Question	Answer	Marks	Guidance
7(a)	$2x^2 - x(3x-2) + (3x-2)^2 = 2$ or $2\left(\frac{y+2}{3}\right)^2 - y\left(\frac{y+2}{3}\right) + y^2 = 2$	**M1**	For a quadratic equation in one variable
	$4x^2 - 5x + 1 = 0$ oe or $4y^2 + y - 5 = 0$ oe	**A1**	Allow multiples but must be a 3 term equation = 0
	$x = \frac{1}{4}$ $x = 1$ $y = -\frac{5}{4}$ $y = 1$	**2**	**A1** for each correct pair
	Midpoint: $\left(\frac{5}{8}, -\frac{1}{8}\right)$	**M1**	Allow for use of *their* coordinates
	Gradient of $AB = 3$	**M1**	**M1** for gradient of $AB = 3$ Allow for use of *their* coordinates
	Perpendicular gradient: $-\frac{1}{3}$	**M1**	**Dep** on previous **M** mark
	Perpendicular equation: $y + \frac{1}{8} = -\frac{1}{3}\left(x - \frac{5}{8}\right)$	**M1**	Allow for *their* perp gradient and *their* midpoint
	When $y = \frac{7}{8}$, $k = -\frac{19}{8}$ or -2.375 oe	**A1**	
7(b)	$\left(\frac{29}{8}, -\frac{9}{8}\right)$ or $(3.625, -1.125)$ oe	**2**	**B1** for each coordinate
8(a)	$\frac{\frac{1}{3}(6x)(3x^2-5)^{-\frac{2}{3}}(x+4) - (3x^2-5)^{\frac{1}{3}}}{(x+4)^2}$ or $\frac{1}{3}(6x)(3x^2-5)^{-\frac{2}{3}}(x+4)^{-1} + (3x^2-5)^{\frac{1}{3}}\left(-(x+4)^{-2}\right)$	**3**	**B1** for $\frac{1}{3}(6x)(3x^2-5)^{-\frac{2}{3}}$ soi **M1** for attempt at differentiation of a quotient or valid product **A1** for all other terms correct
	$\left(2x(x+4) - (3x^2-5)\right)$	**M1**	**M1 dep** on previous **M** mark for simplification of *their* numerator Allow one sign slip but must be dealing with two quadratic terms.
	$\frac{-x^2+8x+5}{(3x^2-5)^{\frac{2}{3}}(x+4)^2}$	**A1**	

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Question	Answer	Marks	Guidance
8(b)	$-x^2+8x+5=0$ oe, together with attempt to solve	**M1**	Allow for use of *their* quadratic numerator from part (a)
	$4\pm\sqrt{21}$	**2**	**A2** for both **A1** for $\frac{8+\sqrt{84}}{2}$ or $\frac{8-\sqrt{84}}{2}$ oe
9(a)	Velocity vector = $\begin{pmatrix}-10\\10.5\end{pmatrix}$ or $\frac{1}{2}\begin{pmatrix}-20\\21\end{pmatrix}$	**B2**	**B1** for $\left\lvert\begin{pmatrix}-20\\21\end{pmatrix}\right\rvert=29$ soi or one correct element
9(b)	$\begin{pmatrix}3\\5\end{pmatrix}+\begin{pmatrix}-10\\10.5\end{pmatrix}t$ oe	**2**	**M1 FT** on *their* velocity vector from part (a) if not correct.
9(c)	$\overrightarrow{PQ}=\begin{pmatrix}5t-4\\-3t-2\end{pmatrix}$ oe	**2**	**Dep M1** must have **M1** in part (b) for $\left(\begin{pmatrix}-1\\3\end{pmatrix}+\begin{pmatrix}-5\\7.5\end{pmatrix}t\right)$ – *their* answer to part (b) or *their* answer to part b $-\left(\begin{pmatrix}-1\\3\end{pmatrix}+\begin{pmatrix}-5\\7.5\end{pmatrix}t\right)$
	$PQ=\sqrt{(5t-4)^2+(-3t-2)^2}$	**M1**	**Dep** on previous **M** mark for using *their* $\overrightarrow{PQ}$
	$PQ=\sqrt{34t^2-28t+20}$	**A1**	
9(d)	For collision $34t^2-28t+20=0$ soi	**M1**	Need to be using *their* quadratic PQ^2 from part (c) or forming a quadratic from their $\overrightarrow{PQ}$ from part (c)
	Discriminant = -1936 So no real roots so no collision oe	**A1**	Discriminant must be correct, but allow unsimplified
10(a)(i)	$d=2\sin 2x$ soi	**B1**	
	$S_n=\frac{n}{2}\left(6\sin 2x+2(n-1)\sin 2x\right)$ or $S_n=\frac{n}{2}\left(3\sin 2x+(2n+1)\sin 2x\right)$	**M1**	For correct use of the sum formula with *their d*
	$n(n+2)\sin 2x$	**A1**	

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