GCSE MARKING SCHEME

APPLICATIONS OF MATHEMATICS
(LINKED PAIR PILOT)

JANUARY 2012

INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2012 examination in GCSE APPLICATIONS OF 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.

Unit 1 – Foundation Tier

Applications U1 Foundation Tier January 2012	Mark	Comment
1.7319 + 6327 + 4978 + 1093 = 19717 19700	M1 A1 B1 3	Attempt to add 3 or 4 numbers CAO FT their total

2. (78 + 41 =) (£)119
   (14.99 + 58.49=) (£)73.48
(119 – 73.48=) (£)45.52 left
 	
Valid reason eg he only has £45.52 left which is not enough money to buy the ticket and No stated or implied
 	
Look for
   • Correct units used
   • Spelling in at least 1 statement/sentence
   • Clarity of text explanation
   • Correct terminology
   • the use of simplified notation (watch for the use '=' being appropriate)
 	
QWC2: Candidates will be expected to
   • present work clearly, with words explaining process or steps
   AND
   • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer
 	
QWC1: Candidates will be expected to
   • present work clearly, with words explaining process or steps
   OR
   • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer
	B1
	B1
	B1
	
	E1
	
	QWC 2
	
	6
		
		Accept needs (£)138.48FT 'their 119' and 'their 73.48'
		FT for their calculations
		
		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.

3. Evidence of at least one car's information substituted into formula correctly with the correct answer
For the correct times for all 3 cars
 	
Statement saying the least time taken was the 2nd car
	M1
	
	A1
	
	E1
	
	3
		Any one correct answer implies M1
		     Time for:
		     1st car = 1.2 hours
		     2nd car = 0.8 hours
		     3rd car = 0.88 hours
		FT if M1 awarded
		Award SC1 for answers of 0.8, 1.25 & 1.1 and 1st car being shortest time.

4. (a) Wednesday
(b) Adding numbers (= 791)
  791÷7
  Mean = 113
  Put in order 30, 68, 68, 80, 120, 185, 240
  Median = 80
  Mode = 68
  Range = 210
	B1
	M1
	m1
	A1
	M1
	A1
	B1
	B1
	8
		
		Attempt to add numbers
		FT 'their 791'
		CAO

5. (a) circle drawn r = 4.5cm
(b) (i) 8.6 (cm) or 86(mm)
(ii) Identifying midpoint of base
  Correct position of top of triangle
 	
(c) 360 – (56 + 90 + 90) or implied equivalent eg 180 - 56
  = 124 (°)
	B2
	B1
	B1
	B2
	
	M1
	A1
	8
		± 2mm B1 for circle radius 9cm
		± 2mm
		± 2mm. Look on diagram for evidence
		± 2mm. Use overlay. For B2 FT 'their midpoint'. Award B1 for any perpendicular line drawn OR for any indication (dot) of being perpendicularly above 'their midpoint' at any height.

Applications U1 Foundation Tier January 2012	Mark	Comment

6.(a) rectangle drawn
    Rectangle overlapping y-axis
    Rectangle with area > 31 cm^2
    4 correct coordinates
 	
(b)Attempt to count area
Estimate of area of their leaf within the range of 15 - 18
	B1
	B1
	B1
	B2
	
	M1
	A1
	7
		Accept square used.
		
		FT from their diagram. B1 for 2 or 3 coordinates correct. Reversed coordinates B0.

7. (a) slippers
   (b) 4/40
   (c) Correct explanation given
	B1
	B1
	E1
	
	3
		ISW
		eg. No because you are asking more people and this may change the probability
		OR No when doing an experiment again it could give a different result
		OR any explanation of different proportion liking flip flops. Eg No because 7 could like flip flops

8. 3 × 16 + 1× 15 = 63 (99 – 63) = 36 (36 ÷ 12 =) 3 nights	M1 A1 B1 B1 **4**	 FT their 63 if M1 awarded FT their 36. Not dependent on M1

9. Idea of buying 4 for price of 3 or evidence of buying 4 lots of 4 tickets
((4.70 × 3) × 3 =)14.1(0) × 3 or 42.3(0) seen or implied
(6.20 + 4.70 + 4.70 =) 15.6(0) seen
£57.9(0) CAO
	S1
	
	B1
	B1
	B1
	
	4
		Eg. 4 free tickets
		        Alternative method
		       11× 4.70 (=51.7(0)) B1
		    FT 'Their 51.7(0)' + 6.2(0) B1
		       £57.9(0) B1 CAO
		
		       (£)76.7(0) B1
		'their 76.70' – (4 × 4.70) or 18.8(0) seen B1
		       57.9(0) B1 CAO
		
		Award SC2 for answer of 62.6(0) from
		   15 × 4.7(0) + 6.2(0) – 3 × 4.7(0)
		      (use of 3 free tickets)
		Award SC1 for incorrect answer to the above method

10. (a) 10119.74 (b) 10000	B2 B1 **3**	B1 for 10119.7(361) or 10120 FT their (a) rounded to 1 significant figure
11. (a) 062 (°) 150 (°) (b) Correct line from The Seabreeze Correct line from The Catcher Lines intersecting (c) 8 (cm) Multiplying by 5 = 40 cm or other correct units	B1 B1 M1 M1 A1 B1 M1 A1 U1 **9**	±2° ±2° Use Overlay. *If only 1 line drawn, the position of the harbour must be marked* FT if at least one M1 given ±2mm (accept 7.8 – 8.2 inclusive) FT their length
12.(a) 10g + 5h (p) (b) 2l + 2w (cm) or l + l ~+ w + w or 2(l + w) or equivalent	B2 B2 **4**	B1 for either 10g (or 10×g) or 5h (or 5×h) If B2, penalise further incorrect work -1 B1 for 2l or 2w or 2 × l + w If B2, penalise further incorrect work -1

13. (a) Journey from Brian's home to friends
   1 ¾ hour stay at friends
   Journey home
(b) 37-38 miles
	B1
	B1
	B1
	B1
	4
		Use Overlay
		FT 'their 1st part of the journey'
		FT 'their stay at friends'
		FT 'from their graph'

Applications U1 Foundation Tier January 2012	Mark	Comment
14.(a) 60(°), 6(cm), 4 (cm)	B3	B1 for each correct answer *FT if at all possible from (a)*
(b) Correct logo, all 3 areas, (see overlay) Tolerance in this question is $\pm$2mm,$\pm$2°	B4 7	B3 2 areas correct with the other area slightly outside tolerance B2 2 of the areas correct B1 1 of the areas correct, but placement may be incorrect

15. 672 ÷ 16
    = 42
   Jane = (£)294   and   Ian = (£)378
	M1
	A1
	A1
	3	

16. One correct evaluation (1dp) $1.8 \le x \le 1.9$ 2 correct evaluations $1.87 \le x \le 1.885$ One either side of 1 2 correct evaluations $1.875 \le x \le 1.885$ One either side of 1 1.88	B1 B1 M1 A1 4	x $x^3 - 3x$ 1.8 0.4(32) 1.81 0.4(997) 1.82 0.5(68) 1.83 0.6(38) 1.84 0.7(095) 1.85 0.7(81) 1.86 0.8(54) 1.87 0.9(29) 1.875 0.9(66) 1.88 1.0(0467) 1.89 1.0(81) 1.9 1.1(59) **1.885 1.0(428)** If values are not shown <u>do not</u> accept the use of statements such as 'greater than one and less than one' or 'too high and too low' Unsupported 1.88 gets B0 B0 M0 A0

Unit 1 – Higher Tier

Applications U1 Higher Tier January 2012	Mark	Comment
1.(a) 10g + 5h (p) (b) x+y+z (x+y+z)/3 or equivalent (c) 2l + 2w (cm) or l + l + w + w or 2(l + w) or equivalent (d) Evidence of need to divide by 4 (£) q/4 or equivalent	B2 B1 B1 B2 B1 B1 8	B1 for either 10g (or 10×g) or 5h (or 5×h) If B2, penalise further incorrect work -1 B1 for 2l or 2w or 2 × l + w or equivalent If B2, penalise further incorrect work -1 Accept q/(3+1)
2.(a) 60(°), 6(cm), 4 (cm) (b) Correct logo, all 3 areas, (see overlay) Tolerance in this question is ±2mm,±2°	B3 B4 7	B1 for each correct answer *FT if at all possible from (a)* B3 2 areas correct with the other area slightly outside tolerance B2 2 of the areas correct B1 1 of the areas correct, but placement may be incorrect
3(a) £6.2(0), £41, £18.75 (b) Suitable explanation clearly mentions 101 boxes or more than 100 QWC2: Candidates will be expected to • present work clearly, with words explaining process or steps. Graph axes are both labelled, appropriate joining of points, clear which lines relate to Box Clever and Box Galore **AND** • 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. Graph axes are both labelled, appropriate joining of points, clear which lines relate to Box Clever and Box Galore **OR** • make few if any mistakes in mathematical form, spelling, punctuation and grammar and include units in their final answer (c) Both axes with suitable uniform scale Accurate plots for Box Clever joined with a straight line from at least 10 to 50 and 50+ to 120 boxes (d)	B4 E2 QWC 2 B1 B2 B1 12	B3 for any 2 correct or £3.2(0), £38, £15.75 B2 for any 1 correct or any 2 of £3.2(0), £38, £15.75, B1 for correct working that could lead to any1 correct answer including the delivery charge Do not FT to (b) from incorrect prices in (a) E1 for a suitable explanation, but not referring to more than 100, perhaps refers to 100. Or for a partial explanation not mentioning the number of boxes exactly, just saying buy more Ignore inaccurate calculations 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. Scale, i.e. > ¼ graph paper is used for plots FT scale. B1 for at least 3 correct plots, or plots and line would be accurate had the delivery charge not been omitted CAO

In (d):

Box Clever
Box Clever
Boxes Galore

Boxes Galore

No.	0	5	10	20	30	50	100	101	110	120	130	140	150
£	3	5	7	11	15	23	43	18.15	19.50	21	22.50	24	25.50

Box Clever

No.	0	5	10	20	30	50	51	60	70	80	100	120	150
£	2	3.50	5	8	11	17	17.25	19.50	22	24.50	29.50	34.50	42

Applications U1 Higher Tier January 2012	Mark	Comment
4.(a) Explanation, e.g. "this information was not recorded", "don't know how many beans in the other boxes", "it doesn't say if more or less than 55"	M1	Do not accept 'No' with a reason related to specific data from the table demonstrating a misunderstanding of what the data tells the reader, M0, A0, i.e. using an argument based on 'not exactly 55' without engaging with 'least 55'
Conclusion: NO or DO NOT KNOW	A1	
(b) Explanation, e.g. "repeating an experiment usually gives different results", 'appears random'	M1	
Conclusion: NO	A1	
		Alternatively: Accept 'they could be similar as there is a small range', or 'similar as the machine is quite consistent', M1, A1 Allow SC1 for "No they are different", or equivalent statement– as an attempt to give a reason with 'no' stated, OR SC1 for 'similar' without giving a reason

(c)(i)

(8)	(15)	(21)	30	38	48	56	62	71	80
(10)	(20)	30	40	50	60	70	80	90	100
.8	.75	.7	.75	.76	.8	.8	.775	.788..	.8

	Mark	Comment
(c)(i) [row 1]	B1	
[row 2]	B1	
[row 3]	B2	FT from their cumulative to last row Accept truncation to 2d.p.. Accept percentages B1 for any 6 correct, or all truncated to 1d.p. FT from (c) only if r.f.<1.5, %<150% (inverse from table) in (ii)
(ii) Uniform scale on vertical axis	B1	Need not start at 0. FT to plots if possible
Correct plots (allow joined or not joined)	B2	FT from (i) as condition stated above. B1 for 6 correct plots No FT to (iii) for either mark for r.f.>1
(iii) (0.8)	B1	Correct response or strict FT from their last relative frequency, but must be ≤ 1
Explanation: e.g. "last point plotted", "all data used"	B1	Do not accept references to most common, all round to 0.8, etc
(iv) Explanation: "more checks", or "collect more data", "re-do the experiment quite a few times to compare"	B1 14	
5.(a)(i) Mid points 1, 3, 5, 7	B1	
1×24 + 3×16 + 5×42 + 7×18 (=408)	M1	FT their mid-points (within & including bounds)
÷ 100	m1	Their Σfx ÷ 100
(£)4.08	A1	Accept an answer of 4 from work seen. FT from their correct Σfx evaluated, M1 and m1
(ii) (£)7.99	B1	
(b)(i) 234, 257, 332, 334	B3	OR B2 for any two correct entries, OR B1 for a correct method seen, or one correct entry
(ii) Explanation: e.g "smoothed out data" , 'overview'	E1	
(iii) Noticing not true from raw data (but is from looking at moving average)	E1 10	Accept 'estimates (profit) over a period of time'
6.(a) Entries 20 55 95 100	B1	
(b) Correct cumulative frequency diagram, points plotted and joined with a curve or straight lines	B2	FT from <u>cumulative</u> (a). B1 points plotted but not joined, correct diagram with 1 point incorrectly plotted, or correct apart from be a 0.5 horizontal translation
(c) Median (approximately 164)	B1	From their <u>cumulative</u> diagram only (Approximately 166 – 162)
Intention to subtract horiz. reading for vertical 75 &25	M1	
Interquartile range (approximately 4)	A1	FT from (c) if possible, if LQ and UQ given
(d) Horizontal scale correctly indicated	B1	Do not penalise break in scale not indicated
Range correct as whiskers, from 155.5 to 170.5	B1	Accept 156 to 170
LQ, median, UQ to form box	B2 10	FT their answers. B1 if one error

7. Straight lines parallel to all 4 sides and 3cm away ($\pm$2mm) Arcs with radius 3cm ($\pm$2mm) at all 4 vertices All arcs joined to straight lines to give the correct locus ($\pm$2mm)	B2 B2 B1 5	B1 for straight lines parallel to 2 sides and 3cm away ($\pm$2mm), OR straight lines parallel to all 4 sides but not at 3cm, but consistent distance B1 for arcs with radius 3cm ($\pm$2mm) at 2 vertices, OR arcs at all 4 vertices but not at 3cm CAO

8. Use of 1 km = 100 000 cm
    Use of $2\Pi r$ OR Πd for either wheel
100 000/ Πd or equivalent
 	
For 60cm, Zen: 530.5 to 530.8 (cm)
For 70cm, Tom: 454.7 to 455 (cm)
Difference   75.78 to 75. 83 (cm)
 	
                76 (cm to 2 s.f.)
	B1
	B1
	M1
	
	A1
	A1
	A1
	A1
	
	7
		Or equivalent, e.g. all conversions to m
		Πd is 188.4 to 188.5 and 219.8 to 220
		FT their 100 000 (i.e. place value error), or their use of 60, 70 as r instead of d
		CAO. Maybe implied by final correct answer
		CAO. Maybe implied by final correct answer
		FT provided M1 awarded and units consistent
		FT provided M1 awarded and units consistent
		Premature rounding is PA-1
		Watch out for equivalent method, award A marks accordingly for similar stages

9. For x+y = 4 :   Any 2 points found correctly
Correct straight line drawn
For quadratic: Any 4 points found correctly
All **necessary** points are plotted correctly
Correct **curve** extending as a minimum between x= 1 and x=4
 	
        x = 4, y = 0
        x = 1, y = 3
	B1
	B1
	M1
	P1
	A1
	
	B1
	B1
	7
		<table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>y</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td><td>-1</td><td>-2</td></tr></table>
		<table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>y</td><td>8</td><td>3</td><td>0</td><td>-1</td><td>0</td><td>3</td><td>8</td></tr></table>FT from their <u>line with a curve</u> provided at least 1 intersection

10. Idea to find areas 2 triangles and 3 trapezia
18 + 37 + 35 + 23 + 7
            120
                m or metres
	M1
	A2
	A1
	U1
	5
		Or equivalent
		A1 for any 3 of the 5 areas correct
		Other A marks are included by sight of 120
		Independent of other marks

11. Stages of working: evidence of understanding1/x
                inverse of squaring being $\sqrt{}$
    6.7×10^8
	M1
	M1
	A1
	3
		In either order
		
		CAO

12.(a) Attempt to find area information for >70
        $4 \times 10 + 2 \times 10 + 0.6 \times 10$ (= 40 + 20 + 6)
            = 66
(b) Groups of equal width 30
For the groups:
0 to 30, 30 to 60, 60 to 90, 90 to 120
    15   150   120   6
 	
            Division by 30
Frequency densities: 0.5, 5, 4, 0.2
Suitable axes with scales and with label frequency density
 	
Attempt to construct histogram with groups of width 30
 	
Correct histogram
(c) Suitable explanation referring to the 1st being the more appropriate, e.g. 'more accurate', 'shows 70'
	S1
	M1
	A1
	S1
	
	M1
	A1
	m1
	A1
	B1
	
	M1
	
	A1
	E1
	12
		
		Allow 1 error in an area
		CAO
		FT from (a) to (b) for all marks if 1 slip with area in (a), but must be working with areas
		
		Correct attempt to find 15, 150, 120, 6
		(15 150 120 6)
		
		For their data, but not to suit15, 150, 120, 6. May be the same as in (a)
		Must have bars with no gaps.
		FT for their FD, but not 15, 150, 120, 6
		FT their 1 slip in area from (a)