

GCSE MARKING SCHEME

METHODS IN MATHEMATICS (LINKED PAIR PILOT)

JANUARY 2012

INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2012 examination in GCSE METHODS IN MATHEMATICS. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

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Unit 1 – Foundation Tier

1. (a) 18 & 15 (b) 5 and/or 10 (c) 5 and/or 13 (d) 21 Eg If answers of 5 & 15 in part (b) award B0 (c) 5 and/or 13 (d) 21 B1 B1 2. 594 B2 B1 for sight of 600 or 6 OR B1 for 100 times a much. 2 2 anuch. 2 3. (a) 268 B1 B1 anuch. (b) 174 B1 B1 anuch. (c) 23 B1 M1 Any correct method for the multiplication of 40 by 27 3. (a) 268 B1 M1 Any correct method for the multiplication of 40 by 27 5. (a) 12501 A1 CAO Place value errors get M0 A0 6 B1 B1 in 26 once only in parts (b) & (c) 5 A (a) (i) impossible B1 B1 (ii) likely B1 B1 in 26 once only in parts (b) & (c) 5 S (c) 40 B1 B1 B1 (b) 126 B1 B1 Penalise consistent use of incorrect notation e.g. (c) 617 5 B1 B2 B2 for 2 or 3 correct 6 (a) (b) (b) (b) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c	Methods U	Jnit 1 Foundatio	on Tier January 2012	Mark	Comment
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$\begin{array}{c c c c c c c c c c c c c c c c c c c $	9260				methods)
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(iii) unlikely B1 (b) 1/26 B1 (c) 6/17 B1 B1 Penalise consistent use of incorrect notation e.g. in 26 once only in parts (b) & (c) 5. A plotted at (2, 4) B1 B(-2, 0) B1 C(4, -2) B1 B1 Penalise consistent use of incorrect notation e.g. (-2x, 0y) 3 6. (a) Position Name Score 3 1 st F. Loxley -7 -7 2 nd -2 4 th G. Francis -1 5 th -7 -1 5 th -1 6 th -1 7 th H. Smith 8 B1 Accept -8 (b) 8 B1		ssible			
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(c) 6/17 B1 in 26 once only in parts (b) & (c) 5. A plotted at (2, 4) B1 Reversed coordinates B0 throughout B(-2, 0) B1 B1 notation e.g. (-2x, 0y) 6. (a) 3 3 6. (a) B3 B2 for 2 or 3 correct 1 st F. Loxley -7 2 nd -1 5 th 3 rd A. Jenkins -2 4 th G. Francis -1 5 th - -1 6 th - -1 7 th H. Smith 8 (b) 8 B1 Accept -8		У			
555. A plotted at $(2, 4)$ B(-2, 0) C(4, -2)581 B1 B1 B1Reversed coordinates B0 throughout Penalise -1 once only for incorrect coordinate notation e.g. (-2x, 0y)6. (a)36. (a)3936. (a)83982 for 2 or 3 correct B1 for 1 correct.1st 2nd 3rd-72nd 3rd 4th 6fh 7th-15th 6fh 7th-15th 6fh 7th-1681Accept -8b) 8B1 B1					
5. A plotted at $(2, 4)$ B(-2, 0) C(4, -2)B1 B1Reversed coordinates B0 throughout Penalise -1 once only for incorrect coordinate notation e.g. (-2x, 0y)6. (a)3 $\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	(c) 0/17				In 20 once only in parts (b) \propto (c)
C(4, -2) B1 notation e.g. (-2x, 0y) 3 3 6. (a) 3 $\boxed{Position Name Score}$ B3 1^{st} F. Loxley -7 2^{nd} -7 2^{nd} -1 3^{rd} A. Jenkins 3^{rd} A. Jenkins 5^{th} -1 5^{th} -1 6^{th} -1 5^{th} -1 6^{th} -1 5^{th} -1 6^{th} -1 8^{th} -1 <	B(-2, 0)				
3 6. (a) B3 B2 for 2 or 3 correct 1^{st} F. Loxley -7 2^{nd} B3 B2 for 1 correct. 3^{rd} A. Jenkins -2 4^{th} G. Francis -1 5^{th} 6 7^{th} H. Smith 8 (b) 8 B1 Accept -8					
6. (a)ScoreB3B2 for 2 or 3 correct B1 for 1 correct. 1^{st} F. Loxley-7 2^{nd}			BI	notation e.g. (-2x, 0y)	
PositionNameScore 1^{st} F. Loxley-7 2^{nd} 3^{rd} A. Jenkins-2 4^{th} G. Francis-1 5^{th} 6^{th} 7^{th} H. Smith8B1Accept -8				3	
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6^{th} B1 7^{th} H. Smith 8	-	G. Francis	-1		
7 th H. Smith 8 (b) 8 B1 Accept -8	-				
(b) 8 B1 Accept -8	-				
	7 th	H. Smith	8		
				R1	Accept 8
(c) A. Jenkins & F. Loxley B1 Accept -2 and -7 OR 1 st and 3 st .		& F Lovley		B1 B1	Accept -8 Accept -2 and -7 OR 1^{st} and 3^{rd} .
(c) A. Jenkins & P. Loxiey 5	(c) A. JEIIKIIIS	a r. LUAICY			
7. (a) 40 B1				B1	
(b) 15 B1			_		
Halving or dividing the previous term by two B1 Accept "divide by 2" OR " \div 2"	•	viding the previo	us term by two		Accept "divide by 2" OR " \div 2"
(c) 1 B1 (d) 13a B1					
(d) $13a$ (e) $13x + 6$ B1 B2 Award B1 for either $13x$ or $+ 6$ within an					Award B1 for either $13x$ or $+ 6$ within an
expression	(0) 100 10				
(f) 5 <i>m</i> – 2 <i>n</i> B1					
(g) 30 or 14 seen B1		seen			
	= 44				CAO
		(h) $10 \times 8 \div 5$			
$\begin{array}{c c} (h) 10 \times 8 \div 5 \\ = 16 \end{array} \qquad $	(h) $10 \times 8 \div 5$				

Methods Unit 1 Foundation Tier January 2012	Mark	Comment
8. (a) $a = 145(^{\circ})$ b = 180 - 145 $= 35(^{\circ})$	B1 M1 A1	Accept (360 – 290) ÷ 2
(b) $c = (180 - 80) \div 2$ = 50(°)	M1 A1	
(c) (180 – 50) ÷ 2 65(°)	M1 A1	
d = 115(°)	A1 8	FT 50 + "their 65" OR 180 – "their 65". "Their 65" may be on the diagram
9. (a) 8 9 10 11 12 7 8 9 10 11 7 8 9 10 6 7 8 9 8	B2	Award B1 for 12 correct.
8 (b) 4/36 ISW	B2	FT their table. B1 for a numerator of 4 in a fraction <1. B1 for the 36 in a fraction <1. Do not penalize incorrect reduction of fractions.
(c) $4/36 \times 180$ = 20	M1 A1	FT their (b) \times 180 (\neq $\frac{1}{2}$) A0 here if there is incorrect reduction M1 A0 for 20/180 <u>Notes</u> Penalise -1 for use of words such as "4 out of 36", "4 in 36" OR "4:36". When fraction and wrong notation seen, DO NOT penalise wrong notation.
10. An attempt to buy box of jam tarts with getting the 2^{nd} at half price A method allowing at least 70 to be bought Cost of their method of buying at least 70 Method to get (cheapest) of 4 Jumbo + 2 Regular Cost = $3 + \pounds 1.50 + 3 + 1.50 + 1.30 + 0.65$ = $\pounds 10.95$ (and implied as cheapest)	S1 M1 A1 M1 M1 A1	Do award S1 if candidates use buy 1 get 1 free. E.g. 5 jumbo boxes $(5 \times 15=75)$ $= 3 + 1.50 + 3 + 1.50 + 3 = \text{\pounds}12$ E.g. $15 + 15 + 15 + 15 + 6 + 6$ (=72) If no other options offered assume £10.95 is cheapest. If a cheaper option also offered award A0.
 Look for Correct units used Spelling in at least 1 statement/sentence Clarity of text explanations Correct terminology the use of simplified notation (watch for the use '=' being appropriate) Clearly linking work with amount of boxes bought QWC2: Candidates would be expected to clearly show how they arrived at their solution and show correct units AND have few errors in spelling, punctuation and 	QWC 2	QWC2 Presents relevant material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar. QWC1 Presents relevant material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar OR evident weaknesses in organisation of material but using acceptable mathematical form, with few if any errors in spelling, punctuation and grammar. QWC0 Evident weaknesses in organisation of material and errors in use of mathematical form
grammar QWC1: Candidates would be expected to • clearly show how they arrived at their solution and show correct units OR • have few errors in spelling, punctuation and grammar	8	material, and errors in use of mathematical form, spelling, punctuation or grammar.

Methods Unit 1 Foundation Tier January 2012	Mark	Comment
11. Three circles with the number 3 in the correct place	B1	
37 correct for football & rounders only		E
9 correct for rounders & dance only	B1	$7 23 \qquad 46 \qquad R$
17 correct for football & dance only	B1	
23 46 1 (any 2 correct) & correct labeling	B1	37 3
	B1	Accept F, R, D for 17
	D.I	labels 9
136 children	B1	CAO
	6	Ď
	0	
12. Left box: any triangles or polygons with ≥ 5 sides	B1	Needs 2 answers for B1. (Accept e.g. isosceles
(including a circle)		triangle & right-angled triangle as different).
		All boxes - do not accept 'polygon' or
		'quadrilateral'
Next box: any 3 quadrilaterals, not rhombus or square	B2	B1 for any 2 correct answers
Next: Rhombus	B1	CAO. Do not accept 'diamond'
Far right: Square	B1	CAO
	5	
13. $a = 70$	B1	
b = 70 c = 75	B1 B1	FT 145 – b
c = 75 d = 35	B1 B1	F1 143 - 6 FT 110 - c
a = 55 e = 145	B1 B1	FI 110-C
6 – 145	5	
14. 1/6	B1	OR e.g. 115/660 OR 1015/6060 OR other suitable
		approximation to 0.166666
Explanation related to FAIR or relative frequency,	E1	With a response of 1/6, accept 'there are 6 faces on
e.g. '6 sides have equal/same probability/chance'		a dice', or 'previous results have no impact on
		fairness'
	2	
15.(a) 15	B1	CAO
(b) 2×3 and 3×7 OR other method	M1	Or sight of $2 \times 3 \times 7$
42	A1	CAO
	3	

Unit 1 – Higher Tier

Methods Unit 1 Higher Tier January 2012	Mark	Comment
1. Left box: any triangles or polygons with ≥5 sides (including a circle)	B1	Needs 2 answers for B1. (Accept e.g. isosceles triangle & right-angled triangle as different). All boxes - do not accept 'polygon' or 'quadrilateral'
Next box: any 3 quadrilaterals, not rhombus or square	B2	B1 for any 2 correct answers
Next: Rhombus	B1	CAO. Do not accept 'diamond'
Far right: Square	B1 5	САО
2.(a) Attempt at method 3÷8	M1	Sight of digits 375
= 0.375	A1 D1	CAO OB 0.02/200 - == 0.12/1200
(b) Numerator 0.0036 Multiplying numerator and denominator by suitable	B1 B1	OR 0.03/300, or 0.12/1200 FT depending on their numerator. OR 36/360000,
multiple of 10 (if correct 10000) – for eliminating	DI	or 3/30000, or 12/120000
decimals		
1/10000	B1	CAO
(c) 420	B2	B1 for sight of 70 with intention to multiply by 6, OR (78-8)×6, OR 2 trials substituted and correctly
	7	evaluated
3. a = 70	B1	
b = 70 c = 75	B1 B1	
c = 75 d = 35	B1 B1	FT 145 – b FT 110 - c
e = 145	B1	
	5	
4.(a) (24 + 8)/16	M1	Allow 1 error with a sign
= 2 (b) $-28x - 85y$	A1 B2	CAO. (an answer of -2 implies M1) B1 for each term. Do not ignore further work if B2
(0) - 20x - 00y	D2	then -1
(c)(i) 5, 16, 33	B2	B1 for 2 correct terms in the correct position, or for 0, 5, 16
(ii) 320	B1	
(d) $(3a+2)^7$	B1 8	
5.(a)(i) The numbers 42 to 50 placed correctly	B3	B2 for 7 or 8 numbers placed correctly, the other 2 or 1 number(s) respectively omitted or incorrectly
43 47 44 46 50		placed, OR B1 for 5 or 6 numbers placed correctly, the other 4 or 3 numbers respectively omitted or incorrectly
48 49		placed
	D f	In $(a)(ii)$ and (b) ignore incorrect cancelling.
(ii) 2/9	B1 B1	Or FT their Venn diagram FT 1 – 1 st answer
7/9 0	B1 B1	
(b) 1/6	B1	OR e.g. 115/660 OR 1015/6060 OR other suitable
	F 1	approximation to 0.166666
Explanation related to FAIR or relative frequency,	E1	With a response of 1/6, accept 'there are 6 faces on a dice', or 'previous results have no impact on
e.g. '6 sides have equal/same probability/chance'	8	fairness'
6.(a) 15	B1	CAO
(b) 2×3 and 3×7 OR other method	M1	Or sight of $2 \times 3 \times 7$
42 (c) $\sqrt{(8 \times 8)}$	A1 M2	CAO M1 for each
$\frac{(c) \sqrt{8 \times 8}}{8}$	A1	CAO
-	6	

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7. Idea × 16 for Saturday and Sunday 8x + 16(x + 2) + 16(x + 3) or equivalent 8x + 16x + 32 + 16x + 48 or equivalent 40x + 80 or 40(x + 2) or other correctly factorised expression	B1 B1 B1 B1 4	<i>FT until 2nd error</i> Not giving double rate for Sat / Sunday is1 error
 8. Square 90° Octagon: 360÷8 Exterior 45° Interior 135° Gap shown to be either 90+45 OR 360 – 135 – 90 Suitable explanation of filling the gap, e.g. 'no gaps', 'fit perfectly together', 'fit together' Confusion between interior and exterior angles will affect the QWC mark, giving a maximum QWC1. 	B1 M1 A1 B1 E1	Or alternative methods At least 1 of the exterior or interior maybe implied FT 180 – their exterior, or equivalent Or equivalent Conclusions must be stated not just implied. Must imply 'Yes' <i>If no calculations shown:</i> <i>SC2 for at least another 2 rows drawn, e.g.</i> <i>hexagons above and hexagons below, with squares</i> <i>OR</i>
If no calculation, still could be QWC2 if sufficient text (e.g. 2 short meaningful sentences, or one long clear meaningful sentence)		SC1 for at least another 1 row drawn, OR appropriate cuts with 'fill in' described or shown, to continue the pattern or complete a rectangle. THEN E mark if appropriate
Do not penalise no ruler in a sketch QWC2: Candidates will be expected to • present work clearly, with words explaining process or steps AND	QWC 2	QWC2 Presents relevant material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar.
 make few if any mistakes in mathematical form, spelling, punctuation and grammar and include units in their final answer QWC1: Candidates will be expected to present work clearly, with words explaining process or steps OR 		QWC1 Presents relevant material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar OR evident weaknesses in organisation of material but using acceptable mathematical form, with few if any errors in spelling, punctuation and grammar.
• make few if any mistakes in mathematical form, spelling, punctuation and grammar and include units in their final answer	8	QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation or grammar.
9.(a) $ax - bx = h + g$ x(a - b) = h + g x = (h + g)/(a - b) (b) $(x + 4)(x - 4)$ (c) $(x - 3)(x - 5)$	B1 B1 B1 B1 B2	Collect x terms FT until 2^{nd} error Factorise Division ISW B1 for (x3)(x 5) or x(x-5) -3(x-5) or equivalent.
(d) $n^2 + 3$	B2	If B2 penalise 'solving' -1 B1 for $n^2 +$ (not 0) OR second difference of 2 with n^2 Alternative:
(e) $(2x+3)(x+4) = -3$	S1	Correct interpretation of the information
$2x^{2} + 8x + 3x + 12$ $2x^{2} + 11x + 15 = 0$ $(2x + 5)(x + 3) = 0$ $x = -5/2 \text{ AND } x = -3$	B1 B1 M1 A1 13	At least 2 suitable trial with product evaluated, 1 above & 1 below First value found At least 2 suitable trials, 1 above & 1 below Second value found with confirmation

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10.(a) 2.4×10^6	B2	B1 for 2.38×10^{6} OR 2 400 000 or equivalent to 2400000 (may be incorrect standard form)
(b)(i) Idea of 2×5 OR 2 and 5 both found as factors	M1	,
$2^6 \times 5^6$	A1	
(ii) E.g. "there is an even number of each of the prime		
factors", OR "all prime factors have even powers", OR	E1	Accept $\sqrt{1000000} = 1000$.
"1 million = 1000×1000 ", OR " $10^6 = 10^3 \times 10^3$ ", ' 10^6		Do not accept 'all powers even' without working.
is an even power'	5	Accept inaccurate notation if intention clear, e.g.
11. 180 – 85 OR 180 – 130	5 M1	square and square root used inaccurately
$a = 95^{\circ}$	A1	Or statement that opposite angle cyclic quad 180°
a = 95 $b = 50^{\circ}$	A1 A1	No FT
0 = 30	3	For reversed answers award SC2
12.(a) 0.3 indicated for no soup	B1	In working or on tree
Idea $0.7 \times = 0.28$	M1	In working of on tree
P(buys a sandwich) = 0.4	A1	In working or on tree
Second branches 0.4 0.6 0.4 0.6	B1	FT their P(buys sandwich) if M1 awarded
(b) 0.3×0.6	M1	FT their 0.6 from (a)
= 0.18	A1	
	6	
13. B A D C E F	B4	B3 for any 4 or 5 unambiguously correct, OR
		B2 for any 2 or 3 unambiguously correct, OR
14 () 1/10002/3 0D 10-2	4	B1 for any 1 unambiguously correct, OR
14.(a) $1/1000^{2/3}$ OR 10^{-2} or similar first step $1/10^2$ OR $1/100$ or similar second step	M1 M1	No do proince of Einst M1 months much a implied
0.01	A1	Needs reciprocal. First M1 mark maybe implied.
(b)(i) $a = 7$	B1	Accept embedded answers
$x^{2} + 14x + 49$ (-2) OR method to find b	M1	Accept embedded answers
b = -2	A1	Accept embedded answers
(ii) $(x + 7)^2 - 2 = 0$	B1	Use of completing the from (i)
$(\mathbf{x}+7)^2 = 2$	M1	
$\mathbf{x} + 7 = (\underline{+})\sqrt{2}$	M1	
$\mathbf{x} = \pm \sqrt{2} - 7$	A1	Must show <u>+</u>
	10	
15. $m = -9/3$ (=-3)	B1	
c = 9	B1	
Equation $y = -3x + 9$	B1	FT their m and c
Use of $x = 1$ OR alternative method to find y coord.	M1 A1	FT FT
y = 6 Perpendicular gradient -1/m (= 1/3)	AI B1	FT FT from their m
Method to find perpendicular equation	M1	FT their -1/m and y coordinate.
x - 3y + 17 = 0 or equivalent	A1	Accept unsimplified forms. Ignore further
a of an or equivalent	8	incorrect working once a correct equation is seen



WJEC 245 Western Avenue Cardiff CF5 2YX Tel No 029 2026 5000 Fax 029 2057 5994 E-mail: <u>exams@wjec.co.uk</u> website: <u>www.wjec.co.uk</u>