Level 3 Certificate

Mathematics

H868/01: Introduction to Quantitative Reasoning

OCR Level 3 Certificate Core Maths A (MEI)

Mark Scheme for June 2023

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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.

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**

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.

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.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO</th><th>Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td>
<table>
<tr><td>Value, £V</td><td>Number of records</td><td colspan="2"></td></tr>
<tr><td>$10 \leqslant V < 50$</td><td>15</td><td>30</td><td>450</td></tr>
<tr><td>$50 \leqslant V < 90$</td><td>4</td><td>70</td><td>280</td></tr>
<tr><td>$90 \leqslant V < 130$</td><td>7</td><td>110</td><td>770</td></tr>
<tr><td>$130 \leqslant V < 170$</td><td>5</td><td>150</td><td>750</td></tr>
<tr><td>Total</td><td>31</td><td></td><td>(£)2250</td></tr>
</table>
</td><td>B1

B1

B1

[3]</td><td>2

1

1</td><td>At least 3 correct mid-points.

At least three correct values of interval totals (their mid-points × frequency).

CAO (£)2250 Full marks for correct answer with no working shown.
Lack of “£” condoned.

Do not credit correct answer in box when there is further work done on this figure and clearly submitted as their answer.</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td>Using a reverse percentage calculation</td></tr>
<tr><td></td><td>(b)</td><td></td><td>150% is (£)45.60

Giving 1% as $\frac{45.60}{150}$

So 100% (Anika’s friend’s selling price) is (£)30.40

This does not agree (with (£)45.60)</td><td>B1

B1

B1

B1</td><td>3

3

3

3</td><td>This may be implied.

May be implied. This and the above mark may be awarded for 45.6 ÷ 1.5 (=30.40).

FT supported by some form of calculation above.</td></tr>
<tr><td colspan="4"></td><td>[4]</td><td colspan="2"></td></tr>
</table>

			Alternative method			Using Anika's answer and working back
1	**(b)**		50% profit of Anika's calculation for the buying price is 50% of (£)22.80 = (£)11.40	**B1**	**3**	
			Giving a selling price of (£)22.80 + (£)11.40	**B1**	**3**	May be implied. This and the above mark may be awarded for 22.8 × 1.5 (=34.20).
			= (£)34.20	**B1**	**3**	
			This does not agree (with (£)45.60)	**B1**	**3**	FT supported by some form of calculation above.
				[4]		
			Alternative method			Using Anika's answer and working back
1	**(b)**		The dealer's profit is (£)45.60 – (£)22.80 = (£)22.80	**B1**	**3**	Can be implied by second B1
			Giving a percentage profit of $\frac{22.80}{22.80}\times 100$	**B1**	**3**	This may be implied by 100% profit stated.
			= 100%	**B1**	**3**	soi
			This does not agree (with the 50% profit) oe	**B1**	**3**	FT supported by some form of calculation above.
				[4]		

1	**(c)**	**(i)**	3600 CAD = 3600 × 0.5579 = (£)2008.44	**B1**	**1**	Allow (£)2008
			(£)2008.44 – (£)7 = (£)2001.44	**B1** **[2]**	**1**	Allow (£)2001 The £7 handling fee may be given retrospectively if the £7 is deducted in part (c) (iii) instead of here. FT (*their* 2008.44) - 7

1	**(c)**	**(ii)**	(100 + 135) × 31 soi = 7.285 (kg) soi Which costs (£)121.55 from table Total air freight cost = (£)121.55 + (£)80 = (£)201.55	**B1** **B1** **B1** **B1** **[4]**	**2** **2** **3** **3**	Accept working in kg Conversion to kg This implies the previous two marks **FT** on *their* £121.55 + £80 (insurance)
1	**(c)**	**(iii)**	Net takings from Canadian deal = (£)2001.44 – (£)201.55 = (£)1799.89 So UK better deal	**B1** **B1** **[2]**	**1** **3**	**FT** on *their* CAD conversion – *their* air freight and insurance (Response 1(c)(i) – response 1(c)(ii)) Accept (£)2008 – (£)201.55 = (£)1806.45 The £7 handling charge taken account of here will gain the second mark in part (c)(i) **FT** on *their* calculated Canadian compared with £1850 UK offer and accept *their* stated difference and comment to the effect that it's not worth the hassle of postage etc.

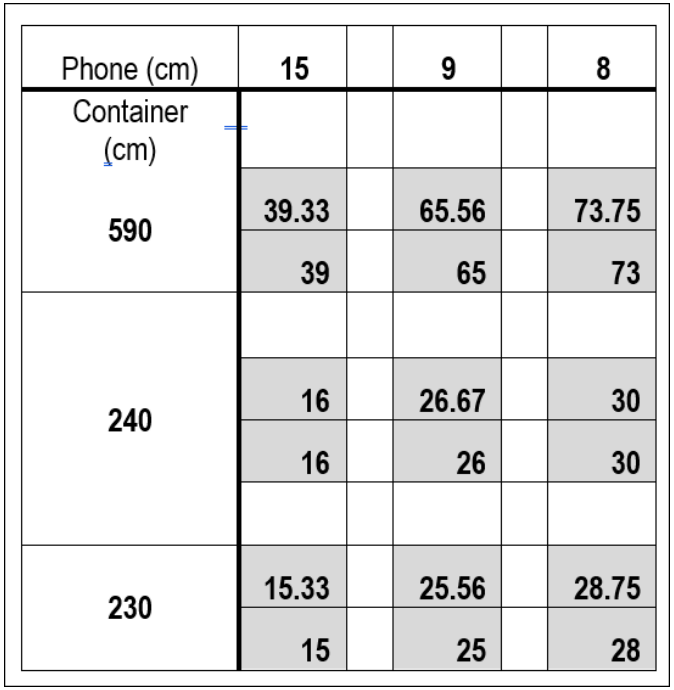
2	**(a)**		Because from 2015 figures are for each single year, this spreads the change out oe.	**B1** **[1]**	**3**	The year scale (*x*-axes) is uneven or better. Condone correct calculation of change after the last 5-year period (2016 to 2020 ≈ 30 million tonnes) (i.e. focus of *x*-axis scale.)
2	**(b)**		590 cm by 240 cm by 230 cm or 0.15 m by 0.09 m by 0.08	**B1**	**2**	Evidence of correct cm ↔m at any point. (e.g. 32.568, 0.00108 or 32568000, 1080)
			Figs 32568 ÷ figs 1080	**B1**	**2**	Condone rounded or truncated i.e. 3256 or 3257 May be evidenced by 26804 … FT from *their* two volumes but must have resulted from some form of calculation.
			32568000 ÷ 1080 or 32.568 ÷ 0.00108 = 30155	**B1**	**3**	CAO
			(30155.6 or 30156 or 30155) × (£)330 = 9 951 348 / 9 951 480 / 10 000 000 / 9 951 333.33 / 9 951 150	**B1**	**3**	Condone lack of verbal comparison correct value shown taken as sufficient. *Their* volume × 330 Allow sensible rounding e.g. 9 900 000 or 10 000 000
			The method assumes that there is no space between boxes (i.e. spacers) – they fit exactly/ the container can be completely filled, may be grouped together in larger boxes oe	**B1** **[5]**	**3**	Allow any other sensible and relevant reasons/assumptions. No credit for mentioning rounding up (it's about realistically fitting).

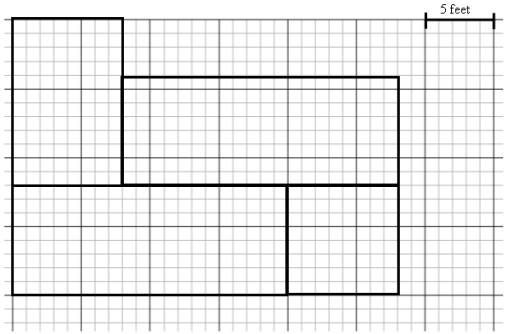
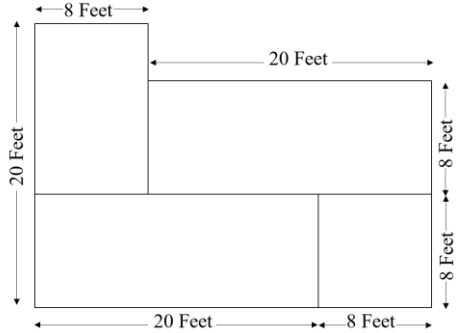
			Alternative method			Finding number of boxes fitting in each dimension by rounding down container dimension ÷ box dimension
			590 cm by 240 cm by 230 cm or 0.15 m by 0.09 m by 0.08	**B1**	**2**	Evidence of correct cm ↔m at any point.
			28392 or 28470 or 29120 or 29200 or 29250 number of boxes	**B2**	**3**	2 for correct number of boxes (see next page) 1 for evidence of 2 correct division below condone failure to round down.
			9 369 360 or 9 395 100 or 9 609 600 or 9 636 000 or 9 652 500	**B1**	**3**	*Their* number of boxes × (£)330 **Or** calculating number of phones via £12 000 000 divided by unit cost £330 = 36 363 boxes and comparing with *their* number of boxes.
			Mention of rounding down (to take account of impossibility of having fractional boxes)	**B1** **[5]**	**3**	Condone bland statement that results of division are rounded down.

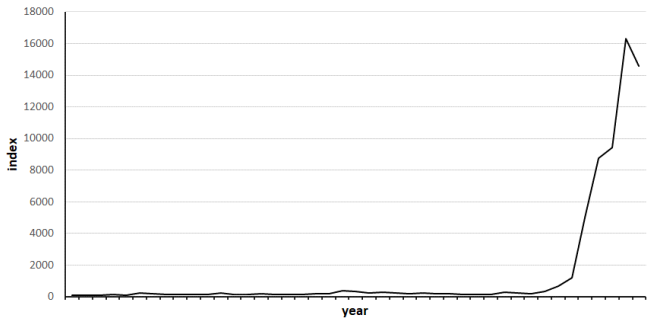
590	÷	**15**	=	39.333333	39	÷	**15**	=	39.333333	39
240	÷	**9**	=	26.666667	26	÷	**8**	=	30	30
230	÷	**8**	=	28.75	28	÷	**9**	=	25.555556	25
					28392					**29250**

590	÷	**8**	=	73.75	73	÷	**8**	=	73.75	73
240	÷	**9**	=	26.666667	26	÷	**15**	=	16	16
230	÷	**15**	=	15.333333	15	÷	**9**	=	25.555556	25
					28470					**29200**

590	÷	**9**	=	65.555556	65	÷	**9**	=	65.555556	65
240	÷	**8**	=	30	30	÷	**15**	=	16	16
230	÷	**15**	=	15.333333	15	÷	**8**	=	28.75	28
					29250					**29120**

			For more complicated configurations involving complex fitting together: 1 Evidence of conversion. 1 Evidence, perhaps a sketch, of correct number of box units in one directions (590 cm, 250 cm or 230 cm) aligned to container) or 1 for correct in just one direction. 1 *Their* total number (not necessarily correct) × (£)330 1 *Their* total cost compared to £12 million 1 Mention of rounding down (to take account of impossibility of having fractional boxes) or similar			 3 cells – integer - only one in each row or column give the container side in phone packet units.
2	**(c)**	**(i)**	C indicated	**B1** **[1]**	**1**	Condone any unambiguous form of indication.

2	**(c)**	**(ii)**	 (or equivalent in different orientation actual dimensions need not be written in)	**B1**	**2**	Accept freehand drawings max "wobble" $\pm\frac{1}{2}$ square. A shape made from at least three distinct rectangles forming a single shape with at least one of them with side lengths: (in feet) 20 by 8 or 12 by 8 or 8 by 8
				**B1**	**3**	A shape made from four distinct rectangles with at least two of them with two side lengths (in feet) of :- 20 by 8 or 12 by 8 or 8 by 8
				B1	**3**	Correctly drawn plan, in any orientation. _____ If total of zero scored for the item **SC2** for 6-sided shape not showing any individual rectangles with sides, in order, in feet $8 \times 4 \times 20 \times 16 \times 28 \times 20$.
				[3[		

3	(a)		$\frac{129}{100} \times 0.74$ (=0.9546) = 0.95 p	B1 B1 [2]	2 2	Can be implied by answer of 0.95 or 0.0095 (i.e. no money units needed). Accept £0.0095, follow through for *their* 0.9546 2 sf Correct money notation to 2 sf.
3	(b)		1 Until about 1950 moves up and down by a small amount oe 2 After about 1950/60/70 there is a large increase oe	B1 B1 [2]	3 3	Condone two features embedded as one for full credit. Allow other observations in line with this:  • The lowest was in 1620 • It rose by 14456 • Condone "it generally goes up but sometimes drops a bit" • "Increases but slight dip in 2020"

3	**(c)**		1920 : 299 1970 : 1213 $\frac{1213}{299} = 4.05 \ldots$ or 4.06 Which is less than the $4\frac{1}{2}$ times increase in average wages.	**B1** **B1** **B1** **[3]**	**2** **2** **2**	Need both May be implied by the correct answer 4.05… or 4.06 **FT** on *their* 4.05 … Must be an explicit comparison with wages Do not accept "similar" if difference greater than 0.05
			Alternative method			Method involving using the 4.5× increase in wages to see the effect of a 4.5× increase in bread and comparing the result with the actual value.
			299 and 1213 seen in working 299 × 4.5 = 1345.5 1345.5 is more than 1213 so bread prices increased by less than wages	**B1** **B1** **B1** **[3]**	**2** **2** **2**	 **FT** on *their* 1345.5 ……. Must be an explicit comparison with wages Do not accept "similar" if difference greater than 20.
			Alternative method			Comparing actual prices of bread using the indices
			299 and 1213 seen in working Wages 1920 = 4.56÷0.221 = 20.63 loaves Wages 1970 = 20.77÷0.898 = 23.129 loaves No difference or very similar	**B1** **B1** **B1** **[3]**	**2** **2** **2**	Implied by Price in 1920 = 221 Price 1970 = 898 Condone 20.6 and 23.1 **FT** on *their* numbers of loaves.

<table>
<tr><td>4</td><td>(a)</td><td>(i)</td><td>34 (mph)</td><td>B1
[1]</td><td>1</td><td>Accept 34 to 35 (mph)</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>(a)</td><td>(ii)</td><td>At 20 mph 15% chance of serious injury
At 30 mph 45% chance of serious injury
The decrease from 45% to 15%
Is a decrease of 3 times (or equivalent)
So, the model is reasonably consistent.</td><td>B1
B1
B1

B1
[4]</td><td>2
2
3

3</td><td>
Allow (44 to 45)%
FT on their percentages

FT on their calculations</td></tr>
<tr><td></td><td></td><td></td><td>Alternative method

At 20 mph 15% chance of serious injury
At 30 mph 45% chance of serious injury
If true 3 × 15% = 45% (or equivalent)
So, the model is reasonably consistent.</td><td>

B1
B1
B1
B1
[4]</td><td>

2
2
3
3</td><td>Assuming 3× greater or reverse equivalent and working backwards

Allow (44 to 45)%
FT on their 15% and their 45%
FT on their calculated above</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>(b)</td><td>(i)</td><td>
<table>
<tr><th rowspan="2">Type of injury</th><th colspan="2">72 months before the 20 mph speed limit imposed</th><th colspan="2">36 months after the 20 mph speed limit imposed</th></tr>
<tr><th>Number of injuries</th><th>Mean annual number of injuries</th><th>Number of injuries</th><th>Mean annual number of injuries</th></tr>
<tr><td>Serious</td><td>243</td><td>40.5</td><td>109</td><td>36.3</td></tr>
<tr><td>Slight</td><td>1849</td><td>308.2</td><td>753</td><td>251</td></tr>
<tr><td>Total</td><td>2092</td><td>348.7</td><td>862</td><td>287.3</td></tr>
</table>
</td><td>B1
B1

[2]</td><td>1
1</td><td>1 for 36.3
1 for 251

SC1 if both answers wrong but sum to 287.3.</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

<table>
<tr><td>4</td><td>(b)</td><td>(ii)</td><td>$\frac{109}{862}$ or $\frac{36.3}{287.3}$</td><td>B1

B1
[2]</td><td>2

2</td><td>Correct numerator

Correct denominator</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>(b)</td><td>(iii)</td><td>Mean annual number of serious accidents decreased from 40.5 to 36.3
or
Mean annual number of slight accidents decreased from 308.2 to 251
or
Mean annual total number of accidents decreased from 348.7 to 287.3
or
Probability that if there is an accident that it is serious about the same 0.13.</td><td>E1

[1]</td><td>3</td><td>Comments based on their mean annual numbers.
Must be supported by the numbers.

Must involve “mean annual numbers”
not “number of injuries”.

<table><tr><th>Type</th><th>Before / After</th></tr><tr><td>Serious</td><td>40.5 / 36.3</td></tr><tr><td>Slight</td><td>308.2 / 251</td></tr><tr><td>Total</td><td>348.7 / 287.3</td></tr></table>
Or decreased by
Serious 4.2 Slight 57.2 Total 61.4

Condone comparison based on Q.4(b)(ii):-
i.e. probabilities 0.126 and 0.116.</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

5	**(a)**	**(i)**	$\frac{1}{308\,915\,776}$ or $\frac{1}{3\times10^8}$	**B1** **[1]**	**1**	Condone answer in standard form: 3.23 ….. × 10^{-9} or
5	**(a)**	**(ii)**	(n =) 8	**B1** **[1]**	**1**	
5	**(b)**	**(i)**	1×10^{18}	**B1** **[1]**	**1**	Condone 1E+18 but not 10^{18}
5	**(b)**	**(ii)**	$(1 \times 10^{18}) \times 10^6 = 1 \times 10^{24}$ From graph is 12-character words	**B1** **B1** **[2]**	**2** **2**	Can be implied by correct answer **FT** on *their* 1×10^{24}
5	**(c)**	**(i)**	There are 10^{40} different words By brute force would take $8 \times 10^{-19} \times 10^{40}$ $= 8 \times 10^{21}$ (years)	**B1** **B1** **[2]**	**2** **2**	Can be implied by correct answer **FT** on *their* 10^{40}
5	**(c)**	**(ii)**	$(8 \times 10^{21}) \div (13.8 \times 10^9)$ Giving 5.7971 … × 10^{11} (times)	 **B1** **[1]**	 **2**	FT on *their* 8×10^{21} Allow 579 710 144 927 or 580 000 000 000 or 6×10^{11} or 5.8×10^{11}

6	**(a)**	**(i)**	$\frac{12.7-0}{15-0}$ = 0.8466 … or 0.85 or 0.8467 or $0.84\dot{6}$ or 0.847	**M1** **A1** **[2]**	**1** **1**	Can be implied by correct answer
6	**(a)**	**(ii)**	1	**B1** **[1]**	**1**	
6	**(a)**	**(iii)**	0.9233 … or 0.92 or $0.92\dot{3}$ or 0.923	**B1** **[1]**	**1**	FT on mean from *their* 1 and *their* 0.8466….
6	**(b)**	**(i)**	The mean (11.282 or B192) is wrong because indicators are between 0 and 1	**B1** **B1** **[2]**	**3** **3**	Dependent on the first B1 Or equivalent Condone "less than 1" Condone "too large an indicator" iff correct response to part (ii).
6	**(b)**	**(ii)**	=AVERAGE(B2:B190) and median empty or copied from above	**B1** **[1]**	**2**	Condone "=average(B2:B190)" Only mean "line" needs be correct for credit.
6	**(c)**	**(i)**	(31 + 15 =) 46	**B1** **[1]**	**1**	

6	**(c)**	**(ii)**	(11 + 4=) 15	**B1** **[1]**	**1**	
6	**(c)**	**(iii)**	Should be bell-shaped	**B1** **[1]**	**3**	• Allow median and mean should be equal • should be symmetrical • it is (negatively) skewed or not symmetrical • mode should be in the middle. Do not accept "positive skew"

7	**(a)**	**(i)**	11(%)	**B1** **[1]**	**1**	
	(a)	**(ii)**	7(%)	**B1** **[1]**	**1**	
7	**(b)**	**(i)**	$20 = 31 - 10p$ $10p = 11$ $p = (£)1.10$	**B1** **B1** **B1** **[3]**	**3** **1** **1**	Allow $20 + 10p = 31$ oe May be implied from next B1 May be implied by correct response Although lack of "£" may be condoned, answer must be 2 d.p.
7	**(b)**	**(ii)**	$S = 31 - 10 \times 3.1$ = 0 or no sales	**B1** **B1** **[2]**	**2** **3**	Evidence of correct substitution Condone "0" or "zero" oe

7	**(c)**		$\frac{498-480}{498}\times 100$ $\approx \frac{500-480}{500}\times 100$ $= \frac{20}{500}\times 100$ = 4(%)	**B1** **B1** **[2]**	**2** **2**	Condone $\frac{500-480}{500}\times 100$ seen or overt evidence of taking 498 ≈ 500 for the denominator Also allowed is: $\frac{18}{500}\times 100 = 3.6(\%)$ (Full credit of 2) **SC1** for response "0" as evidenced from 498 – 480 ≈ 500 – 500 = 0
7	**(d)**	**(i)**	164	**B1** **[1]**	**2**	
7	**(d)**	**(ii)**	120 × 2 = 240 (bars) (£)1.15	**B1** **B1** **[2]**	**2** **3**	If correct response award this mark FT on *their* 240 bars based on a calculation involving "doubling"
				72		

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