



Oxford Cambridge and RSA

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 2023

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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:

- 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	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 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.

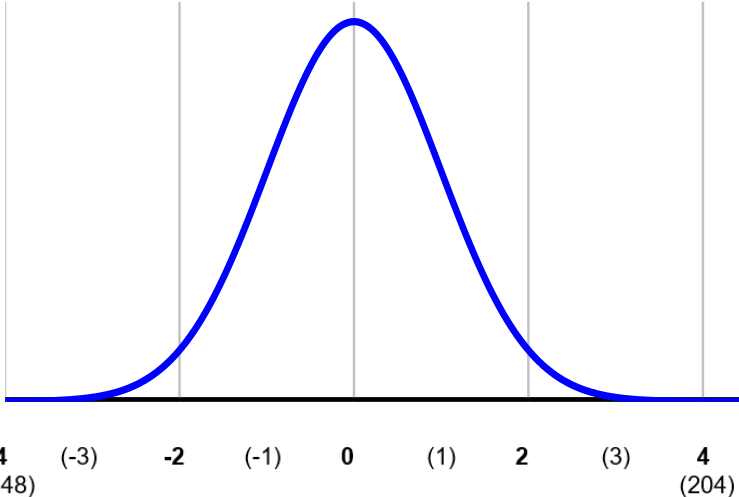
- I Anything in the mark scheme which is in square brackets [...] is not required for the mark to be earned, but if present it must be correct.

Question		Answer	Marks	Guidance
1	(a)	350 - (1 + 2 + 5 + 6) = 336 [spaces were occupied]	B1	OR 14 (spaces were free)
		$\frac{336}{350} \times 100 = 96\% (> 95\%)$	B1	OR $\frac{14}{350} \times 100 = 4\%$ (free/unoccupied) Must be presented as % Note: Relevant calculations are sufficient here, without descriptions / conclusion ALT for 2 nd B1 95% of 350 = 332.5
			[2]	
1	(b)	(i) C	B1	
		(ii) D	B1	
		(iii) B	B1	
		(iv) A	B1	
			[4]	
1	(c)	Any sensible comment to justify that the article was fair or not fair Examples: (Article was fair because) it covered peak times when many people want to use the railway. (Article was not fair because) the journalist should have sampled different times of day to get a better overall picture	B1	<u>Examples:</u> A random sample might well not catch this worst case scenario for parking The number of days sampled is too small There should be parking available all of the time But not generic comments without referring to the context
			[1]	

2	(a)	Q	B1	If not in answer space, check above and mark there																														
			[1]																															
	(b)	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Expected frequency, f_e</th> <th style="text-align: left;">Young people</th> <th style="text-align: left;">Adult women</th> <th style="text-align: left;">Adult men</th> <th style="text-align: left;">Total</th> </tr> </thead> <tbody> <tr> <td>Statement A</td> <td>14.7</td> <td>15.925</td> <td>18.375</td> <td>49</td> </tr> <tr> <td>Statement B</td> <td>10.5</td> <td>11.375</td> <td>13.125</td> <td>35</td> </tr> <tr> <td>Statement C</td> <td>17.7</td> <td>19.175</td> <td>22.125</td> <td>59</td> </tr> <tr> <td>Statement D</td> <td>5.1</td> <td>5.525</td> <td>6.375</td> <td>(17)</td> </tr> <tr> <td>Total</td> <td>(48)</td> <td>(52)</td> <td>(60)</td> <td>(160)</td> </tr> </tbody> </table>	Expected frequency, f_e	Young people	Adult women	Adult men	Total	Statement A	14.7	15.925	18.375	49	Statement B	10.5	11.375	13.125	35	Statement C	17.7	19.175	22.125	59	Statement D	5.1	5.525	6.375	(17)	Total	(48)	(52)	(60)	(160)	B1	B1 for one correct
Expected frequency, f_e	Young people	Adult women	Adult men	Total																														
Statement A	14.7	15.925	18.375	49																														
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Total	(48)	(52)	(60)	(160)																														
			B1	B1 for other 2 correct																														
			[2]																															

2	(c)	$X^2 = 7.217 \dots + 0.967 \dots + 2.211 \dots$ $+ 0.023 \dots + 0.232 \dots + 0.096 \dots$ $+ 1.248 \dots + 0.763 \dots + 0.034 \dots$ $+ 5.100 \dots + 0.420 \dots + 6.884 \dots$ $(\chi^2) = 25.195 \dots = 25.2 \text{ (to 1dp)}$	<p>B1</p> <p>B1</p>	<p>Accept 7.2 or 7.22 (or 7.21)</p> <p>25.2 or better, accept unrounded Note: Allow 25.2 or better from calculator function</p>
			[2]	
2	(d)	<p>[Degrees of freedom] = $(4 - 1)(3 - 1)$</p> <p>$[v] = 6$</p> <p>$25.2 > 16.81$</p> <p>Since $25.2 > 16.81$, H_0 is rejected OR the test is significant AG</p>	<p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p>	<p>Attempt to find v using $(r - 1)(c - 1)$</p> <p>6 seen implies correct method</p> <p>M1 correctly compare <i>their</i> χ^2 with <i>their</i> $\chi^2_{v,1\%}$.</p> <p>Does not depend on earlier M1, but if not 16.81 and no DOF stated earlier then M0 here</p> <p>Note: Correct critical value for $\chi^2_{6,1\%}$ is 16.81</p> <p>Correct conclusion following fully correct work OR Accept H_1</p>
			[4]	

<p>2</p>	<p>(e)</p>	<p><u>Criticism 1:</u> Any sensible criticism <u>Criticism 2:</u> A different sensible criticism</p> <p>Examples: The test is not about who has the best ideas (it’s testing whether views are independent of the categories men, women, young people) The test is not about whether men’s views can be trusted Her sample is not random</p>	<p>B1 B1</p>	<p>Explain why a word or phrase is inappropriate</p> <p><u>Examples:</u> She has only selected from friends and family The “best idea” is subjective so can’t be proved Her sample is too small (to draw conclusions about ‘everywhere’) Her samples may not be representative of the whole population Her statement about proof is too strong <u>But not</u> introducing a personal criticism/view of the statements in the questionnaire</p>
			<p>[2]</p>	

3	(a)	(i)	$z = \frac{204-176}{7} \quad \text{or} \quad z = \frac{148-176}{7}$ <p>Either $X = 204 \rightarrow z = 4$ and $X = 148 \rightarrow z = -4$</p>	<p>M1</p> <p>A1</p> <p>SCB1 max 1/2</p>	<p>Either calculation in any equivalent form eg: $176 + (4 \times 7) = [204]$ or $176 - (4 \times 7) = [148]$</p> <p>Correctly showing both clearly: OR $176 + (4 \times 7) = 204$ and $176 - (4 \times 7) = 148$</p> <p>$z = \frac{176-204}{7} = -4$ and $z = \frac{176-148}{7} = 4$</p>
				[2]	
3	a	(ii)		<p>B1</p>	<p>Check above the diagram</p> <p>Horizontal scale correct</p> <p>Accept with zero and even numbers only</p> <p>Ignore any X values</p>
				[1]	

3		Using standard approximations		
	(b)	eg [Area between $z = -1$ and $z = 0$] $\rightarrow 0.34$ eg [Area to left of $z = -1$] $\rightarrow 0.16$ eg [Area between $z = 0$ and $z = 2$] $\rightarrow 0.475$ eg [Area to right of $z = 2$] $\rightarrow 0.025$ eg [Area of region is $0.34 + 0.475$] = 0.815 (awrt 0.82) eg [Area of region is $1 - (0.16 + 0.025)$] = 0.815 (awrt 0.82)	B1	Relevant area soi: 68% (allow 2/3) or 95%
			B1	Relevant areas soi: from both 68% and 95%, and sight of one of 0.34, 0.16, 0.475, 0.025, 0.135 oe implied by $\frac{95+68}{2}$ or $68 + \frac{1}{2}(95 - 68)$
			B1	Note: 0.8185 (from calculator) is full marks Final answer to 2sf or better Accept final answer as %
			[3]	
3		Using tables or calculator		
	(b)	[Area to the left of $z = -1$ is $(1 - 0.8413)$] = 0.1587	B1	oe sight of 0.8413 is B1
		[Area to left of $z = 2$] = 0.9772	B1	oe OR [area to right of $z = 2$] = $1 - 0.9772 = 0.0228$
		[Area of region is $0.9772 - 0.1587$] = 0.8185 (awrt 0.82)	B1	oe OR $[1 - (0.1587 + 0.0228)] = 0.8185$ (awrt 0.82) Note: 0.8185 (from calculator) is full marks Final answer to 2sf or better Accept final answer as %
			[3]	

3	Using standard approximations		
(c)	<p>[For a height of 190 cm] $z = \frac{190 - 176}{7} = 2$</p> <p>So 2.5% [of men are at least 190 cm tall]</p> <p>2.5% of 1 054 753 = 26 400</p>	<p>M1</p> <p>A1</p> <p>A1</p>	<p>Soi by “2sd” (from the mean) or soi by 95% or 5%</p> <p>Allow decimals throughout</p> <p>Note: eg from $\frac{1}{2}(100 - 95)$ or from $5\% \div 2$</p> <p>CAO</p>
		[3]	
3	Using tables or calculator		
(c)	<p>[For a height of 190 cm] $z = \frac{190 - 176}{7} = 2$</p> <p>[1 - 0.9772 =] 2.28% (of men are at least 190 cm tall)</p> <p>2.28% of 1 054 753 = 24 000</p>	<p>M1</p> <p>A1</p> <p>A1</p>	<p>Allow decimals throughout</p> <p>0.02275 from calculator is M1A1</p> <p>CAO</p>
		[3]	

3	(d)	EITHER USA: cm to inches (or feet)		Allow use of 1 inch = 2.54cm or 1 inch = 2.5cm
		176 cm = $1.76 \times (3 \times 12 + 3.4) = 1.76 \times 39.4$ oe ALT: $1.76 \times 3.283 \times 12$	M1	Apply a correct conversion to get both mean heights into the same system of measurement
		69.344 inches or 5 ft 9 inches (allow 69.0 to 70.5 oe)	A1	69.291 inches or 5ft 9 inches [from 1 inch = 2.54cm] 70.4 inches or 5ft 10 inches [from 1 inch = 2.5cm]
		The mean in the USA is greater by $69.344 - 64.5 = 4.8$ inches Final answer must be between 4.5 and 6.0 inches oe	A1	4.8 inches [from 1 inch = 2.54cm] 5.9 inches [from 1 inch = 2.5cm]
			[3]	
3	(d)	OR Peru: inches to cm (or metres)		Allow use of 1 inch = 2.54cm or 1 inch = 2.5cm
		5 ft 4½ in = $(5 \times 12 + 4.5) \times 2.538 = 64.5 \times 2.538$ oe ALT: $5.375 \text{ ft} \div 3.283$	M1	Apply a correct conversion to get both mean heights into the same system of measurement
		163.7 cm (allow 161 to 164 oe)	A1	163.83 cm [from 1 inch = 2.54cm] 161.25 cm [from 1 inch = 2.5cm]
		The mean in the USA is greater by $176 - 163.7 = 12.3$ cm Final answer must be between 12 cm and 15 cm oe	A1	12.2 cm [from 1 inch = 2.54cm] 14.8 cm [from 1 inch = 2.5cm]
			[3]	
		SPECIAL CASE max 1/3		If considering 190 cm rather than converting the mean height
		Correctly converting 190 cm = 74.9 inches or 6ft 3 inches This answer must be between 74.5 and 76 inches	SC B1	74.8 inches [from 1 inch = 2.54cm] 76 inches [from 1 inch = 2.5cm]

4	(a)							B1	Either Botswana or Canada correct	
		Country	Area	Area rank, x	Roads	Roads rank, y	$d = x - y$			d^2
		Tunisia	163610	5	19418	6	-1			1
		Botswana	581730	2	17916	7	-5			25
		Panama	75420	6	15137	8	-2			4
		Canada	9984670	1	1042300	1	0			0
		Paraguay	406752	3	32059	4	-1			1
		Laos	236800	4	39586	3	1			1
		Jamaica	10991	8	22121	5	3			9
		Denmark	43094	7	74497	2	5			25
Samoa	2831	9	2337	9	0	0	B1	All correct, including $\sum d^2$		
Fig. 4.1				Σ	0	66				
$r_s = 1 - \frac{6 \times \sum d^2}{n(n^2 - 1)} = 1 - \frac{6 \times 66}{9(9^2 - 1)}$						M1	Attempt to use correct formula, implied by $r_s = 0.45$ Allow one slip in the use of the formula			
						A1	CAO			
						[4]				

4	(b)	<p>H_0: There is no association (correlation) between country size (area) and length of roads</p> <p>H_1: There is a positive association (correlation) between country size (area) and length of roads</p>	B1	<p>Both hypotheses correct. Must be in context.</p> <p>Allow “country size and length of roads are independent”</p> <p>Reference to size and length must occur at least once, in either H_0 or H_1</p>
			[1]	
4	(c)	<p>[Critical value is] 0.6(000)</p> <p>$0.45 < 0.6(000)$</p> <p>Accept the null hypothesis oe</p> <p>OR The test does not support Riley’s theory oe</p>	B1 M1 A1	<p>Correct critical value for a 1-tail test at the 5% significance level with $n = 9$</p> <p>Comparison of <i>their</i> r_s ($r_s < 1$) from 4a with <i>their</i> stated critical value in range -1 to 1</p> <p>Fully correct test and conclusion</p>
			[3]	

4	(d)	<p>Small sample size [they should have included more countries]</p> <p>OR</p> <p>Any other sensible reason, which must reference the context</p>	B1	<p><u>Examples:</u></p> <p>Their sample did not include a wide range of countries</p> <p>Countries chosen were not representative of countries around the world</p> <p>Lengths of roads might depend on other factors</p> <p>Correlation between country size and length of roads does not imply causation</p> <p>The test was only carried out at the 5% level</p> <p><u>Do not accept:</u></p> <p>A reference to how close their r_s was to their critical value</p> <p>Just “you can’t prove anything by statistics”</p> <p>Their sample wasn’t random</p> <p>They didn’t use all of the regions</p>
			[1]	
4	(e)	<p>There is a positive association (correlation)</p> <p>OR</p> <p>The high value [for correlation coefficient] with a large sample shows that Riley was correct [and/or Taylor was wrong]</p>	B1	Do not allow weak positive correlation
			[1]	

5	(a)	<p>Ethiopia Population: 105 350 020 Birth rate: 36.5 (/1000)</p> <p>Babies per year = $\frac{105350020}{1000} \times 36.5 = 3\,845\,275.73$</p>	<p>B1 Both correct</p> <p>B1 3 845 275 or 3 845 276 or 3.8 million</p>
			[2]
5	(b)	<p>[365 × 24 × 60 × 60 =] 31 536 000 seconds in 1 year</p> <p>No and correct calculated value:</p> <p>Either: $\frac{3845276}{31536000} = 0.1(22)$ (babies per second)</p> <p>OR: $\frac{31536000}{3845276} = 8(.2)$ (a baby is born every 8s)</p>	<p>B1 Allow 31 449 600 (from $52 \times 7 \times 24 \times 60 \times 60$) Soi by calculations or correct answer</p> <p>B1 ALT: No because $3\,845\,276 < (\neq) 31\,536\,000$ oe (comparison of correct number of babies born in a year and correct number of seconds in a year)</p>
			[2]
5	(c)	Saint Barthelemy, Saint Maartin, Holy See (Vatican), Kosovo, Christmas Island, Cocos (Keeling) Islands, Niue, Norfolk Island, Pitcairn Islands, Tokelau	<p>B1 Any one of these 10 deleted countries</p>
			[1]
5	(d)	<p>C238 The [world] population</p> <p>P238 Number of births [in the world])</p> <p>P239 [average] Birth rate [/1000 population across the world]</p>	<p>B1</p> <p>B1 Accept all births, all babies, or total babies. If a rate is stated, it must be “per year”. Not per second. Not per 1000</p> <p>B1 Accept births per thousand, or births per year. Not per second</p>
			[3]
5	(e)	[About] 4(.3) [babies per second]	<p>B1 CAO as whole number or decimal</p>
			[1]

6	(a)	Japan Population: 126 451 398 Median Age: 47.3	B1	Both required
			[1]	
6	(b)	[Area of the first two bars of the histogram =] $10 \times 1.01 + 10 \times 1.13$ oe = 21.4 (million) AG	B1	Must show a correct calculation using the given heights, implied by 10.1 + 11.3
			[1]	
6	(c)	65-70: $[10 \times 1.59 \div 2] = 7.95$ 70-90: $[20 \times 1.26] = 25.2$ 90-110: $[20 \times 0.12] = 2.4$ Total 35.55 million (35 550 000)	B1 B1 B1	Correct area for the 65-70 group using the given heights Correct area for both groups using the given heights nfwf following both earlier B1B1 35.55 million unsupported scores B3 Note: Accept 36 million or 35.6 million with calculations seen
			[3]	
6	(d)	In education: 21.4 [million] AG In work: $[30 \times 1.5 + 10 \times 1.66 + 5 \times 1.59] = 69.55$ [million] Retired: 35.55 [million]	B1	CAO 69.55 [million] or 69.5 [million] or awrt 69.5 [million] All three answers required
			[1]	

6	(e)	$\left[\frac{\text{Not working}}{\text{Working}} \right] \rightarrow \frac{21.4 + 35.55}{69.55} = \left(\frac{56.95}{69.55} = 0.8188 \right)$ <p>OR</p> $\left[\frac{\text{All}}{\text{Working}} - 1 \right] \rightarrow \frac{21.4 + 69.55 + 35.55}{69.55} - 1 = \left(\frac{126.5}{69.55} - 1 = 0.8188 \right)$ <p>OR</p> <p>[Working : Not working] $\rightarrow 69.55 : 21.4 + 35.55 (= 1 : 0.8188)$</p> <p>(On average each working person is supporting) 0.82 (other people)</p>	M1	Must be using <i>their</i> values from 6d or the correct values
			A1	AWRT 0.8
			[2]	

<p>6</p>	<p>(f)</p>	<p>Sight of the correct numbers in a valid calculation: eg OR $\frac{49}{77.5} = [0.6322] = 0.63$ AG eg OR $\frac{126.5}{77.5} - 1 = [1.6322 - 1] = 0.63$ AG eg 77.50: 49 → [1 : 0.6322] = 1: 0.63 AG</p> <p>This is a considerable reduction in the burden carried by people in work</p>	<p>B1</p> <p>B1</p>	<p>Number in work would be: 69.55 + 7.95 = 77.50 million Number not in work would be: 56.95 - 7.95 = 49 million</p> <p>Correct calculation</p> <p><u>Not</u> dependent on correct answer in part 6d and also not dependent on having shown 0.63</p> <p><u>Examples</u></p> <p>Any valid comment in the context of the retirement age increasing</p> <p>Workers will support fewer (non-working) people</p> <p>Increasing the retirement age to 70 will have a lag as some people are already retired</p> <p>Not everyone will be able to work longer due to health issues</p> <p>There will be more taxpayers</p>
			<p>[2]</p>	

6	(g)	<p>[The Netherlands may be increasing their retirement age because ..]</p> <p>Median age = 42.6 which is high (indicating an aging population)</p> <p>OR</p> <p>Population growth rate = 0.39% which is low (indicating that there may be fewer young people joining the workforce in the future)</p> <p>OR</p> <p>Life expectancy = 81.4 which is high (indicating that people are living long in retirement and need to be supported financially)</p>	B1	<p>Correct value stated, along with a brief explanation</p> <p>Not a justification from birth rate</p>
			[1]	

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