Question Number		Mark	Note
	Accept column vectors throughout apart from in the answer to part (b).		
3a	Use of $\mathbf{a}=\frac{\mathrm{d}\mathbf{v}}{\mathrm{d}t}$ $\left(\mathbf{a}=2\mathbf{i}+(2t-5)\mathbf{j}\right)$	M1	At least two powers of *t* going down by 1.
	$t=4\Rightarrow\mathbf{a}=2\mathbf{i}+3\mathbf{j}\left(\mathrm{m\,s^{-2}}\right)$	A1	Isw if they find the magnitude.
		[2]	
3b	Use $\mathbf{r}=\int\mathbf{v}\,\mathrm{d}t$	M1	At least two powers of *t* going up by 1
	$\mathbf{r}=\left(t^2+3t+A\right)\mathbf{i}+\left(\frac{1}{3}t^3-\frac{5}{2}t^2-15t+B\right)\mathbf{j}$	A1	Allow without constant of integration
	Use of $t=1$, $\mathbf{r}=6\mathbf{i}-2\mathbf{j}$ to **find** the (vector) constant of integration	M1	$\left(1+3+A=6,\quad\frac{1}{3}-\frac{5}{2}-15+B=-2\right)$ Must find *A* and *B*.
	$\left(t^2+3t+2\right)\mathbf{i}+\left(\frac{1}{3}t^3-\frac{5}{2}t^2-15t+\frac{91}{6}\right)\mathbf{j}$	A1	Cao (exact)
		[4]	
3c	Use the velocity and the direction to form an equation in *T*.	M1	Condone if 5 and -3 on the wrong sides of the equation.
	$-3\times(2T+3)=5\times\left(T^2-5T-15\right)$ oe	A1	Correct unsimplified equation in *T* or *t*
	$5T^2-19T-66=0\quad\left((5T+11)(T-6)=0\right)$ $\Rightarrow\quad T=6$	**D**M1	Simplify and solve for *T*, dependent on M1.
	Use of Pythagoras with their *T*: $\left(v=\sqrt{(2\times6+3)^2+\left(6^2-5\times6-15\right)^2}\right)$	M1	Independent but not available if they have more than one positive *T* value.
	$v=\sqrt{306}\left(=3\sqrt{34}\right)\left(\mathrm{m\,s^{-1}}\right)$	A1	Must be exact, accept either. Isw if they go on to give a decimal.
		[5]	
		(11)	