

Mark Scheme (Results)

Summer 2013

GCSE Mathematics Linked Pair Pilot
Application of Mathematics (2AM01)
Higher (Calculator) Paper 2H

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NOTES ON MARKING PRINCIPLES

- 1 All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- 2 Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- 3 All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- 4 Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- 5 Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.
- 6 Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:
 - i) *ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear*
Comprehension and meaning is clear by using correct notation and labeling conventions.
 - ii) *select and use a form and style of writing appropriate to purpose and to complex subject matter*
Reasoning, explanation or argument is correct and appropriately structured to convey mathematical reasoning.
 - iii) *organise information clearly and coherently, using specialist vocabulary when appropriate.*
The mathematical methods and processes used are coherently and clearly organised and the appropriate mathematical vocabulary used.

7 With working

If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.

If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.

If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks. Send the response to review, and discuss each of these situations with your Team Leader.

If there is no answer on the answer line then check the working for an obvious answer.

Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks. Discuss each of these situations with your Team Leader.

If there is a choice of methods shown, then no marks should be awarded, unless the answer on the answer line makes clear the method that has been used.

8 Follow through marks

Follow through marks which involve a single stage calculation can be awarded without working since you can check the answer yourself, but if ambiguous do not award.

Follow through marks which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.

9 Ignoring subsequent work

It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: e.g. incorrect canceling of a fraction that would otherwise be correct

It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect e.g. algebra.

Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

10 Probability

Probability answers must be given a fractions, percentages or decimals. If a candidate gives a decimal equivalent to a probability, this should be written to at least 2 decimal places (unless tenths).

Incorrect notation should lose the accuracy marks, but be awarded any implied method marks.

If a probability answer is given on the answer line using both incorrect and correct notation, award the marks.

If a probability fraction is given then cancelled incorrectly, ignore the incorrectly cancelled answer.

11 Linear equations

Full marks can be gained if the solution alone is given on the answer line, or otherwise unambiguously indicated in working (without contradiction elsewhere). Where the correct solution only is shown substituted, but not identified as the solution, the accuracy mark is lost but any method marks can be awarded.

12 Parts of questions

Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.

13 Range of answers

Unless otherwise stated, when an answer is given as a range (e.g 3.5 – 4.2) then this is inclusive of the end points (e.g 3.5, 4.2) and includes all numbers within the range (e.g 4, 4.1)

Guidance on the use of codes within this mark scheme

M1 – method mark
A1 – accuracy mark
B1 – Working mark
C1 – communication mark
QWC – quality of written communication
oe – or equivalent
cao – correct answer only
ft – follow through
sc – special case
dep – dependent (on a previous mark or conclusion)
indep – independent
isw – ignore subsequent working

PAPER: 5AM2H_01

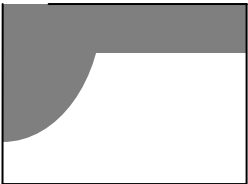
Question		Working	Answer	Mark	Notes
1	(a)		2pm	1	B1 for 2 (pm) (accept 2 o'clock in the afternoon or 14 00 but not 2 am or 0200)
	(b)		Graph completed	2	B1 for line from (2 pm, 2.5) to (3pm, 2.5) B1 for line from (t, 2.5) to (t + 45mins, 0)
	(c)		5	1	B1 for 5 or ft from graph in part (b)
*2			Not enough butter, enough sugar and enough flour	5	<p>M1 for a correct method to find the total number of cookies required (= 50) M1 (dep) for "50" ÷ 20 (= 2.5) M1 (dep on M2) for 2.5 used as a factor A1 for two of: 562.5, 300, 687.5 or two of: 2.22..., 2.5, 3.636... or two of: 200, 120, 400 C1 (dep on M2) for 562.5g and 300g and 687.5g or for 2.22... and 2.5 and 3.636... or for 200g and 120g and 400g AND a correct decision for all three ingredients OR M1 for a correct method to find the total number of cookies required (= 50) M1 for a correct method to find the number of cookies one ingredient could produce M1 for correct method to find the number of cookies that ALL ingredients could produce A1 for two of: 44. ..., 50 and 72. ... C1 (dep on at least M2) for 44. .. cookies and 50 cookies and 72. ... cookies AND a correct decision for all three ingredients</p>

PAPER: 5AM2H_01

Question		Working	Answer	Mark	Notes
3			4100/30 000 or Chloe The larger the sample the better the estimate	2	B1 for identifying the trial that gives the best estimate, e.g. 4100/30 000 or Chloe B1 for the larger the sample the better the estimate oe
4	(a)		Diagram	2	M1 for pentagon with at least two sides correct A1 cao
	(b)	$6 \times 2 = 12$ $4 \times 2 + 0.5 \times 4 \times 1 = 10$ $12 + 12 + 10 + 10 = 44$ $44 \div 8 = 5.5$	42.98	6	M1 for a correct method to find the area of either a side (= 12) or an end (= 10) M1 for a correct method to find both the area of a side (= 12) and the area of an end (= 10) A1 for 44 or '12' and '12' and '10' and '10' M1 for an area $\div 8$ or for a correct method to work out how many m ² can be painted from each tin M1 (dep on previous M1) for a correct method to find a cost of paint required for their number of litres to cover a total area of 4 faces A1 cao
5			40, 60, 100	3	M1 for $200 \div (2 + 3 + 5)$ M1 (dep) for $2 \times "20"$ or $3 \times "20"$ or $5 \times "20"$ A1 for 40, 60, 100 in any order

PAPER: 5AM2H_01					
Question	Working	Answer	Mark	Notes	
*6		She cannot buy enough sand to fill the sandpit	5	<p>M1 for a correct method to find the volume of the sandpit (= 192000) M1 (dep) for "192000" ÷ 10000 (= 19.2) M1 (dep on previous M1) for their number of bags × 2.99 A1 for 59.8(0) (20 bags) or 57.40(8) or 57.41 (19.2 bags) C1 (dep on at least M2) for comparing cost of sand needed (with units) with £50 SC: B1 for correct value(s) with units and correct statement if M0 scored</p> <p>OR</p> <p>M1 for a correct method to find the volume of the sandpit (= 192000) M1 for 50 ÷ 2.99 (= 16.722...) M1 (dep on previous M1) for "16" × 10000 A1 for 160000 (cm³) C1 (dep on at least M2) for comparing volume of sand needed (with units) with volume that can be bought for £50 SC: B1 for correct value(s) with units and correct statement if M0 scored</p>	
7	(a)	$21 \times 90 = 1890$ $\sqrt{1890}$	43	2	<p>M1 for $\sqrt{21 \times 90}$ or 1890 seen A1 for an answer in the range 43 – 43.5</p>
	(b)	$50 = \sqrt{21 \times d}$ $2500 = 21d$ $d = 2500 \div 21$	119	3	<p>M1 for $50 = \sqrt{21 \times d}$ oe or 50^2 M1 for $21d = 50^2$ oe A1 for an answer in the range 119 – 119.05</p>

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Question		Working	Answer	Mark	Notes
8		B1 for arc of radius 3 cm (± 0.2)	Correct region 	4	B4 fully correct [B3 for fully correct shading of the area where people can leave boats] OR B1 for arc of radius 3 cm (± 0.2 cm) centre A B1 for a straight line parallel to ED and 1 cm (± 0.2 cm) from it B1 shading inside their arc or for shading above their line, provided that their line is drawn parallel to ED B1 fully correct Ignore any drawing outside the harbour
9	(a)	$\pi \times 50 \div 2 = 78.5398$ $50 + 50 + 80 + 55 + 55 + 78.5$	368.5	4	M1 for $\pi \times 50 \div 2$ oe M1 for $50 + 50 + 80 + 55 + 55$ oe (= 290) M1 for $50 + 50 + 80 + 55 + 55 + (50\pi$ or $25\pi)$ oe A1 for $368.5 - 369$
	(b)	$\pi \times 25^2 \div 2 = 981.747$ $55 \times 50 = 2750$ $2750 + 981.747$	3731	3	M1 for $\pi \times 25^2 \div 2$ or $\pi \times 25^2$ oe M1 for 50×55 oe A1 for $3731 - 3732$
10	(a)		0.1 on 1 st branch 0.15 on 2 nd branch	2	B1 for 0.1 on 1 st branch B1 for 0.15 on 2 nd branch
	(b)		7344	4	M3 for $0.9 \times 0.85 \times 9600$ (M2 for $0.9 \times 0.85 = 0.765$ or $0.9 \times 9600 = 8640$ or $0.85 \times 9600 = 8160$ M1 for 0.9×0.85 or 0.9×9600 or 0.85×9600) A1 cao

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Question		Working	Answer	Mark	Notes
11	(a)	$0.5 \times x \times 2x \times (x + 5) = 100$ $= x^2 \times (x + 5) = 100$	Proof shown	2	M1 for $0.5 \times x \times 2x \times (x + 5) (= 100)$ A1 fully correct, must include both $x^2 \times (x + 5) (= 100)$ and $x^3 + 5x^2 = 100$
	(b)	3 - 72 4 - 144 3.1 - 77.(841) 3.2 - 83.(96) 3.3 - 90.(387) 3.4 - 97.(104) 3.5 - 104.(125) 3.6 - 111.(456) 3.45 - 100.5(76125) 3.44 - 99.8(755) 3.43 - 99.0(78)	3.4	5	M1 any trial for positive x substituted into $x^3 + 5x^2$ B2 for trial $3.4 \leq x \leq 3.5$ (B1 for trial $3 \leq x \leq 4$) B1 for different trial $3.4 < x \leq 3.45$ B1 (dep on at least one previous B1) for 3.4 All trials must be evaluated correctly to at least the nearest whole number (rounded or truncated) for values of x correct to 1 dp and to at least 1 dp (rounded or truncated) for values of x correct to 2 dp
12			21.2	4	M1 for using Pythagoras with a right-angled triangle M1 for $16^2 - 12^2$ oe M1 for $\sqrt{16^2 - 12^2}$ oe A1 for 21.1 - 21.2 OR M1 for correct trig statement to find an angle M1 for another correct trig statement to find $AC/2$ M1 for a complete correct method to find AC A1 for 21.1 - 21.2

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Question	Working	Answer	Mark	Notes																														
13		75.9	5	M1 for correct statement to find <i>AT</i> or <i>BT</i> using 95 with an appropriate trig ratio A1 for $AT = 79.7$ or $BT = 124$ M1 (dep on M1) for correct trig statement involving <i>BC</i> and ' <i>AT</i> ' or <i>BC</i> and ' <i>BT</i> ' or <i>AC</i> and ' <i>AT</i> ' M1 (dep on M2) for complete correct method A1 for 75.9 – 75.95																														
14	$x + 4x > 2(x + 48)$ $5x > 2x + 96$ $3x > 96$ $x > 32$ <p>OR</p> <table border="1" data-bbox="443 975 824 1203"> <thead> <tr> <th>S</th> <th>N</th> <th>C</th> <th>S+C</th> <th>2N</th> </tr> </thead> <tbody> <tr> <td>10</td> <td>58</td> <td>40</td> <td>50</td> <td>116</td> </tr> <tr> <td>20</td> <td>68</td> <td>80</td> <td>100</td> <td>136</td> </tr> <tr> <td>30</td> <td>78</td> <td>120</td> <td>140</td> <td>156</td> </tr> <tr> <td>32</td> <td>80</td> <td>128</td> <td>160</td> <td>160</td> </tr> <tr> <td>33</td> <td>81</td> <td>132</td> <td>165</td> <td>162</td> </tr> </tbody> </table>	S	N	C	S+C	2N	10	58	40	50	116	20	68	80	100	136	30	78	120	140	156	32	80	128	160	160	33	81	132	165	162	33	5	B1 for $x + 48$ (or $2x + 96$ oe) and $4x$ M1 for $x + 4x > 2(x + 48)$ oe M1 for subtracting $2x$ from both sides A1 for $3x > 96$ oe A1 cao for 33 <p>OR Trial and Improvement</p> B1 for 1 correct trial of S, N and C M1 for an improved correct trial of S, N and C M1 for a correct trial of 32 M1 for a correct trial of 33 A1 (dep on M2) for 33 cao <p>NB: Accept other letters instead of x NB: an answer of 32 without working scores 0 marks</p>
S	N	C	S+C	2N																														
10	58	40	50	116																														
20	68	80	100	136																														
30	78	120	140	156																														
32	80	128	160	160																														
33	81	132	165	162																														

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Question	Working	Answer	Mark	Notes
15	(a)	5.4	2	M1 for '10.4' – '5' with at least one correct A1 for 5.4
	(b)(i)	5	3	B1 cao
	(ii)	1.2		M1 for $\frac{6}{5}$ oe (any pair of values which differ by 1 week) or substitution of a correct pair of values in $A = '5'a'$ A1 for 1.15 – 1.25
	(c)	6.7	3	M1 for $0.5 = r^{10}$ M1 for $r = \sqrt[10]{0.5}$, can be implied by 0.933(03299) seen A1 for 6.69 – 6.7 OR M1 for $0.5 = 1 \times \left(\frac{100-x}{100}\right)^{10}$ M1 for $\sqrt[10]{0.5} = \frac{100-x}{100}$ A1 for 6.69 – 6.7

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Question		Working	Answer	Mark	Notes
16	(a)	$d = k\sqrt{h}$ $22 = k\sqrt{38}$ $k = 22 \div \sqrt{38} = 3.5688\dots$ $3.5688\dots \times \sqrt{25} =$	17.8	3	M1 for $d = k\sqrt{h}$ oe M1 for $k = 22 \div \sqrt{38}$ oe A1 for 17.8 – 17.88
	(b)		C	1	B1 cao
*17		$2465 \div 88.5 = 27.853107$ $27.74011299 \div 1000 \times 3600$ $= 100.2711864$	Yes, average speed could have been as high as 100.27	4	B1 for 88.5 or 2465 seen M1 for upper bound of $2460 \div$ lower bound of 89 M1 for “speed” $\div 1000$ and $\times 3600$ oe C1 for Yes and 100.2(711864) or 100.3
18	(a)		1.5	3	B1 for tangent drawn at $t = 8$ M1 for height \div base for a triangle with the tangent as hypotenuse A1 for 1.25 to 1.75
	(b)		156	3	M1 for attempting to find area under curve M1 for correct method to find the area under the curve between $t = 0$ and $t = 6$ (at least 3 areas) A1 for 150 – 160

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Question	Working	Answer	Mark	Notes
19		3375	3	M1 for $18 \div 12 (= 1.5)$ OR volume scale factor eg 2^3 3^3 eg $3^3 : 2^3$ eg 1.5^3 M1 for $1000 \times "1.5"^{33}$ A1 cao
*20	$\frac{3}{5} \times \frac{1}{5} + \frac{1}{5} \times \frac{2}{5} + \frac{1}{5} \times \frac{2}{5} = \frac{7}{25} \text{ oe}$ $\frac{7}{25} \times \text{£}1 = 28\text{p}$ $40\text{p} > 28\text{p}$ OR e.g. 200 games $200 \times 40\text{p} = \text{£}80$ $"\frac{7}{25}" \times 200 \times \text{£}1 = \text{£}56$ $\text{£}80 > \text{£}56$	Yes, with justification	5	M1 or $\frac{3}{5} \times \frac{1}{5}$ or $\frac{1}{5} \times \frac{2}{5}$ or $\frac{1}{5} \times \frac{2}{5}$ M1(dep) for $\frac{3}{5} \times \frac{1}{5} + \frac{1}{5} \times \frac{2}{5} + \frac{1}{5} \times \frac{2}{5}$ A1 for $\frac{7}{25}$ oe M1 for $"\frac{7}{25}" \times \text{£}1$ OR $"\frac{7}{25}" \times n \times \text{£}1$ and $n \times 40\text{p}$ C1 f.t. (dep on M3) for correct conclusion with fully correct justification based on expected profit per game or expected profit for a particular number of games

Modifications to the mark scheme for Modified Large Print (MLP) papers.

Only mark scheme amendments are shown where the enlargement or modification of the paper requires a change in the mark scheme.

The following tolerances should be accepted on marking MLP papers, unless otherwise stated below:

Angles: $\pm 5^\circ$

Measurements of length: ± 5 mm

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Question		Modification	Notes
Q01		x axis: 1.5 cm for 15 mins. y -axis: 1.5 cm for $\frac{1}{2}$ km.	Standard mark scheme.
Q04	(a)	Model of shed given as well as diagram. Part (a) four shapes given, drawn accurately. Correct answer is B. Look at the diagram for Question 4(a). There are four shapes. Which of the four shapes, A, B, C or D, shows the front elevation of the shed from direction F? (2 marks) Shape _____	Standard mark scheme.
Q04	(b)	Diagram given showing one end and one side of the shed.	Standard mark scheme.

PAPER: 5AM2H_01		
Question	Modification	Notes
Q6	Model and diagram provided.	
Q8	Diagram size x2 exactly. Scale kept the same but 30 m and 10 m changed to 60m and 20 m.	Allow 0.5 cm tolerance on lines and arcs rather than 0.2 cm tolerance in the scheme.
Q10	(a) Decision tree diagram enlarged. Wording added: "There are two spaces to fill."	Standard mark scheme.
Q11	Model and diagram provided. x changed to y throughout.	Standard mark scheme.
Q12	A label 'horizontal ground' is inserted.	Standard mark scheme.
Q18	grid. x-axis: 1.5 cm for $\frac{1}{2}$; y-axis: 1.5 cm for 5	Standard mark scheme.

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