



Oxford Cambridge and RSA

Level 3 Certificate

Core Maths A (MEI)

H868/02: Critical Maths

OCR Level 3 Certificate

Mark Scheme for Autumn 2021

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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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1. **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

2. Subject-specific Marking Instructions

- 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.

- c The following types of marks are available.

M

A suitable method has been selected and *applied* in a manner which shows that the method is essentially understood. Method marks are not usually 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, eg by substituting the relevant quantities into the formula. In some cases the nature of the errors allowed for the award of an M mark may be specified.

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). Therefore M0 A1 cannot ever be awarded.

B

Mark for a correct result or statement independent of Method marks.

E

A given result is to be established or a result has to be explained. This usually requires more working or explanation than the establishment of an unknown result.

Unless otherwise indicated, marks once gained cannot subsequently be lost, eg wrong working following a correct form of answer is ignored. Sometimes this is reinforced in the mark scheme by the abbreviation isw. However, this would not apply to a case where a candidate passes through the correct answer as part of a wrong argument.

- 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 Wrong or missing units in an answer should not lead to the loss of a mark unless the scheme specifically indicates otherwise. Candidates are expected to give numerical answers to an appropriate degree of accuracy, with 3 significant figures often being the norm. Small variations in the degree of accuracy to which an answer is given (e.g. 2 or 4 significant figures where 3 is expected) should not normally be penalised, while answers which are grossly over- or under-specified should normally result in the loss of a mark. The situation regarding any particular cases where the accuracy of the answer may be a marking issue should be detailed in the mark scheme rationale. If in doubt, contact your Team Leader.
- 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 components. This is achieved by withholding one A mark in the question.

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

- i Anything in the mark scheme which is in square brackets [...] is not required for the mark to be earned, but if present it must be correct.

Question			Answer	Marks	Guidance	AOs
3	(a)		35 000	B1 [1]	OR 35 thousand Answer in range 35 000 to 36 000	AO3
3	(b)		Advantage Disadvantage	E1 E1	E.g. <ul style="list-style-type: none"> • Can see both trends on the same graph • Allows a suitable scale for each graph E.g. <ul style="list-style-type: none"> • Might be confusing • People could read the wrong scale 	AO3 AO3
				[2]		
3	(c)		Correct comment	E1	E.g. <ul style="list-style-type: none"> • Correlation does not mean causation • There could be other factors 	AO3
				[1]		
4	(a)	(i)	Total UK population is 65 million	B1 [1]	Answer in range 60 to 70 million	AO1
4	(a)	(ii)	Life span = 90	B1 [1]	70 to 100	AO2
4	(a)	(iii)	<i>Their (i) / their (ii)</i> 722 000	M1 A1 B1 [3]	ALT: Using reasonable estimates of gender split within the population and 1 to 2 children per woman Answer in range 600k to 1 million Rounded to no greater accuracy than nearest 500.	AO2 AO1 AO3

Question			Answer	Marks	Guidance	AOs	
4	(b)		12 000/ <i>their</i> 4(a)(i)	M1	May use a new estimate/ made up number.	AO2	
			1.7%	M1	May subtract 12 000 from their 4(a)(i) for denominator.	AO1	
			This is between 1% and 2%	E1	Express as %	AO3	
				[3]	Answer in range 1 to 2%		
4	(c)		1.59% is between 1% and 2%	E1	oe This does need a comment as well as the corrected value	AO3	
				[1]			
4	(d)	(i)	About 3% of people are twins	B1	2 to 4 % OR $2 \times \textit{their} \%$ in (b)	AO2	
				[1]			
4	(d)	(ii)	Anna is bound to meet people who are twins sometimes so not surprising	E1	OR only a 3% chance so surprising FT from other small percentages in (d)(i)	AO3	
				[1]			
5	(a)	(i)	1.08 × 16,141,241	M1		AO1	
				17,432,540 is close to 17.4 million	A1		AO3
					[2]		
5	(a)	(ii)	$\frac{17,410,742 - 16,141,241}{17,410,742 + 16,141,241} [= 0.0378..]$	B1	Correct denominator (33,551,983) (may work out two separate %ages)	AO2	
				B1	ALT Total = $0.722 \times 46500001 - 25359 = 33547642$	AO1	
				B1	Subtracting in numerator OR subtracting percentages		
				[3]	ALT gives $51.9\% - 48.1\% = 3.8\%$ Correct completion to get 4%	AO3	
			0.0378 × 100 ≈ 4				
5	(a)	(iii)	It's out of all those voting	E1	OE	AO3	
				[1]			
5	(b)	(i)	200	B1		AO1	
				[1]			

Question			Answer	Marks	Guidance	AOs
5	(b)	(ii)	$\frac{\sqrt{400}}{2}$	M1		AO2
			10	A1 [2]		AO1
5	(c)		184 is less than 2 sd from the mean This is not unusual so not convincing evidence (OE)	M1 A1 [2]	Comparison (FT <i>their</i> mean and sd) CAO – must be with reason	AO2 AO3

6	(a)	(i)	9	297	306	B2 B2 if all correct B1 if at least two numbers correct	AO2(1) AO2(1)
			1	693	694		
			10	990	1000		
						[2]	
6	(a)	(ii)	$\frac{9+693}{1000}$	M1		AO2	
			0.702	A1	Fraction, decimal or percentage	AO3	
				[2]			

6	(b)		<table border="1"> <thead> <tr> <th>Expected numbers</th> <th>Broken biscuits</th> <th>Acceptable biscuits</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Automatic process shows broken biscuits</td> <td>180</td> <td>240</td> <td>420</td> </tr> <tr> <td>Automatic process shows acceptable biscuits</td> <td>20</td> <td>560</td> <td>580</td> </tr> <tr> <td>Total</td> <td>200</td> <td>800</td> <td>1000</td> </tr> </tbody> </table>	Expected numbers	Broken biscuits	Acceptable biscuits	Total	Automatic process shows broken biscuits	180	240	420	Automatic process shows acceptable biscuits	20	560	580	Total	200	800	1000	<p>M1 Suitable method e.g.</p> <ul style="list-style-type: none"> table starting with 1000 (or other number) of biscuits tree diagram with frequencies or probabilities <p>Must include some correct labels</p>	AO2(3)
			Expected numbers	Broken biscuits	Acceptable biscuits	Total															
			Automatic process shows broken biscuits	180	240	420															
			Automatic process shows acceptable biscuits	20	560	580															
			Total	200	800	1000															
<p>M1 Attempt to work out “200” or “800” OR one pair of branches correct on tree diagram</p>																					
<p>M1 Enough information in table or tree diagram to work out the probability</p>																					
<p>M1</p>																					
<p>A1 Fraction, decimal or percentage</p>																					
<p>$\frac{\text{their } 180 + \text{their } 560}{\text{their } 1000}$</p> <p>0.74</p>			<p>M1</p>	AO2																	
			<p>A1 [5]</p>	AO1																	
6	(c)	Suitable comment	<p>B1 E.g.</p> <ul style="list-style-type: none"> Better when more biscuits are broken Not suitable as the only method of diagnosis Too many errors to be reliable 	AO3																	
			<p>[1]</p>																		

7	(a)	(i)	$\frac{(21.75-18.75)}{21.75} \times 100$ <p>13.79.....\approx 13.8 [%]</p>	M1	Correct use of formula in either (i) or (ii) (may be evidenced by correct decimal in either case)	AO1															
7	(a)	(ii)	<p>3.645...</p> <p>3.6[%]</p>	A1 M1 A1 [4]	Any accuracy BOTH answers to 1dp	AO1 AO1 AO3															
7	(b)		Median hourly pay for females is more. OE	E2 [2]	Must contain median and hourly (or rate) for two marks. B1 for women earn more OE	AO3															
7	(c)		<p>Median female pay = median male pay</p> $\frac{(A-B)}{A} = \frac{1}{2}$ <p>Total male pay = 2 x total female pay</p> <p>All pay rates at least £12</p>	B1 B1 B1 B1	Seen in the figures rather than stated Relationship seen or implied by correct answer	AO2 AO3 AO2 AO1															
				[4]																	
7	(d)		<p>Each quartile is 50 employees</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td>Q1</td> <td>Q2</td> <td>Q3</td> <td>Q4</td> </tr> <tr> <td>Male</td> <td>38</td> <td>37</td> <td>30</td> <td>50</td> </tr> <tr> <td>Female</td> <td>12</td> <td>13</td> <td>20</td> <td>0</td> </tr> </table> <p>155 male, 45 female</p>		Q1	Q2	Q3	Q4	Male	38	37	30	50	Female	12	13	20	0	M1 M1 A1 [3]	Implied by correct answer for any quartile Working out numbers of men and women in each of Q1 Q2 Q3 (implied by correct answer)	AO3 AO2 AO1
	Q1	Q2	Q3	Q4																	
Male	38	37	30	50																	
Female	12	13	20	0																	
7	(e)		$\frac{(A-B)}{A} = 1 \Rightarrow B = 0$ <p>All workers male OE</p>	M1 E1 [2]	Implied by correct answer OR They have calculated the pay gap incorrectly	AO2 AO3															

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