GCSE

Methods in Mathematics (Linked Pair)

Higher Tier   Unit 2   Geometry and Algebra
Mark scheme

9365

November 2015

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.
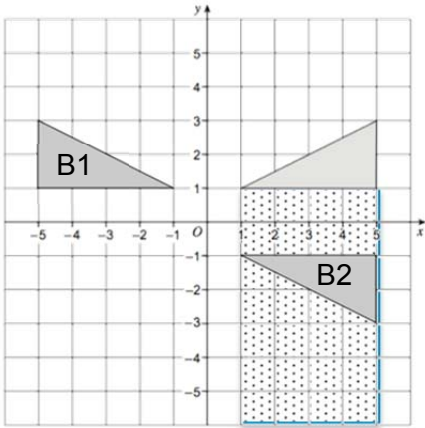
Work not replaced

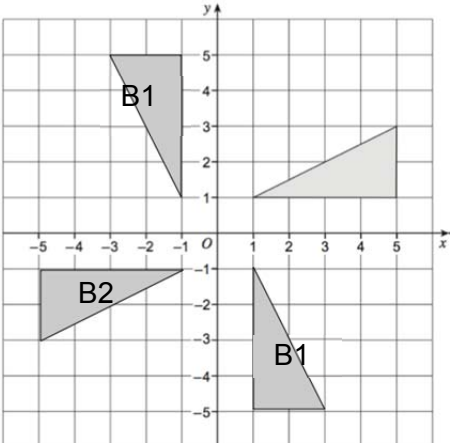Erased or crossed out work that is still legible should be marked.

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)	121	B1	

Q	Answer	Mark	Comments
1 (b)	(11, 2), (11, 7), (19, 3), (23, 7), (41, 5), (43, 7), (67, 3), (71, 7), (83, 2)	B2	B1 for two two-digit or two one-digit primes that subtract to give a square number. B1 for a two digit prime minus 9 or 1 that gives a square number B1 for a two digit odd number minus a 1 digit prime that gives a square number

Q	Additional Guidance		Marks
1 (b)	(17, 13), (23, 19), (41, 37), (71, 67), (83, 79), (29, 13), (47, 31), (53, 37), (59, 43), (83, 67), (89, 73), (47, 11), (53, 17), (59, 23), (67, 31), (73, 37), (79, 43), (83, 47), (89, 53), (97, 61), (83, 19) (13, 9), (73, 9), (17, 1), (37, 1), (39, 3), (27, 2), (21, 5), (51, 2)		B1

Q	Answer	Mark	Comments
2 (a)	Correct reflection 	B2	B1 for reflection in y-axis B1 for reflection in $y = a$, $a < 1$ (dotted area)

Q	Answer	Mark	Comments
2 (b)	Correct rotation	B2	B1 for any 180° rotation or a 90° CW or ACW rotation about the origin

Alternative method 1			
3	$2x + 3x + 125 + 90$	M1	
	Their $(5x + 215) = 360$	M1dep	
	$5x = 145$	A1	
	29	A1ft	ft their equation if both Ms awarded and no further errors. SC1 145 seen SC2 47 from $5x + 125 = 360$
Alternative method 2			
3	$360 - (125 + 90)$	M1	
	145	A1	
	$145 \div 5$	M1dep	
	29	A1ft	ft their equation if both Ms awarded and no further errors.

Q	Answer	Mark	Comments
4	$121.5 \div 6 = 20.25$ or $121.5 \div 6 = \dfrac{81}{4}$ or $121.5 = 6x^2$	M1	
	($\sqrt{}$Their 20.25) or 4.5	M1dep	
	91.125,	A1	oe 91, 91.1, 91.13 with working. T&I must be correct for full marks

Q	Answer	Mark	Comments
5 (a)	Square Rhombus Rectangle Parallelogram	B2	B1 1 or 2 correct

Q	Answer	Mark	Comments
5 (b)	One pair of (opposite) sides parallel	B1	oe

Q	Answer	Mark	Comments
6	$360 \div 8$ or 45 or 1080 ($\div 8$) or 6×180 ($\div 8$)	M1	If angle stated or shown to be interior or exterior wrongly then M0
	135°	A1	
	135 + 135 + 90 = 360	Q1	Strand (ii). Completion of argument

Q	Answer	Mark	Comments
Alternative method 1			
7	$2x - 5$	B1	oe, $x \times 2 - 5$
	Their $(2x - 5) = 4x$	M1	
	$2x = -5$ or $-2x = 5$	A1	Rearranging their equation correctly
	-2.5	A1 ft	ft their equation if M1 awarded and at most one error,
Alternative method 2			
7	$\dfrac{4x + 5}{2}$	B1	oe $4x + 5 \div 2$
	$4x + 5 = 2x$	M1	
	$2x = -5$	A1	
	-2.5 and M awarded	A1 ft	ft their equation if M1 awarded and at most one error,
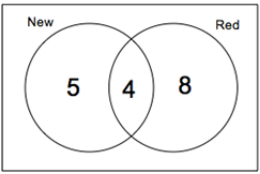
	Additional Guidance	Marks
7	$\dfrac{4x - 5}{2}$, $4x - 5 = 2x$, $2x = 5$, $x = 2.5$	B0, M1, A1, A1ft
	$2x + 5$, $2x + 5 = 4x$, $2x = 5$, $x = 2.5$	B0, M1, A1, A1ft
	$2x - 5$, $2x - 5 = 4x$, $6x = -5$, $x = -\dfrac{5}{6}$	B1, M1, A0, A1ft
	$2x - 5$, $2x - 5 = 4x$, $2x = 5$, $x = 2.5$	B1, M1, A0, A1ft

Q	Answer	Mark	Comments
8	*ACB* = 36 shown or stated	B1	
	ABC = 72 shown or stated	B1	
	BAC = 180 – (36 + 72) = 72	B1	Must be clear, eg 36 + 72 + 72 = 360
	BAC = 72 and statement that an isosceles triangle has two equal angles	Q1	Strand (ii) Must show that angle at B is 72 and not assume or B0, Q0

Q	Answer	Mark	Comments
Alternative method 1			
9	$0.5 \times \pi \times 5^2$	M1	
	[39.25, 39.3]	A1	
	Their area $\times$ 75	M1dep	
	[2940, 2950]	A1ft	ft their area, allow rounding or truncation. SC1 for volume cylinder = [5887, 5891.25] with no subsequent division by 2 SC2 for answer in range [11775, 11782.5] from radius of 10
Alternative method 2			
9	$\pi \times 5^2$	M1	
	[78.5, 78.6]	A1	
	Their area $\times$ 75 ÷ 2	M1dep	
	[2940, 2950]	A1ft	ft their area, allow rounding or truncation

Q	Answer	Mark	Comments
10 (a)	$2x^2 + 3x - 12x - 18$	M1	3 terms out of 4 correct but must have x^2, 2 terms in x (or 1 combined term) and a constant term
	$2x^2 - 9x - 18$	A1	

Q	Answer	Mark	Comments
10 (b)	$(x + 4)(x – 4)$	B1	

Q	Answer	Mark	Comments
10 (c)	$(2x \pm a)(x \pm b)$	M1	ab = 4
	$(2x – 1)(x + 4)$	A1	
	$\dfrac{x - 4}{2x - 1}$	A1ft	ft their factorisations and answer from (b) if M awarded.

	Additional Guidance	**Marks**
10 (c)	$(x + 4)(x + 4)$ from (a) and correct factorisation leading to answer of $\dfrac{x + 4}{2x -1}$	M1, A1, A1ft
	$(x – 4)(x – 4)$ from (a) and incorrect factorisation $(2x + 1)(x – 4)$ of leading to answer of $\dfrac{x - 4}{2x +1}$	M1, A0, A1ft

Q	Answer	Mark	Comments
11	Any diagram showing (5, 6) marked and a square drawn around it, in any orientation	M1	
	Any two from (5 ± √2, 6 ± √2) or (5, 8), (5, 4) (3, 6), (7, 6)	A2	Allow [1.4, 1.45] for √2 A1 for one coordinate. SC1 for $\sqrt{8}$ = 2.82

Q	Answer	Mark	Comments
12 (a)	0.73385(09922..)	B1	First 5 digits after point is all that is needed

Q	Answer	Mark	Comments
12 (b)	0.7339	B1ft	ft their answer to (a)

Q	Answer	Mark	Comments
13	17	B2	B1 for 2 or more sections of Venn Diagram correctly filled in B1 for 12 = 4 : 8

Q	Answer	Mark	Comments
14	4 × DX = 8 × 12	M1	oe
	24	A1	

Q	Answer	Mark	Comments
15	9 ÷ 6 or 1.5 seen or $\dfrac{x}{12} = \dfrac{6}{9}$ or $\dfrac{x}{6} = \dfrac{12}{9}$	M1	oe
	12 × 6 ÷ 9	A1	
	8	A1	

Q	Answer	Mark	Comments
Alternative method 1			
16	$n^2 + 2n + 3 = 258$ or $n^2 + 2n - 255$ (=0)	M1	
	$(n \pm a)(n \pm b)$	M1dep	ab = 255
	$(n + 17)(n - 15)$	A1	
	In sequence when n = 15 or as quadratic will factorise	A1	SC1 list of values showing n = 15 gives 258 with no other valid working
Alternative method 2			
16	$n^2 + 2n + 3 = 258$ or $n^2 + 2n - 255$ (=0)	M1	
	$(n + 1)^2 - 256$	M1dep	
	$n = -1 \pm \sqrt{256}$	A1	
	In sequence when n = 15 or as $\sqrt{256}$ is a whole number	A1	
Alternative method 2			
16	$n^2 + 2n + 3 = 258$ or $n^2 + 2n - 255$ (=0)	M1	
	$\dfrac{-2 \pm \sqrt{2^2 - 4(1)(255)}}{2(1)}$	M1dep	
	$\dfrac{-2 \pm \sqrt{1024}}{2(1)}$	A1	
	In sequence when n = 15 or as $\sqrt{1024}$ is a whole number	A1	

Q	Answer	Mark	Comments
17	Any pair from the following (120, 560), (240, 280)	B3	B2 (40, 1680), (80, 840), (120, 280), (240, 560) B1 40 or 1680 or seen

Q	Answer	Mark	Comments
18	$\dfrac{\sin x}{9} = \dfrac{\sin 78}{10}$	M1	oe
	$\sin x = \dfrac{9 \times \sin 78}{10}$ or 0.8803…	M1	
	[61.68, 62]	A1	62 with working

Q	Answer	Mark	Comments
Alternative method 1			
19	B : C = 3 : 4	M1	
	3 : 15 or 15 : 20	M1dep	
	3 : 20	A1	oe eg $1 : 6\frac{2}{3}$
Alternative method 2			
19	Number picked for C, say 100 and $\frac{3}{4}$ calculated (75)	M1	
	Their '75' divided by 5 (15)	M1dep	
	15 : 100	A1	oe
Alternative method 3			
19	5A = B or 4B = 3C	M1	
	20A = 3C	M1dep	
	3 : 20	A1	oe
Alternative method 4			
19	$5 \div \frac{3}{4}$	M1	
	$5 \times \frac{4}{3}$ or $\frac{20}{3}$	M1dep	
	$1 : 6\frac{2}{3}$	A1	oe

Q	Answer	Mark	Comments
20 (a)	104	B1	
20 (b)	30	B1	
20 (c)	84	B2	B1 for *CAB* = 42 or *OCB* = 48 or *OBC* = 48
21	$6^2 + 8^2$ or $AC = 10$	M1	
	$\dfrac{\sqrt{8^2 + 6^2}}{2}$ or 5	A1	
	tan used with 9 and their 5	M1	
	$\tan^{-1}(9 \div \text{their } 5)$	M1dep	oe
	[60.9, 61]	A1	
22	1.25 or 0.8 seen	M1	oe
	200×1.25^3 or $200 \div 0.8^3$	M1dep	
	[390.6, 391]	A1	Allow 391 with working
23 (a)	$AB = \mathbf{a} - \mathbf{b}$	B1	
	$\dfrac{1}{2}\mathbf{a} - \dfrac{1}{2}\mathbf{b}$	B1	
23 (b)	$BC = \mathbf{b} + 4\mathbf{a}$	M1	$BC = \mathbf{b} - \mathbf{a} + 5\mathbf{a}$
	$BN = \dfrac{1}{4}BC$	M1	
	$\dfrac{1}{4}\mathbf{b} + \mathbf{a}$	A1	