GCSE

Methods in Mathematics (Linked Pair)

Foundation Tier   Unit 2   Geometry and Algebra
Mark scheme

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)	160	B1	

| **1 (b)** | 7400 | B1 | |

| **2 (a)** | 22 | B1 | |

2 (b)	Add 3.5, + 3.5	B1	Condone $3.5n + 1$
	Additional Guidance		**Marks**
2 (b)	More extensive list of acceptable responses to be prepared before standardisation		

| **3 (a)** | Reflex | B1 | |

| **3 (b)** | Pentagon | B1 | |

| **3 (c)** | Isosceles | B1 | |

| **4 (a)** | 81 | B1 | |
| | 12 | B1 | |

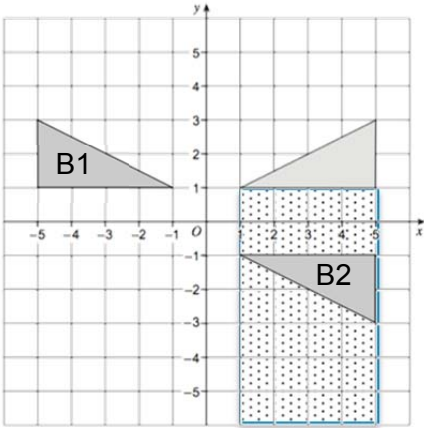| **4 (b)** | 1 + 3 + 5 + 7 + 9 + 11 + 13 | B1 | |
| | 49 | B1 | SC1 for 1 + 3 + 5 + 7 + 9 =25 **and** 1 + 3 + 5 + 7 + 9 + 11 = 36 SC1 for any correct line after 7th. |

Q	Answer	Mark	Comments
5		B3	B2 2 or 3 correct B1 1 correct

6	Attempts to count squares at least half full *or* counts full squares and 'joins' part squares.	M1	Expect this to be on diagram for majority of answers. If every square numbered M0
	[18, 23]	A1	

7	44 ÷ 2 × 3 or 66	M1	
	33	A1	

8	(6, 1)	B2	B1 for correctly plotting *M*

9	4 and 4 0 and 2 1 and 0 or 1 and 1	B3	B2 4 or 5 correct B1 2 or 3 correct

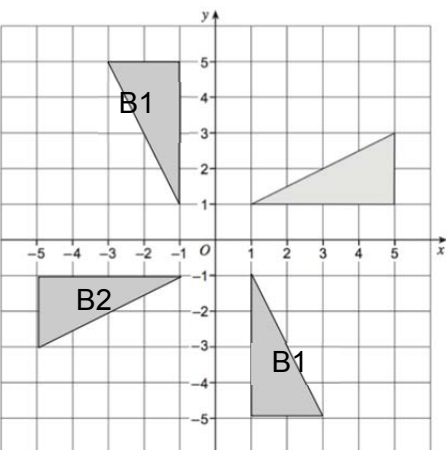| Q	Answer	Mark	Comments
10	9, 9 and 17	B2	B1 for three numbers with a sum of 35 and two numbers the same. B1 for three numbers with two the same and the difference between largest and smallest 8

	Additional Guidance	Marks
10	8, 8 and 17	B0
	10, 10, 15	B1
	8, 8, 16	B1

Q	Answer	Mark	Comments
11	(2, 4)	B2	B1 for (2, ….) B1 for (…., 4)

Q	Answer	Mark	Comments
12 (a)	3.6 or $\dfrac{18}{5}$	B1	oe

Q	Answer	Mark	Comments
12 (b)	2.56 or $\dfrac{64}{25}$	B1	oe

Q	Answer	Mark	Comments
12 (c)	214.4 or $\dfrac{1072}{5}$	B1	oe

Q	Answer	Mark	Comments
13	$21 \div (4 \times 3.5)$	M1	Allow invisible brackets.
	1.5	A1	Allow embedded answer $14 \times 1.5 = 21$

Q	Answer	Mark	Comments
Alternative method 1			
14	180 + 360 or 540	M1	540 seen implies M1
	Their '540' – (30 + 40 + 50 + 80 + 90 + 130)	M1dep	oe Allow invisible brackets.
	120	A1	
Alternative method 2			
14	Triangle 40, 50, 90	M1	
	360 – (30 + 80 + 130)	M1dep	oe Allow invisible brackets.
	120	A1	
Alternative method 3			
14	Sum of all angles = 420	M1	
	420 – 180 = 240 **and** 360 – 240 **or** 420 – 360 = 60 **and** 180 – 60	M1dep	oe
	120	A1	

Q	Answer	Mark	Comments
15 (a)	Correct enlargement	B2	B1 Any enlargement (sf 3 for example) B1 any two adjacent sides correctly enlarged

Q	Answer	Mark	Comments
Alternative method 1			
15 (b)	2² or 4 × 4	M1	
	16	A1ft	Follow through their shape for 2 marks if area correct for their shape
Alternative method 2			
15 (b)	Attempts to calculate area of their answer to (a) by either counting squares, splitting into separate shapes or using $\frac{ab}{2}$ if appropriate.	M1	
	16	A1ft	Follow through their shape for 2 marks if area correct for their shape

Q	Answer	Mark	Comments
16	54.6	B1	
	0.62 × 88	M1	oe
	54.56	A1	
	54.4	B1	oe
	54.4, 54.56, 54.6	Q1ft	Strand (iii) ft for any three values

Q	Answer	Mark	Comments
17 (a)	2 × 5 or 2 × 3 or 2 × 8 or 3 × 4 or 4 × 8	M1	
	22	A1	

Q	Answer	Mark	Comments
17 (b)	24	B1	

Q	Answer	Mark	Comments
18 (a)	Correct reflection	B2	B1 for reflection in y-axis B1 for reflection in $y = a, a < 1$ (dotted area)
18 (b)	Correct rotation	B2	B1 for any 180° rotation or a 90° CW or ACW rotation about the origin

Q	Answer	Mark	Comments
19 (a)	121	B1	

| **19 (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 |

	Additional Guidance		**Marks**
19 (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

20	$121.5 \div 6 = 20.25$ or $121.5 \div 6 = \dfrac{81}{4}$ or $121.5 = 6x^2$	M1	
	($\sqrt{\text{Their } 20.25}$) or 4.5	M1dep	
	91.125	A1	oe 91, 91.1, 91.13 with working. T&I must be correct for full marks

21 (a)	Square Rhombus Rectangle Parallelogram	B2	B1 1 or 2 correct

21 (b)	eg One pair of (opposite) sides parallel	B1	oe

Q	Answer	Mark	Comments
Alternative method 1			
22	$2x + 3x + 125 + 90$	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			
22	$360 - (125 + 90)$	M1	
	145	A1	
	$145 \div 5$	M1dep	
	29	A1ft	ft their equation if both Ms awarded and no further errors.

Q	Answer	Mark	Comments
23	ACB = 36 shown or stated	B1	
	ABC = 72 shown or stated	B1	
	BAC = 180 – (36 + 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			
24	$2x - 5$	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			
24	$\dfrac{4x + 5}{2}$	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**
24	$\dfrac{4x - 5}{2}$, $4x - 5 = 2x$, $2x = 5$, $x = 2.5$		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

25	360 ÷ 8 or 45 or 1080 (÷ 8) or 6 × 180 (÷ 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			
26	$0.5 \times \pi \times 5^2$	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
	cm^3	B1	
Alternative method 2			
26	$\pi \times 5^2$	M1	
	[78.5, 78.6]	A1	
	Their area $\times$ 75 ÷ 2	M1dep	
	[2940, 2950]	A1ft	ft their area, allow rounding or truncation
	cm^3	B1	