Question			Answer	Marks	AOs	Guidance	
13	(a)		$\mathbf{r} = \int (\mathbf{v})\, dt = \int \left(3t^2\mathbf{i} + 7\mathbf{j}\right) dt$ $= t^3\mathbf{i} + 7t\mathbf{j} + \mathbf{c}$	M1*	3.4	Attempt to integrate both components; condone missing +**c**	
			When $t = 0, \mathbf{r} = -\mathbf{i} + 2\mathbf{j} = \mathbf{c}$	M1 dep*	1.1b	Using initial conditions	
			So $\mathbf{r} = \left(t^3 - 1\right)\mathbf{i} + \left(7t + 2\right)\mathbf{j}$ When $t = 2$,	M1 dep*	3.1b	Using $t = 2$ to find position vector or values for x and y	
			$\mathbf{r} = \left(2^3 - 1\right)\mathbf{i} + \left(7 \times 2 + 2\right)\mathbf{j} = 7\mathbf{i} + 16\mathbf{j}$	A1	1.1b	Accept vector form or two clear components.	
			distance = $\sqrt{7^2 + 16^2} = \sqrt{305}$	M1	3.1b	Using Pythagoras	
			distance = 17.5 m	A1 [6]	3.2a	FT their components	
13	(b)		using $x = t^3 - 1, y = 7t + 2$	M1	3.1a	Extracting equations for x and y from their displacement vector	
			Substitute $t = \dfrac{y-2}{7}$ into equation for x	M1 dep	1.1b	Attempt to eliminate t	Equivalent form $y = 7\left(x+1\right)^{\frac{1}{3}} + 2$ for M1M1A0
			$x = \left(\dfrac{y-2}{7}\right)^3 - 1$ **AG**	A1 [3]	1.1b	cao	
13	(c)		$\mathbf{a} = \dfrac{d\mathbf{v}}{dt} = 6t\mathbf{i}$	M1*	3.1b	Must be vector acceleration	
			When $t = 2, \mathbf{a} = 12\mathbf{i}$	M1*	3.4	Evaluating when $t = 2$	a =12 is sufficient here
			The force must be in that direction, so $\mathbf{F} = 48\mathbf{i} = m\mathbf{a}$	M1*	3.1b	Newton's second law in vector form, or in x-direction only	If their **a** has two non-zero components, allow for dividing 48 by the magnitude of their **a**
			So $m = 4$ kg	A1 dep* [4]	1.1b	cao	