



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

Methods Unit 1 Foundation Tier January 2012	Mark	Comment																								
1. (a) 18 & 15 (b) 5 and/or 10 (c) 5 and/or 13 (d) 21	B1 B1 B1 B1 4	Any incorrect answer(s) award B0 throughout Eg If answers of 5 & 15 in part (b) award B0 Accept 3×7																								
2. 594	B2 2	B1 for sight of 600 or 6 OR B1 for 100 times as much.																								
3. (a) 268 (b) 174 (c) 23 (d) 463 $\begin{array}{r} \times 27 \\ 3241 \\ \hline 9260 \\ 12501 \end{array}$	B1 B1 B1 M1 A1 A1 6	Any correct method for the multiplication of 463 by 27 For either 3241 or 9260 (Apply 'one error' in other methods) CAO Place value errors get M0 A0																								
4 (a) (i) impossible (ii) likely (iii) unlikely (b) $1/26$ (c) $6/17$	B1 B1 B1 B1 B1 5	Penalise consistent use of incorrect notation e.g. 1 in 26 once only in parts (b) & (c)																								
5. A plotted at (2, 4) B(-2, 0) C(4, -2)	B1 B1 B1 3	Reversed coordinates B0 throughout Penalise -1 once only for incorrect coordinate notation e.g. (-2x, 0y)																								
6. (a) <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">Position</th> <th style="width: 55%;">Name</th> <th style="width: 30%;">Score</th> </tr> </thead> <tbody> <tr> <td>1st</td> <td>F. Loxley</td> <td>-7</td> </tr> <tr> <td>2nd</td> <td></td> <td></td> </tr> <tr> <td>3rd</td> <td>A. Jenkins</td> <td>-2</td> </tr> <tr> <td>4th</td> <td>G. Francis</td> <td>-1</td> </tr> <tr> <td>5th</td> <td></td> <td></td> </tr> <tr> <td>6th</td> <td></td> <td></td> </tr> <tr> <td>7th</td> <td>H. Smith</td> <td>8</td> </tr> </tbody> </table> (b) 8 (c) A. Jenkins & F. Loxley	Position	Name	Score	1 st	F. Loxley	-7	2 nd			3 rd	A. Jenkins	-2	4 th	G. Francis	-1	5 th			6 th			7 th	H. Smith	8	B3 B1 B1 5	B2 for 2 or 3 correct B1 for 1 correct. Accept -8 Accept -2 and -7 OR 1 st and 3 rd .
Position	Name	Score																								
1 st	F. Loxley	-7																								
2 nd																										
3 rd	A. Jenkins	-2																								
4 th	G. Francis	-1																								
5 th																										
6 th																										
7 th	H. Smith	8																								
7. (a) 40 (b) 15 Halving or dividing the previous term by two (c) 1 (d) $13a$ (e) $13x + 6$ (f) $5m - 2n$ (g) 30 or 14 seen = 44 (h) $10 \times 8 \div 5$ = 16	B1 B1 B1 B1 B1 B2 B1 B1 B1 M1 A1 12	Accept "divide by 2" OR " $\div 2$ " Award B1 for either $13x$ or $+ 6$ within an expression CAO																								

Methods Unit 1 Foundation Tier January 2012	Mark	Comment
<p>8. (a) $a = 145(^{\circ})$ $b = 180 - 145$ $= 35(^{\circ})$</p> <p>(b) $c = (180 - 80) \div 2$ $= 50(^{\circ})$</p> <p>(c) $(180 - 50) \div 2$ $65(^{\circ})$ $d = 115(^{\circ})$</p>	<p>B1 M1 A1</p> <p>M1 A1</p> <p>M1 A1 A1</p> <p>8</p>	<p>Accept $(360 - 290) \div 2$</p> <p>FT 50 + "their 65" OR 180 - "their 65". "Their 65" may be on the diagram</p>
<p>9. (a) 8 9 10 11 12 7 8 9 10 11 7 8 9 10 6 7 8 9 8</p> <p>(b) 4/36 ISW</p> <p>(c) $4/36 \times 180$ $= 20$</p>	<p>B2</p> <p>B2</p> <p>M1 A1</p> <p>6</p>	<p>Award B1 for 12 correct.</p> <p>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. 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.</p>
<p>10. An attempt to buy box of jam tarts with getting the 2nd 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)</p> <p>Look for</p> <ul style="list-style-type: none"> • 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 <p>QWC2: Candidates would be expected to</p> <ul style="list-style-type: none"> • clearly show how they arrived at their solution and show correct units <p>AND</p> <ul style="list-style-type: none"> • have few errors in spelling, punctuation and grammar <p>QWC1: Candidates would be expected to</p> <ul style="list-style-type: none"> • clearly show how they arrived at their solution and show correct units <p>OR</p> <ul style="list-style-type: none"> • have few errors in spelling, punctuation and grammar 	<p>S1</p> <p>M1 A1 M1 M1 A1</p> <p>QWC 2</p> <p>8</p>	<p>Do award S1 if candidates use buy 1 get 1 free.</p> <p>E.g. 5 jumbo boxes ($5 \times 15=75$) $= 3 + 1.50 + 3 + 1.50 + 3 = \pounds 12$ E.g. $15 + 15 + 15 + 15 + 6 + 6 (=72)$</p> <p>If no other options offered assume $\pounds 10.95$ is cheapest. If a cheaper option also offered award A0.</p> <p>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.</p> <p>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.</p> <p>QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation or grammar.</p>

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

Unit 1 – Higher Tier

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

Methods Unit 1 Higher Tier January 2012	Mark	Comment
7. Idea $\times 16$ 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 is 1 error
8. Square 90° Octagon: $360 \div 8$ 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. If no calculation, still could be QWC2 if sufficient text (e.g. 2 short meaningful sentences, or one long clear meaningful sentence) Do not penalise no ruler in a sketch QWC2: Candidates will be expected to <ul style="list-style-type: none"> present work clearly, with words explaining process or steps AND <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> present work clearly, with words explaining process or steps OR <ul style="list-style-type: none"> make few if any mistakes in mathematical form, spelling, punctuation and grammar and include units in their final answer 	B1 M1 A1 A1 B1 E1 QWC 2 8	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. hexagons above and hexagons below, with squares</i> OR <i>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.</i> <i>THEN E mark if appropriate</i> 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, 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) $(x - 3)(x - 5)$ (d) $n^2 + 3$ (e) $(2x + 3)(x + 4) = -3$ $2x^2 + 8x + 3x + 12$ $2x^2 + 11x + 15 = 0$ $(2x + 5)(x + 3) = 0$ $x = -5/2$ AND $x = -3$	B1 B1 B1 B1 B2 B2 S1 B1 B1 M1 A1 13	Collect x terms FT until 2 nd error Factorise Division ISW B1 for $(x \dots 3)(x \dots 5)$ or $x(x-5) - 3(x-5)$ or equivalent. If B2 penalise 'solving' -1 B1 for $n^2 + \dots$ (not 0) OR second difference of 2 with n^2 <i>Alternative:</i> <i>Correct interpretation of the information</i> 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 (b)(i) Idea of 2×5 OR 2 and 5 both found as factors $2^6 \times 5^6$ (ii) E.g. "there is an even number of each of the prime factors", OR "all prime factors have even powers", OR "1 million = 1000×1000 ", OR " $10^6 = 10^3 \times 10^3$ ", '10 ⁶ is an even power'	B2 M1 A1 E1 5	B1 for 2.38×10^6 OR 2 400 000 or equivalent to 2400000 (may be incorrect standard form) Accept $\sqrt{1000000} = 1000$. Do not accept 'all powers even' without working. Accept inaccurate notation if intention clear, e.g. square and square root used inaccurately
11. $180 - 85$ OR $180 - 130$ $a = 95^\circ$ $b = 50^\circ$	M1 A1 A1 3	Or statement that opposite angle cyclic quad 180° No FT For reversed answers award SC2
12.(a) 0.3 indicated for no soup Idea $0.7 \times \dots = 0.28$ $P(\text{buys a sandwich}) = 0.4$ Second branches 0.4 0.6 0.4 0.6 (b) $0.3 \times 0.6 = 0.18$	B1 M1 A1 B1 M1 A1 6	In working or on tree In working or on tree FT their $P(\text{buys sandwich})$ if M1 awarded FT their 0.6 from (a)
13. B A D C E F	B4 4	B3 for any 4 or 5 unambiguously correct, OR B2 for any 2 or 3 unambiguously correct, OR 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 0.01 (b)(i) $a = 7$ $x^2 + 14x + 49 (-2)$ OR method to find b $b = -2$ (ii) $(x + 7)^2 - 2 = 0$ $(x + 7)^2 = 2$ $x + 7 = (\pm)\sqrt{2}$ $x = \pm\sqrt{2} - 7$	M1 M1 A1 B1 M1 A1 B1 M1 M1 A1 10	Needs reciprocal. First M1 mark maybe implied. CAO Accept embedded answers Accept embedded answers Use of completing the from (i) Must show \pm
15. $m = -9/3 (= -3)$ $c = 9$ Equation $y = -3x + 9$ Use of $x = 1$ OR alternative method to find y coord. $y = 6$ Perpendicular gradient $-1/m (= 1/3)$ Method to find perpendicular equation $x - 3y + 17 = 0$ or equivalent	B1 B1 B1 M1 A1 B1 M1 A1 8	FT their m and c FT FT FT from their m FT their $-1/m$ and y coordinate. Accept unsimplified forms. Ignore further incorrect working once a correct equation is seen



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