Free-Standing Mathematics Qualification

Mathematics

4986 Data Handling
Mark scheme

4986
June 2016

Version 1.0: Final Mark Scheme

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

Key to mark scheme abbreviations

M	mark is for method
m or dM	mark is dependent on one or more M marks and is for method
A	mark is dependent on M or m marks and is for accuracy
B	mark is independent of M or m marks and is for method and accuracy
E	mark is for explanation
√or ft or F	follow through from previous incorrect result
CAO	correct answer only
CSO	correct solution only
AWFW	anything which falls within
AWRT	anything which rounds to
ACF	any correct form
AG	answer given
SC	special case
oe	or equivalent
A2,1	2 or 1 (or 0) accuracy marks
–*x* EE	deduct *x* marks for each error
NMS	no method shown
PI	possibly implied
SCA	substantially correct approach
c	candidate
sf	significant figure(s)
dp	decimal place(s)

No Method Shown

Where the question specifically requires a particular method to be used, we must usually see evidence of use of this method for any marks to be awarded.

Where the answer can be reasonably obtained without showing working and it is very unlikely that the correct answer can be obtained by using an incorrect method, we must award **full marks**. However, the obvious penalty to candidates showing no working is that incorrect answers, however close, earn **no marks**.

Where a question asks the candidate to state or write down a result, no method need be shown for full marks.

Where the permitted calculator has functions which reasonably allow the solution of the question directly, the correct answer without working earns **full marks**, unless it is given to less than the degree of accuracy accepted in the mark scheme, when it gains **no marks**.

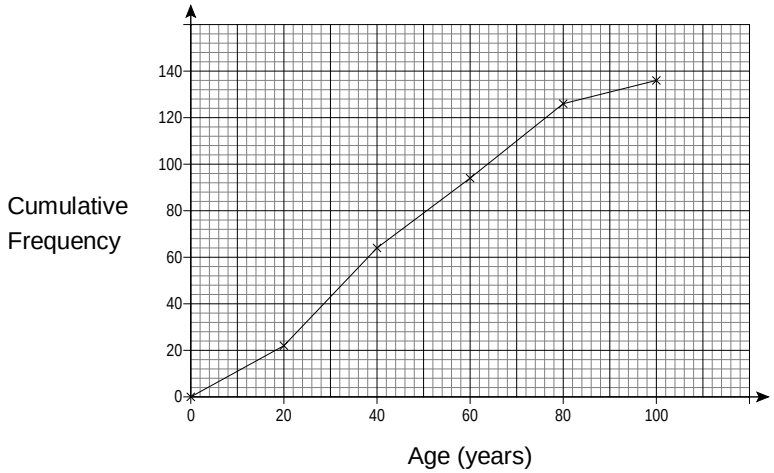
Otherwise we require evidence of a correct method for any marks to be awarded.

Question	Solution	Mark	Total	Comment
1(a)	185 ÷ 1.5 = 123.33(...) or 185 000 000 ÷ 1 500 000 = 123.33 (...)	**B1**	1	Implied by 123.333 (...) or $123.\dot{3}$
1(b)	47.5(0), 47.47, 118.57, 92.74	**B3**	3	All correct values given to the nearest penny B2: for all values correct but inappropriate accuracy, or 3 correct values given to the nearest penny. B1: 1 of the correct values given to the nearest penny or at least 3 correct values inappropriately rounded.
1(c)	=C3/B3	**B1**	1	Do not penalise unnecessary brackets that would not invalidate the formula.
	Total		**5**	

Question	Solution	Mark	Total	Comment
2(a)	Discrete	**B1**	1	
2(b)(i)	The mean is affected by the one very large value, 18	**B1**	1	oe
2(b)(ii)	The mode is the smallest value	**B1**	1	oe
2(c)	$\frac{3}{15}$ (× 100)	**M1**	2	oe
	20 (%)	**A1**		
2(d)	$\frac{10}{15}$	**M1**	2	
	$\frac{2}{3}$	**A1**		
	Total		**7**	

Question	Solution	Mark	Total	Comment
3(a)(i)	$\frac{185.5+251.3+ \ldots \ldots +137.1+183.4}{10}$ or $\frac{17.7+20.2+ \ldots \ldots +16.5+17.9}{10}$	M1	2	Implied by 1805.94 or 166.49
	(Mean total sunshine hours =) 197.1 or 197	A1		
3(a)(ii)	(Mean average daily max temp =) 18.26 or 18.3	A1	1	
3(b)	All 6 points plotted correctly (130.8, 16.3), (137.1, 16.5), (183.4, 17.9), (191.1, 16.8), (225.4, 19.1), (233.5, 20.1)	B2	2	Accept plotting ± half a small square. B1 for 4 or 5 points plotted correctly ± half a small square.
3(c)	Their mean point plotted	M1	2	
	Line through their mean point and gates at each end	A1ft		Gates at (130, 15.5) and (130, 17) at lower end and at (250, 19.5) and (250, 20.5) at upper end. SC1 Line of best fit through the gates but no, or incorrect, mean plotted.
3(d)	Attempt to read off from 165 using line of best fit	M1	2	
	Correct reading from their graph	A1 ft		ft their line of best fit ± half a small square
3(e)	The average daily maximum temperature is lower than expected for 191.1 hours of sunshine.	B1	1	oe
	Total		**10**	

Question	Solution	Mark	Total	Comment
4(a)	There is an overlap (at 10) or a gap (at 16)	**B1**	1	oe Accept a reference to 'I have never read a book' should be either at the top of the list, or should be 0
4(b)	Complete option response listed, no gaps or overlaps with at least 3 options.	**B2**	2	B1 Complete option response listed, at most one gap or overlap with at least 3 options.
	Total		**3**	

Question	Solution	Mark	Total	Comment
5(a)	Cumulative frequencies	B1	4	22, 64, 95, 126, 136
	Plots at upper class limits	B1		
	Plots heights	B1 ft		Dep on increasing function
	Joins points with lines or smooth curve and joins to (0, 0).	B1 ft		Dep on increasing function
				
5(b)(i)	Read off from their 68 (= 42)	B1ft	1	Ft their c.f. graph ± half a small square
5(b)(ii)	Read off from their 34 (= 25 or 26) and their 102 (= 64)	M1ft	2	Ft their c.f. graph ± half a small square
	38 or 39	A1ft		Ft their c.f. graph ± half a small square
5(c) Alt 1	Use of Box and whisker diagram(s)		4	
	Plots their median	B1 ft		±½ small square
	Correct interpretation of medians or point values	B1 ft		Ft any valid 'point' value.
	Plots their quartiles (and completes the box)	B1 ft		±½ small square
	Correct interpretation of IQRs	B1 ft		
5(c) Alt 2	Use of summary values		4	
	Median or LQ or UQ interpreted in context	B2ft		Ft their values from part (b) B1: median for Cartmel stated or correct interpretation of incorrect values from box plot or correct interpretation of central 50% or correct interpretation of upper end

				points.
	IQR for Cartmel = 32	**B1**		
	Correct interpretation of IQRs	**B1 ft**		
	Total		**11**	

Question	Solution	Mark	Total	Comment
6(a)	2 100 000 – 730 000	**M1**	2	1.37 implies M1
	1 370 000 or 1.37 m(illion)	**A1**		SC1: 1 350 000 or 1.35 m(illion)
6(b) Alt 1	$\sqrt{\frac{2.7}{2.1}}$	**M1**	4	
	$\sqrt{\frac{2.7}{2.1}}\times 18$	**M1**		
	20.41 ...	**A1**		
	20.4 (mm)	**A1 ft**		Dep on 1st M mark awarded
6(b) Alt 2	$\sqrt{\frac{2.1}{2.7}}$	**M1**		
	$18 \div \sqrt{\frac{2.1}{2.7}}$	**M1**		
	20.41 ...	**A1**		
	20.4 (mm)	**A1 ft**		Dep on 1st M mark awarded
6(b) Alt 3	$\frac{2.7}{2.1}(\times)9^2$ or 104.14 ...	**M1**		
	$\sqrt{Their\ 104.14\ldots}\times 2$	**M1dep**		
	20.41 ...	**A1**		
	20.4 (mm)	**A1 ft**		Dep on 1st M mark awarded
6(b) Alt 4	$\frac{2.7}{2.1}(\times)18^2$ or 416.57 ...	**M1**		
	$\sqrt{Their\ 416.57\ldots}$	**M1dep**		
	20.41 ...	**A1**		
	20.4 (mm)	**A1 ft**		Dep on 1st M mark awarded
	Total		**6**	

<table>
<tr><th>Question</th><th>Solution</th><th>Mark</th><th>Total</th><th>Comment</th></tr>
<tr><td rowspan="4">7(a)</td><td>Correct class widths</td><td>M1</td><td rowspan="3">5</td><td>At least 7 correct.
May be implied by correct frequency densities</td></tr>
<tr><td>Frequency densities correct</td><td>M1 A1</td><td>M1 for at least 6 correct</td></tr>
<tr><td>Histogram drawn correctly</td><td>M1
A1 ft</td><td>ft their frequency densities
M1 for at least two bars correct</td></tr>
<tr><td colspan="4">
<table>
<tr><th>Height, h, metres</th><th>Number of fells</th><th>cw</th><th>fd</th></tr>
<tr><td>200 ≤ h < 400</td><td>12</td><td>200</td><td>0.06</td></tr>
<tr><td>400 ≤ h < 450</td><td>9</td><td>50</td><td>0.18</td></tr>
<tr><td>450 ≤ h < 500</td><td>8</td><td>50</td><td>0.16</td></tr>
<tr><td>500 ≤ h < 550</td><td>14</td><td>50</td><td>0.28</td></tr>
<tr><td>550 ≤ h < 600</td><td>8</td><td>50</td><td>0.16</td></tr>
<tr><td>600 ≤ h < 700</td><td>12</td><td>100</td><td>0.12</td></tr>
<tr><td>700 ≤ h < 800</td><td>13</td><td>100</td><td>0.13</td></tr>
<tr><td>800 ≤ h < 900</td><td>2</td><td>100</td><td>0.02</td></tr>
<tr><td>Total</td><td>78</td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td rowspan="3">7(b)
Alt 1</td><td>$\frac{70}{100}$ × 13 or 9.1</td><td>M1</td><td rowspan="3">3</td><td>oe</td></tr>
<tr><td>13 – their 9.1 + 2 or 5.9</td><td>M1</td><td></td></tr>
<tr><td>6</td><td>A1</td><td></td></tr>
<tr><td rowspan="3">7(b)
Alt 2</td><td>30 × their 0.13 or $\frac{30}{100}$ × 13 or 3.9</td><td>M1</td><td rowspan="3">3</td><td>oe</td></tr>
<tr><td>their 3.9 + 2 or 5.9</td><td>M1</td><td></td></tr>
<tr><td>6</td><td>A1</td><td></td></tr>
<tr><td></td><td>Total</td><td></td><td>8</td><td></td></tr>
<tr><td></td><td>TOTAL</td><td></td><td>50</td><td></td></tr>
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