Pearson

Mark Scheme (Final)

January 2026

Pearson Edexcel International Advanced Level
In Mechanics M2 (WME02) Paper 01A

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General Marking Guidance

All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.

Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.

Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.

There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.

All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.

Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.

When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.

Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

PEARSON EDEXCEL IAL MATHEMATICS

General Instructions for Marking

1. The total number of marks for the paper is 75.

2. The Edexcel Mathematics mark schemes use the following types of marks:

'M' marks
These are marks given for a correct method or an attempt at a correct method. In Mechanics they are usually awarded for the application of some mechanical principle to produce an equation.
e.g. resolving in a particular direction, taking moments about a point, applying a suvat equation, applying the conservation of momentum principle etc.
The following criteria are usually applied to the equation.

To earn the M mark, the equation
(i) should have the correct number of terms
(ii) be dimensionally correct i.e. all the terms need to be dimensionally correct
e.g. in a moments equation, every term must be a 'force x distance' term or 'mass x distance', if we allow them to cancel 'g' s.
For a resolution, all terms that need to be resolved (multiplied by sin or cos) must be resolved to earn the M mark.

M marks are sometimes dependent (DM) on previous M marks having been earned.
e.g. when two simultaneous equations have been set up by, for example, resolving in two directions and there is then an M mark for solving the equations to find a particular quantity – this M mark is often dependent on the two previous M marks having been earned.

'A' marks
These are dependent accuracy (or sometimes answer) marks and can only be awarded if the previous M mark has been earned. E.g. M0 A1 is impossible.

'B' marks
These are independent accuracy marks where there is no method (e.g. often given for a comment or for a graph)

A few of the A and B marks may be f.t. – follow through – marks.

3. General Abbreviations

These are some of the traditional marking abbreviations that will appear in the mark schemes.

- bod – benefit of doubt
- ft – follow through
- the symbol $\surd$ will be used for correct ft
- cao – correct answer only
- cso - correct solution only. There must be no errors in this part of the question to obtain this mark
- isw – ignore subsequent working
- awrt – answers which round to
- SC: special case
- oe – or equivalent (and appropriate)
- dep – dependent
- indep – independent
- dp decimal places
- sf significant figures
- * The answer is printed on the paper
- ⌐ The second mark is dependent on gaining the first mark

4. All A marks are 'correct answer only' (cao.), unless shown, for example, as A1 ft to indicate that previous wrong working is to be followed through. After a misread however, the subsequent A marks affected are treated as A ft, but manifestly absurd answers should never be awarded A marks.

5. For misreading which does not alter the character of a question or materially simplify it, deduct two from any A or B marks gained, in that part of the question affected.

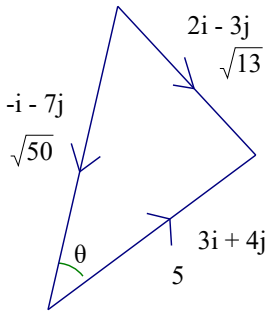
6. If a candidate makes more than one attempt at any question:
   - If all but one attempt is crossed out, mark the attempt which is NOT crossed out.
   - If either all attempts are crossed out or none are crossed out, mark all the attempts and score the highest single attempt.

7. Ignore wrong working or incorrect statements following a correct answer.

General Principles for Mechanics Marking

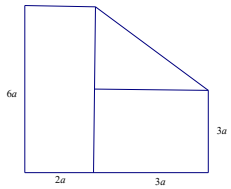
*(**N.B.** specific mark schemes may sometimes override these general principles)*

- Rules for M marks:
  - correct number of terms
  - dimensionally correct
  - all terms that need resolving (i.e. *multiplied* by cos or sin) are resolved
  - only terms that need resolving are resolved
  - +/− errors are condoned
  - sin/cos confusion is condoned
- Omission or extra g in a resolution is an accuracy error not method error.
- Omission of mass from a resolution is a method error.
- Omission of a length from a moments equation is a method error.
- Omission of units or incorrect units is not (usually) counted as an accuracy error.
- DM indicates a dependent method mark, i.e. one that can only be awarded if a previous specified method mark(s) has been awarded.
- Any numerical answer which comes from use of $g = 9.8$ should be given as a decimal to 2 or 3 SF.
- Use of $g = 9.81$ should be penalised once per (complete) question.
  - N.B. Over-accuracy or under-accuracy of correct answers should only be penalised *once* per complete question. However, premature approximation should be penalised every time it occurs.
- Marks must be entered in the same order as they appear on the mark scheme.
- In all cases, if the candidate clearly labels their working under a particular part of a question i.e. (a) or (b) or (c)…then that working can only score marks for that part of the question.
- Accept column vectors in all cases.
- Misreads – if a misread does not alter the character of a question or materially simplify it, deduct two from any A or B marks gained, bearing in mind that after a misread, the subsequent A marks affected are treated as A ft

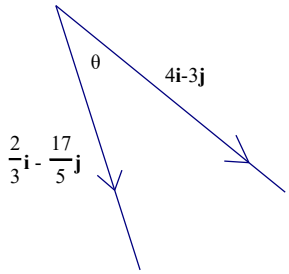
Question Number	Scheme	Marks	Notes
1(a)	Use of Impulse = change in momentum	M1	Dimensionally correct. Condone subtraction in the wrong order.
	$2((2\mathbf{i} - 3\mathbf{j}) - (3\mathbf{i} + 4\mathbf{j})) = \mathbf{I}$	A1	Correct unsimplified. Allow $\pm$
	$= -2\mathbf{i} - 14\mathbf{j}$	A1	Allow $\pm$
	Use of Pythagoras	M1	For *their* impulse
	$\lvert\mathbf{I}\rvert = \sqrt{2^3 + 14^2} = \sqrt{200} = 10\sqrt{2}$ (Nm)	A1	14(Ns) or better. (14.142…..) From correct working (i.e. only from $\pm\mathbf{I}$)
		5	
1(b)	Correct use of trigonometry to find the required angle	M1	For $3\mathbf{i} + 4\mathbf{j}$ and *their* impulse
	$\tan^{-1}\frac{4}{3} + \frac{\pi}{2} + \tan^{-1}\frac{1}{7}$	A1	Correct unsimplified
	$\theta = 2.64$ (radians)	A1	or $150°$ or better (151.2602…..) Accept $209°$ or better: (208.739…)and 3.64 radians
		(3)	
Alt1 1(b)	Using scalar product to find the required angle:	M1	For $3\mathbf{i} + 4\mathbf{j}$ and *their* impulse
	$\cos\theta = \frac{-3 - 28}{5 \times \sqrt{50}}$	A1	Correct unsimplified equation in $\cos\theta$
	$\theta = 151°$	A1	Accept $150°$ or better (151.2602…..), or 2.6(4) radians Accept $209°$ (208.739…) and 3.64 radians
		(3)	
Alt2 1(b)			
	Complete method to find the required angle e.g. use of correct cosine rule to find the obtuse angle	M1	For $3\mathbf{i} + 4\mathbf{j}$ and *their* impulse
	$\cos\theta = \frac{50 + 25 - 13}{2 \times 5 \times \sqrt{50}}$	A1	Correct unsimplified equation in $\cos\theta$
	required angle $(= 180° - \theta) = 151°$	A1	Accept $150°$ or better (151.2602…..), or 2.6(4) radians Accept $209°$ (208.739…)and 3.64 radians
		(3)	

Question Number	Scheme	Marks	Notes
	NB: If they are working with an incorrect impulse e.g. $2\mathbf{i}+14\mathbf{j}$ from (a) then M1A0A0 can be scored in (b)		
		8	

2(a)	Use of $P = Fv$:	M1	$F = \frac{280}{2}(=140)$(N) Seen or implied
	Equation of motion: $F - 75g\sin\theta = R$	M1	Need all terms, condone trig confusion and sign errors Accept $\frac{P}{v} - 75g\sin\theta = R$
	$140 - 75g\sin\theta = R$ $\left(140 - 75\times 9.8\times\frac{1}{21} = R\right)$	A1	Correct substituted equation in R (and θ)
	$R = 105$ (or 110)	A1	3 sf or 2 sf only.
		(4)	
2(b)	Equation of motion:	M1	Need all terms, condone trig confusion and sign errors. Must be using $v = 3.5$ and $m = 75$ unless there is a clear consistent misread
	$75g\sin\theta + \frac{280}{3.5} - 60 = 75a$ $\left(75g\sin\theta + 80 - 60 = 75a\right)$	A1 A1	Unsimplified equation in g, θ and $\pm a$ with at most one error Correct unsimplified equation in g, θ and $\pm a$
	$a = 0.73$ (m s^{-2}) (0.733)	A1	a must be positive 2 sf or 3 sf only A0 for $\frac{11}{15}$
		(4)	
	SC: A candidate who uses $F = Pv$ can score M0M1A0A0 in (a) and 0/4 in (b)		
		8	

<table>
<tr><th>Q</th><th>Scheme</th><th>Marks</th><th>Notes</th></tr>
<tr><td>3(a)</td><td>
<table>
<tr><td></td><td>square</td><td>triangle</td><td>template</td></tr>
<tr><td>Area</td><td>$36a^2(6)$</td><td>$6a^2(1)$</td><td>$30a^2(5)$</td></tr>
<tr><td>From OD</td><td>$3a$</td><td>$\frac{14a}{3}$</td><td>$\bar{x}$</td></tr>
<tr><td>From OA</td><td>$3a$</td><td>$5a$</td><td>$\bar{y}$</td></tr>
</table>
</td><td>B1
B1
B1</td><td>Correct area ratio
Correct horizontal distances
Correct vertical distances
Be aware of other possible splits e.g.</td></tr>
<tr><td></td><td></td><td>


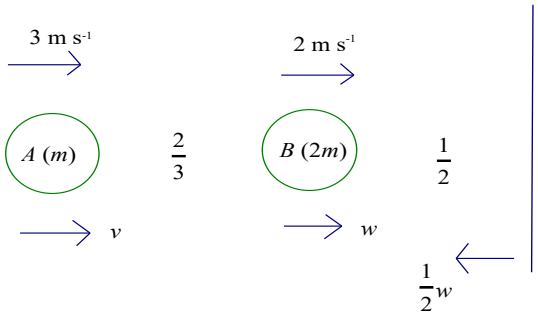
<table>
<tr><td></td><td>Tall rectangle</td><td>triangle</td><td>Lower rectangle</td><td>template</td></tr>
<tr><td>Area</td><td>$12a^2(2)$</td><td>$6a^2(1)$</td><td>$12a^2(2)$</td><td>$30a^2(5)$</td></tr>
<tr><td>From OD</td><td>a</td><td>$\frac{10a}{3}$</td><td>$4a$</td><td>$\bar{x}$</td></tr>
<tr><td>From OA</td><td>$3a$</td><td>$4a$</td><td>$\frac{3}{2}a$</td><td>$\bar{y}$</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td colspan="4">If they do not give you a diagram allow their values to imply a correct table / split
No diagram and incorrect values can score at most M1 for a dimensionally correct moments equation
If they use a non-standard shape (e.g. trapezium) they must show full working for the centre of mass.</td></tr>
<tr><td>(i)</td><td>$6\times3a-1\times\frac{14a}{3}=5\bar{x}$</td><td>M1</td><td>moments equation about OD or a parallel axis OR a moments equation about OA or a parallel axis.
Moments equation must be dimensionally consistent.
Condone sign errors.
SC Allow M1 for work on a framework with 5 sections</td></tr>
<tr><td></td><td>$\Rightarrow \bar{x}=\frac{8a}{3}$ ISW</td><td>A1</td><td>Allow $2.6\dot{a}$ but not an approximate value e.g. $2.67a$</td></tr>
<tr><td>(ii)</td><td>$6\times3a-1\times5a=5\bar{y}\Rightarrow\bar{y}=\frac{13a}{5}$</td><td>A1</td><td>Accept $2.6a$</td></tr>
<tr><td></td><td></td><td>(6)</td><td></td></tr>
<tr><td>3(b)</td><td>Use of trig to find a relevant angle</td><td>M1</td><td>e.g. $\alpha, 180°-\alpha$ or $90°-\alpha$.
Need correct pairing of angles i.e. do not accept $\frac{3}{4}$ vs $\frac{4}{3}$ confusion in their equation for α</td></tr>
<tr><td></td><td>$\alpha=\arctan\left(\frac{6a-\bar{y}}{\bar{x}-2a}\right)-\arctan\left(\frac{3}{4}\right)$</td><td>A1ft
A1ft</td><td>Unsimplified expression with at most one error. For their $\bar{x}, \bar{y}$ (need not be substituted)</td></tr>
</table>

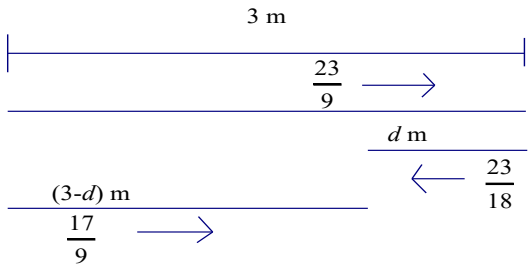
	Or equivalent e.g. $\tan^{-1}\frac{4}{3}-\tan^{-1}\frac{\overline{x}-2a}{6a-\overline{y}}\left(=\tan^{-1}\frac{4}{3}-\tan^{-1}\frac{10}{51}\right)$		Correct unsimplified expression. For *their* $\overline{x}$, $\overline{y}$ (need not be substituted)
	$=42^\circ$	A1	Accept $138°$, but not 42.0° The Q asks for the nearest degree
		(4)	
3b alt			
	Correct statement for scalar product to find a relevant angle	M1	Correct vector for their $\overline{x}$ and $\overline{y}$
	$\cos\theta=\frac{4\times\frac{2}{3}+3\times\frac{17}{5}}{5\times\sqrt{\frac{2701}{225}}}\left(=0.742\right)$	A1ft A1ft	Unsimplified expression with scalar product expanded and at most one error Correct unsimplified expression with scalar product expanded
	$\left(\theta=\right)42^\circ$	A1	Accept $138°$ but not 42.0° The Q asks for the nearest degree
		(4)	
		10	

Q	Scheme	Marks	Notes
4(a)	Accept working in column vectors throughout this question		
	Differentiate **r** to obtain **v**	M1	Powers going down by 1. M0 if clearly dividing by t Condone one slip. Seen or implied
	$\mathbf{v}=\left(3t^2-9t-24\right)\mathbf{i}+\left(-3t^2+6t+12\right)\mathbf{j}$	A1	Correct only. Seen or implied
	$3T^2-9T-24=-3T^2+6T+12$ $\Rightarrow 6T^2-15T-36=0$	M1	Equate coefficients of **i** and **j** from their **v** to obtain a 3-term quadratic in t or T
	Solve for T: e.g. $3\left(2T+3\right)\left(T-4\right)=0$	DM1	Ignore $T=-\frac{3}{2}$ if seen. Can be implied by correct roots of an incorrect quadratic. Allow if they solve a quadratic resulting from a slip in simplifying Dependent on the previous M1
	$\left(T=\right)4$	A1	Only
		(5)	
4(b)	Differentiate *their* **v** to obtain **a**:	M1	Powers going down by 1. M0 if clearly dividing by t Condone one slip. Seen or implied
	$\mathbf{a}=\left(6t-9\right)\mathbf{i}+\left(-6t+6\right)\mathbf{j}$	A1ft	Follow their **v.** Seen or implied
	$\mathbf{a}=\left(6T-9\right)\mathbf{i}+\left(-6T+6\right)\mathbf{j}=15\mathbf{i}-18\mathbf{j}$	DM1	substitute *their* positive T Dependent on the previous M1 Seen or implied
	Use Pythagoras	DM1	Correct method for the magnitude: $\left\|\mathbf{a}\right\|=\sqrt{15^2+18^2}$ Dependent on the previous DM1
	$\left\|\mathbf{a}\right\|=\sqrt{549}=23.4\,(\text{m s}^{-2})$	A1	23 or better e.g. $3\sqrt{61}$
		(5)	
		10	

Q	Solution	Marks	Notes
5(a)	Moments about A:	M1	Or equivalent to obtain an equation for F e.g. moments about another point and vertical resolution. Requires all terms and dimensionally correct. Condone sign errors and sine / cosine confusion. Allow $\cos\theta = \frac{4}{5}$ used without comment.
	$F \times \frac{5a}{4} = mga\cos\theta + 2kmga\cos\theta$	A1 A1	Unsimplified equation with at most one error. Consistent trig confusion counts as 1 error. g missing in both terms is a single error Correct unsimplified equation
	$F = \frac{4mg\cos\theta}{5}(1+2k) = \frac{16}{25}mg(1+2k)$ *	A1*	Obtain **given answer** from full and correct working
			SC allow M1A1A1A0 if a missing throughout
		(4)	
5(b)	resolve horizontally: $H = F\sin\theta$	M1	Condone sine / cosine confusion
	$H = \frac{48}{125}mg(1+2k)$	A1	Or equivalent with trig substituted
	resolve vertically	M1	Requires all three terms. Condone sine/cosine confusion and sign errors.
	$\pm V = mg(1+k) - F\cos\theta$	A1	Correct unsimplified equation
	$= mg(1+k) - \frac{64}{125}mg(1+2k)$ $\left(= mg\left(\frac{61}{125} - \frac{3k}{125}\right)\right)$	A1	Or equivalent with trig substituted Allow for V acting downwards here ISW if they had a correct expression and make an error in simplifying it.
	Either of the above equations could be replaced with an alternative e.g. Resolve parallel to the rod: $\frac{4}{5}H + \frac{3}{5}V = \frac{3}{5}mg + \frac{3}{5}kmg$ Resolve perpendicular to the rod: $\frac{3}{5}H + \frac{4}{5}mg + \frac{4}{5}kmg = \frac{4}{5}V + F$ Moments about C: $\frac{5}{4}a \times \frac{4}{5}V + \frac{3}{4}a \times \frac{4}{5}kmg = \frac{5}{4}a \times \frac{3}{5}H + \frac{1}{4}a \times \frac{4}{5}mg$ NB: the names H and V are not given in the question so they might be using their own alternatives.		
	SC: If they have confused horizontal and vertical, obtain correct values for the two components but name them incorrectly then allow M1M1 (2/5)		
		(5)	

5(c)	Use $H = V$ to form equation in k	M1	For their H, $\pm V$
	Obtain $\frac{48}{125}mg(1+2k) = mg(1+k) - \frac{64}{125}mg(1+2k)$	A1ft	Must now be using V acting vertically upwards. Or equivalent e.g. $48(1+2k) = (61-128k)$ Follow their H and V upwards
	$k = \frac{13}{99}$	A1	Accept 0.13 or better
		(3)	
		[12]	

Q	Solution	Marks	Notes
6a			
	Equation for CLM	M1	Need all terms. Dimensionally consistent. Condone sign errors.
	$3m + 4m = mv + 2mw$	A1	Or equivalent e.g. $7 = v + 2w$
	Equation for Impact Law	M1	Must be used the right way round. Condone sign errors
	$w - v = \frac{2}{3}(3-2)$	A1	Or equivalent e.g. $3w - 3v = 2$
	Solve for w or v e.g. $w - \frac{2}{3} + 2w = 7$	DM1	Dependent on both previous M marks Must have both equations. Not available if all they have is CLM and then work back from the given answer
	$3w = \frac{23}{3}$, $w = \frac{23}{9}$ *	A1*	Obtain **given answer** with no incorrect working seen
	$\frac{23}{9} - v = \frac{6}{9}$, $v = \frac{17}{9}$	A1	Correct only
		(7)	

6(b)			
	Velocity of B after hitting wall $= \frac{23}{18}$ (m s^{-1})	B1	Or equivalent: $\frac{1}{2}\times\frac{23}{9}$ (both values given) Allow +/-
	Time for B to get to the 2nd collision	M1	Using time $= \frac{\text{distance}}{\text{speed}}$
	$= 3\times\frac{9}{23}+d\times\frac{18}{23}$	A1	Or equivalent e.g, $\frac{27+18d}{23}$
	Time for A to get to the 2nd collision $=(3-d)\frac{9}{17}$	B1ft	Follow their v: $\frac{3-d}{v}$
	Equation in d	M1	Using time between collisions for their "correct" times
	$17(27+18d)=9\times23(3-d)$	A1	Or equivalent e.g. $\frac{27+18d}{23}=\frac{9}{17}(3-d)$
	$d=\frac{162}{513}\left(=\frac{6}{19}\right)$	A1	Accept 0.32 or better. ISW
		(7)	
6(b) Alt1	Velocity of B after hitting wall $= \frac{23}{18}$ (m s^{-1})	B1	Or equivalent: $\frac{1}{2}\times\frac{23}{9}$ (both values given) Allow +/-
	Time for B to reach wall $\frac{3}{w}=3\times\frac{9}{23}=\frac{27}{23}$ (s)	M1	
	Distance travelled by A in this time $=\frac{17}{9}\times\frac{27}{23}=\frac{51}{23}$ (m)	A1ft	Follow *their v*: $\frac{27}{23}\times$ *their v*
	Distance between A and B now $=3-\frac{51}{23}=\frac{18}{23}$ (m)	A1	
	Gap closing at $\frac{23}{18}+\frac{17}{9}=\frac{19}{6}$ (m s^{-1})	M1	Relative velocity
	Time to meet $=\frac{18}{23}\div\frac{19}{6}=\frac{18}{23}\times\frac{6}{19}\left(=\frac{108}{437}\right)$	A1	Using time $= \frac{\text{distance}}{\text{speed}}$
	$d=\frac{18}{23}\times\frac{6}{19}\times\frac{23}{18}=\frac{6}{19}$	A1	Accept 0.32 or better ISW
		(7)	

6balt2	Velocity of B after hitting wall = $\frac{23}{18}$ (m s^{-1})	B1	Or equivalent: $\frac{1}{2}\times\frac{23}{9}$ (both values given) Allow +/-
	Time for B to reach wall $\frac{3}{w}=3\times\frac{9}{23}=\frac{27}{23}$ (s)	M1	
	Distance travelled by A in this time $=\frac{17}{9}\times\frac{27}{23}=\frac{51}{23}$ (m)	A1ft	Follow *their v*: $\frac{27}{23}\times$ *their v*
	Total additional distance in time t between B hitting the wall and A & B colliding again $=\frac{23}{18}t+\frac{17}{9}t$	A1	
	$\Rightarrow\frac{17}{9}\times\frac{27}{23}+\frac{17}{9}t+\frac{23}{18}t=3$	M1	Add these two distances to form an equation in t
	$t=\frac{108}{437}$	A1	Seen or implied
	$d=\frac{23}{18}t=\frac{6}{19}$	A1	ISW
		(7)	
		14	

Q	scheme	Marks	Notes
	NB Penalise each type of accuracy error once and only once in any question (incorrect g, answers not to 2 sf or 3 sf)		
7(a)	Vertical speed = 0: $v = 9 - gt = 0$	M1	Complete method using *suvat*
	$t = 0.92\,(\text{s})$ 0.918	A1	2 sf or 3 sf only $\frac{9}{g}$ and $\frac{45}{49}$ score A0 ISW if go on to find the max height Clear use of 9.81 is A0.
		(2)	
7(b)	$x = 4t$	B1	
	$y = 9t - \frac{1}{2}gt^2$	B1	Correct use of *suvat*
	Use $y = x$ Or $4t = 9t - \frac{1}{2}gt^2$, $t = \frac{10}{g}$	M1	e.g. $t = \frac{x}{4} = \frac{k}{4}$, $k = 9 \times \frac{k}{4} - \frac{g}{2} \times \frac{k^2}{16}$, $\frac{5}{4}k = \frac{g}{32}k^2$
	$k = 4.1$ (4.08)	A1	2 sf or 3 sf only $\frac{40}{g}$ and $\frac{200}{49}$ are A0 unless previously penalised. ISW after an acceptable answer
		(4)	
7(c)	Using symmetry for the other point	M1	Time to $A = \frac{k}{4} = \frac{10}{g}$ (s)
	$t = \frac{9}{g} - \left(\frac{10}{g} - \frac{9}{g}\right) = \frac{8}{g}\left(= \frac{40}{49}\right)$	A1	Accept unsimplified e.g. $2 \times \frac{9}{g} - \frac{k}{4}$ Accept as a decimal (0.816…)
	$\mathbf{r} = \left(\frac{4}{5}k\right)\mathbf{i} + k\mathbf{j}$	A1	Accept decimal equivalent Accept column vector
7(c) Alt 1	Other point: $x = \frac{36}{g} - \left(k - \frac{36}{g}\right)$ or $x = \frac{72}{g} - k$	M1	At max ht $x = 4 \times \frac{9}{g} = \frac{36}{g}$
	$x = \frac{9}{5}k - k = \frac{4}{g}k$	A1	Accept unsimplified
	$\mathbf{r} = \left(\frac{4}{5}k\right)\mathbf{i} + k\mathbf{j}$	A1	Accept decimal equivalent Accept column vector

7(c) Alt 2	Same height: $\frac{40}{g} = 9t - \frac{1}{2}gt^2$	M1	Form an equation in t only and solve for t
	Obtain $(gt-10)(gt-8)=0$, $t=\frac{8}{g}$	A1	Accept 0.816 and $\frac{40}{49}$ Allow difference in final decimal place if working with 9.81 throughout and already penalised earlier. Must reject $\frac{10}{g}$ but can be implied by subsequent work
	$(\mathbf{r}=)\left(\frac{4}{5}k\right)\mathbf{i}+k\mathbf{j}$	A1	Accept decimal equivalent Accept column vector
	SC if they start with $k=9t-\frac{1}{2}gt^2$ and stop they score 0/3, but if they solve the quadratic to get to $\frac{36-4\sqrt{81-19.6k}}{9.8}\mathbf{i}+k\mathbf{j}$ then allow 3/3		
	Allow an answer of $(\mathbf{r}=)\frac{32}{g}\mathbf{i}+k\mathbf{j}$ or $(\mathbf{r}=)\left(\frac{72}{g}-k\right)\mathbf{i}+k\mathbf{j}$ or $(\mathbf{r}=)3.3\mathbf{i}+k\mathbf{j}$ or $(\mathbf{r}=)(7.35-k)\mathbf{i}+k\mathbf{j}$ or equivalent Condone exact fractions and figures to more than 3 sf after substitution for g, but an answer of $(\mathbf{r}=)3.3\mathbf{i}+4.1\mathbf{j}$ or $(\mathbf{r}=)\frac{32}{g}\mathbf{i}+\frac{40}{g}\mathbf{j}$ scores M1A1A0 because k is not involved The Q asks for a vector. Should be in **i** and **j** or as a column vector. Coordinates can score M1A1A0		
		(3)	
7(d)	$4\mathbf{i} - n\mathbf{j}$ perpendicular to $4\mathbf{i} + 9\mathbf{j}$	M1	Use ratios or scalar product to find velocity
	$\frac{4}{n}=\frac{9}{4}$, $n=\frac{16}{9}$	A1	Accept 1.8 or better $(1.\dot{7})$ Accept $\pm$
	$-\frac{16}{9}=9-gT$	dM1	Form an equation in T (or t) only Correct signs. Dependent on the previous M1
	$(T=)1.1$ (1.10)	A1	2 sf or 3 sf $\frac{97}{9g}$ is A0 unless previously penalised
		(4)	
		[13]	

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