac{(2x-3)^{\frac{1}{2}}}{e^{2x}}\right) \times \left(\dfrac{4(2x-3)e^{4x} - 2e^{4x}}{(2x-3)^2}\right) = \dfrac{1}{2}\left(\dfrac{4(2x-3)e^{2x} - 2e^{2x}}{(2x-3)^{\frac{3}{2}}}\right)$
	A1	For the correct expression with no errors.