CAMBRIDGE
International Education

Cambridge International AS & A Level

MATHEMATICS **9709/42**

Paper 4 Mechanics **October/November 2025**

MARK SCHEME

Maximum Mark: 50

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2025 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

PUBLISHED

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptions for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:
Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:
Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:
Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:
Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:
Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:
Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Mathematics-Specific Marking Principles

1 Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.

2 Unless specified in the question, non-integer answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.

3 Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.

4 Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).

5 Where a candidate has misread a number or sign in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 A or B mark for the misread.

6 Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Annotations guidance for centres

Examiners use a system of annotations as a shorthand for communicating their marking decisions to one another. Examiners are trained during the standardisation process on how and when to use annotations. The purpose of annotations is to inform the standardisation and monitoring processes and guide the supervising examiners when they are checking the work of examiners within their team. The meaning of annotations and how they are used is specific to each component and is understood by all examiners who mark the component.

We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of the quality of the response.

The annotations listed below were available to examiners marking this component in this series.

Annotations

Annotation	Meaning
	More information required
	Accuracy mark awarded zero
	Accuracy mark awarded one
	Independent accuracy mark awarded zero
	Independent accuracy mark awarded one
	Independent accuracy mark awarded two
	Benefit of the doubt
	Blank Page
	Incorrect
Dep	Used to indicate DM0 or DM1

Annotation	Meaning
DM1	Dependent on the previous M1 mark(s)
FT	Follow through
~~	Indicate working that is right or wrong
Highlighter	Highlight a key point in the working
ISW	Ignore subsequent work
J	Judgement
JU	Judgement
M0	Method mark awarded zero
M1	Method mark awarded one
M2	Method mark awarded two
MR	Misread
O	Omission or Other solution
Off-page comment	Allows comments to be entered at the bottom of the RM marking window and then displayed when the associated question item is navigated to.
On-page comment	Allows comments to be entered in speech bubbles on the candidate response.
PE	Judgment made by the PE
Pre	Premature approximation
SC	Special case
SEEN	Indicates that work/page has been seen

Annotation	Meaning
SF	Error in number of significant figures
✓	Correct
TE	Transcription error
XP	Correct answer from incorrect working

PUBLISHED

Mark Scheme Notes

The following notes are intended to aid interpretation of mark schemes in general, but individual mark schemes may include marks awarded for specific reasons outside the scope of these notes.

Types of mark

M Method mark, awarded for a valid method applied to the problem. Method marks are not lost for numerical errors, algebraic slips or errors in units. However, it is not usually sufficient for a candidate just to indicate an intention of using some method or just to quote a formula; the formula or idea must be applied to the specific problem in hand, e.g. by substituting the relevant quantities into the formula. Correct application of a formula without the formula being quoted obviously earns the M mark and in some cases an M mark can be implied from a correct answer.

A Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. Accuracy marks cannot be given unless the associated method mark is earned (or implied).

B Mark for a correct result or statement independent of method marks.

DM or **DB** When a part of a question has two or more 'method' steps, the M marks are generally independent unless the scheme specifically says otherwise; and similarly, when there are several B marks allocated. The notation DM or DB is used to indicate that a particular M or B mark is dependent on an earlier M or B (asterisked) mark in the scheme. When two or more steps are run together by the candidate, the earlier marks are implied and full credit is given.

FT Implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A or B marks are given for correct work only.

- A or B marks are given for correct work only (not for results obtained from incorrect working) unless follow through is allowed (see abbreviation FT above).
- For a numerical answer, allow the A or B mark if the answer is correct to 3 significant figures or would be correct to 3 significant figures if rounded (1 decimal place for angles in degrees).
- The total number of marks available for each question is shown at the bottom of the Marks column.
- Wrong or missing units in an answer should not result in loss of marks unless the guidance indicates otherwise.
- Square brackets [ ] around text or numbers show extra information not needed for the mark to be awarded.

Abbreviations

AEF/OE	Any Equivalent Form (of answer is equally acceptable) / Or Equivalent
AG	Answer Given on the question paper (so extra checking is needed to ensure that the detailed working leading to the result is valid)
CAO	Correct Answer Only (emphasising that no 'follow through' from a previous error is allowed)
CWO	Correct Working Only
ISW	Ignore Subsequent Working
SOI	Seen Or Implied
SC	Special Case (detailing the mark to be given for a specific wrong solution, or a case where some standard marking practice is to be varied in the light of a particular circumstance)
WWW	Without Wrong Working
AWRT	Answer Which Rounds To

Question	Answer	Marks	Guidance
1	Any method to find x, or a or getting an equation relating x and a For example: $\frac{x}{2}=40$ or $x=2\times40$ or $x=40\times2+\frac{1}{2}(0)2^2$ or $\frac{x-0}{4-6}=-40$ or $x=\frac{1}{2}\times a\times4^2$	**M1**	Condone assumption that speed is 40 at the end of first phase of motion. Allow e.g. $x=\frac{1}{2}\times4\times40$, $x=\frac{1}{2}(0+40)\times4$, $40^2=0^2+2ax$, $a=\frac{40-0}{4}$, $x=40\times4-\frac{1}{2}\times a\times4^2$.
	$x = 80$	**A1**	CWO. Must be $x=\ldots$ **M1A0** for those who have $\frac{x-0}{4-6}=40$ and have $x=-80$ followed by $x=80$ without any explanation.
	$a = 10$	**A1**	CWO.
		3	

Question	Answer	Marks	Guidance
2	Attempt at Newton's second law at least once	*M1	Correct number of terms, allow sign errors, allow sin/cos mix, allow g missing.
	$450000+240000g\times0.04-120000-T=240000a$ $\left[\begin{array}{r} 450000+96000-120000-T=240000a \\ 426000-T=240000a \end{array}\right]$ $T+36000g\times0.04-15000=36000a$ $\left[\begin{array}{r} T+14400-15000=36000a \\ T-600=36000a \end{array}\right]$ $450000+(240000+36000)g\times0.04-120000-15000=(240000+36000)a$ $\left[\begin{array}{r} 450000+110400-120000-15000=276000a \\ 425400=276000a \end{array}\right]$	A2	**A1** for any equation correct. **A2** for any 2 equations correct. Allow $\sin 2.3$ or better for 0.04. A candidate may be using *their* a in the either of the first 2 equations if they have used the 3rd equation to find a.
	Solving for a or T, from equation(s) with the correct number of relevant terms	DM1	Allow g missing, terms should be components where necessary. Must get to $a=\ldots$ or $T=\ldots$
	Acceleration = 1.54 ms^{-2} and Tension = 56100 N	A1	Allow $a=\frac{709}{460}$, $a=1.54130\ldots$, $T=56086.9\ldots$ Allow with use of $\sin 2.3$. If using $a=1.54$, then $T=56400$ from locomotive equation or $T=56040$ from coach equation. If using $a=1.541$, then $T=56160$ from locomotive equation or $T=56076$ from coach equation.
		5	

Question	Answer	Marks	Guidance
3(a)	$175 = \frac{1}{2}(15+20)t$	**M1**	For complete method to get an equation in time only using $s = 175$, $u = 15$ and $v = 20$. May see $a = 0.5$.
	Time = 10 s	**A1**	
		2	

Question	Answer	Marks	Guidance
3(b)(i)	Change in KE $= \pm\left(\frac{1}{2}\times 1400\times 20^2 - \frac{1}{2}\times 1400\times 15^2\right)$ $\left[= \pm(280000-157500) = \pm 122500\right]$ **OR** Work done against resistance $= \pm 800\times 175$ $\left[= \pm 140000\right]$	**B1**	
	Work done by engine $= \frac{1}{2}\times 1400\times 20^2 - \frac{1}{2}\times 1400\times 15^2 + 800\times 175$	***M1**	Attempt at work energy equation. Correct number of relevant terms; dimensionally correct; allow sign errors. May see : Work done by engine = DF × 175 . Using $\frac{1}{2}\times 1400\times(20-15)^2$ is **M0.** For reference if correct WD = 262500, DF = 1500 .
	Av power $\times$ $(their\,10) = \frac{1}{2}\times 1400\times 20^2 - \frac{1}{2}\times 1400\times 15^2 + 800\times 175$	**DM1**	**FT** *their* 10 from **3(a)** or if recalculated t in **3(b)(i)**
	Average power = 26250 W	**A1FT**	**FT** their value of t only so $\frac{262500}{their\,10}$ or $\frac{1500\times 175}{their\,10}$. Allow 26300 from correct working. Allow 26.25 kW or 26.3 kW with units.
	Special case for using N2L Maximum 2 marks		
	$20^2 = 15^2 + 2\times a\times 175 \Rightarrow a = 0.5$; $DF - 800 = 1400\times 0.5 \Rightarrow DF = 1500$	**B1**	This is for getting $DF = 1500$.
	$DF\times 175$ = Average power $\times$ $(their\,10) \Rightarrow$ Average power = 26250 W **OR** $P = 1500\times 15 = 22500$ and $P = 1500\times 20 = 30000$ so Average power $= \frac{1}{2}(22500+30000) = 26250$ W	**B1FT**	**FT** their value of t so $\frac{1500\times 175}{their\,10}$ Allow 26.25 kW with units
		4	

Question	Answer	Marks	Guidance
3(b)(ii)	*their* $26250 = 800v$	**M1**	For use of $P = Fv$.
	Speed = 32.8125 or $\frac{525}{16}$ m s^{-1}	**A1**	OE. Allow 32.875 or 32.9 or better from use of 26300.
		2	

Question	Answer	Marks	Guidance
4(a)	[Height gained by P (s_P)=]$30t - \frac{1}{2}gt^2$ [Height lost by Q (s_Q)=]$10t - \frac{1}{2}gt^2$	***M1**	For use of $s = ut + \frac{1}{2}at^2$ at least once with $a = \pm g$ and $u = \pm 30$ or $u = \pm 10$. Allow this **M1** only if using a found value of t.
	Meet when $30t - \frac{1}{2}gt^2 = 10t - \frac{1}{2}gt^2 + 15$	**DM1**	For use of $s_P = s_Q \pm 15$ with s_P and s_Q of the correct form which would lead to a linear equation in t (so in the expressions for s_P and s_Q the signs of the $\frac{1}{2}gt^2$ terms must be the same).
	$t = \frac{3}{4}$ or 0.75	**A1**	OE. CWO.
	Height = 19.6875 m or $\frac{315}{16}$ m	**A1**	Allow 19.7 or better. CWO. **DO NOT ISW.**
		4	

Question	Answer	Marks	Guidance
4(b)	$[v_P =]\pm\left(30-\frac{3}{4}g\right)[=\pm 22.5]$ $[v_Q =]\pm\left(10-\frac{3}{4}g\right)[=\pm 2.5]$ **OR** $[v_P =]\pm\sqrt{30^2-2g\times 19.6875}[=\pm 22.5]$ $[v_Q =]\pm\sqrt{10^2-2g\times(19.6875-15)}[=\pm 2.5]$	***B1FT**	For either expression for the speed of P or Q before impact **FT** $their\, t=\frac{3}{4}$ and/or **FT** their height. $=\frac{315}{16}=19.6875$. The 2 **M** marks in **4(a)** must have been awarded.
	$0.1\times 22.5+0.4\times 2.5=(0.1+0.4)\times v_{PQ}$	**DM1**	Use of conservation of momentum; correct number of non-zero terms, allow sign errors. 22.5 and 2.5 coming from a correct method. Do not allow with $v_P=\pm 30$ or with $v_Q=\pm 10$. If using mg rather than m, then do not allow subsequent **A** marks.
	$v_{PQ}=6.5$	**A1**	SOI, allow to 2sf.
	$v^2=their\, 6.5^2+2g\times their 19.6875$ **OR** $0=their\, 6.5^2+2(-g)s \quad\Rightarrow s=2.1125$, height above ground $=2.1125+19.6875=21.8$ hence $v^2=0^2+2g\times 21.8$	**DM1**	Dependent on previous **M1** and **B1**. Complete method to get an equation in speed or (speed)^2. May see $t=2.738061302$.
	Speed = 20.9 ms^{-1} or $2\sqrt{109}$ ms^{-1}	**A1**	20.88061303… Use of g in momentum equation can be awarded **B1M1A0M1A0**, 3 marks max.
		5	

Question	Answer	Marks	Guidance
5	For resolving in any direction to form an equation	***M1**	Correct number of relevant dimensionally correct terms; allow sin/cos mix; allow sign errors.
	$R = 5g\cos 10 - 20\sin 35$ $[= 37.76885892]$	**A1**	OE. For reference $F = 15.10754357$
	$20\cos 35 + 5g\sin 10 - F = 5a$ $[25.06544977 - F = 5a]$	**A1**	OE, allow with *their* possibly incorrect F. Allow $F - 20\cos 35 - 5g\sin 10 = 5a$.
	For use of $F = 0.4R$ to get an equation in a only	**DM1**	From both dimensionally correct equations with the correct number of relevant terms. For reference $a = 1.99$ $[1.99158124\ldots]$.
	$v^2 = 2^2 + 2\times(their\,1.99)\times 3$	**DM1**	Dependent on both previous **M** marks. **M0** if their calculated a is negative from using N2L down the plane. **M0** if their calculated a is positive from using N2L up the plane. *Their* calculated 1.99 and 3 must be same sign. For use of $v^2 = u^2 + 2as$ or any complete method to get an equation in v or v^2, where $v^2 > 0$.
	Speed = $3.99\,\text{m s}^{-1}$	**A1**	3.993680939…

Question	Answer	Marks	Guidance
5	**Alternative for Q5 using energy**		
	For resolving perpendicular to the plane to form an equation for normal reaction	***M1**	Correct number of relevant dimensionally correct terms; allow sin/cos mix; allow sign errors.
	$R = 5g\cos 10 - 20\sin 35$ $[= 37.76885892]$	**A1**	OE.
	$20\cos 35 \times 3 + 5g\sin 10 \times 3 + \frac{1}{2} \times 5 \times 2^2 - F \times 3 = \frac{1}{2} \times 5 \times v^2$ $[49.1491\ldots + 26.0472\ldots + 10 - 3F = 2.5v^2]$	***M1**	Attempt at Work-energy equation. Correct number of relevant terms, dimensionally correct, allow sin/cos mix, allow sign errors, allow their F.
		A1	Allow their possibly incorrect F. **Note:** $60\cos 10$ comes from $3 \times 0.4(5g\cos 10)$.
	For use of $F = 0.4R$ to get an equation in v only	**DM1**	Dependent on both previous **M** marks. Attempt at Work-energy equation. Correct number of relevant terms, dimensionally correct.
	Speed = $3.99\,\text{m s}^{-1}$	**A1**	3.993680939…
		6	

Question	Answer	Marks	Guidance
6	Acceleration = 0 when $\left[2(t+1)^{-\frac{1}{2}}-1=0 \Rightarrow (t+1)^{\frac{1}{2}}=2\right]$ $t=3$	**B1**	CWO. Those who use $2(t+1)^{-\frac{1}{2}}$ or claim that $2(t+1)^{-\frac{1}{2}}-1$ is $(2t+2)^{-\frac{1}{2}}-1$ score 0 marks.
	For attempt at integration of $(a=)2(t+1)^{-\frac{1}{2}}-1$	***M1**	$v=at$ is **M0**. Of the form $a(t+1)^{\frac{1}{2}}-t[+c]$, where $a\neq 2$.
	$[v=]\frac{2}{-\frac{1}{2}+1}(t+1)^{-\frac{1}{2}+1}-t[+c]=4(t+1)^{\frac{1}{2}}-t[+c]$	**A1**	Allow un-simplified.
	$v=0$ at $t=0 \Rightarrow\ c=-4$ $\left[\Rightarrow v=4(t+1)^{\frac{1}{2}}-t-4\right]$	**DM1**	For attempt to find c using $v=0$ at $t=0$. Must get a value for c. **M0** for stating $v=0$ at $t=0 \Rightarrow c=0$ with no working.
	Attempt to integrate *their* v, which has come from integration	**DM1**	Increase power by 1 and change of coefficient on the same term from a 3 term expression in t to get an expression of the form $p(t+1)^{\frac{3}{2}}+qt^2+rt$, where $p\neq 0$, $q\neq 0$ and $r\neq 0$. $s=vt$ is **M0**. Dependent on previous 2 **M** marks.
	$[s=]\frac{4}{\frac{1}{2}+1}(t+1)^{\frac{1}{2}+1}-\frac{1}{1+1}t^{1+1}-4t[+k]=\frac{8}{3}(t+1)^{\frac{3}{2}}-\frac{1}{2}t^2-4t[+k]$	**A1**	Allow un-simplified. Condone using $+c$ again.
	$=\left(\frac{8}{3}\times 4^{\frac{3}{2}}-\frac{1}{2}\times 3^2-4\times 3\right)-\left(\frac{8}{3}-0-0\right)$ **OR** evaluate k from using $s=0$ when $t=0$ **AND** substitute $t=$ *their* 3	**DM1**	Use of limits 0 and *their* positive 3 correctly, *their* 3 must have come from considering given $a=0$. Dependent on all 3 previous **M** marks. If evaluating k, then $k=-\frac{8}{3}$ if correct.

Question	Answer	Marks	Guidance
6	Distance $=\frac{13}{6}$m or 2.17m	**A1**	**SC,** If no integrating v seen then **SCB1** for 2.17 so **B1M1A1M1SCB1** 5 marks max
		8	

Question	Answer	Marks	Guidance
	NO MISREADS IN THIS QUESTION		
7(a)	For attempt to resolve in any direction to form an expression or equation	***M1**	Correct number of terms; allow sign errors and sin/cos mix ONLY.
	$[X =] \pm (30\cos 30 + 15\cos 45 - 20\cos 20)$ OR $[S\cos\alpha =] \pm (30\cos 30 + 15\cos 45 - 20\cos 20)$	**A1**	OE. $\pm 17.79351142\ldots$
	$[Y =] \pm (25 + 15\sin 45 - 20\sin 20 - 30\sin 30)$ OR $[S\sin\alpha =] \pm (25 + 15\sin 45 - 20\sin 20 - 30\sin 30)$	**A1**	OE. $\pm 13.76619885\ldots$
	$S = \sqrt{(their 17.7935\ldots)^2 + (their 13.76661\ldots)^2}$ OR $S = \dfrac{their 17.7935\ldots}{\cos(their 37.7278\ldots)}$ OR $S = \dfrac{their 13.76661\ldots}{\sin(their 37.7278\ldots)}$	**DM1**	For attempt to find force from equations with the correct number of relevant terms (only sign errors and sin/cos mix allowed).
	$\alpha = \tan^{-1}\left(\dfrac{their 13.7661\ldots}{their 17.7935\ldots}\right)$ OR $\alpha = \cos^{-1}\left(\dfrac{their 17.7935\ldots}{their 22.4970\ldots}\right)$ OR $\alpha = \sin^{-1}\left(\dfrac{their 13.7661\ldots}{their 22.4970\ldots}\right)$	**DM1**	Allow reciprocal in $\tan^{-1}$ only. For attempt to find angle from equations with the correct number of relevant terms (only sign errors and sin/cos mix allowed).
	$[S =]$ 22.5 $[\alpha =]37.7$	**A1**	$S = 22.497050406\ldots$ $\alpha = 37.72782933\ldots$ Condone $\alpha = 37.8$. Allow $S =$ −22.5 becoming 22.5 with no explanation. Allow $\alpha = -37.7$ becoming 37.7 with no explanation. **A0** for $\alpha = -37.7$ ONLY, **A0** for $S =$ −22.5 ONLY
		6	

Question	Answer	Marks	Guidance
7(b)	$(their\,17.7935\ldots) - F = 0.6a$ OR $30\cos 30 + 15\cos 45 - 20\cos 20 - F = 0.6a$ OR $(their\,S)\cos(their\,\alpha) - F = 0.6a \quad [17.8025 - F = 0.6a]$	***M1**	Using N2L with correct number of dimensionally correct terms, allow sign errors, allow sin/cos mix. $their\,17.7935$ must have come from horizontal component from **7(a)** with only sign errors and sin/cos mix allowed. May be using $their\,F$ and/or $their\,a$ which may be incorrect. OR $(their\,S)\cos(their\,\alpha) - F = 0.6 \times a$ so in this case dependent on all 3 **M** marks in part **(a)** and must be using cosine.
	$2 = 0 + \frac{1}{2}a \times 3^2 \quad \left[a = \frac{4}{9}\right]$	***M1**	Use of $s = ut + \frac{1}{2}at^2$ or other complete method to get an equation in a, using $s = 2, u = 0$ and $t = 3$.
	$R = their(13.7661\ldots) + 0.6g \quad [= 19.7661\ldots]$ OR $R = 25 + 15\sin 45 - 20\sin 20 - 30\sin 30 + 0.6g$ OR $R = (their\,S)\sin(their\,\alpha) + 0.6g \quad [R = 13.759 + 0.6g]$	***B1FT**	$their\,13.7661$ must have come from vertical component from **7(a)** with only sign errors and sin/cos mix allowed. OR $R = (their\,S)\sin(their\,\alpha) + 0.6g$ so in this case dependent on all 3 **M** marks in **7(a)** and must be using sine
	$(their\,17.7935)\ldots - \mu \times 19.7661 = 0.6 \times \left(their\,\frac{4}{9}\right)$	**DM1**	**Dependent on all previous marks.** Use of $F = \mu R$ to get an equation in μ only.
	$\mu = 0.887$	**A1**	0.886711… Condone 0.886. Condone 0.888.

Question	Answer	Marks	Guidance
7(b)	**Alternative scheme for using energy**		
	$\frac{1}{2}\times 0.6\times v^2=(their\,17.7935)\times 2-F\times 2$ OR $\frac{1}{2}\times 0.6\times v^2=(30\cos 30+15\cos 45-20\cos 20)\times 2-F\times 2$ OR $\frac{1}{2}\times 0.6\times v^2=(their\,S)\cos(their\,\alpha)\times 2-F\times 2$	***M1**	Work energy equation with correct number of dimensionally correct terms, allow sign errors, allow sin/cos mix. *their* 17.7935 must have come from horizontal component from **7(a)** with only sign errors and sin/cos mix allowed. May be using *their* F and/or *their* v which may be incorrect. $\frac{1}{2}\times 0.6\times v^2=(their\,S)\cos(their\,\alpha)\times 2-\ F\times 2$, so in this case dependent on all 3 **M** marks in **7(a)** and must be using cosine.
	$2=\frac{1}{2}(0+v)\times 3\ \left[v=\frac{4}{3}\right]$	***M1**	Use of $s=\frac{1}{2}(u+v)t$ or other complete method to get an equation in v, using $s=2$, $u=0$ and $t=3$.
	$R=their(13.7661\ldots)+0.6g\ [=19.7661\ldots]$ OR $R=25+15\sin 45-20\sin 20-30\sin 30+0.6g$ OR $R=(their\,S)\sin(their\,\alpha)+0.6g\ \ [R=13.759+0.6g]$	***B1FT**	*their* 13.7661 must have come from vertical component from **7(a)** with only sign errors and sin/cos mix allowed. Or $R=(their\,S)\sin(their\,\alpha)+0.6g$ so in this case dependent on all **M** marks in **7(a)** and must be using sine.
	$\frac{1}{2}\times 0.6\times\left(their\,\frac{4}{3}\right)^2=(their\,17.7935)\times 2-19.7661\times\mu\times 2$	**DM1**	**Dependent on all previous marks.** Use of $F=\mu R$ to get an equation in μ only.
	$\mu=0.887$	**A1**	0.886711… Condone 0.886. Condone 0.888.
		5	