AQA Qualifications

GCSE

Mathematics

Unit 2 43602H

Mark scheme

43602H
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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

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.
Q	Marks awarded for Quality of Written Communication
ft	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
SC	Special case. Marks awarded within the scheme 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. eg, accept 0.5 as well as $\frac{1}{2}$
[*a*, *b*]	Accept values between *a* and *b* inclusive.
3.14 …	Accept answers which begin 3.14 eg 3.14, 3.142, 3.149.
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.

Q	Answer	Mark	Comments	
1	**Alternative method 1**			
	720 ÷ 20 or 7.2(0) ÷ 0.2(0) or 36	M1	oe	
	their 36 ÷ 4 × 3 or 27	M1	oe eg $\frac{3}{4} \times 36$ correct method to find $\frac{3}{4}$ of their 36	
	their 27 × 5 or 135 or their 27 × 0.05	M1dep	dep on 2nd M1 oe	
	1.35	A1		
	Alternative method 2			
	7.20 ÷ 4 × 3 or 5.4(0)	M1	oe eg $\frac{3}{4} \times 7.20$	
	their 5.4(0) ÷ 20 or 27	M1		
	their 27 × 5 or 135 or their 27 × 0.05	M1dep	dep on 2nd M1 oe	
	1.35	A1		
	Additional Guidance			
	£135			M1M1M1A0
	£ crossed out and 135p			M1M1M1A1
	Do not allow further work to add on or subtract from their 27 for third method mark eg 36 ÷ 4 × 3 = 27 followed by 36 + 27 = 63 and 63 × 5			M1M1M0A0
	Allow rounding, truncation or exact decimal for their 27 in third method mark eg 720 ÷ 20 = 35, 35 ÷ 4 × 3 = 26.25, 26 x 5 (= 130)			M1M1M1A0

Q	Answer	Mark	Comments
2	800 or 1600 or 200 or 60 or 120 or 100	M1	
	800 or 1600 and 200 and 60 or 120 or 100	M1	
	1920 or 1900 or 2000	A1	SC1 1900 without working or 1900 from 1899

3	x = 81 and y = 19	B2	B1 100 – (a square number) correctly evaluated or 100 – (a prime number) correctly evaluated or A list of square numbers up to and including 81 with one error or omission and a list of prime numbers up to and including 19 with one error or omission or A correctly evaluated trial of a square number plus a prime number. eg 49 + 53 = 102
	Additional Guidance		
	Condone x = 19 and y = 81		B2
	x = 9^2 and y = 19		B2
	x = 9 and y = 19 with $9^2 = 81$ or $9^2 + 19$ or 81 + 19 in working		B2
	x = 9 and y = 19 without working		B1
	49 and 51 implies 100 – (a square number) correctly evaluated		B1
	91 and 9 implies 100 – (a square number) correctly evaluated		B1

Q	Answer	Mark	Comments
4	$5x - 3x$ or $2x$ or $-3x + 5x$ or $-2x$ or $7 + 6$ or 13 or $-6 - 7$ or -13	M1	
	$2x = 13$ or $-2x = -13$	A1	
	$\frac{13}{2}$ or 6.5	A1ft	oe ft rearrangement with one error if M1 awarded
	Additional Guidance		
	Ignore further work after correct fraction		
5(a)	2 (×) 100 or 5 (×) 40	M1	oe conditional on one prime factor in a correct product equal to 200 or one prime factor shown in a correct section on a factor tree starting from 200 Any order allow on prime factor tree or repeated division using 2 or 5 correctly condone 100 (×) 2 (×) 1 etc for this mark
	2 (×) 2 (×) 2 (×) 5 (×) 5	A1	Any order allow on prime factor tree or repeated division
	$2^3 \times 5^2$	Q1ft	Strand (i) correct index notation Any order ft correct product of prime numbers in index form from their working
	Additional Guidance		
	$2^3 + 5^2$		M1A1Q0
	(200 =) 2 (×) 2 (×) 5 (×) 5 and $2^2 \times 5^2$ is minimum		Q1ft
	$200 \div 2 = 100$		M1
	2 (×) 10 (×) 10 as a product or shown on a correct section of factor tree		M1
	20 (×) 5 (×) 2 as a product or shown on a correct section of factor tree		M1
	20 (×) 5 (×) 4 as a product or shown on a correct section of factor tree		M0

Q	Answer	Mark	Comments
5(b)	4 and 60 **and** 12 and 20	B2	B1 one correct or one correct and one incorrect or two correct and one incorrect Any indication
6	**Alternative method 1**		
	60 × 40 or 2400	M1	oe
	their 2400 – 2000 or 400 or 2000 – their 2400	M1dep	
	$\frac{\text{their } 400}{2000}$ (× 100) or 0.2	M1dep	oe
	20(%)	A1	
	Alternative method 2		
	60 × 40 or 2400	M1	oe
	their 2400 – 2000 or 400 or 2000 – their 2400	M1dep	
	10% = 2000 ÷ 10 or 1% = 2000 ÷ 100 **and** correctly finds multiplier using build up or division to find percentage equivalent to total their 400	M1	oe Correct build up to find percentage equivalent to total their (their 2400 – 2000) or their (2000 – their 2400) implies M3
	20(%)	A1	

6 (cont)	**Alternative method 3**		
	60 × 40 or 2400	M1	
	$\frac{\text{their } 2400}{2000}$ (×100) or 120(%) or 1.2	M1dep	
	their 120 – 100 or their 1.2(0) – 1(.00) or 100 – their 120 or 1(.00) – their 1.2(0) or 0.2	M1dep	oe
	20(%)	A1	
	Additional Guidance		
	20% on answer line and no working		M1M1M1A1
	480 × 5 (= 2400) from 5 years scores minimum M1		
	60 x 40 = 1800 and 200 scores minimum M1M1		
	60 x 40 = 1800 and 200 and $\frac{200}{2000}$		M1M1M1A0
	60 x 40 = 1800 and $\frac{200}{2000}$		M1M1M1A0
	$\frac{2000}{\text{their } 2400}$ (= 1.2) does not score second method mark on ALT3		

7	$4 < n \leq 8$ or 9, 10, 11, 12, 13, 14, 15, 16 or 4.5, 5, 5.5, 6, 6.5, 7, 7.5, 8 or 4, 5, 6, 7, 8 or 5, 6, 7 or 10, 12, 14, 16	M1	Accept $4 < n$ and $n \leq 8$ List of numbers in any order
	5, 6, 7, 8	A1	Any order
	Additional Guidance		
	Embedded answer fully correct 2 × 5 = 10, 2 × 6 = 12, 2 × 7 = 14, 2 × 8 = 16		M1A0
	4, 5, 6, 7		M0A0

Q	Answer	Mark	Comments
8(a)	$(8^1 =)\ 8$ or $(8^0 =)\ 1$	M1	
	9	A1	SC1 9^1
	Additional Guidance		
	$8^1 + 1$ with answer 9^1		M1A0
	$8^1 + 0$ with answer 8^1		M0A0
	8 on answer line without working		M0A0
	$8^1 + 8^0$ with answer 8		M0A0
	$8 \times 1 = 8$ and $8 \times 0 = 0$ with answer 8		M0A0
8(b)	6^8	B1	
8(c)	$15x^7y^5$	B2	B1 two terms correct
	Additional Guidance		
	$8x^7y^5$		B1
	$15x^6y^5$		B1
	$15x^7 \times y^5$		B1
	$8x^7 \times y^5$ or $15x^7 \times y^6$		B1
	$15x^{12}y^6$		B0
	$15x^7 + y^5$		B0
	$8x^7 + y^5$		B0
9(a)	$y = 3x + 2$	B1	
9(b)	$(PQ =)\ 3 - 0$ or 3	M1	Accept if seen on LHS of ratio (PQ) or as denominator in a gradient calculation for PR
	$(9, 14)$ or $x = 9$ or $(RS =)\ 9 - 4$ or 5	M1	
	3 : 5	A1	

Q	Answer	Mark	Comments
10	1950 or 2049 or 1500 or 2499	M1	
	1500 and 2049 or 1950 and 2499	M1	Must be seen as a linked pair
	549	A1	SC2 550

11(a)	x^2 (+) $9x$ (+) $5x$ (+) 45	M1	Allow one error Any order
	$x^2 + 14x + 45$	A1	Any order
	Additional Guidance		
	Terms may be seen in a multiplication grid		
	Do not ignore attempts to factorise after correct answer seen $x(x + 14) + 45$		M1A0
	$x^2 + 14x + 40$ with no working seen is one error		M1A0
	$x^2 + 10x + 45$ with no working seen is two errors		M0A0
	$x^2 + 5x + 45$ with no working seen		M0A0

11(b)	$5x(x - 2y)$	B2	B1 $5(x^2 - 2xy)$ or $x(5x - 10y)$
	Additional Guidance		
	Condone missing final bracket $5x(x - 2y$		B2
	$5x \times (x - 2y)$		B1
	Condone missing final bracket $5(x^2 - 2xy$		B1

12	$(3a - b)(3a + b)$	B2	B1 $(3a - b)(3a - b)$ or $(3a + b)(3a + b)$ or $(3a - b)^2$ or $(3a + b)^2$ or $(9a + b)(a - b)$ or $(9a - b)(a + b)$
	Additional Guidance		
	$(3a - b) \times (3a + b)$		B1

Q	Answer	Mark	Comments
13(a)	$x + y < 7$	B1	
13(b)	$2y \geq x + 4$	B1	

14(a)	**Alternative method 1**		
	Method to show 4 divided by 9 with answer 0.44(...) or method to show 1 divided by 9 = 0.11(...) and 4 × 0.11(…)	Q1	Strand (ii) full calculation or explanation seen
	Alternative method 2		
	($x = 0.44\ldots$ or $x = 0.\dot{4}$) $10x = 4.4\ldots$ or $10x = 4.\dot{4}$ $9x = 4$ $x = \frac{4}{9}$	Q1	Strand (ii) full calculation or explanation seen
	Alternative method 3		
	0.44... × 10 = 4.4... 0.44… × 9 = 4.4... – 0.44... 0.44... × 9 = 4 0.44... = $\frac{4}{9}$	Q1	Strand (ii) full calculation or explanation seen
	Additional Guidance		
	Minimum of two 4 digits seen		
	$10x = 4.4$ $9x = 4$ $x = \frac{4}{9}$		Q1
	$x = 0.4$ $10x = 4.4$ $9x = 4$ $x = \frac{4}{9}$		Q0

Q	Answer	Mark	Comments
14(b)	**Alternative method 1**		
	$\frac{9}{10}+\frac{4}{90}$ or $\frac{81}{90}+\frac{4}{90}$ or $0.5 + 0.\dot{4}$ or $\frac{1}{2}+\frac{4}{9}$ or $\frac{9}{18}+\frac{8}{18}$	M1	oe
	$\frac{85}{90}$ or $\frac{17}{18}$	A1	oe
	Alternative method 2		
	$10x = 9.\dot{4}$ and $100x = 94.\dot{4}$ or $100x - 10x = 94.\dot{4} - 9.\dot{4}$ or $100x - 10x = 85$ or $90x = 85$	M1	$100x - x = 93.5$ or $99x = 93.5$ or $(x =) \frac{93.5}{99}$
	$\frac{85}{90}$ or $\frac{17}{18}$ or $\frac{187}{198}$ or $\frac{935}{990}$	A1	oe
	Additional Guidance		
	$10x = 9.44$ and $100x = 94.4$ is minimum requirement to score M1 May be recovered by a fully correct answer to score M1A1		
	Ignore further working from correct fraction		
15(a)	63	B1	
15(b)	$5(y + 1)$ or $5y + 5$ or $(4 + 1)(y + 1)$ or $4y + 4 + y + 1$	B1	
	Additional Guidance		
	Condone $(4 + 1) \times (y + 1)$	B1	
	Condone $5 \times (y + 1)$ or $5 \times y + 5$	B1	
	Condone missing final bracket $5 \times (y + 1$	B1	
	Do not ignore further incorrect work		

Q	Answer	Mark	Comments
15(c)	$(x + 1)(y + 1)$ or $x(y + 1) + y + 1$ or $y(x + 1) + x + 1$ or $xy + x + y + 1$	B1	
	Additional Guidance		
	Condone $(x + 1) \times (y + 1)$		B1
	Condone $x \times (y + 1) + y + 1$		B1
	Do not ignore further incorrect work		
15(d)	$(2x + 1)(y + 1)$ or $2x(y + 1) + y + 1$ or $y(2x + 1) + 2x + 1$ or $2xy + 2x + y + 1$	B1	
	Additional Guidance		
	Condone $(2x + 1) \times (y + 1)$		B1
	Condone $2x \times (y + 1) + y + 1$		B1
	Do not ignore further incorrect work		

Q	Answer	Mark	Comments
16	$x(2y-3)$ or $2xy-3x$	M1	oe
	$2xy-3x = 5y+4$	M1dep	oe
	$2xy-5y = 3x+4$ or $y(2x-5) = 3x+4$ or $5y-2xy = -3x-4$ or $y(5-2x) = -3x-4$	M1dep	$\frac{3x+4}{2x-5}$ or $\frac{-3x-4}{5-2x}$ is M3
	$y = \frac{3x+4}{2x-5}$ or $y = \frac{-3x-4}{5-2x}$	A1	
	Additional Guidance		
	If there is choice mark the working linked to the answer line		
	$2xy-3x = 5y+4$ is M1M1 as minimum		
	$2xy-5y = 3x+4$ or $y(2x-5) = 3x+4$ is M1M1M1 as minimum		
	Condone $x \times (2y-3)$		M1
17	$a = 4$ or $(3x-1)(4x+b)$	B1	
	$3ax^2 + 3bx - ax - b$ or $3b - a = -19$ or $12x^2 + 3bx - 4x - b$	M1	
	$3bx - 4x = -19x$ or $3b - 4 = -19$ or $3b = -15$ or $b = -5$ or $(3x-1)(4x-5)$	M1	This mark implies B1M2
	$a = 4$ and $b = -5$ and $c = 5$	A1	
	Additional Guidance		
	$3ax^2 + 3bx - 1ax - b$ or $3ax^2 + 3bx - ax - 1b$		M1
	Condone $3x^2a$ and $3xb$ and xa		
18(a)	$6\sqrt{2}$	B1	

Q	Answer	Mark	Comments
18(b)	$\sqrt{\frac{24}{6}}$ or $\sqrt{\frac{8}{2}}$ or $\sqrt{4}$ or $\frac{\sqrt{8}}{\sqrt{2}}$ or $\frac{2\sqrt{2}}{\sqrt{2}}$ or $\frac{\sqrt{8}\times\sqrt{2}}{\sqrt{2}\times\sqrt{2}}$ or $\frac{\sqrt{16}}{2}$ or $\frac{4}{2}$ or $\frac{\sqrt{3}\times 2\sqrt{2}}{\sqrt{6}}$ or $\frac{2\sqrt{6}}{\sqrt{6}}$ or $\frac{\sqrt{3}\times 2\sqrt{2}\times\sqrt{2}}{\sqrt{6}\times\sqrt{2}}$ or $\frac{2\sqrt{12}}{\sqrt{12}}$ or $\frac{\sqrt{3}\times\sqrt{8}\times\sqrt{6}}{\sqrt{6}\times\sqrt{6}}$ or $\frac{\sqrt{24}\times\sqrt{6}}{\sqrt{6}\times\sqrt{6}}$ or $\frac{\sqrt{144}}{6}$ or $\frac{12}{6}$	M1	
	2	A1	
	Additional Guidance		
	$\frac{\sqrt{24}}{\sqrt{6}}$ does not score alone without further working		M0

Q	Answer	Mark	Comments
19	**Alternative method 1**		
	$x^2 - 6x - 20 = 4 - x$	M1	
	$x^2 - 5x - 24\ (= 0)$	M1	ft one error in collection of terms with all terms correctly collected on one side
	$(x - 8)(x + 3)\ (= 0)$ or $(x + a)(x + b)\ (= 0)$	M1	where ab = ± their 24 or a + b = ± their 5 ft their quadratic or quadratic formula (allow one error)
	$x = 8$ and $y = -4$ **or** $x = -3$ and $y = 7$	A1	
	$x = 8$ and $y = -4$ **and** $x = -3$ and $y = 7$	A1	SC2 for both $(8, -4)$ and $(-3, 7)$ by trial and improvement SC1 for either $(8, -4)$ or $(-3, 7)$ by trial and improvement
	Alternative method 2		
	$y = (4 - y)^2 - 6(4 - y) - 20$ or $y = 16 - 8y + y^2 - 24 + 6y - 20$ or $y = y^2 - 2y - 28$	M1	allow one error in rearrangement of $y = 4 - x$
	$y^2 - 3y - 28\ (= 0)$	M1	ft one error in expansion and collection of terms with all terms correctly collected on one side
	$(y - 7)(y + 4)\ (= 0)$ or $(y + a)(y + b)\ (= 0)$	M1	where ab = ± their 28 or a + b = ± their 3 ft their quadratic or quadratic formula (allow one error)
	$y = -4$ and $x = 8$ **or** $y = 7$ and $x = -3$	A1	
	$y = -4$ and $x = 8$ **and** $y = 7$ and $x = -3$	A1	SC2 for both $(8, -4)$ and $(-3, 7)$ by trial and improvement SC1 for either $(8, -4)$ or $(-3, 7)$ by trial and improvement

	Additional Guidance	
19 (cont)	Substituting $x = y - 4$ into quadratic is two errors in rearrangement of $y = 4 - x$	M0
	Substituting $x = y - 4$ into quadratic followed by collection of terms with all terms correctly collected on one side $y^2 - 15y + 20\ (= 0)$ (allow one error)	M0M1
	Substituting $x = y - 4$ into quadratic followed by $y^2 - 15y + 20\ (= 0)$ followed by attempt to factorise quadratic where ab = ± their 20 or a + b = ± their 15	M0M1M1