AQA Qualifications

GCSE

Methods in Mathematics (Linked Pair Pilot)

93651F
Unit 1: Foundation Tier
Mark Scheme

9365
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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.

M	Method marks are awarded for a correct method which could lead to a correct answer.
M dep	A method mark dependent on a previous method mark being awarded.
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.
B dep	A mark that can only be awarded if a previous independent mark has been awarded.
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 for a common misinterpretation which has some mathematical worth.
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.
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

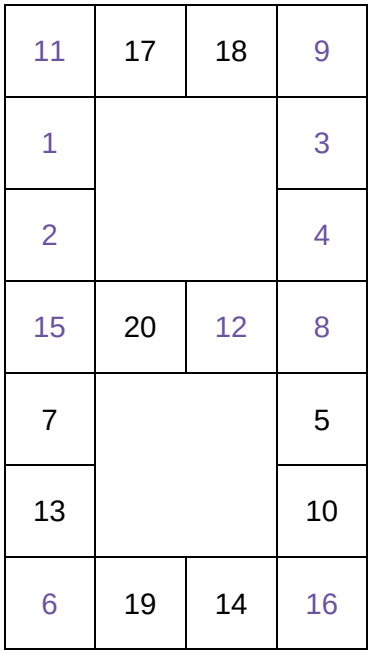
Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise.

Q	Answer	Mark	Comments
1(a)	Identifies coordinates of *A* and *B* or Accurately marks the midpoint of *AB*	M1	(1, 1) and (7, 3)
	4, 2	A1	SC1 4, y or x, 2, where x and y can be any numbers SC1 2, 4
1(b)	Point plotted with coordinates of the form $(a, a + 1)$ or Line $y = x + 1$ drawn	B1	SC1 If answer to 1(a) is 2, 4 then point plotted with coordinates of the form $(a, a – 1)$ or the line $y = x – 1$ drawn
	Additional Guidance		**Mark**
	Condone no labelling of the point. If a line is drawn then the diagonal of a 1cm square is sufficient $4x$, $2y$ implies correct midpoint for M1 A0		M1 A0
2(a)	The counter has a letter on it → Certain	B1	
	The counter has R on it → Likely	B1	
	Additional Guidance		**Mark**
	Do not award the mark if the event is linked to more than one probability		

Q	Answer	Mark	Comments
2(b)	3 with M, 1 with any letter except L or M, 2 without letters or 3 with M, 2 with any letters except L or M, 1 without a letter	B2	Counters without letters may be blank or contain numbers or symbols B1 2 of the 3 criteria met: • 4 or 5 counters with letters • exactly 3 counters with M • no counters with letter L

Additional Guidance	**Mark**
The order of the letters is irrelevant.	
Examples:	
M M M D D triangle	B2
M M M A B C	B1
M M M L blank blank	B1
W X Y Z 3 4	B1
M M M L A 5	B1
H I J K L blank	B0
M M M L L L	B0
M M M M M A	B0
A A A A A blank	B0
Treat O as a letter or zero, whichever would give the higher mark	
Treat I as a letter or one, whichever would give the higher mark	
Z may clearly be the letter Z, but if there is doubt treat it as Z or 2, whichever would give the higher mark	

Q	Answer	Mark	Comments
3	14	B2	B1 2, 6, 10, 18, 22 or 26 or 4, 9, 19, 24 or 29 or number greater than 30 which fulfils the other two conditions, eg 34, 54, 74 etc
	Additional Guidance		**Mark**
	18 ÷ 2 = 9 9 + 6 = 15 18 or 15 given on answer line implies B1 for 18		B1
4(a)	Expression	Q1	Strand (i) correct terminology
4(b)	26	B1	

Q	Answer	Mark	Comments
5		B4	The pairs of numbers (eg 17 & 18) can be in either order B3 Three or four rows/columns add up to 55 using available numbers with no repeats in those rows/columns B2 Two rows/columns add up to 55 using available numbers with no repeats in those rows/columns or All rows and columns add up to 55, but repeated and/or unavailable numbers are used B1 One row/column adds up to 55 using available numbers with no repeats in that row/column or Three or four rows/columns add up to 55, but repeated and/or unavailable numbers are used

Additional Guidance	Mark
Unavailable numbers are those already given in the grid or outside the range 1-20 Mark correct rows/columns first, as B3 may be scored even when repeated or unavailable rows/columns have been used. The answer grid may contain blanks. Treat a blank square as zero (which is an unavailable number) Mark practice grid if answer grid is blank.	

Q	Answer	Mark	Comments
6	$4x - 1$	B2	B1 $4x$ or -1

Additional Guidance	Mark
$-1 + 4x$	B2
$4x$, 1	B1
$4x + -1$	B1
Accept $4 \times x$ or $x \times 4$ for $4x$	
Do not ignore further working:	
$4x - 1 = 3x$	B1
$4x - 1 = 0$ ($x = 0.25$)	B1

7(a)	0.625	B1	Condone .625 Accept 0.6250, 0.62500, etc
7(b)	625	B1	

Q	Answer	Mark	Comments
8(a)	–5	B1	
8(b)	Correctly plots at least two points from their table	M1	1 mm tolerance Condone 1 or 2 incorrect points also plotted
	Correct ruled straight line from (–2, –5) to (2, 3)	A1	
	Additional Guidance		**Mark**
	There is no ft for the accuracy mark from an incorrect value in (a) The correct line will score 2 marks The line must be ruled The line must be within 1 mm of the correct points, otherwise A0 Ignore extra points plotted if the line is correct If there is an incorrect line or no line at all then ignore up to 2 extra incorrect points (but remember that an incorrect value in (a) does not constitute an incorrect point)		

Q	Answer	Mark	Comments
9(a)		B2	B1 all 0s correct or all non-zeros correct

	1	2	3	4
1	0	2	3	4
2	2	0	3	4
3	3	3	0	4
4	4	4	4	0

Additional Guidance	**Mark**
Do **not** accept a blank space as 0	

9(b)	$\frac{6}{16}$ or $\frac{3}{8}$ or 0.375 or 37.5%	B1ft	oe fraction, decimal or percentage ft from a completed table

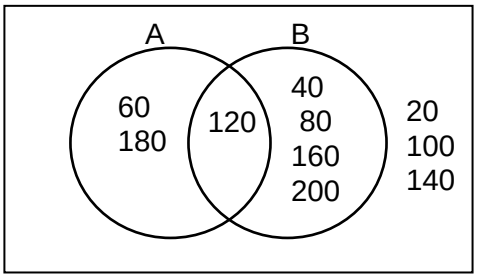
Additional Guidance	**Mark**
Ignore an incorrect simplification of $\frac{6}{16}$ or an incorrect conversion to a decimal or percentage Ignore descriptive words such as 'likely', 'unlikely', etc	

9(c)	0, 9, 9, 16 or 1, 9, 9, 16 or 4, 9, 9, 16 or 9, 0, 0, 16 or 9, 1, 1, 16 or 9, 4, 4, 16	B2	B1 x, 9, 9, 16 where $x < 9$ and $x \neq 0, 1, 4$ or 9, x, x, 16 where $x < 9$ and $x \neq 0, 1, 4$

Additional Guidance	**Mark**
Accept answers written on the spinner or in the table. If they are different, mark the numbers on the spinner 1, 4, 9, 16 scores B0	

Q	Answer	Mark	Comments
10	a and b different primes and $\sqrt{a+b}$ prime eg $a = 2$ $b = 7$ $a = 2$ $b = 23$ $a = 2$ $b = 47$ etc	B2	Values of a and b can be reversed eg $a = 7$ $b = 2$ B1 2, 2 or a or b prime and $\sqrt{a+b}$ an integer eg $a = 3$ $b = 13$, $a = 7$ $b = 9$ etc or a and b prime and $a + b$ prime eg $a = 2$ $b = 5$, or at least four prime numbers identified with no incorrect numbers or at least five prime numbers identified with one incorrect number

Additional Guidance		**Mark**
Examples of answers worth B1		
2, 79 3, 6 5, 20 7, 29	a or b prime and $\sqrt{(a+b)}$ an integer	B1
2, 11 2, 29	a and b prime and $a + b$ prime	B1
If answer line scores 0, check working for a trial that would score B2 or B1 with at most one trial incorrectly evaluated		B1

Q	Answer	Mark	Comments
11(a)		B2	B1 for at least one correct region
11(b)	Gives both probabilities as $\frac{7}{10}$ oe or States that there are 7 numbers for each	B1	SC1 If their Venn diagram is incorrect they may show that the two probabilities are equal or are not equal and still qualify for this mark
	Additional Guidance		**Mark**
	If their Venn diagram is incorrect they can achieve this mark either from a restart or from using their diagram Withhold the mark if their $\frac{7}{10}$ or 7 comes from incorrect working		B0

Q	Answer	Mark	Comments
12	**Alternative method 1**		
	$7x + 14$	M1	
	Their $7x - 3x = 4$ – their 14 or $4x = -10$	M1	oe ft their expansion Rearranges their equation to get x terms on one side and number terms on the other
	–2.5	A1ft	ft on one error in expansion or rearrangement
	Alternative method 2		
	$x + 2 = \frac{3x}{7} + \frac{4}{7}$	M1	
	x – their $\frac{3x}{7}$ = their $\frac{4}{7}$ – 2 or $\frac{4x}{7} = \frac{-10}{7}$	M1	oe ft their division Rearranges their equation to get x terms on one side and number terms on the other
	–2.5	A1ft	ft on one error in expansion or rearrangement

Q	Answer	Mark	Comments

12 (cont.)	Additional Guidance	Mark
	Trial and improvement is 0 or 3 marks	
	Examples	
	$7x + 14 = 3x + 4$ $7x – 3x = 4 – 14$ $x = 2.5$	M1 M1 A0
	BUT	
	$7x + 14 = 3x + 4$ $x = 2.5$ (no working seen)	M1 M0, A0
	$7x + 16 = 3x + 4$ $7x – 3x = 4 – 16$ $x = – 3$ (only 1 error)	M0 M1 A1ft
	$7x + 14 = 3x + 4$ $7x – 3x = 4 + 14$ $x = 4.5$ (only 1 error)	M1 M0 A1ft
	$7x + 14 = 3x + 4$ $7x + 3x = 4 – 14$ $x = –1$ (only 1 error)	M1 M0 A1ft
	$7x + 2 = 3x + 4$ $7x – 3x = 4 – 2$ $x = \frac{1}{2}$ oe (only 1 error)	M0 M1 A1ft
	$7x + 14 = 3x + 4$ $7x + 3x = 4 + 14$ $x = 1.8$ (2 errors)	M1 M0 A0ft

Q	Answer	Mark	Comments
13	500 ÷ (3 + 7) or 50	M1	
	3 × their 50 and 7 × their 50 or 150 and 350 or their 50 × 4	M1dep	
	200	A1	
	Additional Guidance		**Mark**
	150 : 350 150 or 350 implies M1 unless from an incorrect method.		M1M1A0 M1

14	$3x - x < 10$ or $2x < 10$ or $x < \frac{10}{2}$	M1	oe
	$x < 5$	A1	SC1 5 or $x = 5$ or $x \leq 5$ or $x > 5$ or $x \geq 5$
	Additional Guidance		**Mark**
	< 5 or > 5 or ≤ 5 or ≥ 5 x must be less than 5 (ie words used rather than '<')		M1 A0 M1 A1

15(a)	25	B1	
15(b)	3	B1	Accept 3 more squares shaded on diagram
	Additional Guidance		**Mark**
	If answer line is blank check diagram for 3 more squares shaded		

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="3">16(a)</td><td>16</td><td>B1</td><td></td></tr>
<tr><td>14</td><td>B1</td><td></td></tr>
<tr><td>90</td><td>B1</td><td></td></tr>
<tr><td rowspan="3">16(b)</td><td>Attempt at 264 × 10 and 264 × 7
or
attempt at 17 × 200 and 17 × 60 and 17 × 4</td><td>M1</td><td>For example:
264 × 17
2640
1848

17 × 264
3400
1020
68

The order of the rows is interchangeable

<table><tr><td></td><td>200</td><td>60</td><td>4</td></tr><tr><td>10</td><td>2000</td><td>600</td><td>40</td></tr><tr><td>7</td><td>1400</td><td>420</td><td>28</td></tr></table>
There may be errors in the components but the number of digits in each row of the traditional method or each box of the grid method must be correct and the emboldened zeros must be correct

<table><tr><td>2</td><td>6</td><td>4</td><td></td></tr><tr><td>0 / 2</td><td>0 / 6</td><td>0 / 4</td><td>1</td></tr><tr><td>1 / 4</td><td>4 / 2</td><td>2 / 8</td><td>7</td></tr></table>
2, 6, 4, 14, 42, 28 correctly entered into the grid. Allow one calculation error</td></tr>
<tr><td>Adds all the components</td><td>M1</td><td>Traditional method: At least one of the rows must be correct
Grid method: At least four of the six values must be correct
Napier’s Bones method: At least four of the six entries must be correct and all six numbers added in the correct manner</td></tr>
<tr><td>4488</td><td>A1</td><td></td></tr>
</table>

<table>
<tr><th>16(b) (cont.)</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td></td><td>
The 2 method marks are independent

The first mark is about the size of the components and place value. The components must have the required number of digits and zeros when the traditional or grid methods are used

In the traditional method or Napier's bones allow a blank or dash for a 0

The second method mark is independent of the first, but to gain it:
• the addition must consist of all the relevant parts to complete the calculation 264 × 17
• there must be the required accuracy in the components as described in the mark scheme

Example 1

264
17 ×

1852
264 (blank counts as a zero)
4492

<table>
<tr><td></td><td>200</td><td>60</td><td>4</td></tr>
<tr><td>10</td><td>2000</td><td>600</td><td>40</td></tr>
<tr><td>7</td><td>140</td><td>440</td><td>28</td></tr>
</table>

Example 2

2000 + 6000 + 40 + 140 + 440 + 28 = …

(140 incorrect for 1st M mark, but 4 of the values are correct so can score the 2nd M mark)

Example 3

<table>
<tr><td></td><td>200</td><td>60</td><td>4</td></tr>
<tr><td>10</td><td>2000</td><td>600</td><td>40</td></tr>
<tr><td>7</td><td>1400</td><td>420</td><td>24</td></tr>
</table>

Answer: 7184 M1 (only 1 incorrect value) M0 (no working) A0
</td><td>
M1 M1 A0

M0 M1 A0

M1 M0 A0
</td></tr>
</table>

Q	Answer	Mark	Comments

16(b) (cont.)	Additional Guidance	Mark
	Example 4 260 × 10 = 2600 4 × 7 = 28 Answer: 2628 (since not all the necessary calculations have been done) Example 5	M0 M0 A0

	2	6	4
1	2	6	4
7	14	42	24

M0 M0 A0

17			
	1 + 4 + 10 or 15 and 2 + 3 + 7 or 12	M1	
	a in A and b in B where $b - a = 3$ and no number is repeated eg $a = 5, b = 8$ $a = 6, b = 9$ etc	A1	SC1 a, b where $b - a = 3$ but one or both values repeats eg $a = 7, b = 10$ SC1 $a - b = 3$ and no number is repeated eg $a = 8, b = 5$
	Additional Guidance		**Mark**
	a and b can be negative or non-integers If answer is not given on answer lines look for numbers in the boxes		

18(a)			
	55 56 57 65 66 67 75 76 77	B2	B1 All 9 correct numbers with up to 6 incorrect numbers or 6, 7 or 8 correct numbers with up to 3 incorrect numbers
	Additional Guidance		**Mark**
	Be careful of repeated numbers – they count as incorrect numbers		
18(b)	$\frac{6}{9}$	B1ft	oe ft from their (a)

Q	Answer	Mark	Comments

18(b) cont.	Additional Guidance	Mark
	Ignore descriptive words such as 'likely, 'unlikely' etc Ignore any incorrect cancelling or conversion to a decimal or percentage Accept 0.66 or better or 0.67 or 66% or 67% for $\frac{6}{9}$	B1

19(a)	35	B1	
19(b)	3.5 or $3\frac{1}{2}$	B1ft	ft their 35 ÷ 10
	Additional Guidance		**Mark**
	$\frac{35}{10}$		B0
19(c)	73.5 or $73\frac{1}{2}$	B1ft	ft 2 × their 35 + their 3.5

20(a)	Arrow to 0.4	B1	±2 mm on scale
	Additional Guidance		**Mark**
	Arrow does not have to reach line if intention is clear Arrow does not have to start at box		
20(b)	Arrow to 0.8	B1	±2 mm on scale
	Additional Guidance		**Mark**
	Arrow does not have to reach line if intention is clear Arrow does not have to start at box		

Q	Answer	Mark	Comments
21(a)	At least three points plotted, each with coordinates (2, y)	B1	
	Additional Guidance		**Mark**
	Award the mark if the correct line is clearly drawn but individual points have not been identified The line should be at least 2 squares long		
21(b)	At least three points plotted, each with coordinates (x, –1)	B1	SC1 correct points for y = 2 in (a) and x = –1 in (b)
	Additional Guidance		**Mark**
	Award the mark if the correct line is clearly drawn but individual points have not been identified The line should be at least 2 squares long		
22	0.79	B2	B1 full calculation with 1 error
	Additional Guidance		**Mark**
	A misread of sign or number counts as one error		

Q	Answer	Mark	Comments
23(a)	$n + n + 2$ or $2n + 2$ or $2(n + 1)$	B1	oe
	$S =$ or $= S$	Q1	Strand (i) Correct notation for a formula
	Additional Guidance		**Mark**
	Do not ignore further working, e.g. $n + n + 2 = n^2 + 2$		B0
23(b)	$n + n + 2 = 2n + 2 = 2(n + 1)$ or $2n + 2 = 2(n + 1) = n + n + 2$ or $(2n + 2) \div 2 = n + 1$	B1	
	Additional Guidance		**Mark**
	Accept $2(n + 1) = 2n + 2$ if $2n + 2$ is given in part (a) Condone missing brackets if the intention is clear		

24(a)	–11	B1	
24(b)	–24	B1	
24(c)	7	B1	

Q	Answer	Mark	Comments
25	**Alternative method 1**		
	$\frac{15}{40}$	M1	
	3 with $\frac{15}{40}$ or 15 seen	A1	Condone embedded answer of $\frac{3}{8}$ SC1 3 without correct working
	Alternative method 2		
	$33 - 18 = \frac{40x}{8}$	M1	
	3 with $33 - 18 = \frac{40x}{8}$ seen	A1	Condone embedded answer of $\frac{3}{8}$ SC1 3 without correct working
26(a)	$n + 4$	B1	
26(b)	$3(2x + 1)$	B1	
26(c)	$R = \frac{E}{V}$	B1	

Q	Answer	Mark	Comments
27	**Alternative method 1**		
	$\frac{3}{6} + \frac{1}{6}$ or $\frac{4}{6}$ or $\frac{2}{3}$	M1	Common denominator with at least one numerator correct
	1 – their $\frac{2}{3}$ or $\frac{1}{3}$	M1dep	
	40 ÷ their $\frac{1}{3}$ or 40 × 3 or 120 or 40 ÷ 2	M1dep	oe
	20	A1	
	Alternative method 2		
	1 – $\frac{1}{6}$ or $\frac{5}{6}$	M1	
	Their $\frac{5}{6}$ – $\frac{3}{6}$ or $\frac{2}{6}$ or $\frac{1}{3}$	M1dep	Common denominator with at least one numerator correct
	40 ÷ their $\frac{1}{3}$ or 40 × 3 or 120 or 40 ÷ 2	M1dep	oe
	20	A1	
	Alternative method 3		
	$\frac{1}{2} - \frac{1}{6}$	M1	
	$\frac{3}{6} - \frac{1}{6}$ or $\frac{2}{6}$ or $\frac{1}{3}$	M1dep	Common denominator with at least one numerator correct
	40 ÷ their $\frac{1}{3}$ or 40 × 3 or 120 or 40 ÷ 2	M1dep	oe
	20	A1	

Q	Answer	Mark	Comments

27 (cont.)	Additional guidance	Mark
	Be careful of the value $\frac{1}{3}$ This may or may not score 2 marks Example $\frac{3}{6} + \frac{1}{6} = \frac{4}{12} = \frac{1}{3}$	M1 only

Q	Answer	Mark	Comments
28	0.16 or 3.6 or 0.9 or $\frac{16}{100}$ or $\frac{72}{20}$ or $\frac{18}{20}$	B1	oe
	0.72 or $\frac{144}{200}$ or their 0.16 × 4.5 correctly evaluated or their 3.6 × 0.2 correctly evaluated or their 0.9 × 0.8 correctly evaluated or their $\frac{16}{100} \times \frac{9}{2}$ correctly evaluated or their $\frac{72}{20} \times \frac{2}{10}$ correctly evaluated or their $\frac{18}{20} \times \frac{8}{10}$ correctly evaluated	B1	oe
	No and 0.72 or $\frac{72}{100}$ with no incorrect evaluation of $\frac{3}{4}$	Q1ft	Strand iii Correct method for the calculations and correct decision for their product Allow arithmetical errors