3a	Use of $\mathbf{a}=\dfrac{\mathrm{d}\mathbf{v}}{\mathrm{d}t}$ $\left(\mathbf{a}=18\cos 3t\,\mathbf{i}-2\sin t\,\mathbf{j}\right)$	M1	Differentiate to obtain $\mathbf{a}=\lambda\cos 3t\,\mathbf{i}+\mu\sin t\,\mathbf{j}$
	Use of $\mathbf{F}=m\mathbf{a}$: $\mathbf{F}=\dfrac{1}{4}\mathbf{a}$	M1	Must be working in vectors
	$\mathbf{F}=\dfrac{9}{2}\cos 3t\,\mathbf{i}-\dfrac{1}{2}\sin t\,\mathbf{j}$	A1	Or equivalent. e.g. as a column vector
		[3]	
3b	$2\cos t+1=0$	M1	Set **j** component of **v** = 0 and solve for t
	$\Rightarrow t=\dfrac{2\pi}{3}$	A1	ISW if correct answer seen. Only answer $120°$ scores A0 here and the final A0
	Use of $\mathbf{v}=\dfrac{\mathrm{d}\mathbf{r}}{\mathrm{d}t}$ $\left(\mathbf{r}=-2\cos 3t\,\mathbf{i}+\left(t+2\sin t\right)\mathbf{j}\left(+\mathbf{C}\right)\right)$	M1	Integrate **v** with respect to t to obtain $\mathbf{r}=p\cos 3t\,\mathbf{i}+\left(t+q\sin t\right)\mathbf{j}\left(+\mathbf{C}\right)$ Condone if there is no constant of integration.
	$t=0,\quad \mathbf{r}=\left(4\mathbf{i}-\sqrt{3}\mathbf{j}\right)\mathrm{m}$ $\mathbf{r}=\left(-2\cos 3t+6\right)\mathbf{i}+\left(t+2\sin t-\sqrt{3}\right)\mathbf{j}$	M1	Correct use of boundary condition to find their **C.** Could be part of a definite integral e.g. $4\mathbf{i}-\sqrt{3}\mathbf{j}+\int_0^t 6\sin 3t\mathbf{i}+\left(1+2\cos t\right)\mathbf{j}\mathrm{d}t$ for their upper limit
	$=4\mathbf{i}+\dfrac{2\pi}{3}\mathbf{j}\quad(\mathrm{m})$	A1 A1	Accept $4\mathbf{i}+2.1\mathbf{j}$ or better one component correct both components correct ISW if they also offer $4\mathbf{i}+120\mathbf{j}$ "correct" components after an M0 are fortuitous – A0
		[6]	
		(9)	