AQA Qualifications

GCSE

Mathematics

43602H Unit 2: Higher
Mark scheme

4360
November 2016

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 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.

1	40 or 300 or 60 or 5 or 12 000	M1	
	200	A1	
	Additional Guidance		
	200 with no working		M1A1
	Attempt at full calculation		M0A0

2(a)	$6x - 21$	B1	
	Additional Guidance		
	Ignore any attempt to solve eg $6x - 21 = 0$		B1
	Do not accept any attempt to simplify further eg $6x - 21 = -15$		B0

2(b)	$x(x + 8)$	B1	
	Additional Guidance		
	$(x + 8)\ x$		B1
	$x \times (x + 8)$ or $(x + 8) \times x$ or $(x \pm 0)(x + 8)$		B1
	$x(x + 8$		B1

3	$(2 \times)\ 5 \times 5$ or $(2 \times)\ 25$ or 50 or $-3 \times -3 \times -3$ or -27	M1	
	$2 \times$ their 25 + (their –27) or their 50 + (their –27)	M1dep	may be implied by correct evaluation using their values
	23	A1	SC1 73 or 77

4	66 × 15 or 990 or 66 ÷ 3 (× 2) or 22 or 44 or 15 ÷ 3 (× 2) or 5 or 10	M1	oe
	their 990 ÷ 3 (× 2) or their 22 × 15 or 330 or (66 – their 22) × 15 or their 44 × 15 or (15 – their 5) × 66 or their 10 × 66 or 660	M1dep	oe
	75 × 1000 or 75 000 or 75 ÷ 100 × 20 or 15 or 75 ÷ 100 × 80 or 60	M1	oe 0.75 × 1000 or 750 or 0.75 ÷ 100 × 20 or 0.15 or 0.75 ÷ 100 × 80 or 0.6(0)
	their 75 000 × 0.8 ÷ 100 or (75 – their 15) × 1000 ÷ 100 or their 60 × 1000 ÷ 100 or 600	M1dep	oe their 750 × 0.8 or (0.75 – their 0.15) × 1000 or their 0.6(0) × 1000
	660 and 600 and (Company) B	Q1	Strand (iii)

5	28 (×) 2 or 8 (×) 7 or 14 (×) 2 (×) 2 or 2 (×) 4 (×) 7 or 2, 2, 2, 7	M1	allow on prime factor tree or repeated division ignore incorrect products if at least one correct product seen
	$2 \times 2 \times 2 \times 7$ or $2^3 \times 7$	A1	
	Additional Guidance		
	Ignore any × 1 for M1 but not A1		

6(a)	$C = 4d + 20$	B1	

6(b)	**Alternative method 1**		
	their $(4d + 20) + 6d + 10 = 90$	M1	
	$10d = 60$ or their $4d + 6d = 80$ – their 20 correctly evaluated	M1	correctly collects terms on both sides for their $(4d + 20)$
	6	A1	
	Alternative method 2		
	Correct value for hire of drill or sander for d days where $d > 1$	M1	
	Correct total value for hire of drill and sander for d days where $d > 1$	M1	
	6	A1	

Additional Guidance

$20d + 4 + 6d + 10 = 90$ $26d + 14 = 90$ $26d = 76$	$4d + 24 + 6d + 10 = 90$ $10d + 34 = 90$ $10d = 56$	$24d – 4 + 6d + 10 = 90$ $30d + 6 = 90$ $30d = 84$	M1M1A0

number of days	2	3	4	5	6
drill hire (£)	28	32	36	40	44
sander hire (£)	22	28	34	40	46
total hire (£)	50	60	70	80	90

7	$4x - 20$	B1	
	their $4x - x$ or 7 + their 20 or $3x = 27$	M1	oe collecting terms
	9	A1ft	
	Additional Guidance		
	$4x - 5 = x + 7$ $3x = 12$ $x = 4$		B0 M1 A1ft
	$4x - 5 = x + 7$ $3x = 2$ $x = \frac{2}{3}$		B0 M1 A1ft

8(a)	**Alternative method 1**		
	60 + 3 × 40 or 60 + 120 or 180 or 0.6(0) + 3 × 0.4(0) or 0.6(0) + 1.2(0) or 1.8(0)	M1	
	5 × 180 and 900 ÷ 100 = 9 or 5 × 1.8(0) = 9	A1	fully correct method
	Alternative method 2		
	60 × 5 or 300 or 0.6(0) × 5 or 3 or 3 × 40 × 5 or 40 × 15 or 600 or 3 × 0.4(0) × 5 or 0.4(0) × 15 or 6	M1	
	300 + 600 and 900 ÷ 100 = 9 or 3 + 6 = 9	A1	fully correct method
	Additional Guidance		
	5 × 1.8(0)		M1A0
	5 × 180 and 900 ÷ 100		M1A0
	300 + 600 and 900 ÷ 100		M1A0

8(b)	**Alternative method 1**		
	3 × 9 or 27 or 60 × 80 or 4800 or 60 × 0.8(0) or 48	M1	
	their 48 – their 27	M1	
	21	A1	
	Alternative method 2		
	9 ÷ 20 or 0.45 or 900 ÷ 20 or 45	M1	
	(0.8(0) – their 0.45) × 60 or 0.35 × 60 or (80 – their 45) × 60 ÷ 100 or 35 × 60 ÷ 100	M1	
	21	A1	
	Alternative method 3		
	(0.6(0) + 3 × 0.4(0)) ÷ 4 or 1.8(0) ÷ 4 or 0.45 (60 + 3 × 40) ÷ 4 or 180 ÷ 4 or 45	M1	
	(0.8(0) – their 0.45) × 60 or 0.35 × 60 or (80 – their 45) × 60 ÷ 100 or 35 × 60 ÷ 100	M1	
	21	A1	

9(a)	64	B1	

9(b)	–27	B1	

10(a)	$8n - 3$	B1	

10(b)	**Alternative method 1**		
	$x + 6$	B1	oe
	$4x + 9$	B1	oe
	their $(x + 6) + 2x + 7$ + their $(4x + 9) = 57$ or $7x + 22 = 57$	M1	oe
	5	A1	SC2 11, 17, 29
	Alternative method 2		
	$x + 6$	B1	oe
	$4x + 9$	B1	oe
	their $(x + 6) = 11$ or $2x + 7 = 17$ or their $(4x + 9) = 29$	M1	oe
	5	A1	SC2 11, 17, 29
	Additional Guidance		
	$(2x + 7 + 5) \div 2$ or $(2x + 12) \div 2$ are oe for $x + 6$		B1
	$2(2x + 7) - 5$ or $4x + 14 - 5$ are oe for $4x + 9$		B1

11(a)	2.4×10^8	B1	

11(b)	36×10^{11} or 3 600 000 000 000 or 0.004 (×) 900 000 000 000 000	M1	
	3.6×10^{12}	A1	

<table>
<tr><td rowspan="8">12</td><td colspan="4">Alternative method 1</td></tr>
<tr><td>$4x - 6y = 24$</td><td>$10x + 12y = 6$
and
$10x - 15y = 60$</td><td>M1</td><td></td></tr>
<tr><td>$9x = 27$
or $x = 3$</td><td>$27y = -54$
or $y = -2$</td><td>M1dep</td><td></td></tr>
<tr><td colspan="2">$x = 3$ and $y = -2$</td><td>A1</td><td>oe
SC1 for $x = 3$ and $y = -2$ without working or using trial and improvement</td></tr>
<tr><td colspan="4">Alternative method 2</td></tr>
<tr><td>$y = \frac{2x-12}{3}$
or $y = \frac{3-5x}{6}$</td><td>$x = \frac{12+3y}{2}$
or $x = \frac{3-6y}{5}$</td><td>M1</td><td>oe
Rearranging</td></tr>
<tr><td>$9x = 27$
or $x = 3$</td><td>$27y = -54$
or $y = -2$</td><td>M1dep</td><td>oe
Elimination of one variable and simplification</td></tr>
<tr><td colspan="2">$x = 3$ and $y = -2$</td><td>A1</td><td>oe
SC1 for $x = 3$ and $y = -2$ without working or using trial and improvement</td></tr>
</table>

<table>
<tr><td rowspan="3">13(a)</td><td>$125x^6y^{12}$</td><td>B2</td><td>B1 two terms correct</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="2">Ignore × signs for B1 only</td><td></td></tr>
</table>

13(b)	$\frac{4}{3}x^9y^{-4}$ or $\frac{4x^9}{3y^4}$	B2	oe B1 two terms correct
	Additional Guidance		
	$1.\dot{3}x^9y^{-4}$		B2
	Condone $\frac{1.\dot{3}x^9}{y^4}$		B2
	Ignore × signs for B1 only		

14	**Alternative method 1**		
	(RS =) 3 or (6, 3) or (OP =) 9 or (0, 9)	M1	
	(their OP – their RS) × 2 or 6 × 2 or 12 or PQ = their OP – their RS or PQ = 6 or OQ = 6 + 6 + 3 or 6 + 9 or 15	M1dep	oe PQ = 6 or OQ = 15 implies M1M1
	15 : 3 or 5 : 1	A1	
	Alternative method 2		
	(RS =) 3 or (6, 3)	M1	
	$2x + y = c$ and $2 \times 6 + 3 = c$ or $2x + y = 15$	M1	oe $y = –2x + c$ and $3 = –2 \times 6 + c$ or $y = –2x + 15$
	15 : 3 or 5 : 1	A1	
	Additional Guidance		
	Ignore attempts to simplify after 15 : 3 seen		M1M1A1
	Award appropriate marks for values seen on diagram		

15	$y(4x + 9)$ or $4xy + 9y$	M1	oe

	$4xy + 9y = 8 - 3x$	M1dep	oe
	$4xy + 3x = 8 - 9y$ or $x(4y + 3) = 8 - 9y$	M1dep	oe
	$x = \frac{8-9y}{4y+3}$	A1	SC3 $\frac{8-9y}{4y+3}$
	Additional Guidance		
	$y \times (4x + 9)$		M1
	$x = \frac{8-9y}{4y+3}$ seen with answer $\frac{8-9y}{4y+3}$		M1M1M1A1

16(a)	$\frac{1}{9}$	B1	

16(b)	$\frac{1}{8^{\frac{2}{3}}}$ or 2^{-2} or $(\sqrt[3]{8})^{-2}$ or $\left(\sqrt[3]{8}\right)=2$ or $64^{-\frac{1}{3}}$ or $(\sqrt[3]{64})^{-1}$ or $\left(8^2\right)=64$ or $(-8)^0=1$ seen or implied	M1	
	$\frac{1}{\sqrt[3]{8^2}}$ or $\frac{1}{\sqrt[3]{64}}$ or $\frac{1}{(\sqrt[3]{8})^2}$ or $\left(\frac{1}{\sqrt[3]{8}}\right)^2$ or $\sqrt[3]{\left(\frac{1}{8}\right)^2}$ or $\sqrt[3]{\frac{1}{64}}$ or $\frac{1}{64^{\frac{1}{3}}}$ or $\sqrt[3]{\frac{1}{8}}=\frac{1}{2}$ or $\left(8^{\frac{2}{3}}\right)=4$ or $\frac{1}{4}$ or $\frac{1}{2^2}$ or $\left(\frac{1}{2}\right)^2$ or 4^{-1}	M1	oe
	$1\frac{1}{4}$	A1	oe
	Additional Guidance		
	$8^{-\frac{2}{3}}=\frac{1}{64}$ with answer $1\frac{1}{64}$		M1M0A0

17(a)	$4x^2 - 6xy + 6xy - 9y^2$ $(= 4x^2 - 9y^2)$	B1	

17(b)	$\frac{3}{\sqrt{2}}\times\frac{\sqrt{2}}{\sqrt{2}}$ $\left(=\frac{3\sqrt{2}}{2}\right)$	B1	

17(c)	$4\left(\sqrt{3}\right)^2$ or $4\sqrt{9}$ or 4×3 or 12 or $(-)9\left(\frac{1}{\sqrt{2}}\right)^2$ or $(-)\frac{9}{\sqrt{4}}$ or $(-)9 \times \frac{1}{2}$ or $(-)\frac{9}{2}$	M1	
	$12 - 9 \times \frac{1}{2}$ or 12 and $\frac{6}{\sqrt{6}}$ and $-\frac{6}{\sqrt{6}}$ and $-\frac{9}{2}$ seen	M1	oe
	$\frac{15}{2}$ or 7.5	A1	oe

18	$x(x + 3)$	M1	
	$(x + 3)(5x - 4)$ or $(x + a)(5x + b)$	M1	where $ab = \pm 12$ or $5a + b = 11$
	$\frac{5x-4}{x}$ or $5 - \frac{4}{x}$	A1	Do not allow further working

19	$16x^2 - 20x - 20x + 25$ or $16x^2 - 40x + 25$	M1	
	$-15x^2 + 40x$ or $-(15x^2 - 40x)$	M1	
	$x^2 + 25$	A1	from fully correct algebra
	Valid argument	Q1ft	eg $x^2 \geq 0$ for all values of x so $x^2 + 25 \geq 25$ (positive) Strand (ii) correct mathematical argument and M1 scored
	Additional Guidance		
	$16x^2 - 40x + 25$ $-15x^2 + 40x$ Shown as a subtraction alone		M1M1
	$16x^2 - 40x + 25$ $-15x^2 + 40x$ Shown as a subtraction with $x^2 + 25$ $x^2 + 25$		M1M1A1
	$16x^2 - 20x - 20x + 25 - 15x^2 + 40x$		M1M1
	Minimum justification for Q1 after $x^2 + 25$ x^2 is positive, so $x^2 + 25$ is positive		
	For Q1ft the argument may be that their expression is not positive for all values of x following $25 - x^2$ eg $x^2 \geq 0$ so $25 - x^2$ can be positive or negative		
	For Q1ft the argument may be that their expression is not positive for all values of x following $x^2 - 80x + 25$ eg $80x$ can be greater or less than $x^2 + 25$ so $x^2 - 80x + 25$ can be positive or negative		