

# **GCSE MARKING SCHEME**

## METHODS OF MATHEMATICS (LINKED PAIR PILOT)

**SUMMER 2013** 

#### INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2013 examination in GCSE METHODS OF MATHEMATICS (LINKED PAIR PILOT). 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.

### UNIT 1 (FOUNDATION TIER)

(b) forty eight thousand seven hundred and twoB(c) 4B167(d) 3000 or 3 thousandB(e) 51700B(f) Sensible estimates, that would lead to single digitMmultiplicationCorrect answer from their estimates2. (a) 524B(b) 279B(c) 36B(d) 516M $\times 82$ M	B1 B1 B1Award B1 for each correct answer.B1 B3Accept thousand(s) but not 1000.B1 M1Eg $50 \times 4$ or $50 \times 3.9$ or $51 \times 4$ A1Award M1 A1 for unsupported answers of 200, 195 or 204 Award M1 A1 for unsupported answer of 195 - 2049Award M0 A0 for $(51 \times 3.9 =)$ 198.9B1 B1 B1 B1 M1Any correct method for the multiplication of 516 by 82A1For either 1032 or 41280 (Apply 'one error' in other methods) CAO
(b) forty eight thousand seven hundred and twoB(c) 4B167(d) 3000 or 3 thousandB(e) 51700B(f) Sensible estimates, that would lead to single digitMmultiplicationCorrect answer from their estimatesCorrect answer from their estimatesA2. (a) 524B(b) 279B(c) 36B(d) 516M $\times 82$ A	B1 B3Award B1 for each correct answer.B1 B1 M1Accept thousand(s) but not 1000.B1 M1Eg $50 \times 4$ or $50 \times 3.9$ or $51 \times 4$ A1 Award M1 A1 for unsupported answers of 200, 195 or 204 Award M1 A1 for unsupported answer of 195 - 204 Award M0 A0 for $(51 \times 3.9 =)$ 198.9B1 B1 B1 M1Any correct method for the multiplication of 516 by 82A1For either 1032 or 41280 (Apply 'one error' in other methods)
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16 $7$ (d) 3000 or 3 thousandB(e) 51700B(f) Sensible estimates, that would lead to single digitMmultiplicationCorrect answer from their estimatesCorrect answer from their estimatesA $2$ . (a) 524B(b) 279B(c) 36B(d) 516M $\times 82$ A	B1Eg 50 × 4 or 50 × 3.9 or 51 × 4M1Eg 50 × 4 or 50 × 3.9 or 51 × 4A1Award M1 A1 for unsupported answers of 200, 195 or 204 Award M1 A1 for unsupported answer of 195 - 204 99Award M0 A0 for $(51 × 3.9 =)$ 198.9B1B1B1B1B1B1B1For either 1032 or 41280 (Apply 'one error' in other methods)
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(e) 51700B(f) Sensible estimates, that would lead to single digitMmultiplicationACorrect answer from their estimatesA2. (a) 524B(b) 279B(c) 36B(d) 516M $\times 82$ A	B1Eg 50 × 4 or 50 × 3.9 or 51 × 4M1Eg 50 × 4 or 50 × 3.9 or 51 × 4A1Award M1 A1 for unsupported answers of 200, 195 or 204 Award M1 A1 for unsupported answer of 195 - 204 99Award M0 A0 for $(51 × 3.9 =)$ 198.9B1B1B1B1B1B1B1For either 1032 or 41280 (Apply 'one error' in other methods)
(f) Sensible estimates, that would lead to single digit multiplicationMCorrect answer from their estimatesA2. (a) 524 (b) 279 (c) 36 (d) 516 $\times 82$ B	M1Eg $50 \times 4$ or $50 \times 3.9$ or $51 \times 4$ A1Award M1 A1 for unsupported answers of 200, 195 or 204 Award M1 A1 for unsupported answer of 195 - 204 99Award M0 A0 for $(51 \times 3.9 =)$ 198.9B1B1B1M1Any correct method for the multiplication of 516 by 82A1For either 1032 or 41280 (Apply 'one error' in other methods)
multiplication Correct answer from their estimatesA $2. (a) 524$ B(b) 279B(c) 36B(d) 516M $\times 82$ A	<ul> <li>A1 Award M1 A1 for unsupported answers of 200, 195 or 204 Award M1 A1 for unsupported answer of 195 - 204</li> <li>9 Award M0 A0 for (51 × 3.9 =) 198.9</li> <li>B1</li> <li>B1</li> <li>B1</li> <li>M1 Any correct method for the multiplication of 516 by 82</li> <li>A1 For either 1032 or 41280 (Apply 'one error' in other methods)</li> </ul>
Correct answer from their estimatesA $2. (a) 524$ B(b) 279B(c) 36B(d) 516M $\times 82$ A	Award M1 A1 for unsupported answer of $195 - 204$ 9Award M0 A0 for $(51 \times 3.9 =) 198.9$ B1B1B1M1Any correct method for the multiplication of 516 by 82A1For either 1032 or 41280 (Apply 'one error' in other methods)
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Award M1 A1 for unsupported answer of $195 - 204$ 9Award M0 A0 for $(51 \times 3.9 =) 198.9$ B1B1B1M1Any correct method for the multiplication of 516 by 82A1For either 1032 or 41280 (Apply 'one error' in other methods)
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	<ul> <li>9 Award M0 A0 for (51 × 3.9 =) 198.9</li> <li>B1</li> <li>B1</li> <li>B1</li> <li>M1 Any correct method for the multiplication of 516 by 82</li> <li>A1 For either 1032 or 41280 (Apply 'one error' in other methods)</li> </ul>
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	B1B1B1B1M1Any correct method for the multiplication of 516 by 82A1For either 1032 or 41280 (Apply 'one error' in other methods)
(b) 279       B         (c) 36       B         (d) 516       M	<ul> <li>B1</li> <li>B1</li> <li>M1 Any correct method for the multiplication of 516 by 82</li> <li>A1 For either 1032 or 41280 (Apply 'one error' in other methods)</li> </ul>
(c) 36 (d) 516 $\times 82$ B M	B1 M1Any correct method for the multiplication of 516 by 82A1For either 1032 or 41280 (Apply 'one error' in other methods)
$\begin{array}{c} \text{(d) 516} \\ \underline{\times 82} \end{array}$	<ul><li>M1 Any correct method for the multiplication of 516 by 82</li><li>A1 For either 1032 or 41280 (Apply 'one error' in other methods)</li></ul>
<u>× 82</u>	A1 For either 1032 or 41280 (Apply 'one error' in other methods)
1022	
1032	
	AI   CAU
42312 A	Place value errors get M0 A0
(e) 9 B	B1 Watch out for an incorrect answer of -9
	E1 Eg Sian incorrect because 6 coaches would be just over 300
implied)	people, so 10 coaches would be far too many.
implied)	Or 530 is a lot more.
	Do not award E1 for statement incorrect only.
5	8
3.	
	B3 Award B3 for all correct
	Award B2 for 3 or 4 correct entries
7 5 3	Award B1 for 1 correct row or column or the other diagonal or 2
	correct only if working to a total of 15.
2 9 4	
	3
	B1
	B1
	B1
5	B1 For position of 'D' accept $>1/4$ but $< 1/2$
	B2 Award B1 for each correct answer.
3/7	Penalise -1 once only if consistent use of incorrect notation.
(-) Evaluation since and esither more likely as both smaller.	
	E1 Eg.Both have the same chance as they each have 5 tickets with
likely (stated or implied)	different numbers. Each number has the same probability.
	B1
	B1 Accept "times by 3" or " $\times$ 3"
	B1 Accept times by 5 of $\times$ 5 B2 Award B1 for either 4x or – 3 within an expression. Award B1
	for $4x + -3$
(c) Workings for Jenny $(0+2) \times 2 = 4$ AND Steve $0 \times 2 + 2 = 0$	B2 Award B1 for workings for Jenny $(0 + 2) \times 2 = 4$ OR Steve $0 \times 2$
2 AND Steve correct stated or implied by correct working	Have the first of the second
	B1 Accept embedded answers
	B1 Recept childed answers
	B1
	B1 Mark final answer
	10
	B1
	B1
of all 3	
	B1 CAO. Correct answer only award B0 B0 B1
	B2 B1 for either 8 or 25.
	5

7. $a = 180 - 90 - 38$ $= 52(^{\circ})$ b = 180 - 90 - 21 $= 69(^{\circ})$ Sight of $(180 - 114 =) 66(^{\circ})$ c = 180 - 69 - 66 $= 45(^{\circ})$ 8. (Difference in cost of packages) $(845 - 655 =)$ (£)190 (Cost per night) $(190 \div 2 =)$ (£)95 (5 nights costs) $(5 \times 95 =)$ (£)475 (Return airfare) $(655 - 475 =)$ (£)180	M1 A1 M1 A1 B1 M1 A1 7 B1 B1 B1 B1 B1	Alternative method 114 – 'b'FT their b and/or their 66= $45(°)$ S1 M1 A1FT their 190FT their 95OR 7 nights costs (7 × 95 =) (£)665FT their 475Return airfare (845 – 665 =) (£)180 FT their 665
<ul> <li>QWC: Look for <ul> <li>Correct units used</li> <li>Clarity of text explanation</li> <li>Correct terminology</li> <li>the use of simplified notation (watch for the use '=' being appropriate)</li> </ul> </li> <li>QWC2: Candidates will be expected to <ul> <li>present work clearly, with words explaining process or steps</li> </ul> </li> <li>AND <ul> <li>make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer</li> </ul> </li> <li>QWC1: Candidates will be expected to <ul> <li>present work clearly, with words explaining process or steps</li> </ul> </li> <li>QWC1: Candidates will be expected to <ul> <li>present work clearly, with words explaining process or steps</li> </ul> </li> <li>OR <ul> <li>make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer</li> </ul> </li> </ul>	Q W C 2	<ul> <li>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.</li> <li>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.</li> <li>QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation or grammar.</li> </ul>
9. At least 6 additional given shapes tessellating correctly For B2 the tessellation must be in more than one direction. (ie a cluster)	B2 2	Award B1 for at least 3 additional given shapes tessellating correctly with at least one that meets the given shape
10. 42, 138, 42	B3 3	B1 for each correct answer. FT $c = a$ or $c = 180 - b$
11. No AND reason (both the same) 1/6 No AND reason (1/6×1/6 =) 1/36	B2 B2	Accept NO with appropriate sight of 1/6. Accept refer to 1/6 in words. B1 for No AND reason implying both the same, i.e. 1/6 not given in the response, or sight of 1/6 with no conclusion or 'Yes' B1 for No AND reason maybe based on sample space, e.g. 'No because there are more ways of getting it' (without contradiction) or, gives 1/6×1/6 without stating 1/36, or,, gives 1/6×1/6 with an incorrect response, e.g. 2/36 or, sight of 1/36 with no conclusion Do not accept incorrect probability with statement 'No' without working
	4	working

12. Venn diagram correct	B4	No extra number >12
		Mark unique placements of numbers, for duplicates mark the
		incorrect number then award as follows:
$\left  \left( \begin{array}{c} 4 & 8 \\ 4 & 8 \end{array} \right) \left( \begin{array}{c} 3 \\ 6 & 12 \\ 9 \end{array} \right) \right $		B3 for any 9, 10 or 11 numbers correctly placed with no more
		than 1 extra number >12
		B2 for any 6, 7 or 8 numbers correctly placed with no more than
		2 extra numbers >12
		B1 for any 3, 4 or 5 numbers correctly placed and ignore any
5 10		extra numbers If no marks awarded SC1 for sight of sets A, B and C correct
7 11 C		(including any extra numbers), shown in working or within Venn
	4	diagram
13.(a) Strategy to find at least one 4 <sup>th</sup> vertex, e.g. axes with 3	M2	M1 axes and plot the 3 points given, OR a reasonable attempt at
plots of given points <b>and</b> show understanding of parallel side		an arithmetic method, OR axes and plot the 2 of the 3 points
requirement, OR a correct arithmetic method		given with an attempt draw 2 appropriate parallel lines
Any 2 of: (5, 6) (9, -2) (1, -2)	A2	A1 for one correct, or for 2 indicated but coordinates not given or
		given incorrectly
		If one correct, this implies M2 (and A1)
		If no marks, award SC1 for evidence that the 3 coordinates have
		been reversed but a strategy to draw an appropriate parallel line is
		attempted. Do not penalise reverse coordinates if SC1 awarded.
		attempted. Do not penanse reverse coordinates in Self awarded.
		Candidates clearly and consistently working with reverse
		coordinates should be penalised -1 only
	4	
14. (i) At least 2 correct points found or plotted	M1	
Correct straight line shown	A1	
(ii) At least 2 correct points found or plotted	M1	
Correct straight line shown	A1	
15 (c)10m 7	4 B2	D1 for eight of 10n
15. (a)10n - 7 (b) -10n + 60 or equivalent	B2 B2	B1 for sight of 10n For B2 mark final answer. B1 for sight of -10n
(0) -1011 + 00 01 equivalent	В2 4	FOI D2 mark milar answer. D1 for sign of -100
	4	

#### UNIT 1 (HIGHER TIER)

Methods Unit 1 June 2013 Higher Tier		Final
1. 42, 138, 42	B3	B1 for each correct answer.
	3	FT c = a  or  c = 180 - b
2. No AND reason (both the same) 1/6 No AND reason (1/6×1/6 =) 1/36		Accept NO with appropriate sight of 1/6. Accept refer to ¼ in words. B1 for No AND reason implying both the same, i.e. 1/6 not given in the response, or sight of 1/6 with no conclusion or 'Yes' B1 for No AND reason maybe based on sample space, e.g. 'No because there are more ways of getting it' (without contradiction) or, gives 1/6×1/6 without stating 1/36, or,, gives 1/6×1/6 with an incorrect response, e.g. 2/36 or, sight of 1/36 with no conclusion Do not accept incorrect probability with statement 'No' without
	4	working
3. Venn diagram correct $4 \ 8 \ 6 \ 12 \ 9 \ 1 \ 2 \ 5 \ 10 \ C$	B4 4	No extra number >12 Mark unique placements of numbers, for duplicates mark the incorrect number then award as follows: B3 for any 9, 10 or 11 numbers correctly placed with no more than 1 extra number >12 B2 for any 6, 7 or 8 numbers correctly placed with no more than 2 extra numbers >12 B1 for any 3, 4 or 5 numbers correctly placed and ignore any extra numbers If no marks awarded SC1 for sight of sets A, B and C correct (including any extra numbers), shown in working or within Venn diagram
4.(a) Strategy to find at least one 4 <sup>th</sup> vertex, e.g. axes with 3 plots of given points <b>and</b> show understanding of parallel side requirement, OR a correct arithmetic method	M2	M1 axes and plot the 3 points given, OR a reasonable attempt at an arithmetic method, OR axes and plot the 2 of the 3 points given with an attempt draw 2 appropriate parallel lines
Any 2 of: (5, 6) (9, -2) (1, -2)	A2	A1 for one correct, or for 2 indicated but coordinates not given or given incorrectly If one correct, this implies M2 (and A1) If no marks, award SC1 for evidence that the 3 coordinates have been reversed but a strategy to draw an appropriate parallel line is attempted. Do not penalise reverse coordinates if SC1 awarded. <i>Candidates clearly and consistently working with reverse</i> <i>coordinates should be penalised -1 only</i>
(b)Diagonals symmetryOpposite angles equal(Kite)1YesNo(Isos. Trap.)1NoNoRhombus(2)(Yes)(Yes)	B3 7	B2 for any 5 or 6 correct entries B1 for any 3 or 4 correct entries
5.         Fraction         Decimal         Recurring         Terminating           2/5         0.4         No         Yes           5/8         0.625         No         Yes           7/9         0.77(777) or 0.78         Yes         No           2/11         0.18(18)         Yes         No	B4 4	All correct B3 any 3 rows correct or all 4 decimals correct B2 any 2 rows correct or 3 decimals correct B1 any 1 row correct or 2 decimals correct Accept unambiguous intention for Yes/No columns Accept if candidate indicates yes without giving the corresponding no, unless there is a contradiction, and vice versa
6. (1share is 60/4 =) 15kg Either 3×15 or 7×15 seen in working Jade 105 (kg) Bethan 45 (kg)	4 B1 M1 A2 4	FT their 60/4 incorrectly evaluated A1 for each correct response If answers reversed then, B1 M1 A1 SC1 if 60kg misinterpreted but then used correctly leading to correctly evaluated responses, 60/14 = 4.285 leading to 12.85, 17.14 and 30 (accept 13, 17 and 30)

7. An example of a tessellation covering a space having an element of a <u>repeating</u> pattern with at least one 360° point formed by using both of the shapes of tiles	B2	B1 for an example of a tessellation covering a space with at least one 360° point formed by using <b>both</b> of the shapes of tiles.
Use of angles at a point is 360(°)	B1	Accept sight of knowledge that angles at a point is 360(°)
Shows sum to 360(°) including at least one 90(°) and at least one 60(°)	B1 4	Accept if implied, e.g. '2 squares 180° and 3 (isosceles) triangles 180°'
8. (Sum of the three angles given is 300(°)) (Each of other two exterior angles is) 360 – 300 ÷ 2 (Each of the other exterior angles is) 30(°) Use of 'interior angle + exterior angle = 180(°)' Interior angles 75(°), 65(°), 100(°), 150(°), 150(°)	M1 m1 A1 M1 A1	FT their 300, sum of the three angles given FT their 300, sum of the three angles given CAO Or use of 'interior = 180 – exterior' FT 180 – their 30 provided M1 awarded OR Alternatively: (Use of interior angle + exterior angle = 180°) Interior angles 75(°), 65(°), 100(°) Sum of the interior angles = $3 \times 180(°)$ (= $540(°)$ ) M1 Remaining interior angles = $540 - (75 + 65 + 100)$ m1 = 300(°) Each of the remaining angles = $150(°)$ A1 <i>If no marks, SC1 for answers of 120° and 120° from incorrectly</i> <i>using 540° as exterior sum of the angles</i>
<ul> <li>QWC2: Candidates will be expected to</li> <li>present relevant work clearly, with words explaining process or steps</li> <li>AND</li> <li>make few if any mistakes in spelling, punctuation and grammar</li> <li>QWC1: Candidates will be expected to</li> <li>present work clearly which is mostly relevant, with words explaining process or steps</li> <li>OR</li> <li>make few if any mistakes in spelling, punctuation and grammar and include units in their final answer</li> </ul>	QWC 2 7	<ul> <li>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.</li> <li>QWC1 Presents relevant material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar</li> <li>OR evident weaknesses in organisation of material but using acceptable mathematical form, with few if any errors in spelling, punctuation and grammar.</li> <li>QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation or grammar.</li> </ul>

	<b>D1</b>	
9. $180 \div 36 = 5$ and $180 \div 60 = 3$ , OR $36 = 2 \times 2 \times 3 \times 3$ , $60 = 2 \times 2 \times 3 \times 5$ ,	B1	Must <u>check</u> 1 <sup>st</sup> part of Jack's statement
$30 = 2 \times 2 \times 3 \times 3$ , $00 = 2 \times 2 \times 3 \times 3$ , and $180 = 2 \times 2 \times 3 \times 3 \times 5$ , OR		
36, 72, 108, 144, 180, with 60, 120, 180,		
HCF of 36 & 60 is 2×2×3 or 12	B1	
Conclusion, e.g. 'this common factor of 12 is a factor of 180 so	E1	Depends on 2 <sup>nd</sup> B1
Jack is not correct (for this part of his statement)'	3	
10.(a) (i) At least 2 correct points found or plotted	M1	
Correct straight line shown	A1	
(ii) At least 2 correct points found or plotted	M1	
Correct straight line shown (b) No AND a reason, e.g. 'they don't intersect (meet) at 90°	A1 E1	Do not accept 'No they are not perpendicular'
(right angles)'	LI	FT provided one of their lines is correct
(inglit unglos)		Also FT provided one of their lines is correct, but then the
		incorrect line happens to be perpendicular, then 'Yes' with the
	_	reason 'intersect at 90°'
11 (-) 24 2- hf h	5	Incorrect expansions is 1 error FT until 2 <sup>nd</sup> error
11.(a)  3t - 3g = hf - ht 3t + ht = hf + 3g	B1 B1	Incorrect expansions is 1 error $FT$ until $2^{nd}$ error Collection of t terms, or all negative
3t + ht = ht + 3g t(3 + h) = hf + 3g	B1 B1	Factorise t
	B1	Division. Mark final answer
$t = \frac{hf + 3g}{h + 3}$		
(b)(i)10n - 7	B2	B1 for sight of 10n
(ii) $-10n + 60$ or equivalent (iii) $2n^2 + 6$ or equivalent	B2	For B2 mark final answer. B1 for sight of -10n
(11) 211 + 0 of equivalent	B2 10	For B2 mark final answer. B1 for sight of $2n^2$ (or equivalent)
12.(a)(i) Correct sketch	B1	Throughout this question mark intention in the 2 correct
(ii) Correct sketch	B1	quadrants
(b)(i) Correct sketch through (0,0)	B1	-
(ii) Sketch of any vertical translation	B1	
Correct sketch with $(0,2)$ stated on 2 indicated on the second	B1	
either (0,3) stated or 3 indicated on the y-axis (iii) Correct sketch through (0,0)	B1	
	6	
13. $2x^2 + 7x - 8x - 28 + x^2 + x + 4$ OR $2x^2 - x - 28 + x^2 + x + 4$	M2	M1 if 1 slip or error
$3x^2 - 24 = 3(x^2 - 8)$ , i.e.both steps shown	A1	CAO
$14.(a) 5 \times 10^3$	3 B2	B1 for $0.5 \times 10^4$ or $\frac{1}{2} \times 10^4$ or 5000
	В2 В2	
(b) $2.4 \times 10^9$	Б2 В2	B1 for $24 \times 10^8$ or 2 400 000 000 B1 for attempt to match addition of numbers, e.g. breaking
(c) $3.36 \times 10^8$	02	B) for attempt to match addition of numbers, e.g. breaking down to $3.24 \times 10^7 \times 10$ or alternative strategy, or sight of
		336 000 000
	6	
15.(a) 60	B2	B1 for sight of $\sqrt{5} \times \sqrt{5} = 5$
(b) 324	B3	B2 for $(3\sqrt{2})^4$ with an attempt to evaluate, $81 \times$ or ×4, OR
		18×18
	5	B1 for $(3\sqrt{2})^4$ OR multiply pair brackets to 18
16.(a) b = cd/a	B2	B1 for $a \times b = c \times d$
$(b)(i) 90^{\circ}$ or right angle	B1	May be indicated on the diagram
Reason 'tangent meets radius (at 90°)'	B1	
	B1	
$(\Pi) \Delta X$		
(ii) 2x x	<b>B</b> 1	

17.(a) Sight of 6, 12, 18 (as winning tickets) or realising there	B1	
are 3 winning tickets		
Idea to calculate $P(win) \times P(win)$	<b>S</b> 1	Accept from incorrect replacement idea
$3/20 \times 2/19$	M1	FT their 3 if clear that an attempt to find multiples of 6
		ISW
6/380 (=3/190)	A1	15 W
(b) Sight of 1, 2, 3, 6, 9, 18 or realising that there are 6 winning	B1	
tickets		
Considers $P(win) \times P(win)$ , $P(win) \times P(lose)$ , $P(lose) \times P(win)$	<b>S</b> 1	OR 1 – P(not winning). Accept from incorrect replacement idea
	51	or 1 T (not winning). Accept from meoreet replacement idea
$6/20 \times 5/19 + 6/20 \times 14/19 + 14/20 \times 6/19$	M1	FT their factors provided clearly shown at least 4 of them
(30/380 + 84/380 + 84/380)	IVI I	FT their factors, provided clearly shown at least 4 of them
198/380 (= 99/190)		OR $1 - \frac{14}{20} \times \frac{13}{19} (= 1 - \frac{182}{380})$
198/300 (- 99/190)	A1	ISW
	8	
18.(a) (x + 9)(x - 9)	B1	
(2x - 5)(x + 9)	B2	B1 for $(2x \dots 5)(x \dots 9)$
x - 9	B1	FT if possible for similar level of difficulty
$\frac{x-9}{2x-5}$		Mark final answer, do not ISW
(b)(i) a = 6	B1	······································
$x^{2} + 12x + 36$ (-22) OR method to find b	M1	
h = -22	A1	Accept embedded answers
$(ii) (x + 6)^2 - 22 = 0$	B1	Use of completing the square from (i), FT
$(n)(x+6)^2 = 22 = 0$ $(x+6)^2 = 22$	M1	Ose of completing the square non (1), 1 1
$x + 6 = (\pm)\sqrt{22}$	M1	
$\mathbf{x} = \pm \sqrt{22} - 6$	A1	Must show <u>+</u>
	11	

### UNIT 2 (FOUNDATION TIER)

Methods 2 Foundation June 2013		Final
<ul> <li>1. (a) Correct diagram</li> <li>(b) 4 lines of symmetry drawn correctly Only 1 line of symmetry drawn correctly</li> <li>(c) 4, 3, 2</li> </ul>	B2 B2 B1 B3 8	-1 for each incorrect vertex Award B1 for 2 or 3 lines of symmetry correctly drawn CAO Award B1 for each correct one
<ul> <li>2. (a) A correct congruent shape drawn</li> <li>(b) A correct similar shape drawn</li> <li>(c) Radius drawn</li> <li>Tangent drawn</li> <li>Arc drawn</li> </ul>	B1 B1 B3	Do not accept a congruent shape B1 for each correct. Accept intention of each
	5	
3. (a)         34       75(%)         0.3(0)       30(%)	B2 B2	Accept equivalent fractions for <sup>3</sup> / <sub>4</sub> . Ignore incorrect simplification of 75/100. Do not accept 7.5/10.
(b) 42/100 × 630 264.6(0) (c) 3/7 × 364 156	M1 A1 M1 A1 8	CAO Or equivalent CAO
4. (Monday to Friday) $40 \times (\pounds)12.85$ = $(\pounds)514$ (Saturday) $8 \times (12.85 \times 2)$ = $(\pounds)205.6(0)$ (Sunday) $6 \times (12.85 \times 3)$ = $(\pounds)231.3(0)$ (Total =) $(\pounds)950.9(0)$	M1 A1 M1 A1 M1 A1 B1	FT if at least M2 awarded AND 3 values added. If no marks awarded, award SC1 for sight of (£)25.7(0) OR (£)38.55
If 0 missing from the final answer, lose at least QWC1 Look for • spelling • clarity of labels • the use of notation (watch for the use '=' "£" being appropriate)		$\begin{array}{c} Alternative \ method\\ 8\times 2 \ AND \ 6\times 3  M2. \ (award \ M1 \ for \ either)\\ 16 \ AND \ 18  A1\\ 40+18+16 \qquad M1 \ (FT \ provided \ 3 \ values \ added)\\ 74  A1\\ 74\times (\pounds)12.85 \qquad M1 \ (FT \ their \ total \ hours)\\ (\pounds)950.9(0) \qquad A1\end{array}$
<ul> <li>QWC2: Candidates will be expected to <ul> <li>present work clearly, with words explaining process or steps</li> </ul> </li> <li>AND <ul> <li>make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer</li> </ul> </li> <li>QWC1: Candidates will be expected to <ul> <li>present work clearly, with words explaining process or steps</li> </ul> </li> <li>OR <ul> <li>make few if any mistakes in mathematical form, spelling, punctuation and grammar in</li> </ul> </li> </ul>	Q W C 2	<ul> <li>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.</li> <li>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.</li> <li>QWC0 Evident weaknesses in organisation of material, and the set of the set of</li></ul>
their final answer	9	and errors in use of mathematical form, spelling, punctuation or grammar.

5.5	B1	
-3	B1	
66 = 12	B2	Award B1 for 6 OR -6 in the correct place, provided 1 <sup>st</sup>
		is positive AND 2 <sup>nd</sup> negative, with their correct answer
		given e.g. $6 - 1 = 7$ or $5 - 6 = 11$
	4	
	B1	
6. (a) $x = 7$		Accept embedded answers throughout question
(b) $x = 9$	B1	
(c) $5x = 35$	B1	
<i>x</i> = 7	B1	FT "their $35$ " $\div$ 5. If this leads to a whole number it
		must be correctly evaluated. Mark final answer.
	4	
7. For a trial that gives an area of $30 \text{ cm}^2$	B1	Accept non-whole number trial eg $4 \times 7.5$
i i of a dial dial gives an area of so em	21	Maybe seen on a diagram
For a trial that gives an area of 30 cm <sup>2</sup> and the value of	B1	Accept non-whole numbers with the correct perimeter
	DI	Accept non-whole numbers with the correct perimeter
the perimeter stated.		
(Length) 6(cm) and (width) 5(cm)	B1	Accept (width) 6(cm) and (length) 5(cm)
(Perimeter =) 22 (cm)	B1	
		1 by 30 62cm
		2 by 15 34cm
		3 by 10 26cm
		5 by 6 22cm
	4	5 by 0 22cm
	4	
8. (a) For all 4 correct as fractions that allows	M2	Award M1 for any two correct in a fraction that allows
comparison		comparison
$7/12, 2/3, \frac{3}{4}, \frac{5}{6}$ or equivalent fractions	A1	If no marks awarded, award SC1 for correct order
(e.g. 7/12, 8/12, 9/12, 10/12)		without using equivalent fractions
(		
(b) 390 ÷ 3	M1	
$(0) 390 \div 3$	1011	Accepting of the surder of 5 + 2. Accept M1 for sight of
-		Accept in either order $\times$ 5 $\div$ 3. Award M1 for sight of
× 5	m1	130 or 1950
650	A1	CAO
	6	
9. (a)		Accept equivalent in cm
7 AND 5 multiplied by 0.8	M1	
5.6 AND 4 (m)	A1	Seen or implied
$5.6 \times 4$	M1	FT their 5.6 AND 4 but not $7 \times 5$
= 22.4	Al	
$m^2$	U1	Independent mark
	-	muependent mark
(b) $35 \times 45 \times 20$	M1	
31500	A1	Seen or implied in further calculations
$31500 \div (100 \times 15)$	M1	FT their 31500
21 (cm)	A1	
	9	
10. (a) (28416/38400) × 100	M1	Or equivalent full method
10. (a) (28410/38400) × 100 74(%)	A1	
× /		Or aquivalant full method
(b) $766 + 766 \times 12/100$ OR $766 \times 1.12$	M1	Or equivalent full method
(£)857.92	A1	
(c) 2/5 or equivalent fraction	B1	CAO
	5	
11. (a) Enlargement scale factor 2	B2	B1 for any 3 lines correct, or consistent incorrect scale
Correct position	B1	At least 2 points are needed to indicate the correct
Context position	10	
	D2	position
	B2	B1 for a reflection in $y = -x$ ,
(b) Correct reflection in $y = x$		
		OR for sight of the line $y = x$
<ul><li>(b) Correct reflection in y = x</li><li>(c) Correct translation</li></ul>	B1	OK for signt of the line $y = x$
	B1	OK for signt of the line $y = x$
(c) Correct translation		
	B1 B2	B1 near miss, OR 90°clockwise rotation about (2, 1),
(c) Correct translation		

12. (a) $9x - 4 = 7x + 14$ 9x - 7x = 14 + 4 or $2x = 18x = 9(b) 10x > 40x > 4$	B1 B1 B1 M1 A1 5	<i>FT until 2<sup>nd</sup> error</i> No marks for use of "=", unless finally replaced to give x>4 then award M1 A1. SC1 for x>5 from 10x>50 OR sight of 9×6=54 AND 9×7=63
13. (a) $4.5 \times 12.4$ $55.8 (cm^2)$ (b) $x + x + 2 + 2x + 3x + 5 + 4x (=)$ 11x + 7 = 95 or $11x = 88x = 8$	M1 A1 M1 m1 A1 5	Accept 56(cm <sup>2</sup> ) from correct working For the expression with intention to sum the terms given CAO. Unsupported x=8 is awarded no marks

#### UNIT 2 (HIGHER TIER)

Methods 2	2 Higher Summer 2013		Final
	6/38400) × 100	M1	Or equivalent full method
	74(%)	A1	
(b) 766 + 7	766×12/100 OR 766×1.12	M1	Or equivalent full method
(c) 2/5 or e	(£)857.92 equivalent fraction	A1 B1 5	САО
	gement scale factor 2	B2	B1 for any 3 lines correct, or consistent incorrect scale
	ct position	B1	At least 2 points are needed to indicate the correct position
(b) Correct	t reflection in $y = x$	B2	B1 for a reflection in $y = -x$ , OR for sight of the line $y = x$
(c) Correct	translation	B1	
(d) Correct	trotation	B2 8	B1 near miss, OR 90°clockwise rotation about (2, 1), OR 90° anticlockwise rotation about (1, 2)
Metho	d for finding yellow $(2.5 \times 2 \div 3 = 1.666)$ , or d for finding red $(2.5 \times 5 \div 3 = 4.166)$ , or d for finding white $(2.5 \times 90 \div 3 = 75)$	M1	Or equivalent correct method for one colour
AND Yello	4.166 (litres) ow 1.666 (litres) te 75 (litres)	A2	Answers <u>must be from appropriate calculations</u> , correct working with appropriate rounding or truncation A2 for all three correct, accept suitable rounding or truncation, e.g. do not accept red 4 litres, yellow 1 litre For example: Red (accept values 4.1,4.15, 4.16, 4.17,4.2, 4.5litres) Yellow (accept 1.6, 1.7, 2 litres) White (accept 74.7, 74.9, 75 litres) A1 for any <b>two</b> correct
			FT for their amount of paint provided M1 awarded and more than 1 tin is needed for the colour Accept equivalent tin sizes available, e.g. $5 \times 1$ litre tins
Colour White	Number and sizes of tins to buy $7 \times 10$ litre, $2 \times 2.5$ litre	DI	
		B1	For Red do not accept $2 \times 2.5$ litre nor $5 \times 1$ litre
Red	$1 \times 2.5$ litre, $2 \times 1$ litre	B1	For Yellow do not accept $1 \times 2.5$ litre tins
Yellow	$2 \times 1$ litre tins	B1	
Look for			
• c • c • t	pelling connection of colour name with calculation clarity of text explanations and statements he use of notation units (litres or l)	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.
• p p AND • n f t t QWC1: Ca	andidates will be expected to present work clearly, with words explaining process or steps nake few if any mistakes in mathematical form, spelling, punctuation and grammar in heir answer andidates will be expected to present work clearly, with words explaining		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 arrors in use of mathematical form appliing
OR • n f	process or steps nake few if any mistakes in mathematical form, spelling, punctuation and grammar in heir final answer	8	and errors in use of mathematical form, spelling, punctuation or grammar.

		1
4(a) $x = 60 \times 5 / 8$	B1	FT until 2 <sup>nd</sup> error
x = 37.5	B1	Accept 300/8 or equivalent. Mark final answer
(b) $x = 1/4$ or 0.25 or equivalent	B1	Accept 3/12. Mark final answer
(c) $9x - 4 = 7x + 14$	B1	FT until 2 <sup>nd</sup> error
9x - 7x = 14 + 4 or $2x = 18$	B1	
$\mathbf{x} = 9$	B1	
(d) $10x > 40$	M1	No marks for use of "=", unless finally replaced to give
x > 4	Al	x>4 then award M1 A1.
x>+		SC1 for $x>5$ from $10x>50$
		OR sight of $9\times6=54$ AND $9\times7=63$
(e) $x > 60/9$ or $x > 6.6(666)$	M1	
7	A1	Do not accept final answer of $(x)>7$ .
		Do not penalise use of '=' if 7 is given as a final
	10	response, award M1, A1
$5(a) 4.5 \times 12.4$	M1	
55.8 (cm <sup>2</sup> )	A1	Accept 56(cm <sup>2</sup> ) from correct working
(b) $34.6 = \Pi \times r^2$	M1	Recept So(em ) from concert working
$r^2 = 34.6/\Pi$	A1	
r = 3.3(186 cm)	A1	Accept 3(cm) or 3.3(cm) from correct rearrangement
(c) $x + x + 2 + 2x + 3x + 5 + 4x (=)$	M1	For the expression with intention to sum the terms given
11x + 7 = 95 or $11x = 88$	m1	
$\mathbf{x} = 8$	A1	CAO.
	8	Unsupported x=8 is awarded no marks
6(a) 4.4	B2	B1 for 4.38(13) or 4.3
(b) $637$ (×)	B1	D1101 1.50(15) 01 1.5
	B1 B1	
(×) 3192		ET
= 2033304	B1	FT correct evaluation of product from 1 correct value
	_	If no marks then SC1 for interpretation of 'product' and
	5	'of' e.g. by sight of 2 1/3 × 273 × 4 1/5 × 760
7. Strategy: use of Pythagoras' Theorem	S1	OR alternative full correct strategy
and C=IId or C=2IIr		
$h^2 = 4.2^2 + 4.2^2$	M1	OR alternative <u>complete</u> method
$h = \sqrt{35.28}$	A1	
diameter = $5.9(39cm)$ or radius = $2.9698(cm)$	A1	Accept diameter = $6(cm)$ or radius = $3(cm)$ , do not
		accept radius = $2.9$ . Clarification of diameter or radius
		may be implied in further work, penalise here with A0,
		then FT
$C = \Pi \times 5.939$ OR $C = 2 \times \Pi \times 2.9698$		FT their radius or diameter as appropriate provided M1
$C = 11 \times 3.939$ OK $C = 2 \times 11 \times 2.9090$	m1	
10.5 (cm) to $10.7$ (cm)		awarded, including use of $r = 5.9(39)$
18.5 (cm) to 18.7(cm)	A1	(r = 5.9(39) leads to 37(. 4cm)
	6	
8(a) Method to clear fractions, all 3 terms	M2	Intention, i.e. brackets may be missing
$3(3x - 1) - 4(x + 6) = 3 \times 6$		M1 for clearing fractions 2 terms
		Fractions must be cleared before M marks can be
		awarded, not for quotients
9x - 3 - 4x - 24 = 18 OR $5x - 27 = 18$ OR $5x = 45$	A1	FT from M1 or M2
x = 9	Al	FT provided M1 awarded
		If no marks SC1 sight of (5x - 27)/12
		i j no marks SC1 signi oj $(3x - 27)/12$
(b) $\sin x = 28.7/24.2$	1.41	
(b) Sin x = $28.7/34.2$	M1	
57(.0537°) or 57(.1°)	A2	A1 for $x = \sin^{-1} 0.839(181)$
(c) $1.5 \times 10^{11}$	B2	B1 for $1.54(347) \times 10^{11}$
	9	
9. $(x = ) 8.4 \times 6/5$	M1	Or equivalent calculation that could lead to correct
= 10(.08  cm)  or  10.1(cm)	A1	answer
$(y = ) 4.32 / 6/5$ or $(y = ) 4.32 \times 5/6$	M1	Or equivalent calculation that could lead to correct
$(y = ) 4.52 \times 5.5$ = 3.6 (cm)	A1	answer
	4	
	- T	

10.(a) Any two points correct, with no incorrect points	M2	Accept (0, 10) as one of the points with 1 other point,
10.(a) Any two points correct, with no incorrect points	IVI2	provided no other incorrect points plotted
		M1 any one point correct provided no incorrect points
		plotted, do not accept (0, 10), OR
		M1 for any 2 correct points not including (0,10)
Correct straight line drawn from ( but not beyond)	A1	Accept indication for lots and lots of points between.
(30,40) inclusive to $(0,10)$ exclusive		Accept to (0, 10) but not beyond
(b) Explanation of implied NO, e.g. 'not possible to have	E1	
a rectangle with zero lengths'	4	
11(a) Two <b>different</b> corresponding sides and an included	B2	B1 Two corresponding sides not marked as different
angle indicated. (b) Right angle, hypotenuse and a corresponding	В2	and the included angle indicated
different side indicated	D2	B1 Right angle, hypotenuse and a corresponding different length indicated but not marked as different
OR Right angle, hypotenuse and a corresponding		B1 Right angle, hypotenuse and a corresponding angle
different angle indicated		indicated but angles not marked as different, or
		Right angle, hypotenuse & the both of 2 corresponding
		sides marked differently as appropriate
		Accept right angles indicated either as 90 ° or $\Box$ at
	4	vertex
12.	B4	B3 for 820, or
Amount After a decrease of 40% 2%		B2 for 492 × 100/ 60, or B1 for '60% is 492', or
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	4	B1 for $0.98 \times$ 'their 820' correctly evaluated to nearest
	4	penny or unrounded
13.		Mark final answer in each part
(a) $-7x + 10y$	B1	Wark mai answer m each part
(b)(i) $-6x - 3y$ or factorised equivalent	B1	
(ii) $-6x + 7y$	B1	FT (b)(i) + $10y$ simplified correctly
		If (i) and (ii) both correct but left in unsimplified form
	3	allow SC1
14. Strategy: Use of ½ abSinC and cosine rule	S1	Or equivalent full strategy
$42.8 = \frac{1}{2} \times BC \times 17.8 \times \sin 34$ BC = 8.59987	M1 A1	
$AB^{2} = BC^{2} + 17.8^{2} - 2 \times BC \times 17.8 \times \cos 34$	M1	FT their BC, but not as 17.8
$AB^{2} = 136.98$	A1	
AB = 11.7( cm)	A1	Accept 12(cm) from correct working. CAO
		Alternative:
		SI complete strategy, e.g. with perpendicular with
		appropriate trigonometry for both triangles
		M1, A1 for the RHS triangle
	6	M1, A1, A1 for the LHS triangle
15.Volume sphere = $4 \times \Pi \times 6.7^3/3$ (=1259(.833 cm <sup>3</sup> ))	B1	
Volume cone = $\Pi \times r^2 \times 10.4 / 3$	B1 M1	ET their melana and the little is a fi
$r^2 = \frac{\text{Volume sphere} \times 3}{1000}$	M1	FT their volume sphere provided dimensions cm <sup>3</sup> for
$\Pi \times 10.4$		M1 only Or equivalent rearrangement to isolate $r^2$
$r^2 = 115.678$	A 7	or equivalent rearrangement to isolate i
r = 10.078 r = 10.8(cm)	A1 A1	CAO. Must be to 1d.p.
	AI	CAO. Musi de lo ru.p.
		Alternatively:
		$4/3 \times \pi \times R^3 = 1/3 \times \pi \times r^2 \times h$ B1
		$4 \times R^3 = r^2 \times h$ B1
		$4 \times 6.7^3 = r^2 \times 10.4$ M1
	-	$r^2 = 115.678$ A1
	5	r = 10.8(cm) A1 CAO

$1( (\cdot, 0) (IGW)$	D1	
16. $x(x + 2) = y$ (ISW)	B1	The first two B1 marks maybe implied by the correct
12(5 + x) = 4y (ISW)	B1	quadratic, hence if M1 awarded also award BOTH these
		B1 marks
x (x+2) = 15 + 3x OR $12(5 + x) = 4x(x + 2)$	M1	Equating or substituting, allow 1 error, e.g. missing
OR equivalent		brackets, or from incorrect expansion. FT provided at
1		least B1 and equivalent level of difficulty
$x^{2} - x - 15 = 0$ OR $4x^{2} - 4x - 60 = 0$	A1	Must be equate to zero
x - x - 15 = 0 OK $4x - 4x - 00 = 0$	AI	Must be equate to zero
$x = \{ 1 + \sqrt{(-1^2 - 4 \times 1 \times -15)} \} / 2$	M1	Allow 1 slip in substitution.
	IVII	1
OR $x = \{ 4 \pm \sqrt{(-4^2 - 4 \times 4 \times -60)} \} / 2 \times 4$		FT 'their 3 term quadratic' of equivalent level of
		difficulty for M1 and final A1 only
$x = (1 + \sqrt{61})/2$ OR $x = (4 + \sqrt{976})/8$	A1	
(x =) 4.4 (cm)	A1	(-3.4 is not required)
(x + 2 =) 6.4 (cm)	A1	FT provided M1 awarded
	8	1
17. Idea of right angled triangle shown or used with	M1	
height b, base a		
$\sin \theta = b(1)$	A1	Accept $b/\sqrt{a^2 + b^2}$
$\cos \theta = a/(1)$	Al	Accept $a/\sqrt{a^2 + b^2}$
u(1)		If A0 due to notation $-a^2$ as $(-a)^2$ but otherwise correct,
		then allow SC1 as well as M1
	3	inen allow SC1 as well as M1

GCSE Methods of Mathematics MS Summer 2013



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>