OCR
Oxford Cambridge and RSA

GCE

Quantitative Methods (MEI)

Unit **G244**: Introduction to Quantitative Methods (MEI)

Advanced Subsidiary GCE

Mark Scheme for June 2018

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Annotations and abbreviations

Annotation in scoris	**Meaning**
✓and ✗	
BOD	Benefit of doubt
FT	Follow through
ISW	Ignore subsequent working
M0, M1	Method mark awarded 0, 1
A0, A1	Accuracy mark awarded 0, 1
B0, B1	Independent mark awarded 0, 1
SC	Special case
^	Omission sign
MR	Misread
Highlighting	
Other abbreviations in mark scheme	**Meaning**
E1	Mark for explaining
U1	Mark for correct units
G1	Mark for a correct feature on a graph
M1 dep*	Method mark dependent on a previous mark, indicated by *
cao	Correct answer only
oe	Or equivalent
rot	Rounded or truncated
soi	Seen or implied
www	Without wrong working

Subject-specific Marking Instructions for GCE Mathematics (MEI) Mechanics strand

a Annotations should be used whenever appropriate during your marking.

The A, M and B annotations must be used on your standardisation scripts for responses that are not awarded either 0 or full marks. It is vital that you annotate standardisation scripts fully to show how the marks have been awarded.

For subsequent marking you must make it clear how you have arrived at the mark you have awarded.

b An element of professional judgement is required in the marking of any written paper. Remember that the mark scheme is designed to assist in marking incorrect solutions. Correct *solutions* leading to correct answers are awarded full marks but work must not be judged on the answer alone, and answers that are given in the question, especially, must be validly obtained; key steps in the working must always be looked at and anything unfamiliar must be investigated thoroughly.

Correct but unfamiliar or unexpected methods are often signalled by a correct result following an *apparently* incorrect method. Such work must be carefully assessed. When a candidate adopts a method which does not correspond to the mark scheme, award marks according to the spirit of the basic scheme; if you are in any doubt whatsoever (especially if several marks or candidates are involved) you should contact your Team Leader.

d When a part of a question has two or more 'method' steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. (The notation 'dep *' is used to indicate that a particular mark is dependent on an earlier, asterisked, mark in the scheme.) Of course, in practice it may happen that when a candidate has once gone wrong in a part of a question, the work from there on is worthless so that no more marks can sensibly be given. On the other hand, when two or more steps are successfully run together by the candidate, the earlier marks are implied and full credit must be given.

e The abbreviation ft implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A and B marks are given for correct work only — differences in notation are of course permitted. A (accuracy) marks are not given for answers obtained from incorrect working. When A or B marks are awarded for work at an intermediate stage of a solution, there may be various alternatives that are equally acceptable. In such cases, exactly what is acceptable will be detailed in the mark scheme rationale. If this is not the case please consult your Team Leader.

Sometimes the answer to one part of a question is used in a later part of the same question. In this case, A marks will often be 'follow through'. In such cases you must ensure that you refer back to the answer of the previous part question even if this is not shown within the image zone. You may find it easier to mark follow through questions candidate-by-candidate rather than question-by-question.

f Unless units are specifically requested, there is no penalty for wrong or missing units as long as the answer is numerically correct and expressed either in SI or in the units of the question. (e.g. lengths will be assumed to be in metres unless in a particular question all the lengths are in km, when this would be assumed to be the unspecified unit.)

We are usually quite flexible about the accuracy to which the final answer is expressed and we do not penalise over-specification.

When a value is given in the paper
Only accept an answer correct to at least as many significant figures as the given value. This rule should be applied to each case.

When a value is not given in the paper
Accept any answer that agrees with the correct value to 2 s.f.

ft should be used so that only one mark is lost for each distinct error made in the accuracy to which working is done or an answer given. Refer cases to your Team Leader where the same type of error (e.g. errors due to premature approximation leading to error) has been made in different questions or parts of questions.

There are some mistakes that might be repeated throughout a paper. If a candidate makes such a mistake, (eg uses a calculator in wrong angle mode) then you will need to check the candidate's script for repetitions of the mistake and consult your Team Leader about what penalty should be given.

There is no penalty for using a wrong value for *g*. E marks will be lost except when results agree to the accuracy required in the question.

g Rules for replaced work

If a candidate attempts a question more than once, and indicates which attempt he/she wishes to be marked, then examiners should do as the candidate requests.

If there are two or more attempts at a question which have not been crossed out, examiners should mark what appears to be the last (complete) attempt and ignore the others.

NB Follow these maths-specific instructions rather than those in the assessor handbook.

h For a *genuine* misreading (of numbers or symbols) which is such that the object and the difficulty of the question remain unaltered, mark according to the scheme but following through from the candidate's data. A penalty is then applied; 1 mark is generally appropriate, though this may differ for some units. This is achieved by withholding one A mark in the question.

Marks designated as cao may be awarded as long as there are no other errors. E marks are lost unless, by chance, the given results are

established by equivalent working.

'Fresh starts' will not affect an earlier decision about a misread.

Note that a miscopy of the candidate's own working is not a misread but an accuracy error.

i If a graphical calculator is used, some answers may be obtained with little or no working visible. Allow full marks for correct answers (provided, of course, that there is nothing in the wording of the question specifying that analytical methods are required). Where an answer is wrong but there is some evidence of method, allow appropriate method marks. Wrong answers with no supporting method score zero. If in doubt, consult your Team Leader.

j If in any case the scheme operates with considerable unfairness consult your Team Leader.

Question			Answer	Marks	Guidance
1			39 years is $39 \times 365 \times 24$ (= 3.416×10^5 hours)	M1	Converting to hours
			$3.416 \times 10^5 \times 1.079 \times 10^9$	M1	Multiplying by speed of light
			3.686×10^{14}	A1	Power of 10 correct
			= 3.7×10^{14} km to 2 sf	A1	CAO, must be given to 2 significant figures
				[4]	

Question			Answer	Marks	Guidance
2	(i)		160	B1	
				[1]	
	(ii)		=A19*2	B1	
				[1]	
	(iii)		$2^n = 163\,840 \div 5$ $(= 32\,768)$	M1	soi
			$n = 15$	A1	
			Cell is A16	B1	
				[3]	

Question			Answer	Marks	Guidance
3	(i)		Difference = 333 – 396 = -63	B1	Allow + 63
			Percentage = $\frac{-63}{396}\times 100 = -15.9\%$	B1	CAO
			Answer rounds to (-)16% and Negative value shows it is a reduction	B1	
				[3]	
	(ii)		In Totnes town the percentage shoplifting was $\frac{34}{333}\times 100$	M1	
			$=10.2\%$	A1	Allow 10%
			In the other two regions the figures were 1.3% and 3.6% so the rate in Totnes Town was much higher	M1	Attempt at a valid comparison
			There are more shops in the town for people to steal from.	A1	
				[4]	

Question			Answer	Marks	Guidance
4	(i)		2 × 10 = 20 people over the 10 years	B1	
			83% of 20 is 16.6 so 17 males and 3 females	B1	
				[2]	
	(ii)		Female deaths per year are $3.4 \div 10 = 0.34$	M1	
			$\frac{0.34}{34\ 000\ 000} = \frac{1}{100\ 000\ 000}$ so 1 in 100 million	A1	
			For a man it is $\frac{16.6 \div 10}{33\ 000\ 000}$	B1	
			$\frac{1}{19\ 879\ 518}$ or 1 in 20 million	B1	
				[4]	
	(iii)		On average males spend more time outdoors than females	B1	Or other plausible reason
				[1]	
	(iv)		There were 47 deaths among 722 people	B1	Selection of suitable data
			Estimated probability of survival $\frac{722 - 47}{722} = 0.935$.	B1	
				[2]	

Question			Answer	Marks	Guidance
5	(i)	(*A*)	It is bell-shaped	**B1**	
		(*B*)	19 (yards)	**B1**	
				[2]	
	(ii)		95% of the distribution lies within 2 sd of the mean	**M1**	
			5% of 120 is 6, so 6 lie more than 2 sd of the mean	**A1**	
			Almost all lie within 3 sd of the mean	**B1**	
			So the 6 lie in the intervals 16-17 and 21-22		
			By symmetry there are 3 in each interval.	**A1**	
				[4]	
	(iii)		The mean is about 17 so is less than expected. (Charlie is bowling short).	**B1**	Any sensible answer.
			The standard deviation is much greater. (Charlie is not bowling consistently).	**B1**	
			(The distribution is approximately Normal.)		
				[2]	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>6</td><td>(i)</td><td></td><td>50 people</td><td>B1</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>[1]</td><td></td></tr>
<tr><td></td><td>(ii)</td><td></td><td>10 people</td><td>B1</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>[1]</td><td></td></tr>
<tr><td></td><td>(iii)</td><td></td><td><table><tr><th>Price</th><th>Attend</th><th>Income</th><th>Hall</th><th>Profit</th></tr><tr><td>4</td><td>90</td><td>360</td><td>120</td><td>240</td></tr><tr><td>6</td><td>50</td><td>300</td><td>120</td><td>180</td></tr><tr><td>14</td><td>10</td><td>140</td><td>120</td><td>20</td></tr></table></td><td>B1
B1
B1</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>[3]</td><td></td></tr>
<tr><td></td><td>(iv)</td><td>C2</td><td>= A2 * B2</td><td>B1</td><td></td></tr>
<tr><td></td><td></td><td>E6</td><td>= C6 - D6</td><td>B1</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>[2]</td><td></td></tr>
<tr><td></td><td>(v)</td><td></td><td>£4 for maximum profit</td><td>B1</td><td>Accept a different answer if it is fully justified</td></tr>
<tr><td></td><td></td><td></td><td></td><td>[1]</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
6	(vi)		Income must be greater than £120 for there to be a profit	**B1**	
			This is 40% of amount in C column so	**M1**	For using 40% or equivalent. May be implied by a trial and error method.
			$\frac{40}{100} \times C = 120 \Rightarrow C = 300$	**A1**	Or by trial and error
			She breaks even if the entry fee is £6	**B1**	Or by trial and error
			She makes a profit if it is £3. £4 or £5	**B1**	
				[5]	

Question			Answer	Marks	Guidance
7	(a)	(i)	1803 195 minutes 1945 220 minutes 2035 216 minutes	B1 B1	One correct value All three correct
				[2]	
	(a)	(ii)	Mark on the graph (5, 195) (10, 216) (11, 220)	B1 B1 [2]	One correct point All 3 points correct
			Straight line through (3, 180) and (11,220)	B1 B1	Through any one correct point Fully correct
				[2]	
	(a)	(iii)	It leaves some points on each side so it is quite good.	B1	**oe** e.g Close fit for al points.
			165 minutes is the time that a journey would take with no stops	B1	
			5 minutes is the extra time for each stop	B1	
				[3]	

Question			Answer	Marks	Guidance
7	(a)	(iv)	$5n = t - 165$	M1	Forming an equation with $5t$ on its own
			$n = \frac{t-165}{5}$ **oe**	A1	
			$t = 241 \Rightarrow n = 15.2$ so estimate15 stops	A1	
				[3]	

7	(b)	(i)	Stationary for 2 minutes	B1	
			Not at full speed for 7 minutes	B1	
				[2]	
7	(b)	(ii)	40 $m\,s^{-1}$ = 40 × 60 × 60 = 144 000 m per hour	M1	Converting from seconds to hours
			$\frac{144\ 000}{1000} = 144$ km per hour	M1	Converting from m to km
			= $\frac{144}{8} \times 5$ mph	M1	Converting from $km\,h^{-1}$ to mph
			= 90 mph. Yes, this is a realistic speed for a train	A1	Both answers required
				[4]	

Question			Answer	Marks	Guidance
7	(b)	(iii)	Acceleration is given by the gradient	M1	
			$= \frac{40}{180} = 0.22\,\text{m s}^{-2}$	A1	
				[2]	
7	(b)	(iv)	40 × 60 + ½ × 40 × 120 + ½ × 40 × 180 + 40 × 60	M1	
			10 800 m = 10.8 km	A1	
			Without stopping: 40 × 540 = 21 600 m, so 21.6 km	B1	
				[3]	
7	(b)	(v)	The train loses 21.6 - 10.8 = 10.8 km	B1	
			$\frac{10\,800}{40} = 270$ seconds = 4.5 minutes So the journey time is 4½ minutes longer	B1	
			This is close to the 5 minutes for each stop on the Paddington to Plymouth trains.	B1	
				[3]	

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