Question		Answer	Marks	AO	Guidance	
5	(a)	$\frac{dx}{dt} = 0.2 + \sin t$	B1*	1.1	**B1** for $\frac{dx}{dt} = 0.2 \pm \sin t$	
		$\int_0^{\pi} k\sin^2 t(0.2+\sin t)\,dt \Rightarrow$ $\int_0^{\pi} k(1-\cos^2 t)(0.2+\sin t)\,dt$	M1dep*	3.1a	Uses $\int y\frac{dx}{dt}dt$ **and** replaces $\sin^2 t$ with $1-\cos^2 t$ to obtain an expression involving $\cos^2 t$ and $\sin t$	**No limits required for this mark**
		$k\int_0^{\pi}(0.2+\sin t-0.2\cos^2 t-\sin t\cos^2 t)dt(=1)$	A1	2.2a	**AG** (so must be checked carefully for any errors e.g. must contain relevant brackets around the $1-\cos^2 t$ term(s)) A correct expression e.g. $\int_0^{\pi} k(1-\cos^2 t)(0.2+\sin t)\,dt$ followed by the correct given answer can score this mark – **limits and d*t* must be seen at least once (but need not be on the final integral)**	Do not need to see = 1 anywhere in their solution (and condone lack of brackets around the integrand)
			[3]			

Question		Answer	Marks	AO	Guidance	
5	(b)	$\int (0.2+\sin t-0.2(\frac{1}{2})(1+\cos 2t)-\sin t\cos^2 t)\,\mathrm{d}t$	B1	1.2	Correctly **applies** $2\cos^2 t \equiv 1+\cos 2t$ (so **not** just stating this identity) - implied by seeing $-0.1t-0.05\sin 2t$ after integration	e.g. **applies** could be for an attempt to integrate $\frac{1}{2}(1+\cos 2t)$ **or** stating this identity in an integral
		$=0.2t-\cos t$	B1	1.1	**First two terms** integrated correctly (Look out for those that have $0.1t$ only from combining $0.2t$ with $-0.1t$)	**This mark should be awarded if 0.2 is combined with another constant term and integrated correctly**
			M1*	1.1	**M1** for an answer of the form $\pm pt \pm q\sin 2t \pm r\cos^3 t$ **or** an answer of the form $\pm pt \pm q\sin 2t \pm r\sin t\sin 2t \pm u\cos t\cos 2t$ **or** an answer of the form $\pm pt \pm q\cos t \pm r\sin 2t \pm u\sin t\sin 2t \pm v\cos t\cos 2t$ for non-zero p, q, r (and u, v) from integrating $-0.2\cos^2 t-\sin t\cos^2 t$	
		$-0.1t-0.05\sin 2t+\frac{1}{3}\cos^3 t$	A1	1.1	**A1** for the correct remaining three/four terms (Alternatives: $-0.1t-0.05\sin 2t+\frac{1}{6}\sin t\sin 2t+\frac{1}{3}\cos t\cos 2t$ **or** $-0.1t+0.5\cos t-0.05\sin 2t-\frac{1}{3}\sin t\sin 2t-\frac{1}{6}\cos t\cos 2t$)	
		$\left[0.1t-\cos t-0.05\sin 2t+\frac{1}{3}\cos^3 t\right]_0^{\pi}$ $=(0.1\pi-(-1)-0+\frac{1}{3}(-1)^3)-(0-1-0+\frac{1}{3})$	M1dep*	1.1	Uses correct limits correctly $F(\pi)-F(0)$ - condone limits the wrong way round only if the sign of their answer is subsequently changed	Must be using exact values (so must include term(s) in π)
		$k(0.1\pi+2-\frac{2}{3})=1\Rightarrow k=\frac{30}{3\pi+40}$	A1	1.1	**www** oe e.g. $k=\frac{1}{0.1\pi+\frac{4}{3}}$ - isw once a correct expression for k seen	Correct exact value must be seen at some stage for the final mark – **check first A mark carefully**
			[6]			