Question	Answer	Marks	Guidance
8(b)	(Direction vector =) $\begin{pmatrix}4\\3\end{pmatrix}$ soi or x component: $\cos\alpha = \frac{4}{5}$ y component: $\sin\alpha = \frac{3}{5}$ soi	**B1**	
	(Velocity vector =) $\frac{20}{\sqrt{4^2+3^2}} \times their \begin{pmatrix}4\\3\end{pmatrix}$ oe soi or $20\begin{pmatrix}their\cos\alpha\\their\sin\alpha\end{pmatrix}$ soi	**M1**	
	(Position vector =) $\begin{pmatrix}67\\-18\end{pmatrix} + t\begin{pmatrix}16\\12\end{pmatrix}$ oe	**A2**	**A1 FT** $\begin{pmatrix}67\\-18\end{pmatrix} + t \times their \begin{pmatrix}16\\12\end{pmatrix}$ If zero scored, **SC2** for one correct component, either $67+16t$ or $-18+12t$
8(c)	$3+24t = 67+16t$ oe or $-2+10t = -18+12t$ oe	**M1**	**FT** Equates *their x* components, or *their y* components from parts **(a)** and **(b)**, providing of equivalent difficulty, e.g. $a+bt = c+dt$
	$t = 8$	**A1**	**dep** on full marks in **(a)** and **(b)**
	(Position of meeting =) $\begin{pmatrix}195\\78\end{pmatrix}$	**A1**	**dep** on full marks in **(a)** and **(b)**
9(a)	$\frac{\mathrm{d}}{\mathrm{d}x}\left(\mathrm{e}^{-2x}\right) = -2\mathrm{e}^{-2x}$ soi	**B1**	
	$\frac{\mathrm{d}y}{\mathrm{d}x} = k\mathrm{e}^{-2x} - 2kx\mathrm{e}^{-2x}$ oe, isw	**B1**	**FT** for use of product rule $k.\mathrm{e}^{-2x} + kx.\left(their \frac{\mathrm{d}}{\mathrm{d}x}\left(\mathrm{e}^{-2x}\right)\right)$
	Alternative		
	$\frac{\mathrm{d}}{\mathrm{d}x}\left(\mathrm{e}^{2x}\right) = 2\mathrm{e}^{2x}$ soi	**(B1)**	
	$\frac{\mathrm{d}y}{\mathrm{d}x} = \frac{k\mathrm{e}^{2x} - 2kx\mathrm{e}^{2x}}{\left(\mathrm{e}^{2x}\right)^2}$ oe, isw	**(B1)**	**FT** for use of quotient rule $\frac{k.\mathrm{e}^{2x} - kx.\left(their\ 2\mathrm{e}^{2x}\right)}{\left(\mathrm{e}^{2x}\right)^2}$

Question	Answer	Marks	Guidance
9(b)	Equates $\frac{dy}{dx} = 0$ and finds $10 - 20x = 0$ oe	**M1**	**FT** *their* (a), provided of the form $me^{-2x} + nxe^{-2x}$ or $me^{2x} + nxe^{2x}$
	$\left(\frac{1}{2}, \frac{5}{e}\right)$ oe only	**A2**	For both values: $x = 0.5$ **and** $y = 5e^{-1}$ or 1.84 or 1.839[39...] rot to 4 or more sf **A1** for $x = \frac{1}{2}$ only
9(c)	$-2xe^{-2x} - e^{-2x} + c$	**B3**	For fully correct answer or **B2** for $-2xe^{-2x} - e^{-2x}$ or $\left[\int 4xe^{-2x}dx\right] = -2xe^{-2x} + \int 2e^{-2x}dx$ or **B1** for $kxe^{-2x} = \int\left(ke^{-2x} - 2kxe^{-2x}\right)dx$ or better
9(d)	$-2e^{-2} - e^{-2} - \left(0 - e^{0}\right)$ oe	**M1**	Correct substitution of limits into correct expression
	$1 - \frac{3}{e^2}$ or $1 - 3e^{-2}$	**A1**	
10(a)	$a + (3-1)d = 10$ soi	**B1**	
	$\frac{8}{2}\{2a + (8-1)d\} = 116$ soi	**B1**	
	Correct method to eliminate one unknown and attempt to solve to find a or d	**M1**	**dep** on at least **B1** awarded
	$a = 4$ and $d = 3$	**A2**	**A1** for either
10(b)	$S_{30} = \frac{30}{2}\{2(4) + 29(3)\}$ and $S_{11} = \frac{11}{2}\{2(4) + 10(3)\}$	**B2**	**M1 FT** *their a* and *their d* for $S_{30} = \frac{30}{2}\{2(their\,4) + 29(their\,3)\}$ or $S_{11} = \frac{11}{2}\{2(their\,4) + 10(their\,3)\}$
	Correct plan $S_{30} - S_{11}$ attempted	**M1**	**FT** *their a* and *their d*
	1216	**A1**	