Question	Scheme	Marks	AOs
9	Attempts to find the coordinates of P. It requires • an attempt to find $\frac{dy}{dx}$ • setting their $\frac{dy}{dx}=0$ to find a value for x • A value of y found from the value of x	M1	3.1a
	$y = xe^{-2x} \Rightarrow \frac{dy}{dx} = e^{-2x} - 2xe^{-2x}$	B1	1.1b
	$\frac{dy}{dx} = 0 \Rightarrow (1-2x)e^{-2x} = 0 \Rightarrow x = \left(\frac{1}{2}\right)$	M1	1.1b
	So $P = \left(\frac{1}{2}, \frac{1}{2e}\right)$ or $a = \frac{1}{2}, b = \frac{1}{2e}$ oe	A1	2.1
		(4)	
	Attempts $\int xe^{-2x}dx = -\frac{1}{2}xe^{-2x} + \int \frac{1}{2}e^{-2x}dx$	M1	1.1b
	$= -\frac{1}{2}xe^{-2x} - \frac{1}{4}e^{-2x}$	dM1 A1	1.1b 1.1b
	Area $R = \frac{1}{2} \times \frac{1}{2e} - \left[-\frac{1}{2}xe^{-2x} - \frac{1}{4}e^{-2x}\right]_0^{\frac{1}{2}}$	M1	3.1a
	$= \frac{3}{4e} - \frac{1}{4}$ or $\frac{3-e}{4e}$	A1	2.1
		(5)	
			(9 marks)

Notes:

(a)

M1: This is an overall problem solving mark. See scheme on how to award.

B1: Uses the product rule to find $\frac{dy}{dx} = e^{-2x} - 2xe^{-2x}$

M1: Scored for setting $\frac{dy}{dx} = e^{-2x} \pm kxe^{-2x} = 0$ **and** finding x by either cancelling, or factorising out e^{-2x}

A1: Careful and rigorous work leading to an exact value for $P = \left(\frac{1}{2}, \frac{1}{2e}\right)$ or $a = \frac{1}{2}, b = \frac{1}{2e}$ oe

(b)

M1: For attempting to use integration by parts the correct way around.

Score for $\int xe^{-2x}dx = Axe^{-2x} + \int Be^{-2x}dx$

dM1: ....And integrates again to a correct form

A1: $\int xe^{-2x}dx = -\frac{1}{2}xe^{-2x} - \frac{1}{4}e^{-2x}$

M1: A problem solving mark for a complete correct strategy to find the area of R

A1: For careful and precise work leading to either $\frac{3}{4e} - \frac{1}{4}$ or $\frac{3-e}{4e}$