Question Number	Scheme	Marks
5a)	$0.5v\dfrac{\mathrm{d}v}{\mathrm{d}x} = -\sin 2x$	M1
	$\int 0.5v\,\mathrm{d}v = \int -\sin 2x\,\mathrm{d}x$	DM1
	$0.25v^2 = \dfrac{1}{2}\cos 2x\,(+c)$	A1
	$v^2 = 2\cos 2x + c$	
	$x = 0, v = 2 \Rightarrow 4 = 2 + c$	DM1
	$v^2 = 2\cos 2x + 2\left(= 4\cos^2 x\right)$	A1
	$v = 2\cos x$ *	A1*
		(6)
ALT	*Using definite integration*	
	$0.5v\dfrac{\mathrm{d}v}{\mathrm{d}x} = -\sin 2x$	M1
	$\int_2^v 0.5v\,\mathrm{d}v = \int_0^x -\sin 2x\,\mathrm{d}x \quad \left(\text{or } \int_0^x \sin 2x\,\mathrm{d}x\right)$	DM1
	$\left[0.25v^2\right]_2^v = \left[\dfrac{1}{2}\cos 2x\right]_0^x \quad \left(\text{or } \left[-\dfrac{1}{2}\cos 2x\right]_x^0\right)$	A1
	$0.25\left(v^2 - 4\right) = \dfrac{1}{2}\cos 2x - \dfrac{1}{2}$	DM1A1
	$v = 2\cos x$ *	A*
		(6)

Question Number	Scheme	Marks
5b)	$\frac{\mathrm{d}x}{\mathrm{d}t} = 2\cos x$	M1
	$\int \sec x \mathrm{d}x = \int 2\mathrm{d}t$	
	$\ln\lvert\sec x + \tan x\rvert = 2t + k$	DM1
	$t = 0, x = 0 \ \ln 1 = 2(0) + k \Rightarrow k = 0$	A1
	$t = \frac{1}{2}\ln\lvert\sec x + \tan x\rvert = \frac{1}{2}\ln\left(\sec\frac{\pi}{4} + \tan\frac{\pi}{4}\right)$	DM1
	$t = \frac{1}{2}\ln\left(\sqrt{2}+1\right)$ *	A1*
		(5)
ALT	*Using definite integration*	
	$\frac{\mathrm{d}x}{\mathrm{d}t} = 2\cos x$	M1
	$\int_0^{\frac{\pi}{4}} \sec x \mathrm{d}x = \int_0^t 2\mathrm{d}t$	
	$\left[\ln\lvert\sec x + \tan x\rvert\right]_0^{\frac{\pi}{4}} = \left[2t\right]_0^t$	DM1A1
	$2t = \ln\left(\sec\frac{\pi}{4} + \tan\frac{\pi}{4}\right)$	DM1
	. $t = \frac{1}{2}\ln\left(\sqrt{2}+1\right)$ .. *	A1*
		(5)
		[11]

(a)	*Indefinite integration*	
M1	Equation of motion, with acceleration in the form $v\frac{\mathrm{d}v}{\mathrm{d}x}$. Condone sign error.	
DM1	Separate variables to prepare for integration. Depends on the M mark above.	
A1	Correct integration. Constant not needed.	
DM1	Substitute $x = 0,\ v = 2$ to find the constant. Depends on both M marks above.	
A1	A correct result for v^2	
A1*	**Given** result reached through use of double angle formula. (Formula need not be shown.).	
ALT	*Definite integration*	
M1	Equation of motion, with acceleration in the form $v\frac{\mathrm{d}v}{\mathrm{d}x}$. Condone sign error.	
DM1	Separate variables, to prepare for integration. Limits not needed for this mark. Depends on the M mark above.	
A1	Correct integration – limits not needed	
DM1	Correct substitution of correct limits in their integrated function. Limits must be "paired" correctly. Depends on both previous M marks in (a) (Formula need not be shown.).	
A1	Correct expression which can yield v^2	
A1*	**Given** result reached through use of double angle formula. (Formula need not be shown.).	
(b)		
M1	Use of $v = \frac{\mathrm{d}x}{\mathrm{d}t}$	
DM1	Correct separation of variables and attempt integration (integral is in the formula book). Depends on first M of (b) Modulus signs may be missing.	
A1	Correct integration and use limits to find correct value for constant.	
DM1	Substitute $x = \frac{\pi}{4}$ and solve for t. Depends on both previous M marks in (b)	
A1*	Given result reached from fully correct working. (Modulus signs may be missing throughout.).	

ALT	*Definite integration*	
M1	Use of $v = \frac{\mathrm{d}x}{\mathrm{d}t}$	
DM1	Correct separation of variables and attempt integration. Limits not needed. Depends on first M of (b). Modulus signs may be missing.	
A1	Correct integration including correct limits.	
DM1	Substitute their limits and solve for t. Depends on both previous M marks in (b)	
A1*	Given result reached from fully correct working. (Modulus signs may be missing throughout.).	