



## Cambridge O Level

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STATISTICS

4040/23

Paper 2

October/November 2021

MARK SCHEME

Maximum Mark: 100

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**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.

Cambridge International is publishing the mark schemes for the October/November 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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This document consists of **10** 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  $\surd$  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**

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

Question	Answer	Marks	Partial Marks
1(a)	Correct sectional bar heights (thousands may be missing) 1991: 4.6, 13.6, 15 2001: 4, 13.8, 15.4 2011: 5.2, 16.8, 19 <i>(B1ft for 8 bar heights correct)</i>	4	B2
	Linear scale from 0 to 19 000, labelled 'no of people' <b>oe</b>		B1
	Bars labelled 1991, 2001, 2011 and key/labelling for children, adults, seniors		B1
1(b)	Data suggests an increase in overall population	2	B1
	Consideration as to whether the increase is steady, e.g. not steady as smaller increase from 1991–2001/larger increase from 2001–2011 <b>or</b> steady as a (small) increase every 10 years <b>or</b> cannot tell if steady as data only taken every 10 years		B1

Question	Answer	Marks	Partial Marks
2(a)	The [30] students in the class	1	B1
2(b)	21 15 09 10 28 02 <i>(B1 for one error)</i>	2	B2
2(c)	A systematic sample	3	M1
	with interval of 5		M1
	04 09 14 19 24 29		A1

Question	Answer	Marks	Partial Marks
3(a)	W Mean = 11.96	4	B1
	SD = 0.82		B1
	X Mean = 29.6		B1
	SD = 8.2		B1
3(b)	14.5 19.5 17 5 <i>(B1ft for 2 or 3 correct values)</i>	2	B2

Question	Answer	Marks	Partial Marks
3(c)	Mean = 21.8	2	B1
	SD = 4.1		B1

Question	Answer	Marks	Partial Marks
4(a)	<div style="display: flex; justify-content: space-between;"> <div style="text-align: right;"> <p>[Raashida]</p> <p>8 8 4 3 1 0</p> <p>9 3 3 2</p> <p>4</p> <p>4</p> <p>5</p> <p>6</p> </div> <div style="text-align: left;"> <p>4   0   1 2 9 9</p> <p>1   2 3 7</p> <p>2   8 9</p> <p>3   3</p> <p>4   0</p> <p>5</p> <p>6   5</p> </div> <div style="border: 1px solid black; padding: 5px; margin-left: 20px;"> <p>Key: 0 1 2 means 10 [characters] for Raashida and 12 [characters] for Takala</p> </div> </div>	5	
	Correct stem: 0, 1, 2, 3, 4, 5, 6		B1
	Suitable key for back-to-back stem-and-leaf diagram		B1
	Correct, equally spaced, ordered leaves (must be back-to-back) ( <b>B2</b> for 1 error, <b>B1</b> for 2 errors)		B3
4(b)	An extreme value [65] is distorting the mean for Takala	2	B1
	Otherwise Raashida's messages are generally longer/median for Raashida is 18 whereas median for Takala is 15		B1

Question	Answer	Marks	Partial Marks
5(a)	Use of mean = $\Sigma x/n$	4	M1*
	$n = 31$		A1
	Use of correct formula for standard deviation or variance $138\,776/31 - 66^2$ or $138\,776/31 - (2046/31)^2$		M1 dep
	$\sqrt{(138\,776/31 - 66^2)}$		A1
5(b)	$(x - 66)/11.0 = (x - 60)/15$ <b>oe</b>	2	M1
	82.5		A1

Question	Answer	Marks	Partial Marks
6	<b>EITHER</b> $0.8 \times 0.5$ or $0.8 \times 0.3$	5	M1
	$0.2 \times 0.4$ or $0.2 \times 0.25$		M1
	[P(Win) =] $0.8 \times 0.5 + 0.2 \times 0.4$ [= 0.48] or [P(Draw) =] $0.8 \times 0.3 + 0.2 \times 0.25$ [= 0.29]		M1
	'P(Win)' $\times 3$ + 'P(Draw)' [ $\times 1$ ] [+ 'P(Lose)' $\times 0$ ]		M1 dep
	1.73		A1
	<b>OR</b> [Exp pts when wearing red =] $0.5 \times 3 + 0.3$ [ $\times 1$ ] [+ $0.2 \times 0$ ] [= 1.8]		(M1
	[Exp pts when not wearing red =] $0.4 \times 3 + 0.25$ [ $\times 1$ ] [+ $0.35 \times 0$ ]		M1
	[= 1.45] '1.8' $\times 0.8$ [= 1.44] or '1.45' $\times 0.2$ [= 0.29]		M1
	'1.8' $\times 0.8$ + '1.45' $\times 0.2$		M1
	1.73 (If 0 scored, <b>SCB2</b> for final answer with figs 173)		A1)

Question	Answer	Marks	Partial Marks																
7(a)	Correct plots ( <b>B1</b> for 7 or 8 correct plots)	3	B2																
	9 plots correctly joined with straight line segments		B1																
7(b)	7 correct moving average values	3	B2																
	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>Tu</th> <th>Th</th> <th>Sa</th> </tr> </thead> <tbody> <tr> <th>Wk 1</th> <td></td> <td>464</td> <td>457</td> </tr> <tr> <th>Wk 2</th> <td>454</td> <td>450</td> <td>453</td> </tr> <tr> <th>Wk 3</th> <td>443</td> <td>437</td> <td></td> </tr> </tbody> </table>			Tu	Th	Sa	Wk 1		464	457	Wk 2	454	450	453	Wk 3	443	437		
			Tu	Th	Sa														
Wk 1		464	457																
Wk 2	454	450	453																
Wk 3	443	437																	
( <b>B1</b> for 3, 4, 5 or 6 correct moving average values)																			
	In the correct 7 places in the table		B1																
7(c)	$\pm (351 - '464')$ or $\pm (343 - '450')$ or $\pm (312 - '437')$	3	M1*																
	Sum of 3 appropriate differences $\div 3$ (allow $\pm$ )		M1dep																
	-115		A1																

Question	Answer	Marks	Partial Marks
7(d)	7 correct plots vertically	3	B1ft
	7 correct plots horizontally		B1
	Suitable ruled trend line		B1ft
7(e)	Reading at Th Wk 4 + <i>their</i> (c)	2	M1
	'430' – 115 = '315' (ft <i>their</i> trend line, ans in range 300–330)		A1ft
7(f)	One from <ul style="list-style-type: none"> <li>That the trend continues</li> <li>That the seasonal variation continues</li> </ul>	1	B1

Question	Answer	Marks	Partial Marks																	
8(a)	All 4 ticks in the correct column	3	B3																	
	<table border="1"> <thead> <tr> <th></th> <th>Qual</th> <th>Dis quant</th> <th>Cont quant</th> </tr> </thead> <tbody> <tr> <td>Length</td> <td></td> <td></td> <td>✓</td> </tr> <tr> <td>Manufacturer</td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>No. airbags</td> <td></td> <td>✓</td> <td></td> </tr> <tr> <td>Weight</td> <td></td> <td></td> <td>✓</td> </tr> </tbody> </table> <p>(B2 for 3 ticks in the correct column) (B1 for 2 ticks in the correct column)</p>				Qual	Dis quant	Cont quant	Length			✓	Manufacturer	✓			No. airbags		✓		Weight
	Qual	Dis quant	Cont quant																	
Length			✓																	
Manufacturer	✓																			
No. airbags		✓																		
Weight			✓																	
8(b)	<b>EITHER</b> $2/3 \times 15 [= 10]$ oe	4	M1																	
	$80 - (7 + '10')$ oe		M1																	
	63		A1																	
	78.75(%) or 78.8(%)		A1																	
	<b>OR</b> $1/3 \times 15 [= 5]$ oe		(M1																	
	$80 - 22 + '5'$ oe		M1																	
	63		A1																	
	78.75(%) or 78.8(%) (If M1 only scored, SCB1 for answer 21.25(%) or 21.3(%))		A1)																	

Question	Answer	Marks	Partial Marks
8(c)	40 <sup>th</sup> value	4	B1
	10 +		M1
	$(‘40’ - 22)/(45 - 22) \times (10.5 - 10)$		M1
	10.4 awrt		A1
8(d)	Whiskers to 4.6 and 13.7	3	B1
	Box to 9.6 and 11.0		B1
	A box and whisker diagram with ‘10.4’ plotted correctly (if 0 marks scored, <b>SCB1</b> for 13.7 and 9.6 seen)		B1ft
8(e)	Pickup trucks have [generally] greater fuel consumption [on average] oe	2	B1
	Variation in fuel consumption is the same for cars and pickup trucks		B1

Question	Answer	Marks	Partial Marks
9(a)	There has been no change in the price/cost of electricity between 2016 and 2019 ( <b>B1</b> for two correct lines above)	2	B2
9(b)	Weights have not been used	2	B1
	and weights not close to 1:1:1:1 oe		B1
9(c)	$0.15/0.12 [\times 100]$	3	M1
	125		A1
	99		B1
9(d)(i)	$22 \times 113 + 36 \times 108 + 8 \times ‘125’ + 10 \times ‘99’$	3	M1
	$\div (22 + 36 + 8 + 10)$ oe		M1
	110.1 cao		A1



Question	Answer	Marks	Partial Marks
9(d)(ii)	<b>EITHER</b> Expend. in 2016 = 22 000 + 36 000 + 8000 + 10 000 [= 76 000]	3	M1*
	'110.1' × '76 000' ÷ 100		M1dep
	[\$]84 000		A1
	<b>OR</b> (22 000 × 113 + 36 000 × 108 + 8000 × '125' + 10 000 × '99')		(M1*
	/100		M1dep
	[\$]83 640		A1)
9(e)	B and D	2	B1*
	because these have been accounted for in the calculation. ( <b>SCB1</b> for B only or D only with correct reason)		B1dep

Question	Answer	Marks	Partial Marks
10(a)	Mut ex: A&D, B&C, C&D Ind: A&B ( <b>B2</b> for 1 error/omission) ( <b>B1</b> for 2 errors/omissions)	3	B3
10(b)(i)	0	1	B1
10(b)(ii)	Use of $P(A) \times P(B)$ '3/8' × '2/7'	2	M1
	3/28 <b>oe</b>		A1
10(b)(iii)	[P(C) =] 3/8 × 5/7 [= 15/56] <b>oe</b>	3	B1
	Use of $P(B) + P(C)$ 2/7 + '15/56'		M1
	31/56 <b>oe</b>		A1
10(c)	$5/8 \times 3/7 \times 2/6 \times 3$ A product of three probs × 3	3	M1
	$n(n-1)(n-2)$ in the denominator		M1
	15/56 <b>oe</b>		A1

Question	Answer	Marks	Partial Marks
10(d)	'P(BBB from bag)' × 'P(WW from box)' ( $3/8 \times 2/7 \times 1/6 \times 2/10 \times 1/9$ )	4	M1
	P(BBB from bag) = $3/8 \times 2/7 \times 1/6$		B1
	10 × 9 in the denominator		M1
	1/2520 <b>cao</b>		A1