CAMBRIDGE
International Education

Cambridge International AS & A Level

MATHEMATICS **9709/43**

Paper 4 Mechanics **May/June 2026**

MARK SCHEME

Maximum Mark: 50

Published

This mark scheme contains the instructions and marking guidance that our examiners used to mark candidate responses for this component.

Before they start marking, examiners complete a standardisation process. They review a range of candidate responses and discuss the mark scheme in detail to agree which answers can and cannot be accepted. Examiners award marks where it is clear that candidate responses have met the requirements of the mark scheme. These requirements may vary between different components or different versions of the same component, depending on the exact requirements of the question and the candidate responses seen during the standardisation process.

Sometimes, our mark schemes may allow marks to be awarded to responses which contain elements that are factually incorrect or for content not covered by the syllabus. We do this in response to the demands of a specific question to support candidates and make sure that our assessments are fair. However, these allowances should not be used as a guide for teaching and learning.

We cannot discuss the mark scheme with schools, and we recommend that schools read the mark scheme together with the assessment material and the Principal Examiner Report for Teachers.

General marking principles

All examiners must apply these marking principles when marking candidate responses.

1	Examiners must award marks for each response in line with: • the specific **content** defined in the mark scheme • the specific **skills** defined in the mark scheme or in the level descriptions • the **standard of response** required as exemplified by the standardisation scripts.
2	Examiners must award **whole marks** (not half marks, or other fractions).
3	Examiners must award marks **positively**. This means that: • marks are not deducted for errors or omissions • marks are awarded for correct/valid answers as defined in the mark scheme and also for **other valid answers** which go beyond the scope of the syllabus and mark scheme referring to your team leader as appropriate • the quality of spelling, punctuation and grammar are judged **only** when the mark scheme indicates that these features are **specifically assessed** in the question. However, the meaning of all responses must be unambiguous.
4	Examiners must **consistently** apply the requirements of the mark scheme and any rules for what to do when candidates have not followed instructions correctly.
5	Examiners must use the **full range of marks** defined in the mark scheme, unless limited by the quality of the candidate responses seen.
6	Examiners must award marks according to the mark scheme and **must not** award marks with grade thresholds or grade descriptions 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

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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(a)	$u - g \times 5 = 0$ or $u \times 4 + \frac{1}{2} \times (-g) \times 4^2 = u \times 6 + \frac{1}{2} \times (-g) \times 6^2 \quad (\Rightarrow 4u - 80 = 6u - 180)$	**M1**	Setting up an equation in u only e.g. $u - 40 = 0 + 10 \times \left(6 - \frac{1}{10}u\right)$, $10 = u + (-g) \times 4$ Allow sign errors only.
	$u = 50$	**A1**	
		2	
1(b)	$0^2 = (their\ 50)^2 + 2 \times (-g) \times s$	**M1**	Or other complete method to find the maximum height e.g. $s = (their\ 50) \times 5 + \frac{1}{2} \times (-g) \times 5^2$ (may see *their t* (which if correct is 5) being derived from $0 = their\ 50 + (-g) \times t$) - allow sign errors only.
	Greatest height = 125 m	**A1**	CAO.
		2	

Question	Answer	Marks	Guidance
2(a)	$v = 2t^2 - 6t - 3 \Rightarrow a = 4t - 6$	**M1**	For $kt - 6$ where $k \neq 0, 2$.
	1.5 s	**A1**	OE, e.g. $\frac{3}{2}, \frac{6}{4}$.
		2	

Question	Answer	Marks	Guidance
2(b)	For attempt at integration	*M1	The power of t must increase by 1 with a change of coefficient in the same term. Use of $s = vt$ scores **M0**.
	$s = \frac{2}{3}t^3 - 3t^2 - 3t\ [+c]$	A1	Allow un-simplified.
	$\frac{2}{3}\times 3^3 - 3\times 3^2 - 3\times 3\ [-0]\ [= -18]$ or $[0] - \left(\frac{2}{3}\times 3^3 - 3\times 3^2 - 3\times 3\right)\ [= 18]$	DM1	Correct use of correct limits 3 [and 0]. Can be implied following their expression for s (so do not need to see the 3 [and 0] explicitly substituted if their value follows correctly).
	Distance = 18 m	A1	Condone $\frac{2}{3}\times 3^3 - 3\times 3^2 - 3\times 3 = 18$ for this mark. **A0** for -18 as a final answer. **SC** If **no** integration seen then $\int_0^3 \left(2t^2 - 6t - 3\right)\mathrm{d}t = -18$ **B1** $\left\lvert\int_0^3 \left(2t^2 - 6t - 3\right)\mathrm{d}t\right\rvert = 18$ **B2** (condone lack of modulus).
		4	

Question	Answer	Marks	Guidance
3	$R = mg\cos 30$ $[= 5m\sqrt{3}]$	**B1**	
	$20 - F - mg\sin 30 = m \times 2$	***M1**	Use of N2L. Correct number of terms. Allow sin/cos mix, allow sign errors. Must include a component of the weight not mass. Allow F or their (possibly incorrect) expression for F.
	$20 - 0.4 \times mg\cos 30 - mg\sin 30 = m \times 2$ $\left[\Rightarrow 20 - 2\sqrt{3}m - 5m = 2m\right]$	**DM1**	For use of $F = 0.4R$ to get a dimensionally correct equation in m only where R is either $mg\cos 30$ or $mg\sin 30$ only.
	$m = 1.91$	**A1**	AWRT, 1.91 (1.911296…) or exact $\frac{20}{7 + 2\sqrt{3}}$.
		4	

Question	Answer	Marks	Guidance
4	$170 = 32t + \frac{1}{2}at^2 \quad \left[\Rightarrow 340 = 64t + at^2\right]$	*B1	One correct equation in a and t.
	$280 = 32 \times 2t - \frac{1}{2}a \times (2t)^2 \left[\Rightarrow 280 = 64t - 2at^2\right]$ or $280 = (32 - 2at) \times 2t + \frac{1}{2}a \times (2t)^2$ or $32 = \frac{280}{t} - 32 + a \times (2t)$ or $280 = \left(\frac{280}{t} - 32\right) \times 2t + \frac{1}{2}a \times (2t)^2$ or $32 = \sqrt{1024 - 560a} + 2at \quad \left[\Rightarrow 4at^2 - 128t + 560 = 0\right]$ or $32 - 2at = \frac{140}{t} - a \times t$	*B1	A second (**different**) correct equation in a and t – missing brackets must be recovered for this mark. Note that the second equation might be from considering the whole journey from A to C e.g. $450 = (32 - 2at) \times 3t + \frac{1}{2}a \times (3t)^2$ **or** $60 = 3at^2$ etc. Second equation may be implied by taking the first equation, re-arranging (possibly incorrectly) for either a or t and then substituting into what would be a correct second equation.
	Forming an equation in a or t only	DM1	E.g. $\frac{340 - 64t}{t^2} = \frac{128t - 560}{4t^2}$, $340 = 64t + 20$, $170 = 32t + \frac{1}{2} \times \left(\frac{128t - 560}{4t^2}\right) \times t^2$ etc. Must have come from two correct equations but allow slips/errors in the re-arranging (of one equation) before substitution to obtain an equation in a or t only. If correct the speed at A is $24\,\text{m s}^{-1}$ and the speed at C is $36\,\text{m s}^{-1}$.
	$t = 5$	A1	WWW.
	$a = 0.8$	A1	WWW.
		5	

Question	Answer	Marks	Guidance
5(a)	$80000 = 25F \quad [\Rightarrow F = 3200]$	***B1**	For correct use of $P = Fv$.
	Use of N2L on lorry or trailer or system	***M1**	Must have the correct number of correct relevant terms. Allow sign errors. Masses must be correct for their equation(s). With F or using their (possibly incorrect) $F \neq 8000$.
	$F - 2400 - T = 13500a$ $T - 400 = 2500a$ $F - 2400 - 400 = 16000a$	**A1**	For two correct equations (see below for consistent alternatives where acceleration is taken as positive in the opposite direction). With F or using their (possibly incorrect) $F \neq 8000$.
	Attempt to solve for T	**DM1**	Must get to '$T =$'. Must have correct number of relevant dimensionally correct terms in the equation(s) which they are using to find T. Allow sign errors.
	$[a = 0.025 \Rightarrow]$ Tension $= 462.5$ N	**A1**	Allow 463. Note that the following equations and solving to obtain $a = -0.025$ and therefore $T = 462.5$ is correct $-F + 2400 + T = 13500a$ $-T + 400 = 2500a$ $-F + 2400 + 400 = 16000a$.
		5	

Question	Answer	Marks	Guidance
5(b)	Change in KE = $\pm\left(\frac{1}{2}\times(13500+2500)\times30^2-\frac{1}{2}\times(13500+2500)\times27^2\right)$ $\left[\Rightarrow\pm(7200000-5832000)=\pm1368000\right]$	**B1**	For correct change in KE. $\pm\left(\frac{1}{2}\times16000\times30^2-\frac{1}{2}\times16000\times27^2\right)$
	Change in PE = $\pm(13500+2500)g\times x\sin5$	**B1**	For correct change in PE (allow any letter for x). $\pm16000g\times x\sin5$
	Work done against resistance = $\pm(2500+500)x$ $\left[\Rightarrow\pm3000x\right]$	**B1**	For correct change in WD against resistance.
	$55000+16000g\times x\sin5-3000x=\frac{1}{2}\times16000\times30^2-\frac{1}{2}\times16000\times27^2$ $\left[\Rightarrow55000+(13944.91...)x-3000x=7200000-5832000\right]$	**M1**	Attempt at work energy equation with 5 dimensionally correct relevant terms. Must be using the correct total mass of 16000. Allow sign errors but must be a change in KE. Allow sin/cos mix. Change in PE must involve sin 5 or cos 5 but **M0** if work done against resistance includes sin 5 or cos 5.
	Distance AB = 120 m	**A1**	AWRT 120 (119.9643…). **Use of N2L and SUVAT is no marks**.
		5	

Question	Answer	Marks	Guidance
6(a)	Attempt to resolve in any direction to form an expression for either the vertical or horizontal component	***M1**	Must have correct number of relevant terms (forces must have components as required). Allow sin/cos mix and sign errors ONLY so **no** misreads in this part.
	Vertical component $= \pm(40\sin 30 + 50\sin 40 - 65\sin 60)$ $[= \mp 4.15227...]$	**A1**	
	Horizontal component $= \pm(-40\cos 30 + 50\cos 40 + 65\cos 60)$ $[= \pm 36.16120...]$	**A1**	
	For attempt to find resultant or direction	**DM1**	From equations with the correct number of relevant terms. Allow sin/cos mix. Allow sign errors.
	Resultant = 36.4 N e.g. 6.6° below negative x-axis or bearing of 263° or 173° clockwise from the positive x-axis or 6.6° anticlockwise from the negative x-axis or 6.6° below the west	**A1**	For both correct – AWRT 36.4 (36.3988…) **and** 6.5 or 6.6 (6.55039…). Giving an angle only is insufficient. Direction may be seen on a diagram, with minimum of the angle marked and an arrow on resultant. Arrows on both components only is **A0** as it doesn't show the direction of the resultant. If both words and diagram are contradictory mark the words. However, the direction is stated, it must be able to be drawn uniquely.
		5	

Question	Answer	Marks	Guidance
6(b)	$F\sin 30 + 50\sin 40 = 65\sin 60$	***M1**	Resolving vertically to form an equation. Must have correct number of relevant terms (forces must have components as required). Allow sign errors ONLY so do **not** allow sin/cos mix **nor** misreads in this part. For reference if correct $F = 48.30454...$ If obtaining $F = 81.75536...$ from considering resultant in x-direction being zero, then **M0**.
	$\pm(50\cos 40 + 65\cos 60 - (\textit{their } F)\times\cos 30)$	**DM1**	Resolving horizontally to form an expression. Must have correct number of relevant terms (forces must have components as required) using *their* value of F. Allow sign errors ONLY so do **not** allow sin/cos mix.
	29 N in the negative x-direction	**A1**	AWRT 29 (28.96926…) + correct direction. Allow e.g. 'along x-axis to the left', 'towards -ve x-axis', 'along -x axis', 'left horizontally', '180° to the positive x-axis', 'parallel to the x-axis moving in the negative direction', 'to the west', etc. **A0** for 'to the left' only. A single arrow pointing to the left is **not** sufficient.
		3	

Question	Answer	Marks	Guidance
7(a)	For P: $R = 2g \times 0.96$ $[\Rightarrow 19.2]$	**B1**	$2g \times \cos(\sin^{-1} 0.28)$, $2g \times \cos(16(.2602...))$ but must have a numerical value for $\cos\alpha$ or α.
	$F = 0.2 \times (0.96 \times 2g)$ $[\Rightarrow 0.2 \times 19.2 = 3.84]$	**M1**	For use of $F = 0.2R$ where $R = 2g \times 0.96$ or $R = 2g \times 0.28$ ONLY (or in terms of cos(16) or sin(16) or better) but must have a numerical value for either $\cos\alpha$ or $\sin\alpha$ or α.
	For P: $2g \times 0.28 - F = 2a$ $[\Rightarrow 2g \times 0.28 - 3.84 = 2a]$	**M1**	N2L for P parallel to the plane. Correct number of dimensionally correct terms and must have numerical values for either $\cos\alpha$ or $\sin\alpha$ or α. Allow sin/cos mix and sign errors. With F or using their (possibly incorrect) F.
	$a = 0.88$ m s^{-2}	**A1**	**AG** $20 \times 0.28 - 0.2 \times \left(20\cos\left(\sin^{-1} 0.28\right)\right) = 2a$ or $10 \times 0.28 - 0.2 \times \left(10\cos\left(\sin^{-1} 0.28\right)\right) = a$ followed by $a =$ 0.88 scores the first four marks. Minimum for the first four marks is '$5.6 - 3.84 = 2a \Rightarrow a = 0.88$' Condone for the first four marks $20\sin(16(.26...)) - 0.2 \times (2 \times 10 \times \cos(16(.26...)) = 2a$ followed by $a = 0.88$ **but** $a = 0.8799\ldots$ is **B1 M1 M1 A0**
			SC for first four marks $2g\sin\alpha - 0.2 \times 20\cos\alpha = 2a$ $(\Rightarrow 1.76 = 2a)$ followed by $a = 0.88$ with $\cos\alpha = 0.96$ stated but NOT substituted is **B0 M1 M1 A0** (as this is an **AG**). $2g\sin\alpha - 0.2 \times 20\cos\alpha = 2a$ $(\Rightarrow 1.76 = 2a)$ followed by $a = 0.88$ with $\cos\alpha = 0.96$ NOT stated is **B0M0M0A0** (as this is an **AG**).

Question	Answer	Marks	Guidance
7(a)	For Q: $-5g\times0.28-0.2\times(0.96\times5g)=5a$ or $5g\times0.28+0.2\times(0.96\times5g)=5a$ $[\Rightarrow -5g\times0.28-9.6=5a\Rightarrow a=-4.72]$	*M1	N2L for Q parallel to the plane – allow sign errors and sin/cos mix. Must be using the correct value of μ. A value of ±4.72 with no working implies this mark. Can be done independent of the mass of Q e.g. $-g\times0.28-0.2\times(0.96\times g)=a$. Stating 0.88 for Q with no working is **M0** but allow this value coming from incorrect working.
	$s_P=8\times0.25+\frac{1}{2}\times0.88\times0.25^2$ $[=2.0275]$ or $s_Q=u\times0.25+\frac{1}{2}\times(-4.72)\times0.25^2$ $[=0.25u-0.1475]$	*M1	For correct use of $s=ut+\frac{1}{2}at^2$ for either P **or** Q, for P must be using the correct values, for Q must be using the correct t and *their* $\pm a$.
	$2.0275+0.25u-0.1475=3$	DM1	For forming an equation for u only with $s_P+s_Q=3$ from equations for s_P and s_Q that are dimensionally correct and of the correct form. Must be using the correct values for P and must be using correct t and *their* $\pm a$ for Q.
	$u=4.48$	A1	Note that this accuracy mark is independent of the first four marks in this part.
		8	

Question	Answer	Marks	Guidance
7(b)	Velocity of P before impact: $=\pm(8+0.88\times0.25)$ $[\Rightarrow\pm8.22]$	***B1**	Correct expression for the velocity (or velocity squared) of P before impact e.g. $v_P{}^2=8^2+2\times0.88\times2.0275$.
	For reference the velocity of Q before impact is $\pm(4.48-4.72\times0.25)$ $[\Rightarrow\pm3.3]$		
	$5\times3.3-2\times8.22=-5\times0.5+2\times v$ $[\Rightarrow v=1.28]$	***DM1**	Attempt at conservation of momentum – correct number of dimensionally correct terms. Allow sign errors but *their* RHS must include a 5×0.5 and a $2v$ term. Including g is **M0**. If using 8 for the velocity of P and/or *their* u from **7(a)** for the velocity of Q, then **M0**. Dependent on the previous **B1** mark.
	$-2g\times0.28-0.2\times(0.96\times2g)=2a$ $[-2g\times0.28-3.84=2a\Rightarrow a=-4.72]$ or $2g\times0.28+0.2\times(0.96\times2g)=2a$ $[2g\times0.28+3.84=2a\Rightarrow a=4.72]$	***M1**	For N2L with correct number of dimensionally correct terms. Allow sin/cos mix but do **not** allow sign errors (so the two terms on the LHS must have the same sign). If acceleration is stated or derived as ±0.88 then **M0**. Allow stating *their* acceleration for Q from **7(a)** but must have come from an equation which did not contain sign errors. **Not** dependent on any previous mark.
	$0=1.28^2+2\times(-4.72)\times s$ or $0=1.28+(-4.72)\times t\Rightarrow t=\frac{16}{59}$ $(=0.27118\ldots)$ followed by $s=1.28\times0.2711...+\frac{1}{2}\times(-4.72)\times(0.2711...)^2$	**DM1**	Complete method to find required distance. Must be using final speed as 0. Their a must be negative $(\neq-0.88)$ and using *their* 1.28. **Dependent on all previous marks in this part**.
	Distance = 0.174 m	**A1**	AWRT 0.174 (0.173559…) or $\frac{256}{1475}$.
		5	