AQA

GCSE
Mathematics

43652F Paper 2
Mark scheme

4365
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.

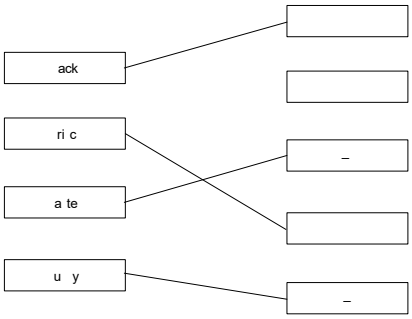
Premature approximation

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

Paper 2 Foundation Tier

Q	Answer	Mark	Comments
1(a)	19 and 81	B1	
1(b)	22 and 8	B1	
1(c)	3 and 6	B1	
2(a)	III IIII ~~IIII~~ I ~~IIII~~ II	B1	Correct tallies Must have five bar gates
	3 4 6 7	B2ft	Correct frequencies or correct frequencies for their tallies B1 for at least one of their frequencies correct or for all 4 correct relative frequencies
	Additional Guidance		
	Ignore cumulative frequencies if included		
	Accept frequencies written next to the tallies		
2(b)	16	B1ft	ft their table
	Additional Guidance		
	ft their table, if bimodal must give both answers		

Q	Answer	Mark	Comments
2(c)	$\frac{3}{20}$ or 0.15 or 15%	B1ft	oe ft numerator from their table ignore fw
	Additional Guidance		
	3 out of 20		B0
	Denominator must be 20 as it was given in the question		
3	6 and 5 seen or 4 and 3 seen or 42 seen or 45 seen or 29 seen or 6 + 5 + 6 + 5 + 6 + 5 + 6 or 4 × 6 + 3 × 5 or 24 + 15	M1	oe
	39	A1	
	6	B1	
	Additional Guidance		

Q	Answer	Mark	Comments
4(a)		B3	B1 for each
	Additional Guidance		

4(b)	50 – 2 or 48 or $3x + 2 = 50$ or $3x = 48$	M1	oe
	16	A1	SC1 for 45 if Eric = $x + 3$ or 51 if Eric = $x – 3$ or 54 if Eric = $x – 6$
	Additional Guidance		

Q	Answer	Mark	Comments
5	(£) 15.50 or (£) 19.50	Q1	Strand (i) Correct money notation
	(£) 15.5(0) and (£) 19.5(0)	B1	
	(£) 16.65	B1	
	(£) 4.66	B1	
	(£) 56.31	B1ft	ft their four prices, must be four
	Additional Guidance		
	Allow for example 4.66p for B marks		
6(a)	314	B1	
	Additional Guidance		
6(b)	360 ÷ 12 or 30(˚) (5 minutes) or 360 ÷ 60 or 6(˚) (1 minute)	M1	oe scaling, provided clear eg 15 minutes is 90(˚) 6 (o'clock) is 180(˚) $\frac{1}{4}$ (of the clock) = 90(˚) (5 minute sections) = 90(˚) (hours) = 90(˚)
	150	A1	SC1 for 210
	Additional Guidance		

Q	Answer	Mark	Comments
7(a)	5 × 3 + 7 × 4 or 15 or 28 seen	M1	oe
	43	A1	
	Additional Guidance		
	5 × 3 = 15x, 7 × 4 = 28y, 15x + 28y		M1A0
	15x + 28y on its own		M0A0
7(b)	2 × 5.4 × 5.4 or 2 × 29.16 or 2 × 29.(…)	M1	oe
	58.32 or 58.3 or 58	A1	
	Additional Guidance		
	2 × 5.4^2		M0
	2 × 5.4^2 = 10.8^2 (= 116.64)		M0
	10.8^2		M0
	10.8^2 or 116.64 on its own		M0

Q	Answer	Mark	Comments
7(c)	58.32 or 58.3 or 58	B1ft	ft their answer to part (b) or correct
	Additional Guidance		
7(d)	$7a + 10b$	B2	B1 for $7a$ or $10b$ Do not ignore fw for B2
	Additional Guidance		
	$7a + 10b = 17ab$		B1
8	4.8 + 3.7 + 4.8 + 3.7	M1	oe
	17	A1	
	Additional Guidance		

Q	Answer	Mark	Comments
9	(Base =) 9 and (top =) 3 or (white area =) 8 or (part squares are) $\frac{1}{4}$ or $\frac{3}{4}$ or (area of triangle =) 9 or (area of two triangles =) 18 or (centre rectangle =) 18 or (shaded squares in centre rectangle =) 10 or (shaded whole squares =) 22 or $\frac{1}{4} + \frac{3}{4}$ (= 1 whole square)	M1	White area or part of shaded area
	(Area of trapezium =) $\frac{1}{2}(3 + 9) \times 6$ or 6×6 or 36 or $22 + 6$ or $54 - 9 - 9 - 8$	M1dep	oe
	28	A1	Do not ignore fw
	cm^2	B1	
	Additional Guidance		
	Shaded area 28, total area 36 cm^2 is full marks		M1M1A1B1
	Shaded area 28, answer $\frac{28}{36}$ cm^2		M1M1A0B1
	28 identified in the working as the shaded area is at least M1M1 eg shaded area = 28, answer 36 cm^2 shaded area = 28, answer 28 cm^2 shaded area = 28, answer 34 cm^2		 M1M1A1B1 M1M1A1B1 M1M1A0B1
	eg $\frac{8}{28}$ or $\frac{8}{36}$ or 8 : 28 or 8 : 36 implies white area = 8 and gets the first M		M1

Q	Answer	Mark	Comments
10(a)	8	B1	
	Additional Guidance		
10(b)	(12 + 11 + 14 + 18 + 10) ÷ 5 or 65 ÷ 5	M1	
	13	A1	
	Additional Guidance		
	12 + 11 + 14 + 18 + 10 ÷ 5 (= 57)		M0
10(c)	5 × 2 or 10 or 55 seen	M1	oe
	Choose any card and reduce by 10	A1	12 → 2 or 11 → 1 or 14 → 4 or 18 → 8 or 10 → 0
	Additional Guidance		
	Beware of 10 as 10 is one of the cards		
11(a)	9 and 14 shaded	B1	
	Additional Guidance		
11(b)	6 and 8 shaded	B1	
	Additional Guidance		

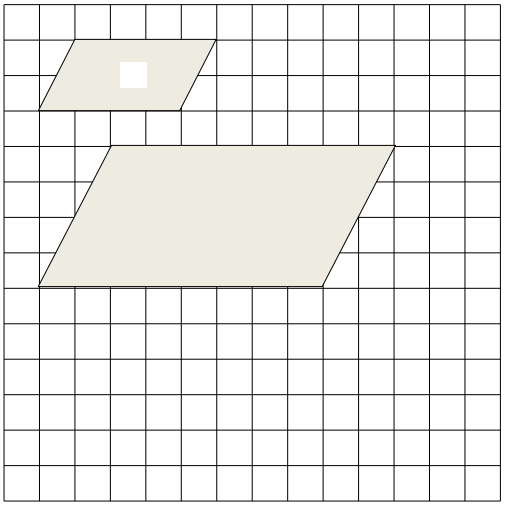
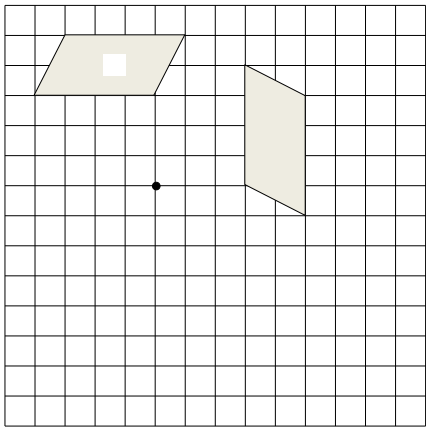
Q	Answer	Mark	Comments
11(c)	3 and 1 shaded	B1	
	Additional Guidance		
12(a)	12 × 19	M1	oe
	228	A1	SC1 for 209 or 247
	Additional Guidance		
	2.28 m		M1A1

Q	Answer	Mark	Comments
12(b)	1 m = 100 cm seen or implied	B1	eg 304 or 0.19 or 304 – 228 or 76
	3.04 ÷ 0.19 or 304 ÷ 19 or digits 16 seen or (304 – 228) ÷ 19 = 4 or 76 ÷ 19 = 4 or 228 + 19 + 19 + 19 + 19 = 304 or 304 – 19 – 19 – 19 – 19 = 228 or 4 (more steps) or 304 ÷ 228 × 12 or 3.04 ÷ 2.28 × 12 or 12 ÷ (228 ÷ 304) or 12 ÷ (2.28 ÷ 3.04)	M1	oe
	16	A1	
	Additional Guidance		
	4 more steps implies B1M1		B1M1
	Allow 228 and 76 to be their 228 and their 76 for the B mark and the M mark eg Answer in part (a) = 230 230 + 19 + 19 + 19 + 19 = 306 = 4 (more steps), answer 16 (304 – 2 0) ÷ 19 = .8(…) = 4 (more steps), answer 1 74 ÷ 19 = .8(…) = 4 (more steps), answer 16		 B1M1A0 B1M1A0 B1M1A0

Q	Answer	Mark	Comments
13(a)	1 .89… or 13.8	B1	
	13.9	B1ft	ft their value provided 2 dp or better
	Additional Guidance		
	13.9 on its own		B1B1
	Note the ft, eg 5.29, answer 5.3		B0B1ft
	Beware of 4.3 + 9.6 = 13.9 (correct answer from wrong working)		B0B0
13(b)	–25	B1	
	Additional Guidance		
14(a)	$\frac{30}{50}$ or $\frac{3}{5}$ or 0.6 or 60%	B1	oe ignore fw
	Additional Guidance		
14(b)	$\frac{2}{50}$ or $\frac{1}{25}$ or 0.04 or 4%	B1	oe ignore fw
	Additional Guidance		

Q	Answer	Mark	Comments
14(c)	Lists the numbers containing a 2 up to 30 2 12 20 21 22 23 24 25 26 27 28 29 or 2 12 20 or 12 (blue) or 3 (red) or 15	M1	
	$\frac{15}{50}$ or 0.3 or 30%	A1	oe
	$\frac{3}{10}$	B1ft	ft their fraction provided less than 1
	Additional Guidance		
	Ignore extras outside the range, eg 32		

Q	Answer	Mark	Comments
15	**Alternative method 1**		
	180 – 152 or 28 or (360 – 152 × 2) ÷ 2	M1	152 – 90 or 62
	their 28 × 2 or (360 – 152 × 2) (÷ 2 × 2)	M1dep	180 – 2 × their 62 or (180 – 90 – their 62) × 2
	56	A1	
	Alternative method 2		
	720 (used for the hexagon)	M1	540 used for a pentagon
	(720 – 4 × 152) ÷ 2 or 112 ÷ 2	M1dep	540 – 152 – 152 – 90 – 90
	56	A1	
	Additional Guidance		
	Angles may be on the diagram but must be in the correct place		
	28 must be for a correct angle If diagram or working shows that 28 is for an incorrect angle then the method is incorrect, eg y = 28 (on diagram in the wrong place) Answer 28 degrees		 M0 M0

Q	Answer	Mark	Comments
16(a)		B2	B1 for any enlargement (not SF 1) or for at least two sides correct length
	Additional Guidance		
	Allow enlargement to go no more than one square off the grid		
16(b)	4	B1	
	Additional Guidance		
	Accept four times as big etc		
16(c)		B3	B2 for rotation of parallelogram 90° anticlockwise about *P* or correct four vertices plotted but not joined B1 for any rotation of parallelogram 90° or correct four vertices plotted but not joined for rotation of parallelogram 90° anticlockwise about *P*
	Additional Guidance		

Q	Answer	Mark	Comments
17(a)	60 – 24 – 9 or 27	M1	oe
	100 – 42 or 42 + 58 (= 100) or 58 or (100 – 42) ÷ 2 or 29	M1	oe
	29 – 9 or 20 or 29 – 27 or 2	M1dep	dep on 2nd M1 dep on both M marks
	Fully correct table 24 9 **27** 60 18 **20** **2** 40 42 **29** **29** 100	A1	
	Additional Guidance		
	Allow use of a letter in the table with the letter worked out in the working		
	If there are two tables mark their best attempt		
	58 can be implied by total part time and total not working		

17(b)	**Alternative method 1**		
	$\frac{24}{60}$ or $24 \div 60$ or 0.4 or $\frac{18}{40}$ or $18 \div 40$ or 0.45	M1	oe eg $40(\%)$ or $45(\%)$ $\frac{2}{5}$ or $\frac{9}{20}$
	$40(\%)$ and $45(\%)$ or 0.4 and 0.45 or $\frac{8}{20}$ and $\frac{9}{20}$	A1	oe format so comparison can be made eg $\frac{4}{10}$ and $\frac{4.5}{10}$
	$40(\%)$ and $45(\%)$ and women or 0.4 and 0.45 and women or $\frac{8}{20}$ and $\frac{9}{20}$ and women	Q1	oe Strand (iii) Correct conclusion with all working correct
	Alternative method 2		
	$60 \div 24$ or 2.5 or $40 \div 18$ or $2.2\ldots$	M1	oe 27 out of 60 (women) or 16 out of 40 (men) or 9 out of 20 (women) or 8 out of 20 (men)
	2.5 and $2.2\ldots$	A1	oe 24 and 27 or 16 and 18 or 8 and 9
	2.5 and $2.2\ldots$ and women	Q1	24 and 27 and women or 16 and 18 and women or 8 and 9 and women Strand (iii) Correct conclusion with all working correct
	Additional Guidance		
	Allow common numerators for comparison		
	Beware of 40 as there are 40 women (40% are women)		

Q	Answer	Mark	Comments
18(a)	250 ÷ 5 × 4 or 200 or 250 ÷ 5 or 50	M1	oe
	200 and 50	A1	
	Additional Guidance		
	Sand 50 and Cement 200		M1A0
	250 ÷ 5 = 50, 250 ÷ 4 = 62.5, Sand 62.5, Cement 50		M1A0
	Allow transcription error if clear in the working		

Q	Answer	Mark	Comments
18(b)	**Alternative method 1**		
	25 × 3 or 75 or 25 × 4 or 100 or 25 × 5 or 125	M1	Total cement Sand Mix
	25 × 3 × 4 or 300 or 75 × 4 or 300 or 25 × 4 × 3 or 100 × 3 or 300 or 75 × 5 or 25 × 5 × 3 or 125 × 3	M1dep	Total sand Total mix
	375	A1	
	Alternative method 2 (uses part (a))		
	25 + 50 or 75 or 200 ÷ 2 or 100 or (200 + 50) ÷ 2 or 125	M1	Total cement Sand Mix
	100 + 200 or 300 or 25 + 50 + 100 + 200 or 125 + 250	M1dep	Total sand Total mix Total mix
	375	A1	
	Alternative method 3 (uses part (a))		
	Scale factor 1.5 seen or implied, eg $\frac{75}{50}$ or 50 × 1.5 or 75	M1	
	200 × 1.5 or 300 or 250 × 1.5	M1dep	Total sand Total mix
	375	A1	
	Additional Guidance		

Q	Answer	Mark	Comments
19(a)	–1 –5 –4	B2	B1 for one or two correct in the correct place
	Additional Guidance		
19(b)	6 or 7 of their points plotted correctly	M1	tolerance ± ½ square
	Fully correct smooth curve	A1	tolerance ± ½ square
	Additional Guidance		
	Curve must be U-shaped and must **not** curve back in or have vertical lines		
19(c)	[2.2, 2.3] and [–2.3, –2.2] or their two values read off from the graph	B1	tolerance ± ½ square
	Additional Guidance		
	Do not accept coordinates		
20(a)	$\frac{15}{100} \times 20$ or 3 or $\frac{12}{100} \times 10$ or 1.2 or $\frac{10}{100} \times 10$ or 1	M1	oe $20 \times 15 + 10 \times 12$ or 420
	3 + 1.2 or 4.2 or 3 + 1	M1dep	oe their 420 ÷ 100
	4	Q1	Strand (i) Rounding down
	Additional Guidance		

Q	Answer	Mark	Comments
20(b)	(85 + 88) ÷ 2 or 86.5 or (0.85 + 0.88) ÷ 2	M1	oe
	0.865 or $\frac{173}{200}$ or 86.5%	A1	oe Allow 0.87 or $\frac{87}{100}$ or 87% if correct method shown
	Additional Guidance		
	Beware of $\frac{26}{30}$ leading to 8 . (…) %		M0A0
	0.87 on its own		M0A0
21(a)	$\pi \times 6^2$ or $\pi \times 36$	M1	oe
	[113, 113.2] or 36π	A1	
	Additional Guidance		
	$\pi 36$		M1A0
21(b)	20 × 50 or 1000	M1	oe
	their 1000 – their [113, 113.2]	M1dep	oe
	[886.8, 887] or $1000 - 36\pi$	A1ft	ft their part (a)
	Additional Guidance		
	Do not ignore incorrect further working for the A mark, eg $1000 - 36\pi = 964\pi$		M1M1A0

Q	Answer	Mark	Comments
22 **Alt 1 of 3** **Alt 2 of 3**	**Alternative method 1**		
	53 – 46 or 7 or 53 million – 46 million or 7 million	M1	oe
	$\frac{7}{46}$ (× 100) or 0.152(…)	M1dep	oe Accept 0.15 if correct method shown
	15.2(…) (%)	A1	Accept 15(%) if correct method shown
	Alternative method 2		
	$\frac{53}{46}$ (× 100) or 1.152… or 115.2(…)	M1	oe Accept 1.15 if correct method shown Accept 115 if correct method shown Accept 0.15 if correct method shown
	1.152… – 1 or 0.152(…) or 115.2(…) – 100	M1dep	
	15.2(…) (%)	A1	Accept 15(%) if correct method shown

Q	Answer	Mark	Comments
22 cont Alt 3 of 3	**Alternative method 3**		
	Any correctly evaluated percentage of 46 (million)	M1	eg 1(%) is 0.46 (million) 5(%) is 2.3 (million) 10(%) is 4.6 (million)
	15(%) (increase) is 52.9 (million) or 15.1(%) (increase) is 52.946 (million) or 15.2(%) (increase) is 52.992 (million) or 15.3(%) (increase) is 53.038 (million) or 15.4(%) (increase) is 53.084 (million) or 15.5(%) (increase) is 53.13 (million)	M1dep	oe 15(%) is 6.9 (million) or 15.1(%) is 6.946 (million) or 15.2(%) is 6.992 (million) or 15.3(%) is 7.038 (million) or 15.4(%) is 7.084 (million) or 15.5(%) is 7.13 (million) and 7 (million)
	15.2(…) (%)	A1	Accept 15(%) with two of the trials listed above (or better), one with an answer below 53 million (or 7 million), the other with an answer above 53 million (or 7 million)
	Additional Guidance		
	Incorrect number of zeros used for millions cannot score A mark		
	15(%) scores at least 2 unless clearly from incorrect working		

Q	Answer	Mark	Comments
23	$8 \times 2x$ or $16x$ or $\frac{1}{2} \times 6 \times (4x + 2)$ or $3(4x + 2)$ or $6(2x + 1)$ or $12x + 6$	B1	oe
	$8 \times 2x = \frac{1}{2} \times 6 \times (4x + 2)$ or $8 \times 2x = 3(4x + 2)$ or $8 \times 2x = 6(2x + 1)$	M1	oe Sets up a correct equation
	$16x = 12x + 6$	M1dep	oe Simplified and bracket expanded
	1.5 or $1\frac{1}{2}$ or $\frac{3}{2}$	A1	
	Additional Guidance		
	$x = \frac{6}{4}$		B1M1M1A0
	Trial and improvement is 0 or 4		

Q	Answer	Mark	Comments
24	31^2 and 8^2 seen or 961 and 64 or 897	M1	oe $\sin^{-1}\left(\frac{8}{31}\right)$ = 14.(9…) or 15 and tan (14.(9…)) = $\frac{8}{h}$ or $\sin^{-1}\left(\frac{8}{31}\right)$ = 14.(9…) or 15 and cos (14.(9…)) = $\frac{h}{31}$ or $\cos^{-1}\left(\frac{8}{31}\right)$ = 75.(0…) or 75 and tan (75.(0…)) = $\frac{h}{8}$ or $\cos^{-1}\left(\frac{8}{31}\right)$ = 75.(0…) or 75 and sin (75.(0…)) = $\frac{h}{31}$
	$\sqrt{1^2 - 8^2}$ or $\sqrt{9\ 1 -\ 4}$ or $\sqrt{897}$	M1dep	oe $\frac{8}{\tan\ (14.(9...))}$ or 1 cos (14.(9…)) or 8 tan (75.(0…)) or 1 sin (75.(0…))
	29.9… or 0	A1	
	[5, 5.1]	B1ft	ft their 30 if first M1 scored
	Additional Guidance		
	Note using $31^2 + 8^2$ gives $\sqrt{1025}$ or 32 leading to answer 3		M1M0A0B1