Level 3 Certificate

Mathematics

H868/02: Critical Maths

OCR Level 3 Certificate Core Maths A (MEI)

Mark Scheme for June 2022

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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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MARKING INSTRUCTIONS

PREPARATION FOR MARKING
RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to RM Assessor and mark the **required number** of practice responses ("scripts") and the **number of required** standardisation responses.

    YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or the RM Assessor messaging system, or by email.

5. **Crossed Out Responses**
    Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

Rubric Error Responses – Optional Questions
Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

Multiple Choice Question Responses
When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).
When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses
When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only **one mark per response**)
Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth **two or more marks**)
If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)
Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there, then add a tick to confirm that the work has been seen.

7. Award No Response (NR) if:
   - there is nothing written in the answer space

   Award Zero '0' if:
   - anything is written in the answer space and is not worthy of credit (this includes text and symbols).

   Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

8. The RM Assessor **comments box** is used by your team leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
   If you have any questions or comments for your team leader, use the phone, the RM Assessor messaging system, or e-mail.

9. *Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.*

10. For answers marked by levels of response: Not applicable in F501
      a. **To determine the level** – start at the highest level and work down until you reach the level that matches the answer
      b. **To determine the mark within the level**, consider the following

Descriptor	Award mark
On the borderline of this level and the one below	At bottom of level
Just enough achievement on balance for this level	Above bottom and either below middle or at middle of level (depending on number of marks available)
Meets the criteria but with some slight inconsistency	Above middle and either below top of level or at middle of level (depending on number of marks available)
Consistently meets the criteria for this level	At top of level

11. **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

12. **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
1	(a)		Possible reasons include: • You can see the trend more clearly • You can read the values/percentages off • Easier to compare age groups • 3D pie charts distort sizes of groups • A pie chart is not appropriate as the data are not parts of a whole	B1, B1	B1 each distinct reason Mark best reason in each answer space Other examples: You can see that disabling illnesses increase with age or any comment about the shape of the distribution Reading the vertical scale is easy Any implied reference to 2D clearer than 3D Positioning of data labels is better on bar chart Comments about colours / patterns will not usually score, unless reason developed sufficiently	AO3
				[2]		
1	(b)		Percentage point increase = 24 [%] $\dfrac{32}{8}$ 300%	B1 M1 A1 [3]	soi eg 400% OR $\dfrac{32-8}{8}$	AO1 AO1 AO1

2	(a)		15[%]	**B1** **[1]**		AO1
2	(b)		23[%]	**B1** **[1]**	Answer in range 22 to 24	AO3
2	(c)		65+ covers a wider age range	**B1** **[1]**	Can be numerical comparison; condone 9 years for 55 to 64 Condone larger/bigger age group	AO3
2	(d)		(25-34 reason) Any relevant comment in context - Potential for growth high - More likely to engage with advertising / online shopping / technology (55-64 reason) Any relevant comment in context - Shop seems more popular with older customers	**B1** **B1** **[2]**	OE eg indicates that for this age group, the shop proportion is lower than **UK proportion** eg younger customers will shop over more years Or scope for growth in this age group Comments about mobility/age will not usually score, unless reason developed sufficiently Note: UK proportions similar in both age groups so this alone is not a reason <u>for either mark</u>	AO3 AO3
2	(e)		They all go down The numbers are the same but out of a higher total	**B1*** **DB1** **[2]**	OE Can only score from correct response Any relevant description or numerical example, based on more of the % being taken (by 25-34 age group) due to doubling Accept justifications referencing proportions	AO2 AO3

3	(a)		Greater cost OR greater probability OR both	**B1** **[1]**	Accept less specific wording, if meaning is clear Mark best part of reason offered	AO3
3	(b)		$0.02 \times 300 + 0.015 \times 60$ [£]6.<u>90</u>	**M1** **A1** **[2]**	At least one term soi or £6 soi or 90p soi 360 scores zero, 180 scores zero	AO2 AO1
3	(c)		$5 \times 12 = 60$ and <u>this is more</u> than their 6.90	**B1** **[1]**	$60 >$ *their* (b)	AO3
3	(d)		Suitable reason, eg • Peace of mind • Makes the cost predictable	**B1** **[1]**	eg Any indication that insurance cost is low compared to replacement cost It's easy to damage your phone / often A lot of phones get stolen	AO3
3	(e)		Suitable reason, e.g. • Need to cover costs • Need to make a profit • Need to allow for more claims than expected	**B1** **[1]**	May give a particular cost eg staff wages Anything that seems relevant in context of profitable business	AO3
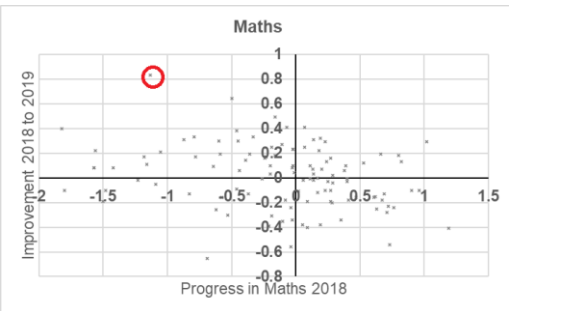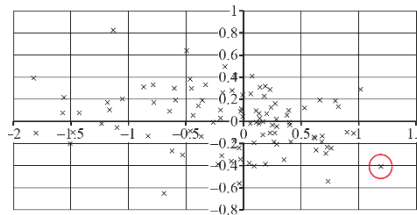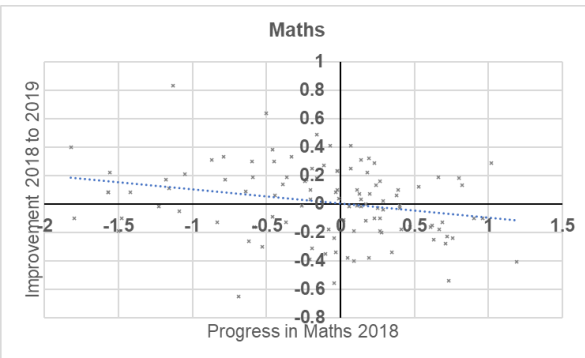
4	(a)		Adult females <u>includes</u> 18+ (which must be more than 25+)	**E1**	OE	AO2
					eg all people who count in category C also count in A but A has some extra people	
					Do not accept "there are more adult females than females 25+" alone, as this doesn't indicate why	
				[1]	Do not accept reasons to do with the survey methodology	
4	(b)		B, C, A, D	**B2**	If incorrect award B1 for:	AO2, AO3
					B above C and A	
					D below C and A	
				[2]		
4	(c)		Suitable reason, eg • small sample size • single location or feature of location • relevant feature about the demographic • certain people more likely to be in town on Saturday morning	**B1**	Other examples include • People might not answer honestly • Some people may refuse to take part • Opinions in this town may be different to the UK • specific time / day Note: any reference implied to <u>groups surveyed</u> (male/female/young) will not usually score here	AO3
				[1]		

5			Lorry length: 10 to 20 metres Lorry width: 2 to 4 metres Lorry height: 3 to 6 metres	**B2**	B2 all 3 dimensions in range B1 for 2 dimensions in range Allow in other units (throughout)	AO2
			Toilet roll size: 10×10×10 cm to 20×20×25 cm	**B1**	All 3 dimensions in range (may be embedded in calculations) Mention or use of diameter counts as 2 dimensions	AO2
			<u>Volumes approach</u>: Volume of lorry formed as a cuboid Volume of toilet roll formed as cuboid or cylinder	**M1** **M1**	Check dimensions of any volume calculation Note: Mark best part of a mixed method	AO3
			<u>Numbers approach</u>: number of rolls/packs that fit into 1D number of rolls/packs in other 2 dimensions	**M1** **M1**	Rolls/packs approach could earn method marks without loo roll/lorry dimensions being stated If working just in 2D to compare areas, then first method mark is available	AO3
			<u>Relevant conversion seen anywhere</u>	**B1**	Correct conversion could be embedded in length, area or volume calculation, on a sketch, or implied by lorry / loo rolls in same units Conversion mark might be implied from fitting appropriate number of packs into height, width or length of lorry	
			Answer in range 6000 to 480 000 Whole number of rolls and no significant error	**A1** **[7]**	Must have **both** M marks to score A1 Note: if working with <u>volumes</u> will need to use division at some point Note: if working with <u>rolls/packs</u> will need to multiply at some point	A02

6	(a)			Tests positive	Tests Negative	Total			Complete the 2-way table	
								B1	2000 and 8000	AO2
			Has taken drug	1940	60	2000		**B1ft**	97% and 3% of ***their*** 2000	AO1
			Has not taken drug	80	7920	8000		**B1ft**	1% and 99% of ***their*** 8000	AO1
									Note: if bottom row wrong withhold one mark	
			Total	2020	7980	**10 000**				
								[3]		
6	(b)		$\dfrac{2020}{10000}$ 20.2 (%)					**M1**	Correct fraction for ***their*** table, soi by answer	AO2
								A1ft	FT from ***their*** table in (a) Must be a percentage	AO1
								[2]		
6	(c)		$\dfrac{1940}{2020}$ 96 (%)					**M1**	Correct fraction for ***their*** table, soi by answer	AO2
								A1ft	[96.04%] FT from ***their*** table in (a)	AO1
								[2]	Must be a percentage	

6	(d)		Use of two-way table OR frequency or probability tree OR relevant calculations:				
			194 seen oe relevant number/probability	**B1**	Note: $194 = 97\%$ of 2% of 10 000	AO2
			98 seen oe relevant number/probability	**B1**	Note: $98 = 1\%$ of 98% of 10 000	AO2
			Adding their two relevant numbers/probabilities **194 + 98**	**DM1**	Method mark is dependent on at least one B1 Note: $194 + 98 = 292$	AO1
			$\frac{292}{10000} = 2.92\% \approx 3\%$ AG Sight of 2.92% or 2.9% is sufficient Accept "292 is close to 300"	**A1**	Convincingly shows the percentage is close to 3% Might go from comparison of *their* 292 with *their* 300 Must go further than presenting a fraction or decimal	AO3

Example of 2-way table with 10 000 people:

	Tests positive	Tests Negative	Total
Has taken drug	**194**	(6)	200
Has not taken drug	**98**	(9702)	9800
Total	292	(9708)	10 000

Note: *their* 10 000 could be anything eg 1000, 5000 or 100, so check the split of *their* starting number for each B mark

Probability approach:
$$0.02 \times 0.97 + 0.98 \times 0.01$$
$$= \mathbf{0.0194 + 0.0098}$$
$$= 0.0292$$
$$= 2.92\%$$

					[4]		
6	(e)		66 (%)	**B1**	Any value between 66 and 67% $[194/292 = 66.4\%]$	AO3
				[1]		

7	(a)	(i)	Maths score doubled [7 × 2]	**B1**	NB working may be seen in results table in question	AO3
			English literature **only** chosen for English slot [9(× 2)]	**B1**	English lit score doubled is sufficient evidence	AO2
			History, chemistry and biology/French chosen [9, 8, 7]	**B1**	EBacc	AO2
			8 subjects chosen and **not** English language {5} and **not** art {4} [RS 8, Bi/Fr 7, Ph6]	**B1**	Note: Ok to choose 9 from English Lit here, if not used earlier for English slot	A01
			77	**B1**	77 with nothing incorrect seen scores full marks	AO1
				[5]		

7	(a)	(ii)	Replacing 18 by 9 + 5	**M1**	OE soi eg "−4"
					
					        Ma: 7×2
					        En: $5 + 9$
					      EBacc: $9 + 8 + 7$
					       Open: $8 + 7 + 6$
						A02

			73	**A1** **[2]**		A01
7	(a)	(iii)	Second statement chosen ☐ ☑ ☐ ☐	**B1**		AO2
			Justification eg You could stay the same if you got the same in language and literature, **and** do not need English Language for the open slot	**B1**	Must fully justify how it is possible for the score to <u>stay the same</u> Note: also allow this justification following response 4	AO3
				[2]		

7	(b)	(i)	Any point in third quadrant of Fig. 7.2 circled.	**B1** **[1]**		AO2
7	(b)	(ii)		**B1** **[1]**	Correct point circled Allow alternative point from misread of axes labelling	AO3
7	(c)	(i)		**B1** **[1]**	Line of best fit: • straight line • negative gradient • through or close to origin ($-0.1 \leq y$-intercept ≤ 0.1) • Gradient that seems to fit points	AO1
7	(c)	(ii)	Negative correlation Or appropriate description	**B1** **[1]**	OE gradient (of line of best fit) is negative Schools with higher maths scores show less improvement (and vice versa)	AO3

8	(a)	(i)	128	**B1**		AO1
				[1]		
8	(a)	(ii)	$\dfrac{\sqrt{256}}{2}$	**M1**	oe $\sqrt{\dfrac{256}{4}}$	AO2
			8	**A1**	cao	AO1
				[2]		
8	(b)		$\dfrac{120-128}{their\ 8}$ soi	**M1**	May be implied by statement about number of *their* standard deviations from mean	AO2
			1 standard deviation from mean	**M1**	Follow through their SD here from (a) Do not award either method mark if their SD does not support this statement	AO2
			Not unusual result so no evidence that Li's assumption is wrong OE	**A1ft**	OE eg Li is correct Full marks available following calculations which reference their standard deviation and lead to a conclusion that is consistent with their standard deviation	AO3
				[3]		