
STATISTICS

4040/23

Paper 2

October/November 2019

MARK SCHEME

Maximum Mark: 100

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

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This document consists of **9** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

the specific content of the mark scheme or the generic level descriptors for the question
the specific skills defined in the mark scheme or in the generic level descriptors for the question
the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
marks are awarded when candidates clearly demonstrate what they know and can do
marks are not deducted for errors
marks are not deducted for omissions
answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

MARK SCHEME NOTES

The following notes are intended to aid interpretation of mark schemes in general, but individual mark schemes may include marks awarded for specific reasons outside the scope of these notes.

Types of mark

- M** Method marks, awarded for a valid method applied to the problem.
- A** Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. For accuracy marks to be given, the associated Method mark must be earned or implied.
- B** Mark for a correct result or statement independent of Method marks.

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 M or B mark is dependent on an earlier, asterisked, mark in the scheme.

The symbol ∇ 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.

Abbreviations

AG	answer given on question paper
awrt	answer which rounds to
cao	correct answer only
dep	dependent
ft	follow through after error
oe	or equivalent
SC	special case
soi	seen or implied
www	without wrong working

Question	Answer	Marks	Partial Marks
1(a)	Successful as trend is downward	1	B1
1(b)	$(-6.5 + -7 + -5.5 + -6 + -5.5)/5 = -30.5/5 = -6.1$ ± at least one appropriate difference	3	M1
	Sum of 5 differences/5		M1
	-6.1		A1
1(c)	Reading from the trend line + their (b), 11 + '-6'	2	M1
	5 ft their negative season component		A1✓

Question	Answer	Marks	Partial Marks
2(a)	31, 01, 24, 00, 12, 27, 11, 36 (B1 for 1 independent error)	2	B2
2(b)	Find how many of each in their sample (4 small, 4 large)	3	M1
	$18/40 \cdot 8 [=3.6]$ or $22/40 \cdot 8 [=4.4]$		M1
	Sample representative / as representative as a sample of size 8 could be		A1✓

Question	Answer	Marks	Partial Marks
3(a)	$(68 - 50)/12 = (1.72 - x)/0.06$ oe	6	M1
	$x = 1.63$		A1
	$(58 - 50)/12 = (5.16 - 5.04)/y$ or $(44 - 50)/12 = (4.95 - 5.04)/y$ oe		M1
	$y = 0.18$		A1
	$(z - 50)/12 = (1.65 - '1.63')/0.06$ oe		M1
	$z = 54$ ft		A1✓
3(b)	To compare a student's high jump performance with their long jump performance [each relative to the rest of the class]	1	B1

Question	Answer	Marks	Partial Marks										
4(a)	<table style="display: inline-table; border-collapse: collapse;"> <tr><td style="border-right: 1px solid black; padding: 2px 5px;">2</td><td style="padding: 2px 5px;">6 6 8 9</td></tr> <tr><td style="border-right: 1px solid black; padding: 2px 5px;">3</td><td style="padding: 2px 5px;">2 4 5</td></tr> <tr><td style="border-right: 1px solid black; padding: 2px 5px;">4</td><td style="padding: 2px 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 2px 5px;">5</td><td style="padding: 2px 5px;">3 4 4 8 9</td></tr> <tr><td style="border-right: 1px solid black; padding: 2px 5px;">6</td><td style="padding: 2px 5px;">0 1 3 3</td></tr> </table> <p style="margin-left: 100px;">Key: 2 6 represents 26 km/h</p>	2	6 6 8 9	3	2 4 5	4		5	3 4 4 8 9	6	0 1 3 3	4	
	2	6 6 8 9											
	3	2 4 5											
	4												
	5	3 4 4 8 9											
6	0 1 3 3												
Suitable stem	B1												
Suitable key (including units)	B1												
Correct leaves (may be unordered) or ordered leaves (allow max 2 errors/omissions)	M1												
Fully correct ordered, equally spaced leaves. No commas	A1												
4(b)	38	1	B1										
4(c)	Anything that would cause a temporary slowing down of traffic, e.g. a slow-moving vehicle (causing queue), traffic lights, an accident, temporary police presence/speed checks	1	B1										
4(d)	Original data not lost	1	B1										

Question	Answer	Marks	Partial Marks
5(a)	$P(A) + P(B) > 1$	1	B1
5(b)	Use of $P(A \cap B) = P(A) + P(B) - P(A \cup B)$	2	M1
	0.5		A1
5(c)	Comparing $P(A) \cdot P(B) = 0.75 \cdot 0.6 [= 0.45]$ with ' $P(A \cap B)$ '	2	M1
	$0.45 \neq 0.5$ so not independent		A1
	Or compare $P(A) + P(B) - P(A) \cdot P(B)$ with 0.85		(M1)
	$0.9 \neq 0.85$ so not independent		(A1)
5(d)	$0.85 - '0.5' = 0.35$ or $0.75 + 0.6 - 2 \cdot '0.5' = 0.35$	1	B1 ^{1/2}
5(e)	0.15	1	B1

Question	Answer	Marks	Partial Marks
6(a)	$(18 + 25)/2 = 21.5$ AG	1	B1
6(b)	'21.5' · 12 + '27.5' · 23 + '35' · 18 + '50' · 7 [=1870.5]	6	M1
	'1870.5'/60		M1
	'21.5' ² · 12 + '27.5' ² · 23 + '35' ² · 18 + '50' ² · 7 [=62490.75]		M1*
	$[\sqrt{('62490.75'/60 - '31.175'^2)}$		M1dep*
	$\sqrt{('62490.75'/60 - '31.175'^2)}$		M1
	OR $(21.5 - 31.175)^2 \cdot 12 + (27.5 - 31.175)^2 \cdot 23 + (35 - 31.175)^2 \cdot 18 + (50 - 31.175)^2 \cdot 7$		(M1*)
	$[\sqrt{('4177.9125'/60)}$		(M1dep*)
	$\sqrt{('4177.9125'/60)}$		(M1)
Mean = 31.175 or 31.18 or 31.2 and s.d. = 8.34 (allow answer in range 8.325 to 8.345)	A1		
6(c)	33.175, 8.34	1	B1 [✓]

Question	Answer	Marks	Partial Marks
7(a)	Discrete quantitative	2	B1 B1
7(b)	$102 \cdot 4.5 [= 459]$	5	M1*
	'459' – sum of letters in 'world health organisation'		M1dep*
	+ letters in 'WHO'		M1dep*
	/100		M1
	4.39		A1
7(c)	Largest = 13	2	B1
	Lower quartile = 3		B1
7(d)	A box plot with: correctly plotted median line at 4	3	B1
	correctly plotted box using, 'LQ', UQ at '3' and 6.5 and whiskers using shortest word, 'longest word' at 1, and '13' (B1 [✓] for 3 correct plots from 1, '3', 6.5 and '13')		B2 [✓]

Question	Answer	Marks	Partial Marks
7(e)	Words in the world news article are [generally] shorter or Words in the sports news article are [generally] longer	2	B1
	Words in the world news article are [generally] less varied or Words in the sports news article are [generally] more varied		B1

Question	Answer	Marks	Partial Marks
8(a)	Any factor which can be used to divide up the university population	2	B1
	Because it impacts on spending patterns		B1
8(b)	105/103 [\cdot 100]	2	M1
	101.9 awrt or 102		A1
8(c)	[Food] prices/cost not changed from 2016 [to 2017]/since base year	1	B1
8(d)	109 and 95	3	B1
	$115/x \cdot 100 = 108$ oe		M1
	106.48 awrt or 106.5 or 106		A1
8(e)(i)	$105 \cdot 35 + 102 \cdot 20 + 111 \cdot 3 + 98 \cdot 2 + 115 \cdot 12 [= 7624]$	3	M1*
	$/ (35 + 20 + 3 + 2 + 12)$		M1 dep*
	105.9 cao		A1
8(e)(ii)	Price/cost (of living) has increased ft By 5.9% ft Between 2016 and 2018 (B1 for any 2 lines above correct)	2	B2 ^{ft}
8(e)(iii)	Spending patterns/weights/categories likely to be different [for all the people in the country compared to the students] Or Weights/price relatives may vary across the country	1	B1
8(f)	$6300 \cdot '105.9'/100$ or $6300 \cdot '5.9'/100 + 6300$	2	M1
	[\$] 6670 cao		A1

Question	Answer	Marks	Partial Marks
9(a)	19/90 or 0.211 oe Correct numerator	2	B1
	Correct denominator		B1
9(b)	52/90' oe	1	B1 ^{1/2}
9(c)	25/52' oe	1	B1 ^{1/2}
9(d)	39/90 · 36/89 · 2 Product of 2 probs · 2	3	M1
	n · (n – 1) in denominator		M1
	0.351 awrt or 2808/8010 or 156/445 oe		A1
9(e)	1 – 0.1 or 0.9 oe	2	B1
	0.86 · 0.9 = 0.774 AG		B1
9(f)	0.72 · (1 – 0.1) or 0.648	3	B1
	0.774 · 83 + '0.648' · 57		M1
	101 or better (101.178)		A1
9(g)	Use of x and 2x oe	4	M1
	0.774 · 2x + '0.648' · x = 79		M1
	x = 36		A1
	108		A1

Question	Answer	Marks	Partial Marks
10(a)	6/10 · 8 [= 4.8] or 4/10 · 8 [= 3.2]	5	M1
	24 – '4.8' or 16 + '3.2' [= 19.2]		M1
	19.2 or 19		A1
	8.00 am – ('19' + 5) mins or 7.55 am – '19' mins		M1
	7.36 [am]		A1
10(b)	Mean because it is influenced by a few longer times/extreme values (B1 for mean as it will be bigger [than median or mode] or B1 for mean as it uses all the values)	2	B2

Question	Answer	Marks	Partial Marks
10(c)	$7/8 \cdot 15$ or $1/8 \cdot 15$ (15 mins cut off)	5	M1
	$6/8 \cdot 4$ or $2/8 \cdot 4$ (30 mins cut off)		M1
	15 and 2		A1
	'15' \cdot 7.3 + '2' \cdot 14.6		M1
	[\$] 138.7[0] or 139		A1
10(d)	24	1	B1
10(e)	The bus journeys are [generally] more minutes late than the train journeys	1	B1