



Mark Scheme

Mock Set 2

Pearson Edexcel GCE Mathematics
Advanced Subsidiary Level in Mathematics
Paper 22 8MA0/22 Mechanics

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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.

EDEXCEL GCE MATHEMATICS

General Instructions for Marking

1. The total number of marks for the paper is 30.
2. The Edexcel Mathematics mark schemes use the following types of marks:
 - **M** marks: method marks are awarded for 'knowing a method and attempting to apply it', unless otherwise indicated.
 - **A** marks: Accuracy marks can only be awarded if the relevant method (M) marks have been earned.
 - **B** marks are unconditional accuracy marks (independent of M marks)
 - Marks should not be subdivided.
3. 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 $\checkmark$ 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
 - $\square$ The second mark is dependent on gaining the first mark
4. 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.
5. Where a candidate has made multiple responses and indicates which response they wish to submit, examiners should mark this response.

If there are several attempts at a question which have not been crossed out, examiners should mark the final answer which is the answer that is the most complete.
6. Ignore wrong working or incorrect statements following a correct answer.
7. Mark schemes will firstly show the solution judged to be the most common response expected from candidates. Where appropriate, alternative answers are provided in the notes. If examiners are not sure if an answer is acceptable, they will check the mark scheme to see if an alternative answer is given for the method used.

General Principles for Mechanics Marking

(But note that specific mark schemes may sometimes override these general principles)

- Rules for M marks: correct no. of terms; dimensionally correct; all terms that need resolving (i.e. multiplied by cos or sin) are resolved.
 - 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 has been awarded.
 - Any numerical answer which comes from use of $g = 9.8$ should be given 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
 - Mechanics Abbreviations

M(A)	Taking moments about A.
N2L	Newton's Second Law (Equation of Motion)
NEL	Newton's Experimental Law (Newton's Law of Impact)
HL	Hooke's Law
SHM	Simple harmonic motion
PCLM	Principle of conservation of linear momentum
RHS, LHS	Right hand side, left hand side.

Question	Scheme		Marks	AOs
1(a)				
	Shape		B1	1.1b
	Figures: V, 16, 18, 5, 20, 25		B1	1.1b
			(2)	
(b)	Complete method to find the value of V		M1	3.4
	$\left(\frac{1}{2}(18+V) \times 5\right)+15 V+\left(\frac{1}{2}(V+16) \times 5\right)=325$		A1	1.1b
			A1	1.1b
	V = 12		A1	1.1b
			(4)	
(c)	$\frac{18-12}{5}$		M1	3.1b
	1.2 (m s ⁻²)		A1	1.1b
			(2)	
(8 marks)				
Notes:				
(a)	B1	Overall shape		
	B1	Figures marked clearly (allow delineators where appropriate)		
(b)	M1	Total area = 325 oe to produce an equation in V only (must have correct number of sections with appropriate number of $\frac{1}{2}$'s)		
	A1	Correct equation with at most one error		
	A1	Correct equation		
	A1	cao		
(c)	M1	Correct method (allow subtraction reversed) using their V		
	A1	cao (must be positive)		

Question		Scheme	Marks	AOs
2(a)		Differentiate x wrt t	M1	3.1a
		$(v \Rightarrow) 12t^2 - 42t + 36$	A1	1.1b
			(2)	
(b)		$12t^2 - 42t + 36 = 0$	M1	3.1a
		$t = (1.5) \text{ or } 2$	A1	1.1b
		$x = 4 \times 2^3 - 21 \times 2^2 + 36 \times 2 + 1$	M1	1.1b
		21 (m)	A1	1.1b
			(4)	
(c)		Differentiate v wrt t	M1	3.1a
		$(a \Rightarrow) 24t - 42$	A1	1.1b
			(2)	
(8 marks)				
Notes:				
(a)	M1	Differentiate x , with at least 2 powers decreasing by 1		
	A1	Correct expression		
(b)	M1	Equate their v to 0 (Must have attempted to differentiate x to find v and be solving a 3 term quadratic)		
	A1	cao		
	M1	Use the larger of their t -values in the given x expression		
	A1	cao		
(c)	M1	Differentiate their v , with at least 1 power decreasing by 1		
	A1	cao		

Question		Scheme	Marks	AOs
3		$(2\mathbf{i} - \mathbf{j}) + (c\mathbf{i} - 13.4\mathbf{j}) = m(10\mathbf{i} - 24\mathbf{j})$	M1	3.1a
		Equate coefficients of $\mathbf{i}$ and $\mathbf{j}$	M1	2.1
		$2 + c = 10m$ and $-1 - 13.4 = -24m$	A1	1.1b
		$c = 4$	A1	1.1b
			(4)	
(4 marks)				
Notes:				
3	M1	Use of $\mathbf{F} = m\mathbf{a}$		
	M1	Allow inclusion of $\mathbf{i}$ and $\mathbf{j}$ on both sides		
	A1	No vectors in equations, seen or implied		
	A1	cao		

Question		Scheme	Marks	AOs
4(a)		Equation of motion for P	M1	3.3
		$5mg - \frac{10mg}{3} = 5ma$	A1	1.1b
		$a = \frac{g}{3}$	A1	1.1b
		Equation of motion for Q or whole system	M1	3.4
		$\frac{10mg}{3} - Mg = M \frac{g}{3}$ or $5mg - Mg = (5m + M) \frac{g}{3}$	A1ft	1.1b
		$M = \frac{5m}{2}$	A1	1.1b
			(6)	
(b)		$\frac{5}{6} = \frac{1}{2} \times \frac{g}{3} T^2$	M1	2.1
		$T = 0.71$ or 0.714 (s)	A1	1.1b
			(2)	
(c)		e.g. Air resistance would slow the particle down so it would take longer to hit the ground oe	M1	2.4
		$T_1 > T$	A1	3.5a
			(1)	
(10 marks)				
Notes:				
(a)	M1	Correct number of terms, condone sign errors		
	A1	Correct equation		
	A1	cao		
	M1	Correct number of terms, condone sign errors		
	A1ft	Correct equation ft on their a		
	A1	cao		
(b)	M1	Complete method to find T using their a (provided it's not g)		
	A1	cao		
(c)	M1	An appropriate comment about the effect of air resistance		
	A1	cao		

