Question Number	Scheme	Marks
1(a)	Differentiate the second expression, $v(t\ldots4)$ wrt t	M1
	Correct derivative $(a=)\frac{1}{4}t+\frac{8}{t^2}$	A1
	$t=8$, $(a=)\ \frac{17}{8}=2\frac{1}{8}$ oe	A1
		(3)
1(b)	Equate velocity expressions, substitute $t=4$ and solve for k $\frac{1}{8}(4)^2=\frac{1}{8}(4)^2-\frac{8}{(4)}+k \quad\Rightarrow\quad k=\ldots$	M1
	$k=2$	A1
	Integrate $v(0\text{,,}\ t<4)$ wrt t $\int\frac{1}{8}t^2\mathrm{d}t=\frac{1}{24}t^3\ \ (+C)$	M1
	Integrate $v(t\ldots4)$ wrt t $\int\frac{1}{8}t^2-\frac{8}{t}+"2"\mathrm{d}t=\frac{1}{24}t^3-8\ln t+"2"t\ \ (+C)$	M1
	Either • a correct **definite** integral • **and** the correct limits, 4 and 8. $\left[\frac{1}{24}t^3-8\ln t+"2"t\right]_4^8$ **Or** • a correct **indefinite** integral $\frac{1}{24}t^3-8\ln t+"2"t+C$ • **and** use $t=4$ to equate distances to find an expression for the constant of integration $\frac{4^3}{24}=\frac{4}{24}^3-8\ln4+4("2")+C$	A1 ft
	$(x=)\ \frac{88}{3}-8\ln2$	A1
		(6)
		(9)
	Notes for question 1	
Note: There is a calculator warning so candidates must show their differentiation and integration.		
(a)		
M1	Differentiate the second expression wrt t, with both powers decreasing by 1. M0 if numerical answer appears without sight of the derivative.	
A1	Correct derivative, accept $\frac{2t}{8}+8t^{-2}$, $\frac{1}{4}t+\frac{8}{t^2}$ o.e.	
A1	Correct answer, accept 2.125, 2.13, 2.1	
(b)		

Question Number	Scheme	Marks
M1	Equate the given expressions for v, substitute $t = 4$ and solve for k. If k is found in part (a) it must be used in (b) to earn the marks.	
A1	Correct answer for k	
M1	Attempt to integrate $v\left(0\text{,, } t<4\right)$ wrt t, with power of t increasing by 1. M0 if numerical answer appears without sight of the integral. $\left(\text{no need to evaluate to } \frac{8}{3} \text{ at this stage}\right)$	
M1	Attempt to integrate $v\left(t\ldots 4\right)$ wrt t, with a power of t increasing by 1 and a ln$t$. Condone working with k or their numerical k. M0 if numerical answer appears without sight of the integral.	
A1ft	Integrate $v\left(t\ldots 4\right)$ wrt t. Condone working in terms of k or ft on their numerical k. $\left(\frac{80}{3}-8\ln 2 \text{ oe may be seen but is not necessary for this mark}\right)$ $\left(C=8\ln 4-8 \text{ oe may be seen but is not necessary for this mark}\right)$	
A1	Correct answer, $\frac{88}{3}-8\ln 2$, $\frac{88}{3}+8\ln\frac{1}{2}$, $\frac{88}{3}+8\ln 0.5$ Accept equivalent exact form but must have fractions combined and ln terms combined	