GCE 2005
January Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Mathematics A
(MAM1)

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales 3644723 and a registered charity number 1073334. Registered address AQA, Devas Street, Manchester. M15 6EX. *Dr Michael Cresswell Director General*

Key to Mark Scheme

M ..... mark is for ..... method
m ..... mark is dependent on one or more M marks and is for ..... method
A ..... mark is dependent on M or m marks and is for ..... accuracy
B ..... mark is independent of M or m marks and is for ..... method and accuracy
E ..... mark is for ..... explanation
√ **or ft or F** ..... follow through from previous incorrect result
CAO ..... correct answer only
AWFW ..... anything which falls within
AWRT ..... anything which rounds to
AG ..... answer given
SC ..... special case
OE ..... or equivalent
A2,1 ..... 2 or 1 (or 0) accuracy marks
-*x* EE ..... deduct *x* marks for each error
NMS ..... no method shown
PI ..... possibly implied
SCA ..... substantially correct approach
c ..... candidate
SF ..... significant figure(s)
DP ..... decimal place(s)

Abbreviations used in Marking

MC – *x* ..... deducted *x* marks for mis-copy
MR – *x* ..... deducted *x* marks for mis-read
ISW ..... ignored subsequent working
BOD ..... given benefit of doubt
WR ..... work replaced by candidate
FB ..... formulae booklet

Application of Mark Scheme

No method shown:
Correct answer without working ..... mark as in scheme
Incorrect answer without working ..... zero marks unless specified otherwise

More than one method/choice of solution:
2 or more complete attempts, neither/none crossed out — mark both/all fully and award the mean mark rounded down
1 complete and 1 partial attempt, neither crossed out — award credit for the complete solution only

Crossed out work — do not mark unless it has not been replaced

Alternative solution using a correct or partially correct method — award method and accuracy marks as appropriate

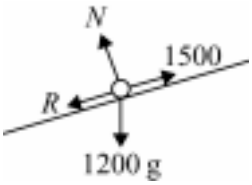
MAM1/W

Q	Solution	Marks	Total	Comments
1(a)	$= \frac{1}{2}(3+V)4$	M1		Full method, (a = 1)
	$V = 7$	A1	2	
(b)(i)	$= 2V$ (=14)	M1		Alternative: Time = $T - 4$
	$S_1 = \frac{1}{2} \times t_2 \times V$	M1		Full method $35 = \frac{1}{2}(T-4+2)\times V$
	$21 = \frac{7}{2} t_2$	A1		Correct subs $35 = \frac{1}{2}(T-2)7$
	$= 6 \quad t = 12$	A1F	4	ft one slip $T = 12$
(ii)	$= \pm\frac{7}{6}$ =1.17 (1.1666..)	M1A1F	2	Accept $\pm$ ft time
(c)	erage speed = $\frac{\text{Total distance}}{\text{time}} = \frac{55}{12}$	M1		Attempt at full area for distance
	$= 4\frac{7}{12}$ (4.5833)	A1F	2	ft time
	Total		**10**	
2(a)	$(3t^2 - 9)\mathbf{i} + 6t\mathbf{j}$	B1B1	2	B1 each term (Vector expressions needed throughout)
(b)	$= (t^2 - 3)\mathbf{i} + 2t\mathbf{j}$	B1F	1	Accept unsimplified
(c)	$(m\mathbf{v}) = 2t\mathbf{i} + 2\mathbf{j}$	M1A1F		Alternative, $\mathbf{F} = m\mathbf{a}$ used, $\mathbf{a} = 6t\mathbf{i} + 6\mathbf{j}$ M1: Differentiation and attempt at $\mathbf{F} = m\mathbf{a}$
	2, $\mathbf{F} = 4\mathbf{i} + 2\mathbf{j}$	A1F	3	$\mathbf{F} = 2t\mathbf{i} + 6\mathbf{j}$ A1F $\mathbf{F} = 4\mathbf{i} + 2\mathbf{j}$ A1F
	Total		**6**	

MAM1 (cont)

Q	Solution	Marks	Total	Comments
3(a)	$0.1\begin{bmatrix}8\\12\end{bmatrix}+0.2\,\mathrm{V}=\ 0.1\begin{bmatrix}-2\\6\end{bmatrix}+0.2\begin{bmatrix}6\\0\end{bmatrix}$	M1A1		M1: correct use of momentum principle and 4 momentum terms
	$0.2\mathbf{V}=\begin{vmatrix}0.2\\0.6\end{vmatrix}$	A1F		ft one slip
	$\mathbf{V}=\begin{bmatrix}1\\-3\end{bmatrix}$	A1F	4	ft one slip
(b)(i)	$S_A=\begin{bmatrix}-4\\12\end{bmatrix}\qquad S_B=\begin{bmatrix}12\\0\end{bmatrix}$	B1B1	2	
(ii)	$\mathbf{d}=\pm\begin{bmatrix}16\\-12\end{bmatrix}$	M1		Attempt at subtraction
	$\lvert\mathbf{d}\rvert=\sqrt{\left(16^2+\left(-12\right)^2\right)}=20$	M1A1F	3	M1: magnitude of vector with two non-zero terms, + needed
	Total		**9**	
4(a)	$R=2\times 9.8,\ \ F=\frac{1}{7}\times 2\times 9.8=2.8\mathrm{N}$	M1A1	2	CAO M1: full method with 2×9.8, accept inequality
(b)(i)	$P=1,\qquad F=1\mathrm{N}$	B1	1	
(ii)	$P=5,\qquad F=2.8$	B1		Used
	$5-2.8=2a$	M1A1		M1: 3 terms, with forces subtracted
	$a=1.1\ \mathrm{ms}^{-2}$	A1F	4	ft one slip
	Total		**7**	

MAM1 (cont)

Q	Solution	Marks	Total	Comments
5(a)(i)		B1 B1	2	3 correct & labelled All correct & labelled, no extras Ignore additional components of weight
(ii)	$1500 = R + 1200\times 9.8\times \frac{1}{14}$	M1A2		M1: 3 terms with component attempted ($\alpha = 4.096$) – 1 each error
	$R = 660$	A1	4	AWRT
(iii)	15ms^{-1}	B1	1	
(b)(i)	$-\frac{1500}{1200}$	M1		Accept $\pm$
	Mag of retardation = 1.25 ms^{-2}	A1	2	
(ii)	$0 = 15 + (-1.25)\,t$	M1		velocities correct, but accept $\pm$ acceleration
	$t = 27.3$ sec (27.27)	A1F	2	ft one slip
	Total		**11**	
6(a)	$0 = (14\cos 60)^2 - 2\times 9.8\times h$	M1		Full method and component of u attempted, v may be present
		A2		– 1 each error including $v \neq 0$
	$h = 2.5$m	A1F	4	AWRT ft cos 30, or + g used
(b)	$2.5 = \frac{1}{2}\times 9.8\times t^2$	M1A1F		M1: full method for time or half time of flight ft h, need signs consistent for A1
	$t = 0.714$ sec $\left(\text{or } \frac{5}{7}\right)$	A1F	3	
	Total		**7**	

MAM1 (cont)

Q	Solution	Marks	Total	Comments
7(a)	$5mg - T = 5m\frac{g}{4}$	M1		3 terms, recognisable, accept *m* missing or *g* missing once
		A1		all correct & algebraic
	$T = 15m\frac{g}{4}$ $= 3.75\ mg$	A1F	3	ft 9.8 used, one *g* missing, *m* missing, sign error provided *T* positive
(b)	$T - kmg = km\frac{g}{4}$	M1A1		as in (a)
	$k = 3$	A1	3	CAO, following fully correct work in (a) & (b)
(c)	Force $= 2T = \frac{15mg}{2}$ $= 7.5\ mg$	B1F	1	
(d)	$t = \frac{2}{3}$			
	$x = 0 + \frac{1}{2} \times \frac{g}{4} \times \frac{4}{9}$ accept $\left(\frac{2}{3}\right)^2$	M1		method for *x*, and $\frac{g}{4}$ used for acceleration
		A1		accept 9.8 substituted
	$d = 2x = \frac{g}{9}$	A1	3	Fully correct, in terms of *g*
	Total		**10**	
	Total		**60**	