AQA

GCSE

Mathematics

Higher Tier Unit 2 Number and Algebra

Mark scheme

43602H

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Version 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 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(a)	100	B1	Accept 1 hour 40 (minutes)
	Additional Guidance		
	100 seen with answer 1:40 or 1.40		B1
	1:40 or 1.40 without 100 seen		B0
1(b)	85	B1	
1(c)	A	B1	
2	16 seen or 32 seen or 27 seen	M1	
	(2×) 16 (+) 27 or 32 (+) 27	M1	
	59	A1	SC2 43

Q	Answer	Mark	Comments
3	**Alternative method 1** Price of 40 batteries using packs		
	40 ÷ 4 or 10 (packs used in offer A) **and** 40 ÷ 5 or 8 (packs used in offer B)	M1	oe 8 is implied by the use of 6 packs in offer B
	their 10 x 2.52 or 25.2(0) or their 2.52 ÷ 3 × 2 or 1.68 or their 8 × 2.75 or 22 or $\frac{3}{4}$ × 40 ÷ 5 or 30 ÷ 5 or 6	M1	oe
	their 25.2(0) ÷ 3 × 2 or 10 × their 1.68 or 16.8(0) or $\frac{3}{4}$ × their 22 or their 6 × 2.75 or 16.5(0)	M1	oe
	16.8(0) and 16.5(0)	A1	oe
	(Offer) B	Q1ft	Strand (iii) ft for correct decision based on their values, with one correct value and first two method marks
	Additional Guidance		
	Allow any correct working in pence up to M3		
	Allow consistent working in pence for M3 and A1Q1ft		
	16.8(0) or 16.5(0) or 6 × 2.75 is minimum M0M1M1		

Q	Answer	Mark	Comments
3 (cont)	**Alternative method 2** Price of 40 batteries using unit price		
	2.52 ÷ 4 or 0.63 **and** 2.75 ÷ 5 or 0.55	M1	oe
	40 × their 0.63 or 25.2(0) or 40 × their 0.55 or 22	M1	oe
	their 25.2 ÷ 3 × 2 or 16.8(0) or $\frac{3}{4}$ × 40 × their 0.55 or 30 × their 0.55 or $\frac{3}{4}$ × their 22 or 16.5(0)	M1	oe
	16.8(0) and 16.5(0)	A1	oe
	(Offer) B	Q1ft	Strand (iii) ft for correct decision based on their values, with one correct value and first two method marks
	Additional Guidance		
	Allow any correct working in pence up to M3		
	Allow consistent working in pence for M3 and A1Q1ft		
	16.8(0) or 16.5(0) is minimum M0M1M1		

Q	Answer	Mark	Comments
3 (cont)	**Alternative method 3** Price per battery		
	252 ÷ 4 or 63 **and** 275 ÷ 5 or 55	M1	oe
	their 63 ÷ 3 × 2 or 42	M1	oe
	$\frac{3}{4}$ × their 55 or 41(.25)	M1	oe
	42 and 41(.25)	A1	oe
	(Offer) B	Q1ft	Strand (iii) ft for correct decision based on their values, with one correct value and first two method marks
	Additional Guidance		
	Allow any correct working in pounds up to M3		
	Allow consistent working in pounds for M3 and A1Q1ft		
	42 or 41(.25) is minimum M0M1M1		

Q	Answer	Mark	Comments
4	$5x - 2$ or $5(x - 2)$ or $5x - 10$	B1	oe
	$5x - 2 - (5x - 10)$ or $5x - 2 - 5(x - 2)$ or $5x - 10 - (5x - 2)$ or $5(x - 2) - (5x - 2)$	M1	oe
	or $5x - 2 - 5x + 10 = 8$ or $5x - 10 - 5x + 2 = -8$	Q1	oe Strand (ii) complete and correct algebra SC2 At least two pairs of correctly evaluated trials for both number machines with same input and a difference of 8 SC1 One pair of correctly evaluated trials for both number machines with same input and a difference of 8
	Additional Guidance		
	Accept other letter used		
	$x \times 5 - 2$	B1	
	$x5 - 2$	B0	
	Do not accept $x - 2 \times 5$ for B1 unless recovered for B1M1 only		
	$3 \times 5 - 2 = 13$ and $(3 - 2) \times 5 = 5$	SC1	
	1 3 –5 2 8 0 3 13 5 4 18 10 5 23 15 6 28 20 7 33 25 8 38 30 9 43 35 10 48 40		

Q	Answer	Mark	Comments
5(a)	**Alternative method 1**		
	$3x - 6$	B1	
	$3x = 21 +$ their 6 or $3x = 27$ or $x = \frac{27}{3}$	M1	
	9	A1ft	ft from B0 their $3x - 6$ from expanding with a term in $3x$
	Alternative method 2		
	$x - 2 = 7$	B1	
	$x = \frac{21}{3} + 2$ or $x =$ their $7 + 2$	M1	
	9	A1ft	ft from B0 their 7 with division seen
	Additional Guidance		
	Answer 9 with no working or no incorrect working		B1M1A1
	ft their $3x - 6$ must be following an attempt at expanding with a term in $3x$ eg $3x - 2 = 21$ $3x = 23$ $x = \frac{23}{3}$		B0M1A1ft
	$3x = 23$ without expanding $x = \frac{23}{3}$		B0M0A0ft
	If ft answer simplifies to an integer this must be seen for A1ft, but if not an integer then mixed number or improper fraction is acceptable		

Q	Answer	Mark	Comments
5(b)	$8x - 6x$ or $2x$	M1	
	12 + 7 or 19	M1	
	$x > 9.5$	A1ft	oe ft correct inequality for their $2x$ and their 19 with M1M0 or M0M1 awarded and only one error SC2 9.5 in final answer
	Additional Guidance		
	Final answer must have correct inequality		
	$2x > 19$ $x > 9.5$ final answer 9.5 or $x = 9.5$		M1M1A0
	$2x = 19$ $x = 9.5$		M1M1A0
6(a)	2 (×) 66 or 3 (×) 44 or 2 (×) 6 (×) 11 or 3 (×) 4 (×) 11 or 12 (×) 11 or 2 (×) 2 (×) 33 or 2 (×) 3 (×) 22	M1	Any order Allow on prime factor tree or repeated division. Condone 2 (×) 66 (×) 1 etc
	$2 \times 2 \times 3 \times 11$ or $2^2 \times 3 \times 11$	A1	Any order
	Additional Guidance		
	2, 2, 3, 11		M1A0

Q	Answer	Mark	Comments
6(b)	**Alternative method 1**		
	2 (x) 5 (x) 11 = 110	M1	
	22	A1	SC1 11
	Alternative method 2		
	List of factors of 110 **and** 132 up to 22 with 2 errors or omissions (1), 2, 5, 10, 11, 22 (55, 110) **and** (1), 2, 3, 4, 6, 11, 12, 22 (33, 44, 66, 132)	M1	
	22	A1	SC1 11
	Additional Guidance		
	(1, 55, 110) and (1, 33, 44, 66, 132) are not omissions		
7	32	B2	B1 4 or 16 or 0.5
8	7 : 5	B2	B1 Any ratio equivalent to 7 : 5 or 5 : 7 or any ratio correctly simplified
9(a)	$2n + 19$	B1	

Q	Answer	Mark	Comments
9(b)	**Alternative method 1**		
	$4a - 9$	B1	
	$8a - 21$	B1ft	ft 2 × their ($4a - 9$) – 3 correctly simplified
	7	B1ft	7 scores B1B1B1 ft correct solution of their ($8a - 21$) = 35
	Alternative method 2		
	19	B1	
	11	B1ft	ft (their 19 + 3) ÷ 2 correctly evaluated
	7	B1ft	7 scores B1B1B1 ft (their 11 + 3) ÷ 2 correctly evaluated
	Additional Guidance		
	7 in working with a different final answer eg 19, 11, 7, 5 with answer 5		B1B1B0
	Accept embedded answers		

Q	Answer	Mark	Comments
10	**Alternative method 1**		
	$4x - 6y = 48$ and $18x + 6y = -15$	$6x - 9y = 72$ (and $6x + 2y = -5$)	M1	oe Equating coefficients
	$22x = 33$ or $x = 1.5$	$-11y = 77$ or $y = -7$	M1 dep	oe Elimination of one variable
	$x = 1.5$ and $y = -7$		A1	oe SC1 for $x = 1.5$ and $y = -7$ without working or using trial and improvement
	Alternative method 2		
	$x = \frac{24 + 3y}{2}$ or $y = \frac{2x - 24}{3}$ or $x = \frac{-5 - 2y}{6}$ or $y = \frac{-5 - 6x}{2}$		M1	oe Rearranging
	$22x = 33$ or $x = 1.5$	$-11y = 77$ or $y = -7$	M1 dep	oe Elimination of one variable
	$x = 1.5$ and $y = -7$		A1	oe SC1 for $x = 1.5$ and $y = -7$ without working or using trial and improvement

Q	Answer	Mark	Comments
11	$\frac{11}{4}$ or $\frac{16}{9}$	M1	oe fraction
	$\frac{their11 \times their16}{4 \times 9}$ or $\frac{176}{36}$	M1dep	oe fraction $\frac{11 \times 8}{2 \times 9}$ or $\frac{88}{18}$ or $\frac{11 \times 4}{9}$ or $\frac{44}{9}$
	$4\frac{8}{9}$	A1	oe mixed number SC2 $4.\dot{8}$
	Additional Guidance		
	$4\frac{16}{18}$ or $4\frac{32}{36}$		M1M1A1
	Working in decimals is SC2 or 0		

Q	Answer	Mark	Comments
12	$3y = 15x - 3$ and $y = 5x - 3$	B2	B1 $3y = 15x - 3$ and $y = 5x - 3$ and one incorrect or $3y = 15x - 3$ or $y = 5x - 3$ and none or one incorrect
13	$y = 3x - 2$	B3	oe eg $\frac{y}{3} = x - \frac{2}{3}$ B2 $y = -3x - 2$ or $3x - 2$ or $y = 3x + c$ or gradient = $\frac{6}{2}$ or 3 and intercept = –2 B1 $y = mx - 2$ or $y = -3x + c$ or $-3x - 2$ or $3x + c$ or gradient = $\frac{6}{2}$ or 3 or intercept = –2
	Additional Guidance		
	Gradient is implied by correct division		

Q	Answer	Mark	Comments
14	**Alternative method 1**		
	Correct order **and** all three correct values $\sqrt{20}$, $\sqrt{24}$ and $\sqrt{28}$	B3	B2 three correct values $\sqrt{24}$, $\sqrt{28}$ and $\sqrt{20}$ or $\sqrt{20}$ and $\sqrt{24}$ or $\sqrt{20}$ and $\sqrt{28}$ or $\sqrt{24}$ and $\sqrt{28}$ B1 $\sqrt{20}$ or $\sqrt{24}$ or $\sqrt{28}$
	Alternative method 2		
	Correct order **and** all three correct values $2\sqrt{5}$, $2\sqrt{6}$ and $2\sqrt{7}$	B3	B2 three correct values $2\sqrt{6}$, $2\sqrt{7}$ and $2\sqrt{5}$ or $2\sqrt{5}$ and $2\sqrt{6}$ or $2\sqrt{5}$ and $2\sqrt{7}$ or $2\sqrt{6}$ and $2\sqrt{7}$ B1 $2\sqrt{5}$ or $\frac{10\sqrt{5}}{5}$ or $2\sqrt{6}$ or $2\sqrt{7}$
	Alternative method 3		
	Correct order **and** all three correct values 20, 24 and 28	B3	B2 three correct values 24, 28 and 20 or 20 and 24 or 20 and 28 or 24 and 28 B1 20 or $\frac{100}{5}$ or 24 or $4 \times 3 \times 2$ or 12×2 or 8×3 or 4×6 or 28
	Additional Guidance		
	Correct order is $\frac{10}{\sqrt{5}}$, $2\sqrt{3} \times \sqrt{2}$, $\sqrt{\frac{56}{2}}$		

Q	Answer	Mark	Comments
14 (cont)	20, 24, 28 using Alt 3		B2
	B1 values using Alt 3 can be seen inside square root $\sqrt{\frac{100}{5}}$ or $\sqrt{4\times3\times2}$ or $\sqrt{12\times2}$ or $\sqrt{8\times3}$ or $\sqrt{4\times6}$		B1
15(a)	$(ax + p)(bx + q)$	M1	where $ab = 3$ and $pq = \pm10$ or $aq + bp = -13$
	$(3x + 2)(x – 5)$	A1	
15(b)	$3x(x – 5)$	M1	
	$\frac{3x}{3x+2}$	A1ft	ft their answer to part (a) correctly simplified from common linear factors
	Additional Guidance		
	Do not allow further incorrect work eg $\frac{3x}{3x+2}$ incorrectly simplified to $\frac{1}{2}$		M1A0
16	**Alternative method 1**		
	$(2^2)^4$ or $(2^3)^4$ or 2^{12}	M1	
	$2^{12} \div 2^8$ or 2^4 or $2^8 \times 2^4 = 2^{12}$	M1	oe
	4	A1	
	Alternative method 2		
	256 or 4096	M1	
	$4096 \div 256 = 16$ and $2^4 = 16$	M1	
	4	A1	

Q	Answer	Mark	Comments
17	**Alternative method 1**		
	$xy = 3x + 5$	M1	oe
	$xy - 3x = 5$ or $x(y - 3) = 5$	M1dep	oe
	$x = \frac{5}{y-3}$ or $x = \frac{-5}{3-y}$	A1	SC2 $\frac{5}{y-3}$ or $\frac{-5}{3-y}$
	Alternative method 2		
	$y = 3 + \frac{5}{x}$	M1	oe
	$y - 3 = \frac{5}{x}$ or $\frac{x}{5} = \frac{1}{y-3}$	M1dep	oe
	$x = \frac{5}{y-3}$ or $x = \frac{-5}{3-y}$	A1	SC2 $\frac{5}{y-3}$ or $\frac{-5}{3-y}$
	Additional Guidance		
	Condone multiplication signs $x \times y$ or use of bracket $x(y)$		

Q	Answer	Mark	Comments
18(a)	**Alternative method 1**		
	$(x-5)^2$	M1	
	$(x-5)^2-13$ or $a=5$ and $b=-13$	A1	
	Alternative method 2		
	$x^2-2ax+a^2+b = x^2-10x+16$ or $2a=10$ or $a=5$ or $b=-13$	M1	
	$(x-5)^2-13$ or $a=5$ and $b=-13$	A1	
18(b)	2	B1	
19	$\frac{1}{125^{\frac{2}{3}}}$ or 5^{-2} or $(\sqrt[3]{125})^{-2}$ or $\sqrt[3]{125}=5$	M1	
	$\frac{1}{\sqrt[3]{125^2}}$ or $\frac{1}{(\sqrt[3]{125})^2}$ or $\left(\frac{1}{\sqrt[3]{125}}\right)^2$ or $\sqrt[3]{\left(\frac{1}{125}\right)^2}$ or $125^{\frac{2}{3}}=25$ or $\frac{1}{5^2}$ or $\left(\frac{1}{5}\right)^2$ or 25^{-1} or 0.2^2	M1dep	
	$\frac{1}{25}$	A1	oe 0.04

Q	Answer	Mark	Comments
20	**Alternative method 1**		
	$4x^2 + 6xy + 6xy + 9y^2$ or $4x^2 – 6xy – 6xy + 9y^2$	M1	Four terms, three correct with a term in x^2 and a term in y^2 or $4x^2 \pm 12xy + ay^2$ with $a \neq 0$ or $bx^2 \pm 12xy + 9y^2$ with $b \neq 0$
	$4x^2 + 12xy + 9y^2 – (4x^2 – 12xy + 9y^2)$ or $4x^2 + 12xy + 9y^2 – 4x^2 + 12xy – 9y^2$	M1dep	oe allow one error, which may be missing brackets
	$24xy = 360$	M1	oe
	$xy = 15$ (and 15 is a multiple of 5)	A1	
	Alternative method 2		
	$(2x + 3y + 2x – 3y)(2x + 3y – (2x – 3y))$ or $(2x + 3y + 2x – 3y)(2x + 3y – 2x + 3y)$	M1	allow one error, which may be missing brackets
	their $4x$ × their $6y$	M1dep	Correct simplification of both of their brackets and intention to multiply
	$24xy = 360$	M1	oe
	$xy = 15$ (and 15 is a multiple of 5)	A1	
	Additional Guidance		
	Missing brackets in Alt 1 for second method mark may be recovered for M3 or M3A1		