Question Number	Scheme	Marks
5 (a)	$2y\frac{dy}{dx} = e^{-2x}\frac{dy}{dx} - 2ye^{-2x} - 3$ $\left(e^{-2x} - 2y\right)\frac{dy}{dx} = 2ye^{-2x} + 3 \Rightarrow \frac{dy}{dx} = \frac{2ye^{-2x}+3}{e^{-2x}-2y}$ *	B1 M1 A1 A1* **(4)**
(b)	Puts $x = 0$ into the equation of the curve $\Rightarrow y = y^2 \Rightarrow y = 1$ Attempts tangent at $(0,0)$ **or** $(0,1)$ $\quad y = 3x$ **or** $y = -5x+1$ Solves $y = 3x$ with $y = -5x+1 \Rightarrow R = \left(\frac{1}{8}, \frac{3}{8}\right)$	B1 M1 A1 dM1 A1 **(5)** **(9 marks)**

(a) Originally scored M1 B1 A1 A1, now B1 M1 A1 A1

B1: Correct differentiation using the chain rule $y^2 \rightarrow 2y\frac{dy}{dx}$.

M1: Attempts to apply the product rule of differentiation on ye^{-2x} to give $e^{-2x}\frac{dy}{dx} \pm ...ye^{-2x}$

A1: Correct differentiation $2y\frac{dy}{dx} = e^{-2x}\frac{dy}{dx} - 2ye^{-2x} - 3$

Allow $2y\,dy = e^{-2x}dy - 2ye^{-2x}dx - 3dx$

A1*: Proceeds to the given answer via an intermediate line equivalent to $\left(e^{-2x} - 2y\right)\frac{dy}{dx} = 2ye^{-2x} + 3$ with correct bracketing.

(b)

B1: Deduces or implies that $x = 0, y = 1$ at P . May state or use coordinates of P (0,1)

M1: Scored for an attempt to find the equation of the tangent at O **or** the equation of the tangent at P

E.g. Substitutes $(0,0)$ into $\frac{dy}{dx} = \frac{2ye^{-2x}+3}{e^{-2x}-2y} = \beta$ and states $y = \beta x$

Alternatively substitutes $(0,"1")$ into $\frac{dy}{dx} = \frac{2ye^{-2x}+3}{e^{-2x}-2y} \rightarrow "k"$ and attempts $y - 1 = "k"x$ or equivalent

A1: Achieves a correct equation for **either** tangent. Look for **either** $y = 3x$ **or** $y = -5x+1$ o.e.

dM1: Correct attempt **at both** tangents with an attempt to solve simultaneously.

For the attempt to solve accept $y = 3x$, $y = -5x+1 \Rightarrow x = ..., y = ...$

A1: Correct coordinates for $R = \left(\frac{1}{8}, \frac{3}{8}\right)$ oe

Question Number	Scheme	Marks
6 (a)(i)	Area $R = \int y \frac{\mathrm{d}x}{\mathrm{d}t}\,\mathrm{d}t = \int 4\sin t \times -4\sin 2t\,\mathrm{d}t$	M1 A1
	$= -\int 32\sin^2 t\cos t\,\mathrm{d}t$	dM1
	$x = 0 \Rightarrow t = \frac{\pi}{4}$ and $y = 0 \Rightarrow t = 0 \Rightarrow$ Area $= -\int_{\frac{\pi}{4}}^{0} 32\sin^2 t\cos t\,\mathrm{d}t = \int_{0}^{\frac{\pi}{4}} 32\sin^2 t\cos t\,\mathrm{d}t$ *	A1*
		(4)
(ii)	Area $= \left[\frac{32}{3}\sin^3 t\right]_0^{\frac{\pi}{4}} = \frac{32}{3}\times\frac{2\sqrt{2}}{8} = \frac{8\sqrt{2}}{3}$	M1 A1
		(2)
(b)	Attempts to use $\cos 2t = 1 - 2\sin^2 t \Rightarrow \frac{x}{2} = 1 - 2\left(\frac{y}{4}\right)^2$	M1A1
	$y = \sqrt{8 - 4x}$	A1
		(3)
(c)	Range is $0 \leqslant \mathrm{f} \leqslant 4$	B1
		(1)
		(10 marks)