AQA Qualifications

GCSE

Mathematics

Paper 2 43652H

Mark scheme

43652H

November 2013

Final version 1.0

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.

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AQA Qualifications

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.

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.
Q	Marks awarded for quality of written communication.
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.
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.
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 $a \leq$ value $< b$
25.3 …	Allow answers which begin 25.3 e.g. 25.3, 25.31, 25.378
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.

Paper 2 Higher Tier

Q	Answer	Mark	Comments
1	Two correct points calculated	B1	May be implied from plotting ± ½ square
	At least 2 points plotted correctly	M1	May be implied from straight line ± ½ square
	Fully correct straight ruled line from – 2 to 2	A1	± ½ square SC2 incorrect straight line (any length) of gradient 2 SC1 incorrect sloping straight line (any length) passing through (0, –1)
2(a)	495 ÷ 55 or 9 or 80 ÷ 55 or 1.45… or 80 × 495 or 39 600	M1	55 ÷ 495 or $\frac{1}{9}$ or 55 ÷ 80 or 0.68… or 0.69
	495 ÷ 55 × 80 or 80 × their 9 or 495 × their 1.45… or 80 × 495 ÷ 55 or 495 + (80 – 55) × their 9	M1dep	oe 80 ÷ their $\frac{1}{9}$ or 495 ÷ their 0.68…
	720	A1	

Q	Answer	Mark	Comments
2(b) Alt 1	55 ÷ 495 or $\frac{1}{9}$ or 495 ÷ 55 or 9 or 160 ÷ 495 or 0.32… or 160 × 55 or 8800	M1	495 ÷ 160 or 3.09...
	55 ÷ 495 × 160 or 160 ÷ their 9 or 160 × their $\frac{1}{9}$ or 55 × their 0.32… or 160 × 55 ÷ 495	M1dep	oe 55 ÷ their 3.09375
	17.7… or 17.8	A1	
	18	B1ft	Rounding to nearest whole number
2(b) Alt 2	80 ÷ their 720 or $\frac{1}{9}$ or their 720 ÷ 80 or 9 or 160 ÷ their 720 or 0.22… or 160 × 80 or 8800	M1	their 720 ÷ 160 or 4.5
	80 ÷ their 720 × 160 or 160 ÷ their 9 or 160 × their $\frac{1}{9}$ or 80 × their 0.22… or 160 × 80 ÷ their 720	M1dep	oe 80 ÷ their 4.5
	17.7… or 17.8	A1	
	18	B1ft	Rounding to nearest whole number

Q	Answer	Mark	Comments
3(a)	Continuous	B1	
3(b)	Discrete	B1	
3(c)	Continuous	B1	
3(d)	Discrete	B1	
4	Height of triangle = 4 seen or implied	B1	Identifies height of trapezium as 9
	(Area of rectangle) 234 or 378	B1	(Area of trapezium) $\frac{(13+21)\times 9}{2}$
	$\frac{1}{2}$ × 18 × their 4 or 36 / $\frac{1}{2}$ × 9 × their 4 or 18	M1	17 × 9 or $\frac{34\times 9}{2}$ or $\frac{306}{2}$
	$\frac{1}{2}$ × 18 × their 4 × 2 or 72 / $\frac{1}{2}$ × 9 × their 4 × 4 or 72	M1dep	153
	306	A1	
5(a)	4 + 3 + 5 + 2 or 20 – 5 – 1	M1	oe
	14	A1	
5(b)	4 + 5 or 9	M1	$\frac{4}{20}\times 100$ or 20 or $\frac{5}{20}\times 100$ or 25
	$\frac{4+5}{20}\times 100$	M1dep	oe their 20 + their 25
	45	A1	

Q	Answer	Mark	Comments
5(c)	3 out of 12 or 2 out of 8 or $\frac{3}{12}$ or $\frac{2}{8}$	M1	oe 3 : 12 or 2 : 8
	3 out of 12 **and** 2 out of 8 or $\frac{3}{12}$ **and** $\frac{2}{8}$ or $\frac{1}{4}$ or 25% or 0.25	A1	oe 3 : 12 and 2 : 8 All answers must be correct
	States the same	Q1ft	Strand (iii) Must see a correct comparison from their relative frequencies dependent on M1 SC1 for $\frac{3}{20}$ **and** $\frac{2}{20}$ and states boys larger oe
6(a)	$6x + 4 - x - 7$	M1	Allow one error
	$6x + 4 - x - 7$	A1	
	$5x - 3$	A1ft	ft their four terms Do not ignore further work

Q	Answer	Mark	Comments
6(b)	3 × 6 – 2 × –4 or 18 + 8 or 26 or 3 × 7 – 2 × –4 or 21 + 8 or 29 or 3 × 6 – 2 × –5 or 18 + 10 or 28 or 3 × 7 – 2 × –5 or 21 + 10 or 31	M1	
	Two correctly evaluated	A1	26 29 28 31
	(Largest) 31 and (Smallest) 26	Q2	Strand (iii) Fully correct Q1 for their largest and smallest stated with largest 31 or smallest 26 with the four calculations seen Note 7 and –5 give the answer 31 6 and –4 give the answer 26 SC2 for largest 31 or smallest 26 SC3 for three correct calculations with one incorrect calculation and their largest and smallest correct
7	180 – 56 – 56 or 68	M1	$2x$ + 56 + 56 + 90 = 360 oe
	90 – their 68 or 22 360 – 56 – 56 – 90	M1dep	$2x$ = 360 – 112 – 90
	(180 – their 22) ÷ 2 or (360 – 56 – 56 – 90) ÷ 2	M1dep	$2x$ = 158
	79	A1	

Q	Answer	Mark	Comments
8(a)	$y - 8 = 3w$ or $-3w = 8 - y$	M1	$\frac{y}{3} = w + \frac{8}{3}$
	$\frac{y-8}{3} = w$ or $\frac{y}{3} - \frac{8}{3} = w$	A1	SC1 $\frac{y-8}{3}$ or $\frac{y}{3} - \frac{8}{3}$ Do not ignore further work
8(b)	$5x + 20$ and $3x + 21$ (+ 2)	B1	
	$5x - 3x$ or $2x$ or 21 + 2 – 20 or 23 – 20	M1	their 21 + 2 – their 20 or their 23 – their 20
	$5x - 3x = 21 + 2 - 20$ or $5x - 3x = 23 - 20$ or $2x = 3$	M1dep	$5x - 3x$ = their 23 – their 20
	1.5	A1ft	oe
9	15.7 × 4 or 62.8	M1	
	their 62.8 = π × diameter	M1dep	oe their 62.8 = 2 × π × radius
	their 62.8 ÷ π	M1dep	their 62.8 ÷ 2π radius = [9.95, 10]
	[19.9, 20]	A1	SC2 for [4.9, 5]
10	Triangle is correct with two equal arcs seen for angle of 60°	B3	B2 Triangle correct but no arcs B2 Fully correct constructions (3rd side missing) B1 for either *AB* = [7.4, 7.6] or *AC* = [6.2, 6.4] or 60° tolerance [58°, 62°]

Q	Answer	Mark	Comments
11	1.04 × 53 (000 000) or 55.12 (million) or 55.1 (million) or 55 (million)	M1	oe 57.24 (million) or 57.2 (million)
	1.04 × 1.04 × 53 (000 000) or 1.04 × their 55.12 (million)	M1dep	oe M2 for $(1.04)^2 \times 53$ seen
	57 324 800 or 57 325 000 or 57 320 000 or 57 300 000 or 57.3 million	A1	oe Accept 57 million if working shown Ignore further rounding of correct answer
12	Fully correct enlargement with vertices at (–3, –4), (–4, –2) and (–4, –4)	B2	B1 for any enlargement SF $\frac{1}{3}$ B1 for 2 correct vertices
13	(Vertical scale) does not start at 0 or incorrect height bars or vertical scale is incorrect or Area not proportional to frequency	B1	Any order
	Last bar (should be at height 1)	B1	
	Label on vertical scale incorrect e.g. should be frequency density	B1	
14(a)	$2 < x \leq 6$	B1	

Q	Answer	Mark	Comments
14(b)	1, 2, 3, 4, 5, 6	B2	B1 for 5 correct and 1 missing B1 for 6 correct and 1 incorrect B1 for $1 \leq x < 7$ B0 for 2 or more errors 1, 2, 3, 4, 5 B1 1, 2, 3, 4, 5, 6, 7 B1 2, 3, 4, 5, 6, 7 B0
15	Sequence continued correctly horizontally for at least two terms	M1	128 and 256 (and 512)
	A calculation that leads to x if evaluated correctly or extending the sequence to at least row 3	M1dep	2^{24} or 4^{12} 16×32^4 64^4
	16 777 216	A1	
	their value in standard form or their value to 3 s.f.	B1ft	$1.67(77216) \times 10^7$ or 1.6×10^7 or 1.7×10^7 or 16 800 000 For standard form allow rounding or truncation
	1.68×10^7	B1ft	
16(a)	150	B1	

Q	Answer	Mark	Comments
16(b)	360 – 150 or 210 or 360 – their 150	M1	oe *OCA* = 18 seen or implied or 180 – 18 – 75 or 87
	360 – 18 – 75 – 210 or 360 – 18 – 75 – their 210	M1dep	oe *OCB* = 75 – 18 or 57 seen or implied 180 – 93 – 30 or 87 – 30
	57	A1	
17(a)	$14x^7y^7z^7$ or $14(xyz)^7$	B3	B2 for 3 correct terms B1 for 2 correct terms Do not ignore further work for final mark
17(b)	$\frac{2(x-5)}{(x+4)}$ or $\frac{2x-10}{x+4}$	B2	B1 for $\frac{2(x-5)^2}{(x-5)(x+4)}$ B1 for $\frac{6(x-5)}{3(x+4)}$ or $\frac{6x-30}{3x+12}$ Do not ignore further work
17(c)	$(x + 1)(x + 1 + 4)$	M1	$x^2 + x + x + 1 + 4x + 4$ or $x^2 + 2x + 1 + 4x + 4$ or $x^2 + 6x + 5$
	$(x + 1)(x + 5)$	A1	
17(d)	$2(x – 5y)(x + 5y)$	B3	B2 for $(2x – 10y)(x + 5y)$ B2 for $(x – 5y)(2x + 10y)$ B1 for $2(x^2 – 25y^2)$ SC2 for $(\sqrt{2}x – \sqrt{50}y)(\sqrt{2}x + \sqrt{50}y)$ SC2 for $(\sqrt{2}x – 5\sqrt{2}y)(\sqrt{2}x + 5\sqrt{2}y)$ SC1 for $2(x – 5)(x + 5)$ SC1 for $(x – 5y)(x + 5y)$

Q	Answer	Mark	Comments
18	$2 \times \pi \times 12$ or [75.3, 75.4]	M1	oe 24π
	$\frac{135}{360} \times 2 \times \pi \times 12$ (+ 24) or [28.2, 28.3]	M1dep	oe 9π (+24)
	[52.2, 52.3]	A1	Do not award if $\pi = 3$ used
19	$\frac{6.9}{\sin A} = \frac{11.3}{\sin 71}$	M1	oe ($\frac{h}{6.9}$ = sin 71, h = 6.52(4…)) sin A = $\frac{\text{their } 6.52}{11.3}$
	$\frac{6.9 \sin 71}{11.3}$ or 0.57(7…)	M1dep	$\sin^{-1}$ ($\frac{\text{their } 6.52}{11.3}$)
	35.2(645…)	A1	
	35 or 35.3	B1ft	
20	0.65 seen	B1	
	$4.8 \times 1.2 \times$ their 0.65 or 3.744 or $4.8 \times$ their 0.65 or 3.12	M1	their 0.65 must be in range [0.65, 0.75] but not 0.7 $\frac{h}{4.8}$ = $\frac{\text{their } 0.65}{2.8}$
	their $3.744 \div (1.2 \times 2.8)$ or their $3.12 \div 2.8$	M1dep	$\frac{\text{their } 0.65 \times 4.8}{2.8}$
	1.11…	A1	
	1.1	B1ft	SC2 for 1.2 ft their rounded value from 2 d.p. or more

Q	Answer	Mark	Comments
21	$8 \times \frac{1}{2}n(n+1)$ (+1)	M1	
	$4n(n + 1)$ (+ 1) or $4n^2 + 4n$ (+ 1)	M1dep	
	$(2n + 1)^2$ or $(2n + 1)(2n + 1)$	A1	
	$(2n + 1)^2$ is a square number or $2n + 1$ is odd **and** odd × odd = odd or multiple of 4 is even **and** even + 1 = odd or $4(n^2 + n)$ is even **and** even + 1 = odd or $4n^2$ is even **and** $4n$ is even **and** even + 1 = odd	A1	oe odd^2 = odd or $n(n + 1)$ is odd × even or even × odd so $n(n + 1)$ is even **and** even × 4 = even **and** even + 1 = odd
	$(2n + 1)^2$ is a square number **and** $2n + 1$ is odd **and** odd × odd = odd or multiple of 4 is even **and** even + 1 = odd or $4(n^2 + n)$ is even **and** even + 1 = odd or $4n^2$ is even **and** $4n$ is even **and** even + 1 = odd	Q1	Strand (ii) Both parts of the proof required. or $n(n + 1)$ is odd × even or even × odd so $n(n + 1)$ is even **and** even × 4 = even **and** even + 1 = odd SC1 for 8 × *S* = even **and** even + 1 = odd

Q	Answer	Mark	Comments
Alt 1 22(a)	$\frac{3}{4}$ or $\frac{4}{5}$ seen	M1	oe decimal or percentage
	$\frac{3}{4} \times \frac{4}{5}$	M1dep	oe decimal or percentage
	$\frac{3}{5}$ or $\frac{12}{20}$	A1	oe 0.6 or 60%
Alt 2 22(b)	$\frac{3}{4} \times \frac{1}{5}$ or $\frac{3}{20}$	M1	Hit then miss
	$\frac{1}{4} \times \frac{4}{5}$ or $\frac{4}{20}$ or $\frac{1}{5}$	M1	Miss then hit
	$\frac{3}{20} + \frac{4}{20}$	M1dep	dependent on both previous marks
	$\frac{7}{20}$	A1	oe 0.35 or 35%
Alt 3 22(b)	$\frac{1}{4} \times \frac{1}{5}$ or $\frac{1}{20}$	M1	Miss then miss
	$\frac{1}{20}$ + their $\frac{12}{20}$	M1	ft from their (a)
	$1 - \frac{1}{20}$ – their $\frac{12}{20}$	M1dep	oe
	$\frac{7}{20}$	A1	oe 0.35 or 35%