

Level 3 Certificate

Mathematics

H869/02: Core Maths B (MEI): Statistical problem solving

OCR Level 3 Certificate Core Maths B (MEI)

Mark Scheme for June 2025

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

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, email or via the RM Assessor messaging system.
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 the annotation 'SEEN' to confirm that the work has been seen and mark any responses using the annotations in section 11.

7. There is a NR (**No Response**) option. Award NR (No Response):

- if there is nothing written at all in the answer space
- OR if there is a comment which does not in any way relate to the question (e.g., 'can't do', 'don't know')
- OR if there is a mark (e.g., a dash, a question mark) which is not an attempt at the question.

Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

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.**

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

To determine the level – start at the highest level and work down until you reach the level that matches the answer

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

Annotation	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 must be used during your marking. For a response awarded zero (or full) marks a single appropriate annotation (cross, tick, M0 or ^) is sufficient, but not required.

For responses that are not awarded either 0 or full marks, you must make it clear how you have arrived at the mark you have awarded and all responses must have enough annotation for a reviewer to decide if the mark awarded is correct without having to mark it independently.

It is vital that you annotate standardisation scripts fully to show how the marks have been awarded.

Award NR (No Response)

- if there is nothing written at all in the answer space and no attempt elsewhere in the script
- OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
- OR if there is a mark (e.g. a dash, a question mark, a picture) which isn't an attempt at the question.

Note: Award 0 marks only for an attempt that earns no credit (including copying out the question).

If a candidate uses the answer space for one question to answer another, for example using the space for 8(b) to answer 8(a), then give benefit of doubt unless it is ambiguous for which part it is intended.

- 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 always 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, escalate the question to your Team Leader who will decide on a course of action with the Principal Examiner.

If you are in any doubt whatsoever 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, e.g. 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 method mark may usually be implied by a correct answer unless the question includes the DR statement, the command words “Determine” or “Show that”, or some other indication that the method must be given explicitly.

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, e.g. 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, what is acceptable will be detailed in the mark scheme. If this is not the case please, escalate the question to your Team Leader who will decide on a course of action with the Principal Examiner.

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. We are usually quite flexible about the accuracy to which the final answer is expressed; over-specification is usually only penalised where the scheme explicitly says so.
- When a value is given in the paper only accept an answer correct to at least as many significant figures as the given value.
 - When a value is not given in the paper accept any answer that agrees with the correct value to 3 s.f. unless a different level of accuracy has been asked for in the question, or the mark scheme specifies an acceptable range.
- NB for Specification B (MEI) the rubric is not specific about the level of accuracy required, so this statement reads "2 s.f".

Follow through should be used so that only one mark in any question is lost for each distinct accuracy error.

Candidates using a value of 9.80, 9.81 or 10 for g should usually be penalised for any final accuracy marks which do not agree to the value found with 9.8 which is given in the rubric.

- g. Rules for replaced work and multiple attempts:
- If one attempt is clearly indicated as the one to mark, or only one is left uncrossed out, then mark that attempt and ignore the others.
 - If more than one attempt is left not crossed out, then mark the last attempt unless it only repeats part of the first attempt or is substantially less complete.
 - if a candidate crosses out all of their attempts, the assessor should attempt to mark the crossed out answer(s) as above and award marks appropriately.
- 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 or B mark in the question. Marks designated as cao may be awarded as long as there are no other errors.
- If a candidate corrects the misread in a later part, do not continue to follow through. Note that a miscopy of the candidate's own working is not a misread but an accuracy error.
- i. If a calculator is used, some answers may be obtained with little or no working visible. Allow full marks for correct answers, provided that there is nothing in the wording of the question specifying that analytical methods are required such as the bold "In this question you must show detailed

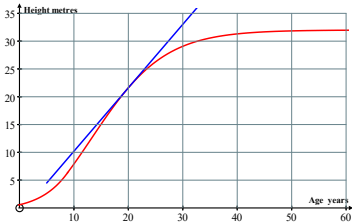
reasoning”, or the command words “Show” or “Determine”. Where an answer is wrong but there is some evidence of method, allow appropriate method marks. Wrong answers with no supporting method score zero. If in doubt, consult your Team Leader.

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

Question			Answer	Marks	AO	Guidance																																																							
1	(a)		<table><tr><th>Age \ Score</th><th>0</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>Total</th></tr><tr><td>16 to 24</td><td>0</td><td>0</td><td>1</td><td>1</td><td>2</td><td>1</td><td>4</td><td>9</td><td>12</td><td>30</td></tr><tr><td>25 to 64</td><td>1</td><td>2</td><td>3</td><td>2</td><td>4</td><td>4</td><td>3</td><td>3</td><td>3</td><td>25</td></tr><tr><td>65 +</td><td>4</td><td>3</td><td>3</td><td>2</td><td>1</td><td>3</td><td>1</td><td>0</td><td>3</td><td>20</td></tr><tr><td>Total</td><td>5</td><td>5</td><td>7</td><td>5</td><td>7</td><td>8</td><td>8</td><td>12</td><td>18</td><td>75</td></tr></table>	Age \ Score	0	1	2	3	4	5	6	7	8	Total	16 to 24	0	0	1	1	2	1	4	9	12	30	25 to 64	1	2	3	2	4	4	3	3	3	25	65 +	4	3	3	2	1	3	1	0	3	20	Total	5	5	7	5	7	8	8	12	18	75	B1 [1]	AO1	All correct
	Age \ Score	0	1	2	3	4	5	6	7	8	Total																																																		
	16 to 24	0	0	1	1	2	1	4	9	12	30																																																		
25 to 64	1	2	3	2	4	4	3	3	3	25																																																			
65 +	4	3	3	2	1	3	1	0	3	20																																																			
Total	5	5	7	5	7	8	8	12	18	75																																																			
	(b)		[90 - 75 =] 15	B1FT [1]	AO2	FT from 90-their total from 1(a)																																																							
	(c)		The 16 to 24 group [are the most concerned] with reason eg: - in this age group more people have higher scores - in this age group there are more scores of (7 and) 8 - in this age group there are more “agree” [2] scores - in this age group 12 people scored 8 - in this age group the mean score is around 6 or 7 - in this age group a high proportion (87%) scored 5 or more - most of the 8 marks are in the 16-24 age group	B1 [1]	AO3	B0 because they had the most returns (30) to the questionnaires B0 the 16-24 group has the highest total / score																																																							

1	(d)	(i)	Option 1 $\frac{[5 \times 0] + (5 \times 1) + (7 \times 2) + (5 \times 3) + (7 \times 4) + (8 \times 5) + (8 \times 6) + (12 \times 7) + (18 \times 8)}{75} \left[= \frac{378}{75} \right]$ 5.04 AG	M1 M1 A1 [3]	AO2 AO1 AO3	Attempt $\sum fx$ with one error, soi by 378 Sum $\div 75$ or Sum $\div$ their total from 1(a) Shown without any errors
		(ii)	Option 2 [378 $\div$ 90 =] 4.2	B1 [1]	AO2	
		(iii)	Option 1 [is more appropriate] <u>with reason</u> eg because • it's unlikely that all non-respondents would have put zero • non-respondents may have chosen higher scores • Option 2 would be an under-estimate • Option 2 makes assumption that non-respondents don't care about climate change • non-respondents / missing data should not be included in the calculation • with Option 2 Emma would be making up data/responses • assuming zeros brings the mean down • only collected/sampled data should be in the calculation	B1 [1]	AO3	Do not allow Option 2 Attempt at sensible comment required containing some of the ideas given B0 "option 2 skews the data" is not sufficient unless explained further

Question			Answer	Marks	AO	Guidance
2	(a)		<u>Feet to metres</u> 100 feet = 30.48 [metres] 30.48 < 32m [the mean] so more than half the trees are over 30.48m	B1	AO1	Accept 30.5 (but not 30.4)
				B1	AO2	
		OR	<u>Metres to feet</u> 32 metres = 104.9(86..) [feet] Half the trees are over 105 feet, so more than half are over 100 feet	B1	AO1	Accept 105 (but not 104)
				B1	AO2	
		OR	<u>Probability calculations</u> $P(X \geq 30.48)$ = 0.7284 > 0.5 or 73% > 50% oe in words	B1	AO1	30.48 is implied by $P(Z \geq \pm 0.608)$
				B1	AO2	Awrt 0.73 eg using $z = -0.61$ gives 0.7291 $0.7284 \times 240 = 174.8$ more than half /120
				[2]		
2	(b)		$z = \frac{35 - 32}{2.5} [= 1.2]$ [$\Phi(1.2)$ from table] = 0.8849 (1 - 0.8849) $\times$ 240 = 27.6 $\rightarrow$ 27 or 28 [trees over 35m tall] oe eg $240 - 0.8849 \times 240 = 27.6 \rightarrow 27$ or 28 trees	M1	AO2	Attempt at Z score, soi by ± 1.2
				A1	AO1	Table value correct. Allow 88.49 (%) [$P(X \geq 35) =$] 0.115(1) scores M1A1
				A1	AO2	
						<u>SC max 2/3</u> Estimating number of trees over 1sd above the mean: M1 16(%) [above 1sd] A1 $0.16 \times 240 = 38(.4) \rightarrow$ 38 trees
				[3]		

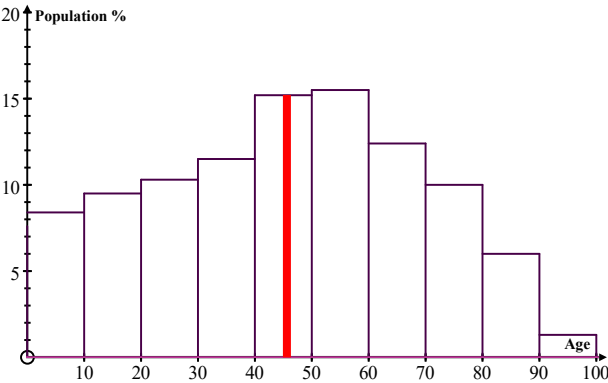
2	(c)		 [gradient is] eg $\frac{22-10}{20-10} = [1.2]$ [Growing at] 1.2 metres per year			B1 AO2 Suitable tangent drawn at 20 M1 AO1 Forms gradient calculation using any two points on their <u>tangent</u> Note: Can be B0M1 A1 AO3 Allow between 1 and 1.4 Must be from tangent drawn at 20 [3]
2	(d)	(i)	Use a percentage between 1% and 5% in a relevant calculation so to obtain answer in range 4800 to 24000 eg 12000 trees would create 240 resistant trees on the basis of 2% eg if we plant 24000 saplings at least 240 will mature eg 4800 saplings should be planted	B1* AO3 eg 1% → 24000 2% → 12000 2.5% → 9600 3% → 8000 4% → 6000 5% → 4800 Their final answer may be a range Allow their final estimate to be larger with some additional justification DB1 AO2 Explanation in context that must link to their correct-answer [2]		

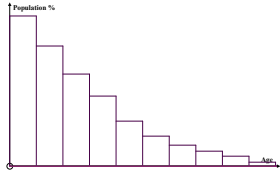
	(d)	(ii)	The number of trees will [continue to] fall but then increase because the saplings have more resistance to the disease eg eventually the numbers of ash trees will recover eg the number of trees with resistance will increase [over time] eg eventually there will be no/fewer diseased trees eg recovery will take a long time and the ecosystem will suffer / change meanwhile eg depletion of trees may lead to changes in biodiversity	B1 [1]	AO3	Allow sensible comments in context that indicate reduction / recovery or other relevant ecological effects B0 all the trees will die / decrease B0 for deforestation arguments B0 the trees will increase (without any context)
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Question			Answer	Marks	AO	Guidance																														
3	(a)		Observed frequencies <table><tr><td></td><td>None</td><td>Short</td><td>Medium</td><td>Long</td><td>Total</td></tr><tr><td>Early</td><td>10</td><td>10</td><td>9</td><td>6</td><td>35</td></tr><tr><td>Normal</td><td>7</td><td>11</td><td>16</td><td>11</td><td>45</td></tr><tr><td>Late</td><td>13</td><td>15</td><td>8</td><td>4</td><td>40</td></tr><tr><td>Total</td><td>30</td><td>36</td><td>33</td><td>21</td><td>120</td></tr></table>		None	Short	Medium	Long	Total	Early	10	10	9	6	35	Normal	7	11	16	11	45	Late	13	15	8	4	40	Total	30	36	33	21	120	B1 [1]	AO1	
	None	Short	Medium	Long	Total																															
Early	10	10	9	6	35																															
Normal	7	11	16	11	45																															
Late	13	15	8	4	40																															
Total	30	36	33	21	120																															
3	(b)		[120 ÷ 5 =] 24 [weeks]	B1FT [1]	AO2	FT from their 120 from 3(a)																														
3	(c)	(i)	The length of the delay is independent of the start time	B1 [1]	AO2	3 rd box indicated																														
		(ii)	Expected frequencies <table><tr><td></td><td>None</td><td>Short</td><td>Medium</td><td>Long</td><td>Total</td></tr><tr><td>Early</td><td>8.75</td><td>10.5</td><td>9.625</td><td>6.125</td><td>35</td></tr><tr><td>Normal</td><td>11.25</td><td>13.5</td><td>12.375</td><td>7.875</td><td>45</td></tr><tr><td>Late</td><td>10</td><td>12</td><td>11</td><td>7</td><td>40</td></tr><tr><td>Total</td><td>30</td><td>36</td><td>33</td><td>21</td><td>120</td></tr></table>		None	Short	Medium	Long	Total	Early	8.75	10.5	9.625	6.125	35	Normal	11.25	13.5	12.375	7.875	45	Late	10	12	11	7	40	Total	30	36	33	21	120	B1 B1 [2]	1 1	At least one of 12, 11, 7 correct All 9 cells correct
	None	Short	Medium	Long	Total																															
Early	8.75	10.5	9.625	6.125	35																															
Normal	11.25	13.5	12.375	7.875	45																															
Late	10	12	11	7	40																															
Total	30	36	33	21	120																															

Question			Answer	Marks	AO	Guidance
3	(c)	(iii)	$X^2 = \frac{1.25^2}{8.75} + \frac{(-0.5)^2}{10.5} + \frac{(-0.625)^2}{9.625} + \frac{(-0.125)^2}{6.125}$ $+ \frac{(-4.25)^2}{11.25} + \frac{(-2.5)^2}{13.5} + \frac{3.625^2}{12.375} + \frac{3.125^2}{7.875}$ $+ \frac{3^2}{10} + \frac{3^2}{12} + \boxed{\frac{(-3)^2}{11}} + \boxed{\frac{(-3)^2}{7}}$ $= 0.178\ 57... + 0.023\ 80... + 0.040\ 58... + 0.002\ 55...$ $1.605\ 55... + 0.462\ 96... + 1.061\ 86... + 1.24\ 007...$ $+ \boxed{0.9} + \boxed{0.75} + \boxed{0.81(818...)} + \boxed{1.28(57...)}$ $= 8.37\ (2\ \text{decimal places})$	M1 A1 [2]	AO1 AO1	OR without negatives $\frac{(8-11)^2}{11}$ and $\frac{(4-7)^2}{7}$ with their f_e for 11 and 7 M0: $\frac{-3^2}{11}$ and/or $\frac{-3^2}{7}$
3	(c)	(iv)	Degrees of freedom: $\nu = (3 - 1) \times (4 - 1)$ $\nu = 6$ 8.37 < 10.64 [Accept H_0 or reject H_1] The data does not provide enough evidence to suggest changing start time would change travel time oe Or The length of delay is independent of the start time oe	M1* A1 DM1 A1 [4]	AO1 AO2 AO3 AO3	Attempt to find ν using $(r - 1)(c - 1)$ with r as 3 or 4 and c as 4 or 5 “6” seen implies method Correctly compare 8.37 with 2-tail $\chi^2_{\nu,10\%}$ critical value that matches their stated DOF Correct conclusion following fully correct work and must mention the context

10
2.706
4.605
6.251
7.779
9.236
10.64
12.02
13.36
14.68
15.99
17.28
18.55
19.81
21.06
22.31
23.54
24.77
25.99
27.20
28.41

Question			Answer	Marks	AO	Guidance
4	(a)		Italy: Median age 46.5 Annual population growth rate -0.11 [%]	B1 [1]	AO1	Both required Allow without % sign
4	(b)			B1 [1]	AO2	The line must be between 46 and 48

4	(c)	Uses median line: [left of median] $8.4 + 9.5 + 10.3 + 11.4 + 0.65 \times 15.2$ [$\approx 49.5\%$] OR [right of median] $0.35 \times 15.2 + 15.5 + 12.4 + 10 + 6 + 1.3$ [$\approx 50.5\%$] Answer in range 45% to 55% → “which is close to” 50% or half	M1	AO2	Sum of values one side with a split of 40-50 group using 50/50 or better. Allow approx heights Note: M1 can be scored by considering <u>areas</u> to left and right of median line [≈ 495 or ≈ 505]
			A1	AO3	Answer must result from split of 65/35 for the 40-50 group
			[2]		<u>SCB1B0</u> Left and right: sum 0-40 ($\sim 40\%$) and sum 50-100 ($\sim 45\%$) or Left: sum 0-40 ($\sim 40\%$) and 0-50 ($\sim 55\%$) or Right: sum 50-100 ($\sim 45\%$) and 40-100 ($\sim 60\%$) and the median is therefore in the 40-50 group
4	(d)	There are fewer people age 0-10 than age 10-20 [or 20-30 30-40..] [which is consistent with a declining population] eg There are fewer people in the <u>younger age groups</u> than <u>older groups</u> eg There are fewer children than middle-aged adults eg Lower percentages below age 40 than above age 40 eg Population in younger <u>age groups</u> is <u>decreasing/falling</u> eg [The bars show] the birth rate is shrinking	B1	AO3	Relevant comment that makes a clear comparison between younger/older age groups or the decreasing population in younger groups
			[1]		B0 eg there are fewer children than adults B0 eg if refer only to bell shape B0 eg there are fewer young people B0 eg low percentages below 40
	(e)		B1	AO3	2 nd diagram indicated
			[1]		

Question			Answer	Marks	AO	Guidance																																																																																		
5	(a)	(i)	The forestation rate is 0.1% and nearly all the other countries in Africa are higher than this oe	B1	AO2	Must compare to other African nations																																																																																		
			Most of Libya/North Africa is (in the Sahara) desert so has no trees	B1 [2]	AO3	Accept: eg too dry and hot for trees to grow																																																																																		
		(ii)	81.6% CAO	B1 [1]	AO2	Must have %																																																																																		
5	(b)	(i)	1-tail	B1 [1]	AO1	1 st box indicated																																																																																		
		(ii)	<table border="1"> <thead> <tr> <th>Country</th><th>Urban %</th><th>Urban rank, x</th><th>Forest %</th><th>Forest rank, y</th><th>$d = x - y$</th><th>d^2</th></tr> </thead> <tbody> <tr><td>Tunisia</td><td>70.5</td><td>7</td><td>6.6</td><td>9</td><td>-2</td><td>4</td></tr> <tr><td>Botswana</td><td>72.9</td><td>6</td><td>19.8</td><td>8</td><td>-2</td><td>4</td></tr> <tr><td>Belize</td><td>46.6</td><td>9</td><td>60.6</td><td>1</td><td>8</td><td>64</td></tr> <tr><td>Greenland</td><td>87.9</td><td>3</td><td>0.0</td><td>10</td><td>-7</td><td>49</td></tr> <tr><td>Chile</td><td>88.0</td><td>2</td><td>21.9</td><td>7</td><td>-5</td><td>25</td></tr> <tr><td>Indonesia</td><td>58.5</td><td>8</td><td>57.1</td><td>3</td><td>5</td><td>25</td></tr> <tr><td>Russia</td><td>75.3</td><td>5</td><td>49.4</td><td>4</td><td>1</td><td>1</td></tr> <tr><td>Cuba</td><td>77.5</td><td>5</td><td>27.3</td><td>5</td><td>-1</td><td>1</td></tr> <tr><td>Belgium</td><td>98.2</td><td>1</td><td>22.4</td><td>6</td><td>-5</td><td>25</td></tr> <tr><td>Samoa</td><td>17.5</td><td>10</td><td>60.4</td><td>2</td><td>8</td><td>64</td></tr> <tr> <td colspan="5">Total, Σ</td><td>0</td><td>262</td></tr> </tbody> </table>	Country	Urban %	Urban rank, x	Forest %	Forest rank, y	$d = x - y$	d^2	Tunisia	70.5	7	6.6	9	-2	4	Botswana	72.9	6	19.8	8	-2	4	Belize	46.6	9	60.6	1	8	64	Greenland	87.9	3	0.0	10	-7	49	Chile	88.0	2	21.9	7	-5	25	Indonesia	58.5	8	57.1	3	5	25	Russia	75.3	5	49.4	4	1	1	Cuba	77.5	5	27.3	5	-1	1	Belgium	98.2	1	22.4	6	-5	25	Samoa	17.5	10	60.4	2	8	64	Total, Σ					0	262	B1 [2]
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5	(b)	(iii)	$r_s = 1 - \frac{6 \times 262}{10(10^2 - 1)}$ $= -0.58(78 \dots)$ $0.58(78) > \mathbf{0.5636}$ oe eg $-0.5878 < -\mathbf{0.5636}$	M1	AO2	Attempt to use correct formula, soi by 0.59 or 0.58(78..). Allow one slip in use of formula
				A1	AO1	-0.59 or awrt -0.59 or $-\frac{97}{165}$ oe
				M1	AO2	Correctly compare <i>their</i> r_s with correct critical value where their r_s ≤ 1 Do not allow -0.58>0.5636 Do not allow -0.58<0.5636
			The test (result) is significant oe AG OR Reject H_0 OR accept H_1 OR There is evidence to suggest a negative association (or negative correlation) between forest percentage and urban population	A1	AO3	From fully correct work A0: there is association A0: there is correlation A0: the relationship is significant
				[4]		
5	(c)		[Jane randomly selected] one country from each region / continent	B1	AO3	
				[1]		
5	(d)	(i)	False	B1	AO3	
			True	[1]		

5	(d)	(ii)	The size of PMCC is smaller than the size of r_s oe eg PMCC is closer to zero [than r_s] eg correlation indicated by PMCC is smaller than correlation indicated by r_s eg $0.0087 < 0.587$ eg $-0.0087 < -0.587..$ OR r_s is a significant result, whereas PMCC is not a significant result	B1	AO2	We must see a relevant and fully correct comparison in words or as an inequality, and this mustn't be contradictory Must be from $-1 \leq r_s \leq 1$ in 5biii Condone $-0.0087 > -0.5878$
			The PMCC is more reliable because it uses the whole population / spreadsheet (all of the data) rather than a sample oe OR PMCC (-0.0087) is more reliable because high degree of scatter in fig 5.2 suggests there is no correlation oe OR PMCC is more reliable because it uses exact values rather than ranks oe	B1	AO3	Do not allow Spearman's is more reliable Note: cleaning data is not a relevant reason
				[2]		

Question			Answer	Marks	AO	Guidance
6	(a)	(i)	India: Population 1 399 179 585 CO ₂ emissions 2 314 738 000	B1 [1]	AO1	
		(ii)	CO ₂ emissions per person: [2 314 738 000 / 1 399 179 585] = 1.65(4 ...)	B1FT [1]	AO2	Awrt 1.65 Correct or FT from their values from 6(ai)
	(b)		USA: $\frac{5\,144\,361\,000}{339\,665\,118} = [15.1(45)]$ 15.1(45)/1.65(4) = 9.1(548..) oe [so nearly 10 or ≈ 10]	M1 A1 [2]	AO2 AO3	Must evaluate Awrt 9.2 Valid approx comparison from 6aii that rounds to 1.65 eg $1.65(4) \times 10 = 16.5(4)$ which is $\approx 15.1(45)$ or $15.1(45) \div 10 = 1.51(45)$ which is $\approx 1.65(4)$
	(c)	(i)	Q2/P2 $\frac{151\,633\,000}{44\,758\,398} = [3.387] = \mathbf{3.39\ AG}$ <u>CO₂ emissions per person</u> in <u>Algeria</u>	B1 B1 [2]	AO2 AO3	Must see the correct division or 3.387.. and 3.39 Must have the 3 elements
		(ii)	CO ₂ [emission] per person living in the UK [is 5.84 metric tonnes] Or UK emits more CO₂ per person than Algeria	B1 [1]	AO3	

Question			Answer	Marks	AO	Guidance
	(d)		Any one from: Andorra, Anguilla, Christmas Island, Cocos Islands, Curacao, Guernsey, Holy See, Isle of Man, Keeling Islands, Liechtenstein, Monaco, Norfolk Island, Northern Mariana Islands, Palau, Pitcairn Islands, Saint Barthelemy, Saint Martin, San Marino, Sint Maarten, Tokelau, Tuvalu, Wallis and Fortuna	B1 [1]	AO2	
	(e)		World average: $35\,532\,499\,700 / 7\,978\,557\,003 = 4.45(3)$ Sight of <u>5.84</u> and <u>4.45</u> oe and [People in the UK emit] have above average CO2 emissions when compared with the rest of the world	M1 A1 [2]	AO2 AO3	Must evaluate Allow comparison in words eg [4.45] which is less than 5.84 Allow more for above average Allow: average for the rest of the world is below the UK

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