Question	Scheme	Marks	AOs
1(a)	Use of $\mathbf{v} = \mathbf{u} + \mathbf{a}t$ with $t = 2$: $\mathbf{v} = 4\mathbf{i} + 2(2\mathbf{i} - 3\mathbf{j})$ **OR integration**: $\mathbf{v} = (2\mathbf{i} - 3\mathbf{j})t + 4\mathbf{i}$, with $t = 2$	M1	3.1a
	$\mathbf{v} = 8\mathbf{i} - 6\mathbf{j}$	A1	1.1b
		(2)	
1(b)	Use of $\mathbf{r} = \mathbf{u}t + \frac{1}{2}\mathbf{a}t^2$ at $t = 3$: $(\mathbf{i} + \mathbf{j}) + \left[3 \times 4\mathbf{i} + \frac{1}{2} \times (2\mathbf{i} - 3\mathbf{j}) \times 3^2\right]$ **OR**: find $\mathbf{v}$ at $t = 3$: $4\mathbf{i} + 3(2\mathbf{i} - 3\mathbf{j}) = (10\mathbf{i} - 9\mathbf{j})$ then use $\mathbf{r} = \frac{1}{2}(\mathbf{u} + \mathbf{v})t$ $(\mathbf{i} + \mathbf{j}) + \left[\frac{1}{2}[4\mathbf{i} + (10\mathbf{i} - 9\mathbf{j})] \times 3\right]$ or $\mathbf{r} = \mathbf{v}t - \frac{1}{2}\mathbf{a}t^2$ $(\mathbf{i} + \mathbf{j}) + \left[3 \times (10\mathbf{i} - 9\mathbf{j}) - \frac{1}{2} \times (2\mathbf{i} - 3\mathbf{j}) \times 3^2\right]$ **OR integration:** $\mathbf{r} = (\mathbf{i} + \mathbf{j}) + \left[(2\mathbf{i} - 3\mathbf{j})\frac{1}{2}t^2 + 4t\mathbf{i}\right]$, with $t = 3$	M1	3.1a
	$\mathbf{r} = 22\mathbf{i} - 12.5\mathbf{j}$	A1	2.2a
		(2)	
			(4 marks)

Notes:		**Accept column vectors throughout**
1a	M1	Complete method to find **v**, using **ruva***t* or integration (M0 if **i** and/or **j** is missing)
	A1	Apply isw if they also find the speed
1b	M1	Complete method to find the p.v. but this mark can be scored if they omit **(i + j)** i.e. the M1 is for the expression in the square bracket If they integrate, the M1 is earned once the expression in the square bracket is seen with $t = 3$ (M0 if **i** and/or **j** is missing)
	A1	cao

Question	Scheme	Marks	AOs
8(a)	Use of $\mathbf{r} = \mathbf{u}t + \frac{1}{2}\mathbf{a}t^2$: $(7\mathbf{i} - 10\mathbf{j}) = 2(2\mathbf{i} - 3\mathbf{j}) + \frac{1}{2}\mathbf{a}2^2$	M1	3.1b
	$\mathbf{a} = (1.5\mathbf{i} - 2\mathbf{j})$	A1	1.1b
	$\lvert\mathbf{a}\rvert = \sqrt{1.5^2 + (-2)^2}$	M1	1.1b
	= 2.5 m s^{-2} * GIVEN ANSWER	A1*	2.1
		(4)	
(b)	Use of $\mathbf{v} = \mathbf{u} + \mathbf{a}t = (2\mathbf{i} - 3\mathbf{j}) + 2(1.5\mathbf{i} - 2\mathbf{j})$	M1	3.1b
	$= (5\mathbf{i} - 7\mathbf{j})$	A1	1.1b
	$\mathbf{v} = (5\mathbf{i} - 7\mathbf{j}) + t(4\mathbf{i} + 8.8\mathbf{j}) = (5 + 4t)\mathbf{i} + (8.8t - 7)\mathbf{j}$ and $(5 + 4t) = (8.8t - 7)$	M1	3.1b
	t = 2.5 (s)	A1	1.1b
		(4)	
			(8 marks)

Notes: Allow column vectors throughout

(a)

No credit for individual component calculations

M1: Using a complete method to obtain the acceleration. **N.B.** Equation, in **a** only, could be obtained by two integrations

ALTERNATIVE

M1: Use velocity at half-time (t = 1) = Average velocity over time period

So at $t = 1$, $\mathbf{v} = \frac{1}{2}(7\mathbf{i} - 10\mathbf{j})$ so $\mathbf{a} = \frac{1}{2}(7\mathbf{i} - 10\mathbf{j}) - (2\mathbf{i} - 3\mathbf{j})$

N.B. could see $(7\mathbf{i} - 10\mathbf{j}) = (4\mathbf{i} - 6\mathbf{j}) + 2\mathbf{a}$ as first line of working

A1: Correct **a** vector

M1: Attempt to find magnitude of their **a** using form $\sqrt{a^2 + b^2}$

A1*: Correct GIVEN ANSWER obtained correctly

(b)

M1: Using a complete method to obtain the velocity at A e.g.by use of $\mathbf{v} = \mathbf{u} + \mathbf{a}t$ with t = 2 and **u** = 2**i** – 3**j** and their **a**

OR: by use of $\mathbf{s} = \mathbf{v}t - \frac{1}{2}\mathbf{a}t^2$

OR: by integrating their **a,** with addition of **C** = 2**i** – 3**j,** and putting t = 2

A1: correct vector

M1: Complete method to find equation in t only

Question	Scheme	Marks	AO
2(a)	$(\mathbf{v}=)\mathbf{C}+(2\mathbf{i}-3\mathbf{j})t$	M1	3.1a
	$(\mathbf{v}=)(-\mathbf{i}+4\mathbf{j})+(2\mathbf{i}-3\mathbf{j})t$	A1	1.1b
	$\frac{4-3T}{-1+2T}=\frac{-4}{3}$ oe	M1	3.1a
	$T=8$	A1	1.1b
		(4)	
(b)	$(\mathbf{s}=)\mathbf{C}t+(2\mathbf{i}-3\mathbf{j})\frac{1}{2}t^2$ $(+\mathbf{D})$	M1	3.1a
	$(\mathbf{s}=)(-\mathbf{i}+4\mathbf{j})t+\frac{1}{2}(2\mathbf{i}-3\mathbf{j})t^2$ $(+\mathbf{D})$	A1	1.1b
	$AB=\sqrt{12^2+8^2}$ **N.B. Beware you may see 4(2i – 3j) which leads to** $\sqrt{(8^2+12^2)}$ this is M0A0M0A0.	M1	3.1a
	$=4\sqrt{13}\,(=14.422051....)$ (m)	A1**cso**	1.1b
		(4)	
		(8)	

Marks		Notes
2a	M1	Use of $\mathbf{v}=\mathbf{u}+\mathbf{a}t$ **OR** integration to give an expression of the form $\mathbf{C}+(2\mathbf{i}-3\mathbf{j})t$ **, where C is a non-zero constant <u>vector</u>** M0 if **u** and **a** are reversed Condone use of **a** = (2**i** + 3**j**) for this M mark
	A1	Any correct unsimplified expression seen or implied
	M1	Correct use of ratios, <u>using a velocity vector</u> (must be using $\frac{-4}{3}$) to give equation <u>in *T* only</u> M0 if they equate $4-3T=-4$ and/or $-1+2T=3$ and therefore M0 if they then divide to produce their equation
	A1	Correct only
		N.B. (i) Can score the second M1A1 if they get $T=8$, using a calculator to solve two simultaneous equations, but if answer is wrong, and no equation in *T* only, second M0 (ii) Can score M1A1 M1A1 if they get $T=8$, using trial and error, but if they don't get $T=8$, can only score max M1A1M0A0

Question	Scheme	Marks	AOs
2(a)	Use of $\mathbf{v} = \mathbf{u} + \mathbf{a}t$ or integrate to give: $\mathbf{v} = (-2\mathbf{i} + 2\mathbf{j}) + 2(4\mathbf{i} - 5\mathbf{j})$	M1	3.1a
	$(6\mathbf{i} - 8\mathbf{j})\ (\text{m s}^{-1})$	A1	1.1b
		(2)	
2(b)	Solve problem through use of $\mathbf{r} = \mathbf{u}t + \frac{1}{2}\mathbf{a}t^2$ or integration (M0 if $\mathbf{u} = \mathbf{0}$) **Or** any other complete method e.g use $\mathbf{v} = \mathbf{u} + \mathbf{a}T$ and $\mathbf{r} = \frac{(\mathbf{u} + \mathbf{v})T}{2}$:	M1	3.1a
	$-4.5\mathbf{j} = 2t\mathbf{j} - \frac{1}{2}t^2 5\mathbf{j}$ (**j** terms only)	A1	1.1b
	The first two marks could be implied if they go straight to an algebraic equation.		
	Attempt to equate **j** components to give equation in T only $(-4.5 = 2T - \frac{5}{2}T^2)$	M1	2.1
	$T = 1.8$	A1	1.1b
		(4)	
2(c)	Solve problem by substituting <u>their</u> T value (M0 if $T < 0$) into the **i** component equation to give an equation in λ only: $\lambda = -2T + \frac{1}{2}T^2 \times 4$	M1	3.1a
	$\lambda = 2.9$ or 2.88 or $\frac{72}{25}$ oe	A1	1.1b
		(2)	

Notes: Accept column vectors throughout		**(8 marks)**
2a	M1	For any complete method to give a **v** expression with correct no. of terms with $t = 2$ used, so if integrating, must see the initial velocity as the constant. Allow sign errors.
	A1	Cao isw if they go on to find the speed.
2b	M1	For any complete method to give a vector expression for **j** component of displacement in t (or T) only, using $\mathbf{a} = (4\mathbf{i} - 5\mathbf{j})$, so if integrating, RHS of equation must have the correct structure. Allow sign errors.
	A1	Correct **j** vector equation in t or T. Ignore **i** terms.
	M1	Must have earned 1st M mark.

Question	Scheme	Marks	AOs
8(a)	Use of $\mathbf{v} = \mathbf{u} + \mathbf{a}t$: $(10.5\mathbf{i} - 0.9\mathbf{j}) = 0.6\mathbf{j} + 15\mathbf{a}$	M1	3.1b
	$\mathbf{a} = (0.7\mathbf{i} - 0.1\mathbf{j})$ m s^{-2} Given answer	A1	1.1b
		(2)	
(b)	Use of $\mathbf{r} = \mathbf{u}t + \frac{1}{2}\mathbf{a}t^2$	M1	3.1b
	$\mathbf{r} = 0.6\mathbf{j}\,t + \frac{1}{2}(0.7\mathbf{i} - 0.1\mathbf{j})\,t^2$	A1	1.1b
		(2)	
(c)	Equating the **i** and **j** components of **r**	M1	3.1b
	$\frac{1}{2} \leftarrow 0.7\,t^2 = 0.6\,t - \frac{1}{2} \leftarrow 0.1\,t^2$	A1ft	1.1b
	$t = 1.5$	A1	1.1b
		(3)	
(d)	Use of $\mathbf{v} = \mathbf{u} + \mathbf{a}t$: $\mathbf{v} = 0.6\mathbf{j} + (0.7\mathbf{i} - 0.1\mathbf{j})\,t$	M1	3.1b
	Equating the **i** and **j** components of **v**	M1	3.1b
	$t = 0.75$	A1 **ft**	1.1b
		(3)	
			(10 marks)

Notes:

(a)
M1: for use of $\mathbf{v} = \mathbf{u} + \mathbf{a}t$
A1: for given answer correctly obtained

(b)
M1: for use of $\mathbf{r} = \mathbf{u}t + \frac{1}{2}\mathbf{a}t^2$
A1: for a correct expression for **r** in terms of t

(c)
M1: for equating the **i** and **j** components of their **r**
A1ft: for a correct equation following their **r**
A1: for $t = 1.5$

(d)
M1: for use of $\mathbf{v} = \mathbf{u} + \mathbf{a}t$ for a general t
M1: for equating the **i** and **j** components of their **v**
A1ft: for $t = 0.75$, or a correct follow through answer from an incorrect equation

Question Number	Scheme	Marks
6a	Horizontal distance: $x = 7t$	B1
	Vertical distance : $y = 7\sqrt{3}\ t - \frac{1}{2}\ gt^2$	M1A1
	Sub for t : $y = 7\sqrt{3} \times \frac{x}{7} - \frac{g}{2} \times \frac{x^2}{49} = \sqrt{3}x - \frac{g}{98}x^2$ ***Given Answer***	**DM**1A1 (5)
6b	Differentiate to find gradient: $\frac{dy}{dx} = \sqrt{3} - \frac{2gx}{98}$	M1A1
	Sub $x = 20$ & use tan: $\tan^{-1}\left(\sqrt{3} - \frac{40g}{98}\right)$	**DM**1
	$= 66.2°$ or 66^o below the horizontal oe	A1 (4)
	Or :in the direction of (parallel to is A0) (7**i** – 16**j**) or (7**i** – 15.9**j**)	
6balt	$x = 20 = 7t \Rightarrow t = \frac{20}{7}$	M1
	Vertical cpt $= 7\sqrt{3} - \frac{20}{7}g$	A1
	$= \tan^{-1}\left(\frac{7\sqrt{3} - \frac{20g}{7}}{7}\right) = -66.2^0$; 66^o below the horizontal oe	**DM**1A1 (4)
6c	Use the x/y ratio to form an equation in T: $7T = 14\sqrt{3}T - gT^2$	M1A1
	Solve for T: $T = \frac{14\sqrt{3} - 7}{g}(= 1.8)$ (1.76)	**DM**1A1 (4)
6c alt	$= 2\ \sqrt{3}\ \ \frac{g}{98}(2\ )^2$	M1A1
	$T = \frac{2}{7} = 1.76$	**DM**1A1 (4)
		[13]
	Notes	
6a	B1 for $x = 7t$ seen or implied M1 for vertical motion equation $y = 7\sqrt{3}t - 1/2\ gt^2$ need correct no. of terms, but condone sign errors First A1 for a correct equation Second **DM**1, dependent on first M1, for substituting for t Second A1 for **given answer**.	

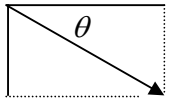
Question Number	Scheme	Marks
2(a)	$(-10\mathbf{i}+a\mathbf{j})+(b\mathbf{i}-5\mathbf{j})+(2a\mathbf{i}+7\mathbf{j}) = 3(3\mathbf{i}+4\mathbf{j})$ $a-5+7=12 \Rightarrow a=10$ $-10+b+2a=9 \Rightarrow b=-1$	M1 M1 A1 M1 A1 (5)
(b)	$20\mathbf{i}+20\mathbf{j}=\mathbf{u}+4(3\mathbf{i}+4\mathbf{j})$ $\mathbf{u}=(8\mathbf{i}+4\mathbf{j})$ $u=\sqrt{8^2+4^2}=\sqrt{80}=8.9$ (or better)	M1 A1 M1 A1 (4) **9**
	Notes	
2(a)	First M1 for applying **F** = *m***a**; need all terms but allow slips and allow *m* instead of 3 Second M1 (independent but M0 if they have **0** instead of *m***a**) for equating *coefficients* of **j** First A1 for $a = 10$ Third M1 (independent but M0 if they have **0** instead of *m***a**) for equating *coefficients* of **i** Second A1 for $b = -1$	
(b)	First M1 for applying **v** = **u** + *t***a**; need all terms and must be vector **u** First A1 for 8**i** + 4**j** Second M1 (independent) for finding magnitude of their vector **u** Second A1 for √80 or 8.9 or better	

Question Number	Scheme	Marks
4.(a)	$\mathbf{p} = (-5\mathbf{i} + 9\mathbf{j}) + t(\mathbf{i} - 2\mathbf{j})$	M1 A1 (2)
(b)	$2 = 9 - 2t$ $t = 3.5$ $\mathbf{p} = (-5\mathbf{i} + 9\mathbf{j}) + 3.5(\mathbf{i} - 2\mathbf{j}) = (-1.5\mathbf{i} + 2\mathbf{j})$	M1 A1 M1 A1 (4)
(c)	$\frac{2b-1}{5-2b} = \frac{1}{-2}$ $b = -1.5$	M1 A1 **DM1** A1 (4) **10**
	Notes	
4.(a)	M1 for clear attempt at $\mathbf{p} = (-5\mathbf{i} + 9\mathbf{j}) + t(\mathbf{i} - 2\mathbf{j})$ (allow slips but must be ' + ') A1 if correct	
(b)	First M1 for equating the **j** *component* of their **p** to 2 First A1 for $t = 3.5$ Second M1 (independent) for substituting their t value into their **p** Second A1 for (-1.5**i** + 2**j**)	
(c)	First M1 for $\frac{2b-1}{5-2b} = \pm\frac{1}{2}$ or $\frac{2b-1}{5-2b} = \pm\frac{2}{1}$ (must be in b only but allow slips) First A1 for a correct equation in b only Second M1 (dependent on first M1) for solving for b Second A1 for b = -1.5	

Question	Scheme	Marks	Notes
6. (a)	$\mathbf{v} = (10\mathbf{i} + 4\mathbf{j}) + 6(-2\mathbf{i} + 3\mathbf{j})$	M1	Use of $\mathbf{v} = \mathbf{u} + \mathbf{a}t$ with $t = 6$
	$= -2\mathbf{i} + 22\mathbf{j}$	A1	
	$\tan\theta = \pm\frac{22}{2}$ or $\tan\theta = \pm\frac{2}{22}$	M1	Correct use of trig to find a relevant angle for their **v**
	$\theta = 85^\circ$ or $5°$	A1	Seen or implied
	bearing is 355°	A1	
		(5)	
(b)	$\mathbf{v} = (10\mathbf{i} + 4\mathbf{j}) + t(-2\mathbf{i} + 3\mathbf{j})$	M1	Use of $\mathbf{v} = \mathbf{u} + \mathbf{a}t$
	$\left(= (10 - 2t)\mathbf{i} + (4 + 3t)\mathbf{j})\right)$	A1	Correct unsimplified
	$(10 - 2t) = (4 + 3t)$	DM1	Equate coefficients to give equation in t only
	$t = 1.2$	A1	
		(4)	
		[9]	

Question Number	Scheme	Marks	Notes
5.(a)	$(2\mathbf{i}-3\mathbf{j})+(p\mathbf{i}+q\mathbf{j})=(p+2)\mathbf{i}+(q-3)\mathbf{j}$	M1	Resultant force = $\mathbf{F}_1+\mathbf{F}_2$ in the form $a\mathbf{i}+b\mathbf{j}$
	$\frac{p+2}{q-3}=\frac{1}{2}$ or $\left.\begin{matrix}p+2=n\\q-3=2n\end{matrix}\right\}$ for $n\neq 1$	M1	Use parallel vector to form a scalar equation in p and q.
		A1	Correct equation (accept any equivalent form)
	$4+2p=-3+q$	DM1	Dependent on no errors seen in comparing the vectors. Rearrange to obtain given answer. At least one stage of working between the fraction and the given answer
	$2p-q+7=0$	A1	**Given Answer**
		(5)	
5.(b)	$q=11\Rightarrow p=2$	B1	
	$\mathbf{R}=4\mathbf{i}+8\mathbf{j}$	M1	$(2+p)\mathbf{i}+8\mathbf{j}$ for their p
	$4\mathbf{i}+8\mathbf{j}=2\mathbf{a}$ $(\mathbf{a}=2\mathbf{i}+4\mathbf{j})$	M1	Use of $\mathbf{F}=m\mathbf{a}$
	$\lvert\mathbf{a}\rvert=\sqrt{2^2+4^2}$	DM1	Correct method for $\lvert\mathbf{a}\rvert$ Dependent on the preceding M1
	$=\sqrt{20}=4.5$ or 4.47 or better (m s^{-2})	A1	$2\sqrt{5}$
		(5)	
	Alternative for the last two M marks:		
	$\lvert\mathbf{F}\rvert=\sqrt{16+64}\left(=\sqrt{80}\right)$ M1		Correct method for $\lvert\mathbf{F}\rvert$
	$\sqrt{80}=2\times\lvert\mathbf{a}\rvert$ DM1		Use of $\lvert\mathbf{F}\rvert=m\lvert\mathbf{a}\rvert$ Dependent on the preceding M1
		[10]	

Alt (c)	$M(A)$: $15gAY + 6g \times 2 = 1.5 \times 21g$	M1	Requires all terms present and of the correct structure. No additional terms
		A2	Correct unsimplified equation -1 each error
	$AY = 1.3$ m	A1	
		(4)	
Alt (c)	$M(C)$: $6g \times 0.5 = 15g(1.5 - AY)$	M1	
		A2	-1 each error
	$AY = 1.3$ m	A1	
		(4)	
7.	$(2\mathbf{i} + 9\mathbf{j}) - (-3\mathbf{i} - 3\mathbf{j})$	M1	Use of $\mathbf{v} - \mathbf{u}(= \mathbf{a}t)$ seen or implied
	$= (5\mathbf{i} + 12\mathbf{j})$	A1	
	$k^2(5^2 + 12^2) = 2.6^2 \quad (k = 1/t)$	M1	Use magnitude = 2.6 = $k\lvert\mathbf{a}\rvert$ (linking 2.6 & 13)
	$c = 5\text{x}0.2 = 1$	A1	
	$d = 12\text{x}0.2 = 2.4$	A1	
		(5)	

Question Number	Scheme	Marks	Notes
5 (a)	Speed = $\sqrt{3^2+(-2)^2}$ or $\sqrt{3^2+2^2} = \sqrt{13}$ m s^{-1}	M1 A1(2)	Use Pythagoras Accept 3.6 or better Ignore their diagram if it does not support their working
(b)			
	$\tan\theta = \frac{2}{3}$, $\theta = 33.7$ OR $\tan\theta = \frac{3}{2}$, $\theta = 56.3$ OR find another useful angle	M1 A1	Find a relevant angle Their angle correct (seen or implied)
	Bearing = 124	A1 (3)	Correct bearing. Accept 124^o or awrt 124/124^o Accept N 124 E or S 56 E
(c)	$\mathbf{r}_B = 10\mathbf{j} + t(3\mathbf{i} - 2\mathbf{j})$	M1 A1	Find the position vector of B or G at time t Correct for B
	$\mathbf{r}_G = 4\mathbf{i} - 2\mathbf{j} + t\left(\frac{5}{3}\mathbf{i} + 2\mathbf{j}\right)$	A1	Correct for G
	$3t = 4 + \frac{5}{3}t$ OR $10 - 2t = -2 + 2t$	DM1	Compare coefficients of **i** or of **j** to form an equation in t.
	(i) $t = 3$ s (ii) $\mathbf{r} = 10\mathbf{j} + 3(3\mathbf{i} - 2\mathbf{j}) = (9\mathbf{i} + 4\mathbf{j})$ m OR $\mathbf{r} = 4\mathbf{i} - 2\mathbf{j} + 3\left(\frac{5}{3}\mathbf{i} + 2\mathbf{j}\right) = (9\mathbf{i} + 4\mathbf{j})$ m	A1 A1 (6)	Correct unambiguous conclusion. Final answer. Accept with no units. Do not ignore subsequent working.
		[11]	

Question Number	Scheme	Marks
6a	Resultant force $=(2\mathbf{i}+3\mathbf{j})+(4\mathbf{i}-5\mathbf{j})=6\mathbf{i}-2\mathbf{j}$ (N)	M1
	Use of $\mathbf{F}=m\mathbf{a}$: $6\mathbf{i}-2\mathbf{j}=2\mathbf{a}$, $\mathbf{a}=3\mathbf{i}-\mathbf{j}$	M1
	Magnitude: $\lvert a\rvert=\sqrt{3^2+1^2}=\sqrt{10}\,(=3.2 \text{ or better})$ (ms^{-2})	M1A1
		(4)
6b	$(10\mathbf{i}+2\mathbf{j})=(-u\mathbf{i}+u\mathbf{j})+T(3\mathbf{i}-\mathbf{j})$	M1
	$10=-u+3T$ and $2=u-T$	**DM**1A1**ft**
	$T=6$	A1
	(i) $u=8$	A1
	(ii)	(5)
		[9]
	Notes for question 6	
6a	First M1 for adding forces – must collect **i**'s and **j**'s	
	Second M1 for use of $\mathbf{F}=m\mathbf{a}$ or $F=ma$	
	Third M1 for finding a magnitude	
	A1 for $\sqrt{10}\,(=3.2 \text{ or better})$	
6b	First M1 for use of $\mathbf{v}=\mathbf{u}+\mathbf{a}t$ with their **a** (M0 if clearly using **F** instead of **a**)	
	Second **DM**1, dependent on previous M, for equating cpts of **i** and **j**	
	First A1**ft** for two correct equations following their **a**	
	Second A1 for $T=6$	
	Third A1 for $u=8$	

Question Number	Scheme	Marks
	Accept column vectors throughout	
2a	Use of $\mathbf{F} = m\mathbf{a}$: $2\mathbf{i} + 3\mathbf{j} = 0.5\mathbf{a}$	M1
	$\mathbf{a} = 4\mathbf{i} + 6\mathbf{j}$ (m s^{-2})	A1
		(2)
2b	Use of $\mathbf{v} = \mathbf{u} + 3\mathbf{a}$ with their $\mathbf{a}$	M1
	$=16\mathbf{i}+18\mathbf{j}$	A1
	Use of Pythagoras: speed $=\sqrt{16^2+18^2}$	M1
	$=\sqrt{580}$ or 24 (m s^{-1}) or better	A1
		(4)
2c	In component form: $\mathbf{v} = 4\mathbf{i} + t(4\mathbf{i} + 6\mathbf{j})$	M1
	$4 + 4T = 2 \times 6T$	M1
	$T = \frac{1}{2}$	A1
		(3)
		[9]
	Notes	
2a	M1 for use for $\mathbf{F} = m\mathbf{a}$:	
	A1 for $4\mathbf{i} + 6\mathbf{j}$ (m s^{-2}) isw if magnitude found.	
2b	First M1 for $\mathbf{v} = 4\mathbf{i} + 3(4\mathbf{i} + 6\mathbf{j})$ with their $\mathbf{a}$ (but M0 if they use 2**i** + 3**j** (the force) instead of **a**)	
	First A1 for $16\mathbf{i}+18\mathbf{j}$ seen or implied	
	Second M1 for finding magnitude of their **v**	
	Second A1 for 24 or better (24.0831…) or √580	
2c	First M1 for $\mathbf{v} = 4\mathbf{i} + t(4\mathbf{i} + 6\mathbf{j})$ with their $\mathbf{a}$ (but M0 if they use 2**i** + 3**j** (the force) instead of **a**)	
	Second independent M1 for a correct method to give an equation in T *(t) only* using their **v**	
	A1 for (T) = ½	