Question Number	Scheme	Marks
8 (a)	$\int y^{-\frac{1}{3}}\mathrm{d}y = \int 6x\mathrm{e}^{-2x}\mathrm{d}x$	B1
	$\frac{3}{2}y^{\frac{2}{3}} = -3x\mathrm{e}^{-2x} + \int 3\mathrm{e}^{-2x}\mathrm{d}x$	M1 M1
	$\frac{3}{2}y^{\frac{2}{3}} = -3x\mathrm{e}^{-2x} - \frac{3}{2}\mathrm{e}^{-2x} + c$	dM1 A1
	Substitutes $(0,1) \Rightarrow c = 3$	M1
	$y^2 = \left(-2x\mathrm{e}^{-2x} - \mathrm{e}^{-2x} + 2\right)^3$	A1
		(7)
(b)	As $x \to \infty, \mathrm{e}^{-2x} \to 0$ and $y^2 = (2)^3 \Rightarrow y = 2^{\frac{3}{2}}$	M1 A1
		(2)
		(9 marks)

(a)

B1: Separates the variables either $\int y^{-\frac{1}{3}}\mathrm{d}y = \int 6x\mathrm{e}^{-2x}\mathrm{d}x$ or $\int \frac{1}{6}y^{-\frac{1}{3}}\mathrm{d}y = \int x\mathrm{e}^{-2x}\mathrm{d}x$

Condone with missing integral signs but the dx and dy **must be present** and **in the correct positions**

M1: For integrating the lhs $y^{-\frac{1}{3}} \to y^{\frac{2}{3}}$

M1: For integrating the rhs by parts the right way around. Look for $\int x\mathrm{e}^{-2x}\mathrm{d}x \to \ ..x\mathrm{e}^{-2x} \pm \int ...\mathrm{e}^{-2x}\mathrm{d}x$

dM1: For fully integrating the rhs to obtain $..x\mathrm{e}^{-2x} \pm ...\mathrm{e}^{-2x}$. Depending upon the previous M

A1: Correct integration with or without '+ c'.

Look for $\frac{3}{2}y^{\frac{2}{3}} = -3x\mathrm{e}^{-2x} - \frac{3}{2}\mathrm{e}^{-2x} + c$ or equivalent such as $3y^{\frac{2}{3}} = -6x\mathrm{e}^{-2x} - 3\mathrm{e}^{-2x} + a$

dM1: Must have a "+c " now. Substitutes $(0,1) \Rightarrow c = ...$

It is dependent upon having a correct attempt to integrate one side so M1 or M2 must have been awarded.

A1: CSO $y^2 = \left(-2x\mathrm{e}^{-2x} - \mathrm{e}^{-2x} + 2\right)^3$

(b)

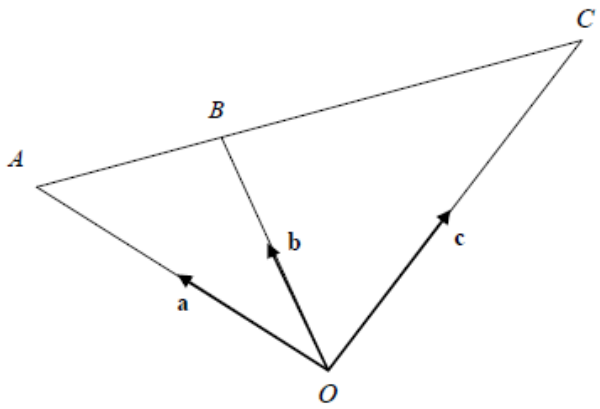
M1: For $\mathrm{e}^{-2x} \to 0 \ \ y^2 = (\text{"2"})^3$

Follow through on their $\mathrm{g}(x)$ in $y^2 = \mathrm{g}(x)$ but $\mathrm{g}(x)$ must be a function of e^{-kx} with $\mathrm{g}(0) \neq 0$

Implied by a correct decimal answer for their $y^2 = \mathrm{g}(x)$

A1: $y = 2^{\frac{3}{2}}$ o.e such as $y = \sqrt{8}$ cso. ISW after sight of this. Condone $y = \pm 2^{\frac{3}{2}}$ o.e.

Question Number	Scheme	Marks
9 (i)	Attempts two of $\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$, $\overrightarrow{AC} = \mathbf{c} - \mathbf{a}$ **and** $\overrightarrow{BC} = \mathbf{c} - \mathbf{b}$ either way around	M1
	Attempts $\mathbf{c} - \mathbf{b} = 2 \times (\mathbf{b} - \mathbf{a})$ oe such as $\mathbf{c} - \mathbf{a} = \mathbf{3} \times (\mathbf{b} - \mathbf{a})$	dM1
	$\Rightarrow \mathbf{c} = 3\mathbf{b} - 2\mathbf{a}$ *	A1 *
		(3)
(ii)	Assume that there exists a number n that isn't a multiple of 3 yet n^2 is a multiple of 3	B1
	If n is not a multiple of 3 then $m = 3p+1$ or $m = 3p+2$ $(p \in \mathbb{N})$ giving	
	$m^2 = (3p+1)^2 = 9p^2 + 6p + 1$	M1
	Or $m^2 = (3p+2)^2 = 9p^2 + 12p + 4 = 3\left(3p^2 + 4p + 1\right) + 1$	M1 A1
	$(3p+1)^2 = 9p^2 + 6p + 1\left(= 3\left(3p^2 + 2p\right) + 1\right)$ is one more than a multiple of 3	
	$(3p+2)^2 = 9p^2 + 12p + 4$ is not a multiple of 3 as 3 does not divide into 4 (exactly)	
	Hence if n is a multiple of 3 then n^2 is a multiple of 3	A1
		(5)
		(8 marks)



(i)

M1: Attempts any two of $\overrightarrow{AB}$, $\overrightarrow{AC}$ **and** $\overrightarrow{BC}$**.**

Condone the wrong way around but it must be subtraction.

Allow marked in the correct place on a diagram

dM1: Uses the given information.

Accept $\overrightarrow{AB} = \frac{1}{3}\overrightarrow{AC}$, $\overrightarrow{BC} = 2 \times \overrightarrow{AB}$, $\overrightarrow{BC} = \frac{2}{3} \times \overrightarrow{AC}$ etc condoning slips as in previous M1.

A1*: Fully correct work inc bracketing leading to the given answer $\mathbf{c} = 3\mathbf{b} - 2\mathbf{a}$

Expect to see the brackets multiplied out. So $\mathbf{c} - \mathbf{b} = 2 \times (\mathbf{b} - \mathbf{a}) \Rightarrow \mathbf{c} - \mathbf{b} = 2\mathbf{b} - 2\mathbf{a} \Rightarrow \mathbf{c} = 3\mathbf{b} - 2\mathbf{a}$ is fine.