



GCSE MARKING SCHEME

**APPLICATIONS OF MATHEMATICS
(LINKED PAIR PILOT)**

SUMMER 2011

INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2011 examination in GCSE APPLICATIONS 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.

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GCSE APPLICATIONS OF MATHEMATICS

UNIT 1 - FOUNDATION TIER

Applications of Mathematics June 2011 Unit 1 Foundation Tier	Mark	Comments Post conference version
<p>1. (a) 639, 762, 574 762, 574 Answer = 762</p> <p>(b) $2 \times 3.20 + 3 \times 2.30$ (6.40 + 6.90) = 13.3(0) $2 \times 6.40 + 3 \times 4.30$ (12.80 + 12.90) = 25.70 Saved (£)12.4(0)</p>	<p>B1 B1 B1</p> <p>M1 A1 M1 A1 A1</p> <p style="text-align: center;">8</p>	<p>Alternative method 2×3.20 = 6.40 3×2 = 6 Total saving 12.40 Or $(3 \times 4.30) - (3 \times 2.30)$ M1 = 6.40 A1 $(2 \times 6.40) - (2 \times 3.20)$ M1 = 6.00 A1 Saved $(6.40 + 6.00)$ 12.40 A1 FT for one arithmetic error for final A1, both M marks must be awarded.</p>
<p>2. (a) 370 (grams) (b) Arrow at 48 m.p.h. (c) circle drawn, $r=5\text{cm}$ (d) (i) 127° (ii) 8.3 cm (e) Triangular prism (f) A</p>	<p>B1 B1 B1 B1 B1 B1 B1 7</p>	<p>Arrow >47 and <49 ± 2 mm $\pm 2^\circ$ ± 2 mm</p>
<p>3. (a) $12 \text{ (cm}^2\text{)}$ (b) Rectangle drawn with area of $12 \text{ (cm}^2\text{)}$</p>	<p>B1 B2</p> <p style="text-align: center;">3</p>	<p>Either 6×2, 12×1 or 4×3 B1 for drawing a rectangle. Or B1 for a shape of area $12 \text{ (cm}^2\text{)}$ FT 'Their area' if a rectangle drawn</p>
<p>4. (a) Moscow (b) Cape Town (c) 16° (d) Cardiff and Helsinki</p>	<p>B1 B1 B1 B1 4</p>	<p>Accept clear abbreviations for cities such as M, CT, C, H, S Accept -16</p>
<p>5. (a) Suitable explanation (b) Attempt to add numbers (= 40) $40 \div 7$ = 5.7(14.....)</p> <p>(c) For 2 correct values that give a range of 7 AND a median of 6.</p>	<p>E1 M1 m1 A1</p> <p style="text-align: center;">B2</p> <p style="text-align: center;">6</p>	<p>Eg. 5 is the most popular number FT 'their total' $\div 7$ CAO Accept answer of 6 from correct workings shown Eg 9 & 10, 10 & 10, 6 & 10, 7 & 10, 8 & 10 B1 for 2 values that either give a range of 7 or a median of 6. OR B1 for 10 shown.</p>
<p>6. (a) $24 \times 1.80 + 3.10$ = (£)46.3(0)</p> <p>(b) $(37.30 - 3.10) \div 1.80$ = 19</p>	<p>M1 A1</p> <p>M1 A1 4</p>	<p>Multiplying and adding For $24 \times 1.80 + 3.10$ = 117.60 M0 A0 For showing a subtraction then a division Accept embedded 19.</p>

Applications of Mathematics June 2011 Unit 1 Foundation Tier	Mark	Comments Post conference version
7. Job 2 ($= 2850 \times 12$) = 34 200 Job 3 ($= 1300 \times 26$) = 33 800 Job 4 ($= 652 \times 52$) = 33 904 Highest = £34 200 or Job 2	B1 B1 B1 B1 4	If candidates correctly evaluate 24 and 48 weeks respectively for jobs 3 & 4 Award B0, B1. FT their answers No workings and Job 2 given as final answer award B0
8(a)(i) Suitable entry for the table (ii) Suitable suggestion (iii) Suitable diagram/chart (b) Appropriate comment.	B1 B1 B1 E1 4	Eg. Display/represents the data, analyses the data, find outcome of data, draws a graph, Adds up results, calculates results. B0 for Give out results Eg. Ask girls and boys or asks people in town or asks outside a computer store Eg. Tally chart/bar chart/line graph Eg. The sales have decreased.
9. Spinner 1 Suitable explanation.	B1 E1 2	Eg. Ethan has 50% chance of a yellow & Kyle has 25% of a red.
10. Suitable strategy used (6, -3)	S1 B2 3	Evidence on diagram or if at least 1 correct coordinate B1 for either coordinate. If only one coordinate correct award S1 B1 <i>for (-3, 6) award S1 only</i>
11. (a) 13.39 (b) 57000	B2 B1 3	B1 for 13.3(9173312) or 13 or 13.4
12. Lisa = $x + 3$ ISW Julian = $2(x + 3)$ ISW Expansion of bracket = $2x + 6$ $4x + 9$	B1 B1 B1 B1 4	Accept $2 \times x + 3$ or $x + 3 \times 2$. FT $2 \times$ their Lisa if Lisa $ax + b$ where $b \neq 0$ FT if $2(ax \pm b)$
13. Graph B Reference to horizontal line representing a stop Reference to steeper line after stop or less steep before stop	B1 E1 E1 3	This can be gained from graphs B, C, D
14. (a) $x = 76^\circ$ $y = 50^\circ$ (b)(i) 076° (ii) 256° (c) $360 - (50 \pm 2^\circ)$ 310°	B1 B1 B1 B1 M1 A1 6	$\pm 2^\circ$ $\pm 2^\circ$ FT from 'their x' FT from 'their x' or FT $180 +$ their (i). Accept if re-measured $\pm 2^\circ$. FT $360 -$ 'their y' $\pm 2^\circ$

Applications of Mathematics June 2011 Unit 1 Foundation Tier	Mark	Comments Post conference version
<p>15.(a) Completely accurate (through the centre, $30^\circ \pm 2^\circ$) with <u>lines</u> towards circumference (need not touch the circumference)</p> <p>(b) Appropriate arcs (dashes) shown on both lines Intersection arcs shown, using first set of arcs</p> <p>Angle bisector drawn</p>	<p>B3</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>6</p>	<p>B2 for at least 6 of the sectors accurate $\pm 2^\circ$, towards but not necessarily touching the circumference or shown by dots, OR B1 for sight of $(360 \div 12 =) 30 \pm 2$ mm ± 2 mm. FT from their arcs if ± 3 mm. FT from 'holes' from where arcs should be. FT if M0, M1 awarded SC1 if steps of process seen but slightly outside tolerance, OR SC1 if assumed lines are equal with 1 set of arcs with bisector shown</p>
<p>16.</p> <p>Longer diagonal 9.6cm (drawn as a diagonal or in working)</p> <p>Longer diagonal split 3.6cm & 6cm or calculated as 18cm & 30cm</p> <p>Diagonals intersect at right angles</p> <p>Shorter diagonal 5 cm (drawn as a diagonal or in working)</p> <p>Correct scale drawing of the kite</p>	<p>B1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>5</p>	<p>Watch for answers in the information table given All measurements ± 2 mm or $\pm 2^\circ$</p> <p>SC1 for a drawing with sides 9.6cm, 9.6cm, 5cm and 5cm(± 2 mm). Candidates awarded this SC1 can also access the B1 for the diagonals <u>shown</u> intersecting at right angles.</p>
<p>17. Appropriate choice of sketch Axes labelled appropriately Appropriate reason for their choice of sketch</p> <p>Look for</p> <ul style="list-style-type: none"> • relevance • spelling • clarity/flow of text explanations <p>Ignore previous errors in not labelling axes or in their reasoning For QWC2 need at least 1 statement/sentence in both parts of the question, otherwise maximum is QWC1 if the spelling and flow of text is satisfactory QWC2: Candidates will be expected to</p> <ul style="list-style-type: none"> • present work clearly, with words explaining choices <p>AND</p> <ul style="list-style-type: none"> • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer <p>QWC1: Candidates will be expected to</p> <ul style="list-style-type: none"> • present work clearly, with words explaining choices <p>OR</p> <ul style="list-style-type: none"> • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer 	<p>B1</p> <p>B1</p> <p>B1</p> <p>x2</p> <p>QWC 2</p> <p>8</p>	<p>Minimum is label for axes, not scales, or vv If no scale, the scale must be described in order to get the reason mark. Ignore extra incorrect reasoning, if appropriate reasoning seen <u>NO marks for an inappropriate choice of sketch</u></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>

UNIT 1 - HIGHER TIER

Applications of Mathematics Unit 1 June 2011 Higher Tier		Comments Post conference version
1.(a) Completing the table correctly (b)(i) 1/36 (ii) 1/36 (iii) 5/36 (c) 2 AND 12 (d) 1/2	B1 B1 B1 B1 B2 B1 7	ISW. FT for their completed table in (b) and (c) ISW ISW B1 for each answer. Accept double 1 AND double 6 ISW
2.(a)(i) 076 (°) (ii) 256 (°) (b) 360 – (50 ± 2°) 310(°)	B2 B1 M1 A1 5	± 2°. Award B1 if 0 omitted FT 180 + their (i). Accept if re-measured ± 2°. ± 2°
3.(a) Completely accurate (through the centre, 30° ± 2°) with <u>lines</u> towards circumference (need not touch the circumference) (b) Appropriate arcs (dashes) shown on both lines Intersection arcs shown, using first set of arcs Angle bisector drawn	B3 M1 M1 A1 6	B2 for at least 6 of the sectors accurate ± 2°, towards but not necessarily touching the circumference or shown by dots, OR B1 for sight of (360÷12 =) 30 ± 2 mm ± 2 mm. FT from their arcs if ± 3 mm. FT from ‘holes’ from where arcs should be. FT if M0, M1 awarded SC1 if steps of process seen but slightly outside tolerance, OR SC1 if assumed lines are equal with 1 set of arcs with bisector shown
4.(a) 2 × (8.5 + 4.6) + 4 × 2.2 (+ 18) and no others = 53 (cm) (b) 2 × l + 2 × w + 4 × h + 18 (and no extras)	M1 A1 B2 4	Or equivalent. Attempt to consider all 6 sides (+ 18) CAO. <i>An answer of 35 implies M1</i> B1 for 1 error or 1 slip in notation. Treat an answer of 1 + w + 4 × h + 18 is 1 error (omit bottom), hence award B1. If B2 penalise extra incorrect working -1
5. (a) A $y = 3a + 3b - b$ $y = 3a + 2b$ B $y = a^2 + (1)a + b$ C $y = 3a + 2b$ D $y = 2ab + 2b + 3a - 2ab$ $y = 3a + 2b$ (b) A, C and D	B1 B1 B1 B1 B2 B1 B1 8	In this question do not ignore further incorrect working, mark final answer FT until second error CAO CAO B1 for each bracket expanded correctly FT from one error in 1 of the 4 terms FT provided at least two of the three are correct
6. Longer diagonal 9.6cm (drawn as a diagonal or in working) Longer diagonal split 3.6cm & 6cm or calculated as 18cm & 30cm Diagonals intersect at right angles Shorter diagonal 5 cm (drawn as a diagonal or in working) Correct scale drawing of the kite	B1 B1 B1 B1 B1 5	Watch for answers in the information table given All measurements ±2 mm or ±2° SC1 for a drawing with sides 9.6cm, 9.6cm, 5cm and 5cm(±2 mm). Candidates awarded this SC1 can also access the B1 for the diagonals <u>shown</u> intersecting at right angles.

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<p>7. Appropriate choice of sketch Axes labelled appropriately Appropriate reason for their choice of sketch</p> <p>Look for</p> <ul style="list-style-type: none"> relevance spelling clarity/flow of text explanations <p>Ignore previous errors in not labelling axes or in their reasoning For QWC2 need at least 1 statement/sentence in both parts of the question, otherwise maximum is QWC1 if the spelling and flow of text is satisfactory QWC2: Candidates will be expected to</p> <ul style="list-style-type: none"> present work clearly, with words explaining choices <p>AND</p> <ul style="list-style-type: none"> make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer <p>QWC1: Candidates will be expected to</p> <ul style="list-style-type: none"> present work clearly, with words explaining choices <p>OR</p> <ul style="list-style-type: none"> make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer 	<p>B1 B1 B1</p> <p><u>x2</u></p> <p>QWC 2</p> <p>8</p>	<p>Minimum is label for axes, not scales, or vv If no scale, the scale must be described in order to get the reason mark. Ignore extra incorrect reasoning, if appropriate reasoning seen <u>NO marks for an inappropriate choice of sketch</u></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>
<p>8.(a) Suitable uniform scales on both axes with vertical to at least 700 & horizontal to at least 10 At least 3 points plotted accurately including times at (1 or 2) and 10 minutes</p> <p>(b)(i) (£)590 Explanation that intermediate points between whole number are invalid, or mentions 'jumps' in the graph or similar</p>	<p>B1 P2</p> <p>B1 E2</p> <p>6</p>	<p>Any break in scale must be indicated, or labelled to the end</p> <p>Maybe implied by a correct straight line through times 1 and 10 P1 for one point correct (maybe 0,500)</p> <p>Not a FT from an incorrect graph E1 if explained using values rather than generalised, OR E1 for correct but includes incorrect element, e.g. mentions rounding up and down, OR E1 for mention of always rounding up, OR E1 for a partial explanation</p>
<p>9. 22600×85 $\times 1000$ 1.9×10^9</p>	<p>M1 A1 B2</p> <p>4</p>	<p>Sight of digits 19(21) implies this M1</p> <p>B1 for $1.92(1) \times 10^9$ or 1 900 000 000 Also FT from M1 A0: e.g. B2 for 1.9×10^6, or B1 for $1.92(1) \times 10^6$ or 1 900 000 OR from their incorrect value 2s.f and standard form, B2 both, B1 for either</p>
<p>10.(a) (i) Mid points 5, 15, 25, 35, 45 $\frac{5 \times 2 + 15 \times 20 + 25 \times 44 + 35 \times 28 + 45 \times 6}{100}$ 26.6</p> <p>(ii) $10\,000 \div 26.6$ Either 375 or 376</p> <p>(b) (i) 486, 518, 548</p> <p>(ii) Explanation including implication of "smoothing out" or reducing impact of large or small numbers</p>	<p>B1 M1 m1 A1 M1 A1 B3</p> <p>E1 10</p>	<p>FT their midpoints, including bounds. Attempts Σfx FT their $\Sigma fx / 100$ Only accept 27 from working. 26 gets A0 FT from (i) Accept rounding up or down on FT FT from their first entry, +32 and +30. B2 for any 2 correct entries, B1 for a correct method towards at least 2 of the entries seen, or B1 for 1 correct entry, or B1 for sight of 4860, 5180 and 5480 Do not accept 'estimates number of books', nor 'rough average'</p>

Applications of Mathematics Unit 1 June 2011 Higher Tier		Comments Post conference version																												
11.(a) 28, 68, 80 (b) Correct cumulative frequency diagram, points plotted at bounds and joined by a curve or straight line (c) Median (approx. 62.5 (mm)) Intention to subtract readings from horizontal axis for vertical 60 & 20 (approx. 66 – approx. 57.5) Interquartile range (approx 8.5(mm)) (d) <u>General idea</u> of what box – whisker should be Range ends correctly indicated (46.5 and 74.5) Median line correctly indicated (approx 62.5) UQ and LQ correctly indicated (approx 66 and 57.5)	B1 B2 B1 M1 A1 S1 B1 B1 B1 B1 10	FT only if cumulative in (a) B1 for points correct but not joined, OR B1 correct apart from 0.5 translation, OR B1 if one error in plotting but joined correctly FT from their cumulative entries. Not cumulative means no FT Needs to show a box and whiskers FT their median FT their UQ and LQ readings																												
12.(a) $5 \times 12 + 4$ $\begin{array}{ccc} & & 12 \times 14 + 3 \\ 64 & \text{and} & 171 \\ \text{BMI} = \frac{171 \times 703}{64^2} \\ & = & 29.3(4887\dots) \\ & \text{Overweight} & \end{array}$ (b) Sight of $14s + p$ or equivalent Sight of $12f + i$ or equivalent (BMI =) $\frac{703(14s + p)}{(12f + i)^2}$	M1 M1 A1 M1 A1 B1 M1 M1 A2 10	Both correct, maybe implied in later working FT their 64 and 171 provided M1 award Accept 29 from correct working FT interpretation of their BMI provided at least M2 awarded previously Mark final answer A1 if correct formula seen before incorrect simplification, or A1 if 1 error in notation, or A1 for either numerator or denominator correct SC1 for $\frac{703(12s + p)}{(14f + i)^2}$																												
13. (a) Entries in frequency table: 30 and 27 Histogram: 0 to 3 f.d. 8 , 9 to 15 f.d. 5 (b) Identifying that the answer is in the range >6 and <9 Realising need $\frac{1}{2}$ of the entry for $6 < t \leq 9$ ($x =$) 7.5 (hours) or equivalent	B2 B2 M1 M1 A1 7	B1 for each correct entry B1 for each correct bar Maybe shown on the histogram Maybe shown on the histogram																												
14. (a) Height of tide 12(m) 2 of the 3 answers to $\frac{1}{12}$, $\frac{1}{6}$ & $\frac{1}{4}$ of 12 (1, 2 & 3) Graph paper axes showing upto 15(m) and 24(hrs) Suitable labels for the axes Heights of tides correct for at least 12 hours Plots correct for the 24 hour period (joined or not) (b) Method, e.g. use of graph or linear between 4 and 5 hours An answer that rounds to 13 (m) (c) 12 hours Explanation, e.g. complete cycle	S1 B1 S1 S1 B1 B1 M1 A1 B1 E1 10	<table border="1"> <tr> <td>Hr</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td> </tr> <tr> <td>Ht</td><td>3</td><td>4</td><td>6</td><td>9</td><td>12</td><td>14</td><td>15</td><td>14</td><td>12</td><td>9</td><td>6</td><td>4</td><td>3</td> </tr> </table> Or 12(m) between highest and lowest plots Or of 15 (1.25, 2.5 and 3.75) Units maybe omitted <u>No further marks if not using the 3m low tide start or not using 12m tide</u> Shown in working or on the graph FT for M1 only if at least 3 marks awarded in (a) CAO. If units are given they must be correct Hours must be stated. An answer of 12 gets B0 SC1 for 'tide goes in and out twice in 24 hours'	Hr	0	1	2	3	4	5	6	7	8	9	10	11	12	Ht	3	4	6	9	12	14	15	14	12	9	6	4	3
Hr	0	1	2	3	4	5	6	7	8	9	10	11	12																	
Ht	3	4	6	9	12	14	15	14	12	9	6	4	3																	



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