AQA Qualifications

GCSE

Methods in Mathematics (Linked Pair Pilot)

93651H
Unit 1: Higher Tier
Mark Scheme

9365
November 2014

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.

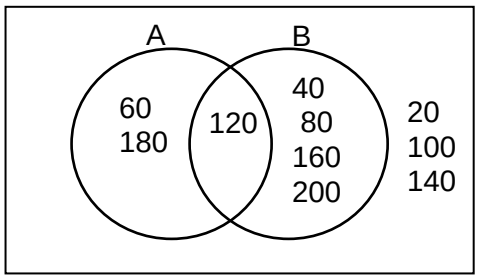
Choice
When a choice of answers and/or methods is given, mark each attempt. If both methods are valid then M marks can be awarded but any incorrect answer or method would result in marks being lost.

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)	–3	B1	
1(b)	Plots the given points and their point	M1	ft their (a) if it can be plotted
	Draws smooth curve through the correct seven points	A1	
	Additional guidance		**Mark**
	The first mark can be awarded if their answer to (a) is in the range [–5, 7]. There is no ft on the second mark. If they have given a wrong, or no, answer to (a) they can still be awarded two marks in (b) for a correct curve through (0, –3). For one or both mark(s), allow the points plotted within ½ square of the correct point.		
2(a)	$x(x + 5)$	B1	
	Additional guidance		**Mark**
	Accept $x(5 + x)$ and accept $(5 + x)$ instead of $(x + 5)$ in any of the following. Condone $x \times (x + 5)$ and $(x + 5) \times x$ and $(x + 5)x$ Condone $x(x + 5$ and $x \times (x + 5$		
2(b)	$2(4y – 7)$	B1	
	Additional guidance		**Mark**
	Condone $2 \times (4y – 7)$ and $(4y – 7) \times 2$ but not $(4y – 7)2$		

Q	Answer	Mark	Comments
3(a)	$x + x + 1 + x + 2 + x + 3 + x + 4$ $= 5x + 10$	B1	
	Additional guidance		**Mark**
	Addition signs may be missing if addition is clearly indicated, for example in vertical arrangement with total underneath		
3(b)	$10n + 10$	B1	
	$10(n + 1)$ or argument that both terms in the expression are multiples of 10	Q1	Strand ii – correct algebraic proof
	Additional guidance		**Mark**
	$10n + 1$ may come from a substitution of $2n$ for x or it may come from a restart, with $2n$, $2n + 1$, $2n + 2$, $2n + 3$ and $2n + 4$ added. If a different letter (including x) is used, award B1Q1 if the letter has been defined and B0Q1 for an otherwise correct answer		
4(a)		B2	B1 for at least one correct region
4(b)	Gives both probabilities as $\frac{7}{10}$ oe or States that there are 7 numbers for each	B1ft	ft 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
5(a)	$x + 3x + 0.2 + 6x = 1$	B1	oe $10x + 0.2 = 1$
	0.08	B1ft	oe ft their equation of the form $ax + b = 1$ oe
	Additional guidance		**Mark**
	Accept $10x = 0.8$ for the equation 0.08 without a correct equation scores B0B1		
5(b)	4 × their 0.08	M1	oe their 0.08 + 3 × their 0.08
	0.32	A1ft	oe fraction, decimal or percentage ft their 0.08 if 0 < their 0.08 < 0.25 SC1 $4x$
	Additional guidance		**Mark**
	The condition on the follow though is to ensure that their probability for A or B is greater than 0 and less than 1		
6	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

Q	Answer	Mark	Comments
7	1.15 or 115%	M1	
	4715 ÷ 1.15 or 4715 ÷ 115 (× 100)	M1dep	oe
	4100	A1	
8(a)	5	B1	
8(b)	–2	B1	
8(c)	$2r + 1$	B1	oe $r + r + 1$

Q	Answer	Mark	Comments
9	**Alternative method 1**		
	$5x - 15y = 80$	M1	Multiplies one or both equation(s) to equate coefficients of x Allow one arithmetic error
	$-16y = 72$	M1	$16y = -72$ Subtracts equations Allow one arithmetic error
	$y = -4.5$	A1	
	$x = 2.5$	A1ft	ft from M1M1A0 with clear working shown and only one arithmetic error throughout
	Alternative method 2		
	$15x + 3y = 24$	M1	Multiplies one or both equation(s) to equate coefficients of y Allow one arithmetic error
	$16x = 40$	M1	Adds equations Allow one arithmetic error
	$x = 2.5$	A1	
	$y = -4.5$	A1ft	ft from M1M1A0 with clear working shown and only one arithmetic error throughout
	Alternative method 3		
	$x = 3y + 16$	M1	Finds one variable in terms of the other Allow one arithmetic error
	$5(3y + 16) + y = 8$	M1	oe $15y + 80 + y = 8$ Correctly substitutes their expression Allow one arithmetic error
	$y = -4.5$	A1	
	$x = 2.5$	A1ft	ft from M1M1A0 with clear working shown and only one arithmetic error throughout

Q	Answer	Mark	Comments
9 (cont.)	**Alternative method 4**		
	$y = 8 - 5x$	M1	Finds one variable in terms of the other Allow one arithmetic error
	$x - 3(8 - 5x) = 16$	M1	oe $x - 24 + 15x = 16$ Correctly substitutes their expression
	$x = 2.5$	A1	
	$y = -4.5$	A1	
10	$t(2x + 1) = 3x + 7$	M1	
	$2tx + t = 3x + 7$	M1dep	
	$2tx - 3x = 7 - t$	M1dep	
	$x = \frac{7 - t}{2t - 3}$ or $x = \frac{t - 7}{3 - 2t}$	A1	
11	$x^2 + y^2 = 49$	B1	
	7	B1ft	ft their equation in the form $x^2 + y^2 = r^2$ 7 gets full marks ignore units
	Additional guidance		**Mark**
	The most likely error for the first mark is probably to subtract 13 and get $x^2 + y^2 = 23$. If this is followed by an answer of $\sqrt{23}$ B0B1 is scored. For the ft, their r^2 must be positive.		
12(a)	$\frac{1}{2}$	B1	oe any equivalent fraction or decimal
12(b)	$y = -ax$ (+ 4) or (m =) – 2	M1	–1 ÷ their $\frac{1}{2}$ from (a)
	2	A1ft	ft 1 ÷ their answer to (a)

Q	Answer	Mark	Comments
13	6	B1	
	10	B1	
	3 or –1	B1	
14	$10x - 6x$ or $4x$ or $6x - 10x$ or $-4x$	M1	For M1M1 the rearrangements must be a correct pair: $10x - 6x$ or $4x$ and $17 - 3$ or 14 or $6x - 10x$ or $-4x$ and $3 - 17$ or -14
	$17 - 3$ or 14 or $3 - 17$ or -14	M1	
	3.5 or $3\frac{1}{2}$ or $\frac{7}{2}$	A1ft	ft M1M0 or M0M1 with one rearrangement or arithmetic error

Q	Answer	Mark	Comments
15	**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

15 (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
16	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

Q	Answer	Mark	Comments
17(a)	Sections may not be the same size or spinner may be biased	B1	
17(b)	$\frac{20}{50}$ or $\frac{2}{5}$ or 0.4	B1	oe fraction, decimal or percentage
17(c)	No and correct reason eg No, it's just chance how the second 50 spins land	B1	
	Additional guidance		**Mark**
	Accept any indication that the results of the second 50 spins could be different to the first 50		
17(d)	Katy and Most spins	B1	
18(a)	2 + 1 = 3 or $2^1 + 1^2 = 3$	Q1	Strand ii
	Additional guidance		**Mark**
	3 without working		Q0
18(b)	3	B1	Accept $2^3 + 3^2 = 8 + 9 = 17$ with 17 as answer
18(c)	Correct trial for any value of n other than 1 or 3	M1	n: 2 4 5 K: 8 32 57 The trial for n = 2 may be seen in 18(b)
	6	A1	Accept $2^6 + 6^2 = 64 + 36 = 100$ with 100 as answer

Q	Answer	Mark	Comments
19(a)	$\frac{3}{4}$ and $\frac{1}{2}$ and $\frac{1}{2}$	B1	oe fraction, decimal or percentage
19(b)	Their $\frac{3}{4}$ × their $\frac{1}{2}$ or $\frac{3}{8}$	M1	All probabilities must be between 0 and 1
	$\frac{1}{4}$ + their $\frac{3}{8}$	M1dep	1 – their $\frac{3}{8}$
	$\frac{5}{8}$	A1	
20(a)	0	B1	
20(b)	$-a$	B1	
21(a)	$(x + 4)(x – 4)$	B1	Brackets in either order
21(b)	$(x + 6)(x – 4)$	B2	Brackets in either order B1 for $(x + a)(x + b)$ where $a + b = 2$ or $ab = \pm 24$
21(c)	$\frac{x+4}{x+6}$	B1ft	ft their answers to (a) and (b) if simplification is possible
	Additional guidance		**Mark**
	If they give the answer $(x – 6)(x + 4)$ to (b) they should simplify to $\frac{(x+4)(x-4)}{(x+4)(x-6)} = \frac{x-4}{x-6}$ for B1		
22	$7^2 + 10^2 + 11^2$	M1	49 + 100 + 121 or 270
	$\sqrt{\text{their } 270}$	M1dep	$\sqrt{9}\sqrt{30}$
	$3\sqrt{30}$	A1	

Q	Answer	Mark	Comments
23	**Alternative method 1**		
	$y = kx^3$ or $12 = k \times 2^3$	M1	
	$k = 1.5$	A1	
	1500	A1ft	ft their 1.5 × 1000 and M1 scored
	Alternative method 2		
	$(10 \div 2)^3$ or 5^3	M1	
	125	A1	
	1500	A1ft	ft their 125 × 12 and M1 scored
24	**Alternative method 1**		
	$\frac{2 \times 10^6}{5 \times 10^{-3}}$	M1	
	0.4×10^9	M1	
	4×10^8	A1	
	Alternative method 2		
	$(2.5 \times 10^{-9})^{-1}$	M1	
	0.4×10^9	M1	
	4×10^8	A1	
	Alternative method 3		
	$\frac{2\,000\,000}{0.005}$	M1	
	400 000 000	M1	
	4×10^8	A1	

Q	Answer	Mark	Comments
25	**Alternative method 1**		
	$\frac{6}{\sqrt{3}}$	M1	
	$\frac{6\sqrt{3}}{\sqrt{3}\times\sqrt{3}}$ or $\frac{6}{\sqrt{3}}\times\frac{\sqrt{3}}{\sqrt{3}}$	M1	
	$2\sqrt{3}$ or $a = 2$	A1	SC1 $2\sqrt{3}$ or $a = 2$ without appropriate working
	Alternative method 2		
	$6\sqrt{5}\times\frac{\sqrt{15}}{\sqrt{15}\times\sqrt{15}}$ or $6\sqrt{5}\times\frac{\sqrt{15}}{15}$	M1	
	$6\sqrt{5}\times\sqrt{5}\times\frac{\sqrt{3}}{15}$	M1	oe
	$2\sqrt{3}$ or $a = 2$	A1	SC1 $2\sqrt{3}$ or $a = 2$ without appropriate working
	Alternative method 3		
	$6\sqrt{5} = a\sqrt{3}\times\sqrt{15}$	M1	
	$6\sqrt{5} = a\sqrt{3}\times\sqrt{5}\times\sqrt{3}$	M1	oe
	$2\sqrt{3}$ or $a = 2$	A1	SC1 $2\sqrt{3}$ or $a = 2$ without appropriate working