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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Question	Answer	Marks	Guidance
10(a)(ii)	$-220\sqrt{3}$ isw	**2**	Allow 'starting again' **M1** for use of *their* answer to (a), but must be a correct method, $\sin\left(\frac{4\pi}{3}\right)$ needs to be evaluated to give an exact answer.
10(b)(i)	$2^{n-1}\ln 2y$ or $(\ln 2y)2^{n-1}$ or $\ln(2y)^{2^{n-1}}$	**B2**	**B1** for $r=2$
10(b)(ii)	$\ln 2y\dfrac{(1-\textit{their } r^n)}{(1-\textit{their } r)}$	**M1**	For correct use of sum formula with *their* non-logarithmic *r*
	$(2^n-1)\ln 2y$ or $-1(1-2^n)\ln 2y$ or $\ln(2y)^{2^n-1}$ or $-\ln 2y+2^n\ln 2y$ oe isw when appropriate	**A1**	**A0** if denominator is still present.
10(c)	$-\frac{3}{8}<w<\frac{5}{8}$ $-0.375<w<0.625$ $w<\frac{5}{8}$ **and** $w>-\frac{3}{8}$	**3**	**B2** for $\left\|2w-\frac{1}{4}\right\|<1$ or $-1<2w-\frac{1}{4}<1$ or $\frac{5}{8}$ **and** $-\frac{3}{8}$ seen **B1** for $r=2w-\frac{1}{4}$. May be seen in the sum to infinity formula
11(a)	$x+2x\ln x$	**2**	**M1** for attempt at product rule Allow unsimplified for **A1**
11(b)	$mx^2\ln x$	**M1**	**Mark final answer** **Dep** on **M1** in part (a)
	$\int x\ln x\ \mathrm{d}x=\frac{1}{2}x^2\ln x-\frac{x^2}{4}+c$ oe	**2**	**A1** for $\frac{1}{2}x^2\ln x$ oe **A1** for $-\frac{x^2}{4}+c$ oe

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