Level 3 Certificate

Core Maths B (MEI)

H869/01: Introduction to Quantitative Reasoning

OCR Level 3 Certificate

2021 Mark Scheme (DRAFT)

This is a DRAFT mark scheme. It has not been used for marking as this paper did not receive any entries in the series it was scheduled for. It is therefore possible that not all valid approaches to a question may be captured in this version. You should give credit to such responses when marking learner's work.

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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.

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 units. 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.

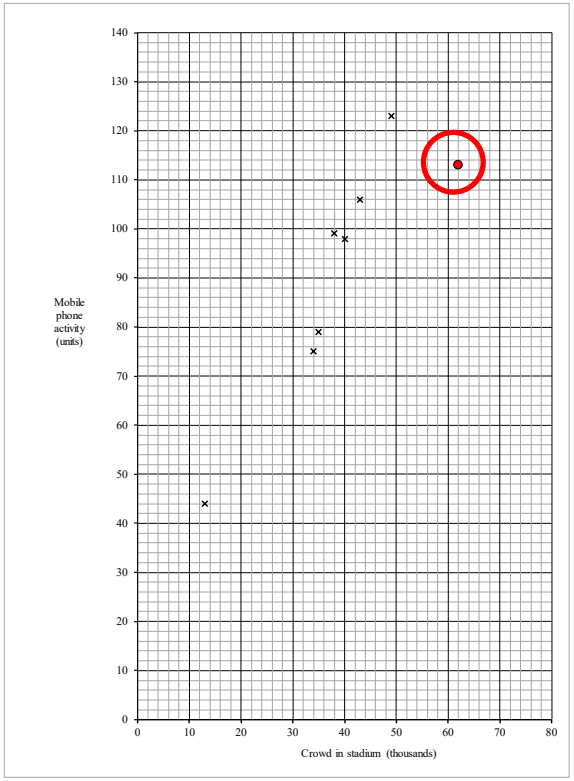
i Anything in the mark scheme which is in square brackets […] is not required for the mark to be earned, but if present it must be correct.

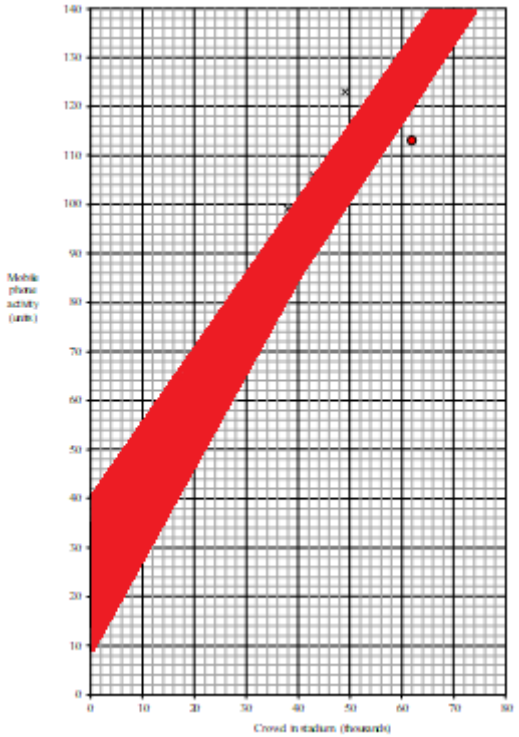
Question		Answer	Mks	Guidance	AO
1	(a)	$\frac{295 \times 257}{32}$	B1		2
		= 2369.21 …	B1	Implies first B1	1
		which rounded is 2369 / 2370 / 2400 / 2500	B1	*Their* 2369.21 … (must be the result of a calculation) rounded to 2, 3 or 4 sf.	2
			[3]		
1	(b)	Mean of 1(a) and 526 calculated (1447.5 / 1448 / 1463 / 1513)	B1	Correct mean based on *their* part (a)	2
		"No", the mean is too far away from either of the two figures oe Or "Yes" with a sensible reason fitting this.	E1	Reason must be based on *their* calculated mean	3
			[2]		
1	(c)(i)	640 000 ÷ 4	M1	640 000 ÷ 4 soi	1
		= 160 000 (children in Aracaju)	A1		1
			[2]		
	(c)(ii)	1 in 10 000 = 160 000 ÷10 000 = 16	B1	*Their* 160 000 (from c(i))÷10 000	2
		No, newspaper is wrong it isn't 526 (or 2369 or 1448) oe	B1	Correct comparison of *their* 16 with 526 (or 2369 or 1448)	3
		_____or _____ 526 out of 160 000 is 0.00328 … or 32 or 32.875 .. per 10 000 children, so no.	B1 B1	_____ or _____ Follow through on *their* calculation.	2 3
			[2]		

2	**(a)**	Total profit **£390.50**	**B1**	£390.50 (must have correct money notation. £390.5 or £390.500 not allowed)	2
		Estimated number sold = **3**	**B1**		3
		£20	**B1**	*Their* largest total profit FT on *their* £390.50 _____ **Total Profit** could be the total number of customers at or above the chosen selling price × profit at that selling price. Therefore £15 is a valid alternative correct answer.	2
			[3]		
2	**(b)(i)**	=E$1 (or =E1)	**B1**	Must have "=" Allow "=E1"	1
			[1]		
2	**(b)(ii)**	=C4*D4	**B1**	Condone lack of "="	1
			[1]		
2	**(b)(iii)**	New cost to make a pendent is (£)15	**B1**		2
		Total profit at new pendent price is (£) 210	**B1**	Or % drop in profit = $\frac{390-210}{390} = 46(.15...)\%$	2
		Half of (£)390 is (£)195 so she is wrong / not quite right oe	**B1**	Comparison together with a sensible conclusion, based on *their* £210 (or 46% with 50%)	3
			[3]		

2	**(c)**	Old cost of silver is (£)8.00	**B1**	(80% of £10 =) (£)8.00soi	2
		Increase in cost of silver = 12% of (£)8.00	**B1**	(12% of *their* £8.00) (=(£)0.96)	2
		Which is (£)0.96	**B1**	Can imply the above 2 marks	2
		Or 9.6%	**B1**	$\frac{their\ 0.96}{10}\times 100$ or better soi	3
			[4]		
3	**(a)**	$(10 \times 4 \times 400) + (10 \times 5 \times 400)$	**B1**	$(9 \times 4.25 \times 400) \approx 10 \times 4 \times 400$ **or** $(11 \times 4.75 \times 400) \approx 10 \times 5 \times 400$	1
		= 16 000 + 20 000	**B1**	*Their* rounded two terms added	1
		Which is 35 000 / 36 000 / 40 000	**B1**	*Their* answer (from a calculation) given to 1 or 2 sf.	1
			[3]		
3	**(b)(i)**	Area of rectangle = 36 ×400 = 14 400 (m^2)	**B1**		3
		Area of triangle = 144 00 ÷2 = 7 200 (m^2)	**B1**		1
		_____ **or** _____	**or**	_____ **or** _____	---
		Area of triangle = 0.5 × 6 × 6 (small squares)	**B1**	$0.5 \times 6 \times 6$ (=18) or better	1
		Which is 18 ×400 = 7 200 (m^2 in reality)	**B1**	*Their* 18 ×400 = 7200	3
			[2]		

3	(b)(ii)	Maximum crowd density is 5 per m^2	B1	Must be explicitly stated	2
		Maximum crowd is 5×7200 = 36 000 people	B1	*Their* 5 × *their* 7 200	2
		This is not equal to the claimed 200 000 people	B1	Correct comparison of *their* max. crowd with the claimed figure of 200 000, condone just "no" or "yes" or equivalent iff result of calculation	3
		_____ **or** _____	**or**	_____ or _____	---
		If 200 000 people, this gives a crowd density of 200 000 ÷ 7200	B1	Crowd density = 200 000 ÷*their* 7 200 (=27.77 …)	2
		Which is 27.7 … per m^2	B1	Maximum density is 5 per m^2stated	2
		Larger than the 5 per m^2, so claim is false.	B1	Correct comparison of *their* density with *their* stated maximum density, condone just "no" or "yes" or equivalent iff result of calculation	3
			[3]		

3	(c)(i)	Point correctly added (62, 113)  	B1	(62, 113) correctly marked ($\pm \frac{1}{2}$ division)	1
			[1]		

3	(c)(ii)		B1	Straight line at least 10 cm long totally within the red zone – (see overlay)	1
			[1]		
3	(c)(iii)	10 to 40 (units)	B1		3
			[1]		

4	(a)(i)	Goes up, goes down … or highest is in 2012 or highest is (270 to 275) … then remains (fairly) steady or stayed above 2009's value (or 100)	B1 B1	Condone a specific point. A comment about the trend must be made.	3 3
			[2]		
4	(a)(ii)	2014	B1		2
			[1]		
4	(b)	Cost of gold in 2018 was (1.24 to 1.36) × £25.12 Which was (£)31.15 to (£)34.16 per gram Gold (was the higher priced in 2018)	M1 A1 B1	Cost of gold (1.24 to 1.36) × 25.12 soi Gold was the higher priced in 2018 supported by *their* working for gold compared with given figure for palladium	2 2 3
			[3]		
4	(c)	1 cm^3 of palladium costs £840.36 / 840 (12×£70.03 / £70) Volume of £1 million = 1 000 000 ÷ 840.36 or 840 = 1189.9 … (or 1190) (cm^3) Giving a cube of side $\sqrt[3]{(1189.9... \text{ or } 1190)}$ 11 or 10.6 or 10.60 cm	B1 M1 A1 M1 A1	 Volume of £1 million = 1 000 000 ÷ *their* 840.36 soi FT 1189.9 (662 …) Side of cube = $\sqrt[3]{their\ (1189.9... \text{ or } 1190)}$ soi FT 10.6 or 10.60 or 11 cm	2 2 2 2 2
			[5]		

5	**(a)**	Total number of locusts 6.435×10^{13}	**M1**	$495\,000 \times 130 \times 1\,000\,000$ or better	2
		$6.435 \times 10^{13} \div 10^{12} = 64.35$ trillion	**A1**	= *their* $6.435 \times 10^{13} \div 10^{12}$ correct	2
		Which is 64 (trillion locusts)	**B1**	Their rounded 64.35 (trillion)	2
			[3]		
5	**(b)(i)**	19.5 + 39.5 = 59 (million people)	**B1**	Condone 59 000 000	1
			[1]		
5	**(b)(ii)**	59 × 600 = 35 400 (million grams) oe	**B1**	*Their* 59 × 600 = … Condone 35 400 000 000	2
			[1]		
5	**(b)(iii)**	There are 80 ×59.1 = 4 728 (million locusts)	**B1**	Condone 4 728 000 000 oe	3
		The locusts eat 4728 × 2 = 9 456 (million grams)	**B1**	*Their* 4728×2 Condone 9 456 000 000	3
		Statement is not true as the locusts eat 9456 million (g) and the people eat 35 400 million (g)	**B1**	The statement is true or false based on *their* two calculated masses of food consumed in a day – condone any relevant rational qualifications. Condone simple "yes" or "no" based on their calculations.	3
			[3]		
5	**(c)(i)**	10 (locusts)	**B1**		3
			[1]		
5	**(c)(ii)**	20	**B1**		1
			[1]		
5	**(c)(iii)**	Both correct	**B1**		1
			[1]		

Age of swarm (months)	3	6	9
No spraying	200	4000	80 000
Spaying at 3 months	20	**400**	**8 000**

6	**(a)**	No because the distribution is not symmetrical oe	**B1**	Condone "not even"	1
			[1]		
6	**(b)(i)**	5 (nights)	**B1**	Accept 5 days.	1
			[1]		
6	**(b)(ii)**	There are 292 (nights) with temperatures below 14ºC	**B1**		3
		292 out of 365 is 0.8 of the time (oe e.g. 80%)	**B1**	$\frac{their\ 292}{365}$ soi	3
		And 4 out of 5 is 0.8 or 80%	**B1**	This mark may be gained iff there is clear evidence of simplifying $\frac{292}{365}$	3
			[3]		
6	**(c)(i)**	Equally likely to be below -8ºC on each day oe	**B1**	e.g. "temperatures are independent"	2
6	**(c)(ii)**	"No" or "Yes" with a sensible reason	**B1**	"No" with statement to effect that not all days will have the same probability of below -8ºC because of time of year "Yes" followed through on their part (c)(i)	3
			[2]		

<table>
<tr><td>7</td><td>(a)</td><td>All correct
<table><tr><th>Shape</th><th>Area (cm^2)</th><th>Perimeter (cm)</th><th>Compactness $\frac{(\text{area})}{(\text{perimeter})}$</th></tr><tr><td>A</td><td>9</td><td>12</td><td>0.75</td></tr><tr><td>B</td><td>6</td><td>10</td><td>0.6</td></tr><tr><td>C</td><td>3</td><td>8</td><td>0.375 or 0.38</td></tr></table></td><td>B1

B1</td><td>One correct row in table

Another correct row

Or if zero scored SC1 for both areas and perimeters correct.</td><td>1

1</td></tr>
<tr><td></td><td></td><td></td><td>[2]</td><td></td><td></td></tr>
<tr><td>7</td><td>(b)(i)</td><td>$\frac{1}{4}$ or 0.25

$\frac{1}{2}$ or 0.5

No because it gives a different value for each sized square as a result of fractions reduced to comparable form and compared e.g. $\frac{1}{4}, \frac{1}{2}$ oe</td><td>B1

B1

B1</td><td>o.e.

or $\frac{2}{4}$ or $\frac{4}{8}$ o.e.

Allow follow through on their calculated values of compactness.</td><td>2

3

3</td></tr>
<tr><td></td><td></td><td></td><td>[3]</td><td></td><td></td></tr>
<tr><td>7</td><td>(b)(ii)</td><td>$\frac{1}{16}$ or 0.0625

$\frac{4}{64} = \frac{1}{16}$ or = 0.0625</td><td>B1

B1</td><td>

$\frac{1}{16}$ and $\frac{4}{64} = \frac{1}{16}$ seen as distinct answers (the same value for both squares need not be explicitly stated)</td><td>2

3</td></tr>
<tr><td></td><td></td><td></td><td>[2]</td><td></td><td></td></tr>
</table>

7	(c)(i)	Correct recall of area of circle formula soi	B1		1
		$C = \frac{4\pi\left(\pi \times 4\right)}{\left(2\pi \times 2\right)^2}$ or $C = \frac{4 \times 3.142... \times \left(3.142... \times 4\right)}{\left(2 \times 3.142... \times 2\right)^2}$ soi	B1		2
		= 1	B1		3
			[3]		
7	(c)(ii)	Useful to have C = 1 for the most compact shape oe	B1		3
			[1]		

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