

GCSE

Methods in Mathematics (Linked Pair)

Foundation Tier Unit 2 Geometry and Algebra
Mark scheme

9365
November 2016

Version/Stage: 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

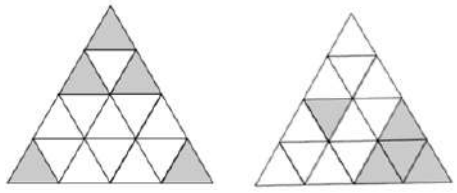
Erased or crossed out work that has been replaced is not awarded marks.

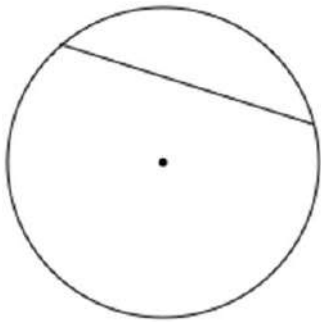
Premature approximation

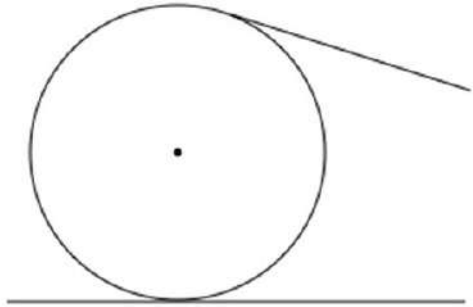
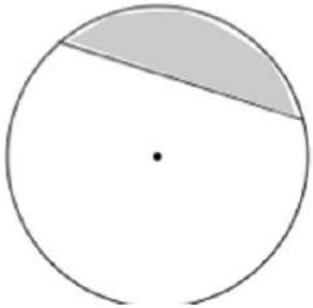
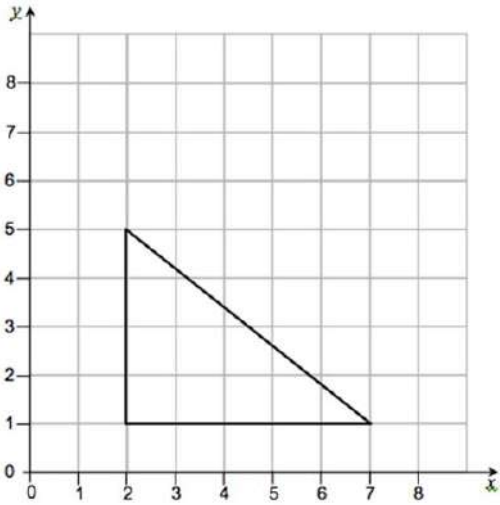
Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise.

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.

Q	Answer	Mark	Comments
1 (a)	42	B1	
1 (b)	90	B1	
1 (c)	48	B1	
2 (a)	A and C	B1	Either order
2 (b)	D and E	B1	Either order
2 (c)	(L), R, P, Q, N, M or (L) N, Q, R, P, M	B2	B1 for any list that has LR or LN as first entry and M as the last entry. Must be a list of 5 after L. B0 if any shape repeated B0 May be shown on diagram
3 (a)	1358	B1	
3 (b)	Evidence of listing with at least 3 listed or $3 \times 2 \times 1$	M1	
	6	A1	
Additional Guidance			
3 (b)	List is: 8513, 8531, 8351, 8315, 8135, 8153		
4 (a)	$\frac{1}{64}$	B1	
4 (b)	eg 	B2	Any (line) symmetrical pattern with 5 triangles shaded. B1 for any (line) symmetrical pattern with [4, 7] triangles shaded.
Additional Guidance			
4 (b)	If answer pattern blank, mark practice pattern		

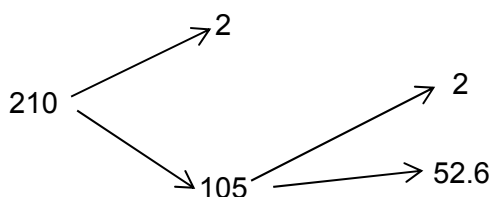
Q	Answer	Mark	Comments
5 (a)	0	B1	
5 (b)	4	B1	
5 (c)	45	B1	
5 (d)	Reflex	B1	
5 (e)	Evidence of counting squares to give 3 or 2×2 or 4	M1	
	12	A1	
6 (a)	2.75 or $\frac{11}{4}$ or $2\frac{3}{4}$	B1	oe
6 (b)	-2	B1	
6 (c)	$2t = 23$	M1	
	11.5	A1	SC1 4.5 from $2t = 9$ Allow $2 \times 11.5 = 23$
7 (a)	eg 	B1	Any chord, which may extend beyond the circle, including a diameter. Must be at least $\frac{1}{2}$ mm from circumference, inside circle and intention to be straight.

Q	Answer	Mark	Comments
7 (b)	eg 	B1	Any tangent. If it starts on circle make sure the radius is approximately at right angles. Must be within $\frac{1}{2}$ mm of circumference and outside circle, or within $\frac{1}{2}$ mm if inside circle and intention to be straight
7 (c)	eg 	B1	Any segment. Must be shaded. Accept larger part shaded. Chord must be at least $\frac{1}{2}$ mm from circumference, inside circle and intention to be straight.
8 (a)	Correctly plotted points (Triangle need not be shown) Points do not need to be labelled 	B2	B1 two points correct B1 All coordinates reversed B1 points plotted but triangle not drawn B1 A(2, 5) plotted and B plotted at (2, a) and C plotted at (7, a) where $a \neq 1$
8 (b)	Right-angle(d) and/or Scalene	B1	ft their triangle in (a)

Q	Answer	Mark	Comments
8 (c)	6.4	B1	
9 (a)	30	B1	
9 (b)	+4.5, $4.5n$, goes up by $4\frac{1}{2}$	B1	Accept $4.5n + a$, even if $a \neq 3$
Alternative method 1			
9 (c)	Writes out the next 5 terms after 29 correctly, ie 26 23 20 17 14 ...	M1	
	-1	A1	
Alternative method 2			
9 (c)	$29 - 10 \times 3$ or $26 - 9 \times 3$	M1	oe, eg $41 - 14 \times 3$
	-1	A1	
Alternative method 3			
9 (c)	$-3n + 44$ oe $-3 \times 15 + 44$	M1	
	-1	A1	
10 (a)	29	B1	
10 (b)	22 or their (a) - 7	B1ft	ft their answer in (a)
11	Three acute angles that add up to 180° that have $a < b < c$ eg 30, 70, 80	B2	B1 Three angles one of which may be obtuse that add up to 180° that have $a < b < c$, eg 30, 40, 110 B1 Three acute angles that add up to 180° that have either $c > b$ or $b > a$ eg 80, 20, 80 or 50, 80, 50
12	14.99	B1	
13	$(26 - 2 \times 5) \div 2$ or $13 - 5$ or 8	M1	
	Their $(8 - 5) \div 2$	M1dep	
	1.5	A1	

Q	Answer	Mark	Comments
14	$ABC = 40$	B1	
	$BCA = 100$ or $ACD = 80$	B1	
	20	B1	SC1 $CAD = 180 - 2 \times$ their ACD if ACD from angles within ABC .
15 (a)	9	B1	
15 (b)	All prime numbers apart from 2 are odd	Q1	Strand (i)
	38 is even and Odd + Odd = Even	Q1	Strand (ii) odd + odd + odd = odd if all 3 odd
	Additional Guidance		
	If they were all odd then the answer would be odd and 40 is even	Q1	Doesn't say all other primes are odd
	If they were all odd then the answer would be odd because 3 odds make an odd and 40 is even	Q1	ditto (and odd + odd + odd = odd)
	2 is even but other primes are odd. 40 is even and can only be made with odd + odd + even	Q2	Allow the fact that 40 cannot be made by even + even + even as primes apart from 2 defined as odd.
	2 is the only even prime.	Q1	Implies all others are odd
15 (c)	7 + 31 or 19 + 19 or 9 + 29 if 9 not chosen as answer to (a)	B2ft	B1 1 + 37 3 + 35 or 5 + 33 or 11 + 27 or 13 + 25 or 15 + 23 or 17 + 21
16	Alternative method 1		
	$6 \times 6 \times \pi$	M1	oe
	36π or [113, 113.112]	A1	
	mm^2	B1	
	Alternative method 2		
	$0.6 \times 0.6 \times \pi$	M1	oe
	0.36π or [1.13, 1.13112]	A1	
cm^2	B1		

Q	Answer	Mark	Comments
17	Alternative method 1		
	0.37 or 1.37 seen	M1	oe
	460 × their 1.37 or 460 × their 0.37 or 170.2	M1	oe
	630.2	A1	
	Alternative method 2		
	10% = 46, 1% = 4.6	M1	Any valid percentage stated, eg 5% = 23
	460 + 3 × Their 10% + 7 × their 1%	M1	Any valid combination, eg 460 + 4 × their 10% – 3 × their 1%
	630.2	A1	
18 (a)	They are alternate angles	B1	
18 (b)	$a + b = 180$	B1	
19 (a)	60	B1	
19 (b)	Any product, or division, of 210 that involves a prime number, eg 2×105 , 5×42 , $210 \div 7 = 30$ etc	M1	
	$2 \times 3 \times 5 \times 7$	A1	
	Additional Guidance		
	Product may be implied for M1 by a prime factor tree, or values written as pairs, eg (2, 105)		
	Do not award M1 if there is a clear indication of misunderstanding, eg		



Q	Answer	Mark	Comments
---	--------	------	----------

20 (a)	Rotation	B1	Any combined transformation is B0
	90° clockwise or -90 or (+) 270° (anti-clockwise)	B1	-90° or +270°
	(5, 4)	B1	

20 (b)		B2	<p>B2 correct translation.</p> <p>B1 a translation of $\begin{pmatrix} -4 \\ 3 \end{pmatrix}$</p> <p>B1 a translation of $\begin{pmatrix} 3 \\ a \end{pmatrix}$, $a \neq -4$</p> <p>B1 a translation of $\begin{pmatrix} b \\ -4 \end{pmatrix}$, $b \neq 3$</p> <p>ie correct shape in correct orientation in the light grey areas.</p>
--------	--	----	--

Q	Answer	Mark	Comments	
21	5 or 4.5	B1	oe	
	18 × their 5 × their 5 or 20 × their 4.5 × their 4.5	M1	their 5 or 4.5 must come from $20 \div 4$ or $18 \div 4$	
	450 and 405	A1		
	Correct conclusion based on their volumes if one volume correct.	Q1ft	Strand (iii) ft their volumes.	
	Additional Guidance			
	Volume A = $18 \times 4 \times 4$ Volume B = $20 \times 4.5 \times 4.5$ A = 288 and B = 405 B has the greater volume		B0 M1 A1 Q1	
	Volume A = $18 \times 5 \times 5$ Volume B = $20 \times 4.5 \times 4.5$ A = 180 and B = 405 B has the greater volume		B1 M1 A0 Q1	
	Volume A = $18 \times 5 \times 5$ Volume B = $30 \times 4.5 \times 4.5$ A = 450 and B = 607.5 B has the greater volume		B1 M1 A0 Q1 Take 30 as misread. Loses A mark.	
	Volume A = $18 \times 5 \times 5$ Volume B = $20 \times 4.5 \times 4.5$ A = 180 and B = 180 Volumes same		B1 M1 A0 Q0 Correct conclusion but neither volume correct	

Q	Answer	Mark	Comments
22	Alternative method 1		
	$42^2 - 18^2$ or 1440 or $42 + 18^2$ or 2088	M1	
	$\sqrt{1440}$	M1dep	
	$[37.9, 38]$ or $12\sqrt{10}$	A1	
	Alternative method 2		
	$\cos^{-1}(18 \div 42)$ or 64.6... and $42 \times \sin$ their 64.6... or $18 \times \tan$ their 64.6...	M2	$\sin^{-1}(18 \div 42)$ or 25.3... and $42 \times \cos$ their 25.3.. or $18 \div \tan$ their 25.3..
$[37.9, 38]$ or $12\sqrt{10}$	A1	Answers outside this range due to premature rounding score A0	
23	$\frac{x}{2} = -1$ or $x + 10 = 8$	M1	
	-2	A1	SC1 3 from $x + 5 = 8$ SC1 -6 from $x + 10 = 4$

Q	Answer	Mark	Comments
24	$3x - 3 = x + 4$	M1	
	$2x = 7$	A1	
	$(x =) 3.5$	A1ft	ft their equation if of the form $2x = a$ where a is not $-3, 3$ or 4 or of the form $bx = 7$ where b is not 1 or 3
	(Side =) their $x + 4$ or 7.5 or 56.25	A1ft	ft their $x + 4$ only if no further errors
	56	B1ft	ft their $(x + 4)^2$ rounded to the nearest whole number only if no further errors. ft (their x) ² and rounded to nearest whole number, eg $x = 3.5$ answer 12 SC1 $3x^2 + 9x - 12$ if seen and no other marks awarded.
	Additional Guidance		
	NB follow through allowed on at most one error. After 2 nd error no further marks		
	$3x - 3 = x + 4$ $2x = 1$ $(x =) 0.5$ $4.5^2 = 20.25$ 20	First error	M1 A0 A1ft A1ft B1ft
	$3x - 3 = x + 4$ $2x = 1$ $(x =) 2$ $6^2 = 36$ 36	First error Second error	M1 A0 A0ft A0ft B0ft
	$3x - 3 = x + 4$ $4x = 7$ $(x =) 1.75$ $5.75^2 = 33.0625$ 33	First error	M1 A0 A1ft A1ft B1ft
	$3x - 3 = x + 4$ $2x = 7$ $(x =) 3.5$ $3.5^2 = 12.25$ 12	First error	M1 A1 A1 A0ft B1ft
	$3x - 3 = x + 4$ $x = 1$ $(x =) 3.5$ $3.5^2 = 12.25$ 12	2 errors	M1 A0 A0ft A0ft B0ft
$3x - 3 = x + 4$ $2x = 7$ $(x =) 4.5$ $4.5^2 = 20.25$ 20	First error Second error	M1 A1 A0 A0ft B0ft	