AQA Qualifications

GCSE

Mathematics

43601H Unit 1: Higher

Mark scheme

4360
November 2016

Version/Stage: 1.0 Final

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

Glossary for Mark Schemes

GCSE examinations are marked in such a way as to award positive achievement wherever possible. Thus, for GCSE Mathematics papers, marks are awarded under various categories.

If a student uses a method which is not explicitly covered by the mark scheme the same principles of marking should be applied. Credit should be given to any valid methods. Examiners should seek advice from their senior examiner if in any doubt.

M	Method marks are awarded for a correct method which could lead to a correct answer.
A	Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied.
B	Marks awarded independent of method.
ft	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
SC	Special case. Marks awarded for a common misinterpretation which has some mathematical worth.
M dep	A method mark dependent on a previous method mark being awarded.
B dep	A mark that can only be awarded if a previous independent mark has been awarded.
oe	Or equivalent. Accept answers that are equivalent. e.g. accept 0.5 as well as $\frac{1}{2}$
[*a*, *b*]	Accept values between *a* and *b* inclusive.
[a, b)	Accept values a ≤ value < b
3.14 …	Accept answers which begin 3.14 e.g. 3.14, 3.142, 3.1416
Q	Marks awarded for quality of written communication
Use of brackets	It is not necessary to see the bracketed work to award the marks.

Examiners should consistently apply the following principles

Diagrams

Diagrams that have working on them should be treated like normal responses. If a diagram has been written on but the correct response is within the answer space, the work within the answer space should be marked. Working on diagrams that contradicts work within the answer space is not to be considered as choice but as working, and is not, therefore, penalised.

Responses which appear to come from incorrect methods

Whenever there is doubt as to whether a candidate has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the candidate. In cases where there is no doubt that the answer has come from incorrect working then the candidate should be penalised.

Questions which ask candidates to show working

Instructions on marking will be given but usually marks are not awarded to candidates who show no working.

Questions which do not ask candidates to show working

As a general principle, a correct response is awarded full marks.

Misread or miscopy

Candidates often copy values from a question incorrectly. If the examiner thinks that the candidate has made a genuine misread, then only the accuracy marks (A or B marks), up to a maximum of 2 marks are penalised. The method marks can still be awarded.

Further work

Once the correct answer has been seen, further working may be ignored unless it goes on to contradict the correct answer.

Choice

When a choice of answers and/or methods is given, mark each attempt. If both methods are valid then M marks can be awarded but any incorrect answer or method would result in marks being lost.

Work not replaced

Erased or crossed out work that is still legible should be marked.

Work replaced

Erased or crossed out work that has been replaced is not awarded marks.

Premature approximation

Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise.

Continental notation

Accept a comma used instead of a decimal point (for example, in measurements or currency), provided that

it is clear to the examiner that the candidate intended it to be a decimal point.

Q	Answer	Mark	Comments
1(a)	Appropriate key	B1	
	Stem 4, 5, 6, 7	B1	or 7, 6, 5, 4
	Leaves correct and ordered 0 7 1 2 5 6 0 1 3 4 9 2 5	B1	Must match the order of their stem if present eg if 7, 6, 5, 4 leaves should be 5 2 9 4 3 1 0 6 5 2 1 7 0
	Appropriate alignment of leaves	Q1ft	ft their single digit leaves Strand (ii) Logical organised working so row lengths show the distribution
	Additional Guidance		
	For the Q mark: • Leaves may be unordered and/or incorrect (but need at least 11) • Leaves must be single digit • Lengths of rows need to correspond to *their* number of leaves ie row with most leaves should be longest etc		
	The Q mark is independent so B0B0B0Q1ft is possible		
	Ignore lines/ commas between numbers which may be working for (b)		
	If not crossed out and replaced, mark the stem-and-leaf on the grid		

Q	Answer	Mark	Comments
1(b)	(Thursday's median =) 60	B1	
	their 60 × 0.15 or 9 or their 60 × 0.85	M1	oe their 60 must be in the range [40, 75]
	51	A1ft	ft B0M1 for a correct answer rounded to the nearest integer
	Additional Guidance		
	56 → 8 or 8.4 or 47.6 → answer 48 58 → 9 or 8.7 or 49.3 → answer 49 59 → 9 or 8.85 or 50.15 → answer 50 60.5 → 9 or 9.075 or 51.425 → answer 51 61 → 9 or 9.15 or 51.85 → answer 52		B0 M1 A1ft B0 M1 A1ft B0 M1 A1ft B0 M1 A1ft B0 M1 A1ft
2	620 and 1000 chosen	B1	May be implied by correct answer
	37 820 ÷ their 620 or 61	M1	their 620 must be in the range [440, 630]
	(75 – their 61) × their 1000 or 14 × 1000	M1	oe their 1000 must be in the range [810, 1200]
	14 000	A1	SC3 13 000 from scale misread of 610
	Additional Guidance		
	14 000 from a scale misread		max M2
3(a)	$\frac{1}{10}$	B1	

Q	Answer	Mark	Comments
3(b)	Refers to a large number of trials	B1	Condone eg lots, multiple times, repeatedly, a large amount, numerous times, loads, many times, any number greater than or equal to 30
	Comments on how to decide if it is fair (or biased) by referring to matching the (theoretical) probability of $\frac{1}{6}$ or working out expected number for each score using their number of trials or stating that the frequencies of each result should be (approximately) equal	B1	oe Assume their statement is to show it is fair unless otherwise stated
	Additional Guidance		
	Throw it a few times/ several times/ a number of times		1st B0
	Number of trials < 30		1st B0
	It should land on each side $\frac{1}{6}$ of the time		2nd B1
	A fair dice has a 1 in 6 chance of landing on each side		2nd B1
	It should land on each side once out of 6 throws		2nd B1
	If it lands on one side 4 times out of 12 it is biased		2nd B1
	If fair, it will land equally on each side		2nd B1
	If it lands on one side more than the others it's biased		2nd B1
	The probability of it landing on each side is even if it's fair (allow even → equal)		2nd B1
	It should land equally		2nd B1
	See which side is the mode		2nd B0
	The results should be random if it's fair		2nd B0

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="8">4</td><td>15 women chose A</td><td>B1</td><td>Award B0B1 if women A : C in ratio 1 : 3 and total at least 24 (6 : 18)</td></tr>
<tr><td>45 women chose C</td><td>B1</td><td></td></tr>
<tr><td>90 women and 70 men</td><td>B1ft</td><td>ft their 15 + 30 + their 45
and 160 – their 90</td></tr>
<tr><td>Total A = 53, Total B = 56
and Total C = 51</td><td>B1</td><td></td></tr>
<tr><td>38 men chose A and 6 men chose C</td><td>B1ft</td><td>ft two of
their 53 – their 15
their 51 – their 45
their 70 – 26 – their 6 or – their 38</td></tr>
<tr><td colspan="3">The correct table is
<table>
<tr><th></th><th>A</th><th>B</th><th>C</th><th>Total</th></tr>
<tr><td>Women</td><td>15</td><td>30</td><td>45</td><td>90</td></tr>
<tr><td>Men</td><td>38</td><td>26</td><td>6</td><td>70</td></tr>
<tr><td>Total</td><td>53</td><td>56</td><td>51</td><td>160</td></tr>
</table></td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="2">
<table>
<tr><th></th><th>A</th><th>B</th><th>C</th><th>Total</th></tr>
<tr><td>Women</td><td>15</td><td>30</td><td>45</td><td>90</td></tr>
<tr><td>Men</td><td>23</td><td>26</td><td>21</td><td>70</td></tr>
<tr><td>Total</td><td>38</td><td>56</td><td>66</td><td>160</td></tr>
</table></td><td>B1 B1 B1
B0 B1ft</td></tr>
<tr><td colspan="2">Mark the table</td><td></td></tr>
<tr><td colspan="2">Blank cell does not equal 0</td><td></td></tr>
</table>

Q	Answer	Mark	Comments
5	$\frac{1}{5} \times 45$ or 9 or $\frac{1}{5} \times 2.75$ or 0.55 or $\frac{4}{5}$ seen	M1	oe
	45 – their 9 or $\frac{4}{5} \times 45$ or 36 or $\frac{4}{5} \times 3.20$ or 2.56	M1dep	oe
	$\frac{1}{5} \times 45 \times 2.75$ or 24.75 or $\frac{4}{5} \times 45 \times 3.20$ or 115.2(0)	M1	Allow $\frac{1}{5} \times 45 \times 3.20$ or 28.8(0) **and** $\frac{4}{5} \times 45 \times 2.75$ or 99
	139.95	A1	SC3 127.8(0)
	Additional Guidance		
	9 × (3.20 + 2.75)		M1 M0 M0
	24.75		M1 M0 M1
	115.2(0)		M1 M1 M1

6(a)	90, 200, 355, 400	B1	Must be in part (a)

Q	Answer	Mark	Comments
6(b)	Plotted at UCBs (±½ square)	M1	Plotted at 30, 50, 65, 80, 100 Allow one error or omission Increasing non-linear function
	Heights correct (±½ square)	M1	50, ft their 90, their 200, their 355, their 400 Allow one error or omission Increasing non-linear function
	Smooth curve or polygon through points (±½ square)	A1ft	ft M0 M1 or M1 M0 and all five of their points within class boundaries Increasing non-linear function
	Additional Guidance		
	Condone any attempt to join the graph to the axis before the first point		
	If only bars drawn, may gain the heights mark		M0 M1 A0
	If bars and cumulative frequency graph drawn, mark the cumulative frequency graph		
	Plotted within class boundaries eg using midpoints and joined		M0 M1 A1ft
7	7.6 × 5 or 38	M1	Five numbers 6.5, x, y, z, 9.9 where $x + y + z = 21.6$ implies M1 M1dep
	their 38 – 6.5 – 9.9 or 21.6	M1dep	
	their 21.6 ÷ 3 or 7.2 or 7.4 × 3 or 22.2	M1	
	7.2 and Beth or 21.6 and 22.2 and Beth	A1	
	Additional Guidance		
	If an incorrect difference between the mean scores or totals is worked out then ignore it and treat it as further work		
	7.2 and no decision or 7.2 and Amy chosen		M3 A0
	21.6 seen		M1 M1dep

Q	Answer	Mark	Comments
8(a)	0.25 or 0.75 seen or 123	M1	oe Allow 123.75 or 124 from $n + 1 = 165$
	41	A1	Allow 41.25 or 41 from $n + 1 = 165$
	Additional Guidance		
	Recognition that upper quartile represents a quarter may be on diagram		
	0.25 × 164 = 41, more than 72 = 40		M1 A0
8(b)	**Alternative method 1**		
	$190 - \frac{164}{2}$ or 108 or 190 – their 41 × 2	M1	oe ft their answer to (a) but not 82
	216	A1ft	ft 2 × (190 – their 41 × 2) only but not 82
	Alternative method 2		
	190 × 2 or 380	M1	
	216	A1	

Q	Answer	Mark	Comments
9	0.74 or 74 seen	M1	Must be used if a calculation shown
	0.000 001 216...	A1	oe May be implied by correct standard form
	$1.2(...) \times 10^{-6}$	Q1ft	Strand (i) ft any ordinary answer seen, correctly converted to standard form SC2 7.1428×10^{-7} SC2 6.66×10^{-7} SC1 0.000 000 71428 oe or 0.000 000 666 oe SC1 1.134×10^{-6} SC1 1.566×10^{-6} SC1 2.34×10^{-7}
	Additional Guidance		
	0.74 or 74 seen but the student goes on to use 1.74, 1.26 or 0.26		M0
	For the Q mark the standard form must be the final answer		
	To award the Q1ft must see the ordinary number before the conversion to standard form except for common incorrect values awarded SC marks		
	7.1428×10^{-7} is from a misread of decrease as increase		SC2
	6.66×10^{-7} is from $9 \times 10^{-7} \times 0.74$		SC2
	1.134×10^{-6} is from $9 \times 10^{-7} \times 1.26$		SC1
	1.566×10^{-6} is from $9 \times 10^{-7} \times 1.74$		SC1
	2.34×10^{-7} is from $9 \times 10^{-7} \times 0.26$		SC1
	Allow truncation or rounding to 2sf or better for any of the special cases		

Q	Answer	Mark	Comments
10	**Alternative method 1**		
	502 + 398 – (340 + 260) or 900 – 600 or 300 or $\frac{75}{1500}$ or $\frac{1500}{75}$ or $\frac{1}{20}$ or 20 or 0.05	M1	oe
	$\frac{\text{their } 300}{1500} \times 75$ or their $300 \div 20$	M1dep	oe
	15	A1	
	Alternative method 2		
	$\frac{502+398}{1500} \times 75$ or $\frac{900}{1500} \times 75$ or 45 or $\frac{340+260}{1500} \times 75$ or $\frac{600}{1500} \times 75$ or 30 or $\frac{502}{1500} \times 75$ or $\frac{398}{1500} \times 75$ or $\frac{340}{1500} \times 75$ or $\frac{260}{1500} \times 75$ or 25(.1) or 19.9 or 20 or 17 or 13	M1	oe
	$\frac{502+398}{1500} \times 75$ or $\frac{900}{1500} \times 75$ **and** $\frac{340+260}{1500} \times 75$ or $\frac{600}{1500} \times 75$ or 45 **and** 30 or $\frac{502}{1500} \times 75$ **and** $\frac{398}{1500} \times 75$ **and** $\frac{340}{1500} \times 75$ **and** $\frac{260}{1500} \times 75$ or 25(.1) **and** 19.9 or 20 **and** 17 **and** 13	M1dep	oe 45 : 30 is M2
	15	A1	

Q	Answer	Mark	Comments

Question 10 continues on the next page

10 cont	**Alternative method 3**		
	(Adult =) $\frac{2}{5}$ and (Child =) $\frac{3}{5}$	M1	
	75 ÷ 5	M1dep	
	15	A1	
	Additional Guidance		
	Working out how many more males than females are in the sample may score up to M2 as a misread (42 males, 33 females – difference of 9)		
	45 and 30 seen (or correct method for both) seen		M2
	25(.1) and 19.9 or 20 and 17 and 13 (or correct method for all) seen		M2

11(a)	**Alternative method 1**		
	0.9 × 30 or 27 or 1.5 × 10 or 15 or 0.6 × 30 or 18	M1	
	0.9 × 30 + 1.5 × 10 + 0.6 × 30 (= 60)	A1	Must show full method
	Alternative method 2		
	(Square =) 0.25 × 10 or 2.5 or (Small square =) 0.05 × 2 or 0.1	M1	
	0.25 × 10 × 24 (= 60) or 0.05 × 2 × 600 (= 60)	A1	Must show full method
	Additional Guidance		
	Only 27 + 15 + 18 = 60		M1 A0
	Addition may be implied by vertical column and total		

Q	Answer	Mark	Comments
11(b)	Midpoints seen or implied 15, 35, 55	B1	Must be seen or used in part (b) Condone one error
	their 27 × 15 or 405 or their 15 × 35 or 525 or their 18 × 55 or 990 or 1920	M1	ft their frequencies from (a) and their midpoints
	(their 405 + their 525 + their 990)÷ 60 or their 1920 ÷ 60	M1dep	Condone bracket error
	32	A1	
	Additional Guidance		
	Consistent use of UCBs for midpoints can score both method marks eg (27 × 30 + 15 × 40 + 18 × 70) ÷ 60		B0 M1 M1 A0
	NB Reference to the median or working for the median 27 + 3 ÷ 15 × 10 = 32		B0 M0 M0 A0

11(c)	$\frac{12}{\text{their } 18}$ or $\frac{\text{their } 18 - 12}{\text{their } 18}$	M1	oe ft their 18 from (a)
	50	A1	SC1 13(.33) Accept [50, 51.67]

Q	Answer	Mark	Comments
12(a)	$\frac{10}{100}$ and $\frac{9}{99}$ or $\frac{n}{100} \times \frac{n-1}{99}$	M1	oe 0.1 and 0.0909... or $\frac{1}{10}$ and $\frac{1}{11}$
	$\frac{90}{9900}$ or $\frac{1}{110}$ or 0.009...	A1	oe
	Additional Guidance		
	$\frac{10}{100} + \frac{9}{99} = \frac{21}{110}$		M1 A0
	Ignore any incorrect cancelling or change of form once correct answer seen		

Q	Answer	Mark	Comments
12(b)	**Alternative method 1**		
	$\frac{12}{100} \times \frac{88}{99}$ or $\frac{88}{100} \times \frac{12}{99}$ or $\frac{1056}{9900}$ or $\frac{8}{75}$ or 0.1066...	M1	oe
	$\frac{12}{100} \times \frac{88}{99} + \frac{88}{100} \times \frac{12}{99}$	M1dep	oe
	$\frac{2112}{9900}$ or $\frac{16}{75}$ or 0.213...	A1	oe
	Alternative method 2		
	$\frac{12}{100} \times \frac{78}{99}$ **and** $\frac{12}{100} \times \frac{10}{99}$ or $\frac{78}{100} \times \frac{12}{99}$ **and** $\frac{10}{100} \times \frac{12}{99}$ or $\frac{936}{9900}$ **and** $\frac{120}{9900}$ or $\frac{26}{275}$ **and** $\frac{2}{165}$	M1	oe
	$\frac{12}{100} \times \frac{78}{99} + \frac{12}{100} \times \frac{10}{99} + \frac{78}{100} \times \frac{12}{99} + \frac{10}{100} \times \frac{12}{99}$	M1dep	oe
	$\frac{2112}{9900}$ or $\frac{16}{75}$ or 0.213...	A1	oe