Question	Scheme	Marks	AOs
14(a)	$\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{\left(x^3+4\right)2\mathrm{e}^{2x} - 3x^2\mathrm{e}^{2x}}{\left(x^3+4\right)^2}$	M1 A1 A1	1.1b 1.1b 1.1b
		(3)	
(b)	At P $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{\left(p^3+4\right)2\mathrm{e}^{2p} - 3p^2\mathrm{e}^{2p}}{\left(p^3+4\right)^2}$ $\Rightarrow y - \dfrac{\mathrm{e}^{2p}}{p^3+4} = \dfrac{\left(p^3+4\right)2\mathrm{e}^{2p} - 3p^2\mathrm{e}^{2p}}{\left(p^3+4\right)^2}(x-p)$	M1	3.1a
	As l passes through (0, 0), $-\dfrac{\mathrm{e}^{2p}}{p^3+4} = \dfrac{\left(p^3+4\right)2\mathrm{e}^{2p} - 3p^2\mathrm{e}^{2p}}{\left(p^3+4\right)^2}(-p)$	M1	1.1b
	$\Rightarrow \left(p^3+4\right)\mathrm{e}^{2p} = \left(p^3+4\right)2p\mathrm{e}^{2p} - 3p^3\mathrm{e}^{2p}$ $\Rightarrow 2p^4 - 4p^3 + 8p - 4 = 0$ $\Rightarrow p^4 - 2p^3 + 4p - 2 = 0$ so p satisfies $x^4 - 2x^3 + 4x - 2 = 0$*	A1*	2.1
		(3)	
(c)	$x_1 = 0.5 \Rightarrow x_2 = \dfrac{2\left(0.5\right)^3 + 2}{0.5^3 + 4} = \ldots$	M1	1.1b
	$x_2 = 0.5455$	A1	1.1b
	$p = 0.5646$	A1	2.2a
		(3)	
(d)	Gradient of l is $\dfrac{\left(p^3+4\right)2\mathrm{e}^{2p} - 3p^2\mathrm{e}^{2p}}{\left(p^3+4\right)^2} = 1.31$	B1	2.2a
		(1)	
			(10 marks)

Notes

(a)

M1: For $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{\alpha\left(x^3+4\right)\mathrm{e}^{2x} - \beta x^2\mathrm{e}^{2x}}{\left(x^3+4\right)^2}$

A1: For $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{2\left(x^3+4\right)\mathrm{e}^{2x} - \ldots}{\left(x^3+4\right)^2}$ or $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{\ldots - 3x^2\mathrm{e}^{2x}}{\left(x^3+4\right)^2}$

A1: Fully correct derivative in any form

(b)

M1: Fully correct strategy for l. E.g. substitutes $x = p$ into their (a) result to find the gradient of l and uses this with $\left(p, \dfrac{\mathrm{e}^{2p}}{p^3+4}\right)$ to form an equation for l which may be implied

M1: Sets $x = 0$ and $y = 0$ to establish an equation in p

A1*: Completes to the given answer with no errors

(c)

M1: Attempts to use the given recurrence relation with $x = 0.5$

A1: Awrt 0.5455

A1: For deducing that $p = 0.5646$ only
(d)
B1: Uses the value of p to deduce the gradient of l. Allow awrt 1.31