

Mark Scheme (Results)

Summer 2012

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If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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

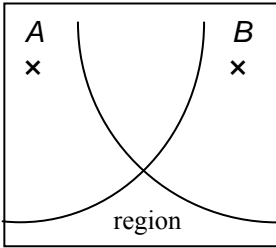
Guidance on the use of codes within this mark scheme

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

5AM2H_01					
Question		Working	Answer	Mark	Notes
1	(a)	$2.85 \div 3 = 0.95$ $4.80 - (0.95 \times 2)$	2.90	3	M1 for $2.85 \div 3$ or $285 \div 3$ or sight of 0.95 or 95 M1 for $4.80 - ('0.95' \times 2)$ oe A1 for 2.90 accept 2.9
	(b)	$480 \div (5 + 3) = 60$ 3×60 5×60	3.00 1.80	3	M1 for $4.8 \div (5 + 3)$ or 60 seen or at least three multiples of 5:3 M1 for ' $60' \times 3$ or ' $60' \times 5$ A1 for 3.00 and 1.80 accept 3 and 3.0 and 1.8
*2		$13.3^2 \div (2 \times 3.86) = 22.9\dots\dots$ OR $\sqrt{(2 \times 3.86 \times 25)} = 13.89\dots\dots$	yes with reason	3	M1 for $13.3^2 \div (2 \times 3.86)$ A1 for 22.9... C1 (dep on M1) for correct decision based on their figures and comparison with 25, eg yes and ' $22.9' < 25$ oe OR M1 for $\sqrt{(2 \times 3.86 \times 25)}$ A1 for 13.8 – 13.9 C1 (dep on M1) for correct decision based on their figures and comparison with 13.3, eg yes and ' $13.8(9)' > 13.3$ oe

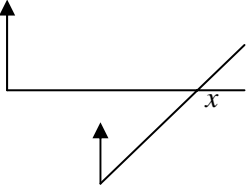
5AM2H_01				
Question	Working	Answer	Mark	Notes
3	$250 \div (2.35 + 0.1) = 102.04\dots$ $102 \times (2.35 + 0.1) = 249.9$ $249.9 + 0.1 = 250$ OR $250 - 0.1 = 249.9$ $249.9 \div (2.35 + 0.1) = 102$ OR $(2.35 + 0.1) \times 100 = 245$ $245 + 2.45 = 247.45$ $247.45 + 2.45 = 249.9$ $249.9 + 0.1 = 250$ OR $0.1n + 2.35(n - 1) = 250$ $2.45n = 252.35$ $252.35 \div 2.45$	103	3	<p>M1 for $250 - 0.1$ or $2.35 + 0.1$ or 2.45 seen or $250 \div (\text{a combination of fences and posts})$ M1 for $250 \div (2.35 + 0.1)$ or $(250 - 0.1) \div (2.35 + 0.1)$ or 102 seen A1 cao</p> <p>OR (build-up method) M2 for a combination of at least 100 fences and at least 100 posts, eg $(2.35 + 0.1) \times 100 (=245)$ (M1 for a combination of at least 10 fences and at least 10 posts) A1 cao</p> <p>OR (algebraic method) M1 for $0.1n$ or $2.35(n - 1)$ M1 for $0.1n + 2.35(n - 1) = 250$ A1 cao</p>

5AM2H_01					
Question		Working	Answer	Mark	Notes
4		$2 \times (40 \times 30) + 2 \times (30 \times 20)$ $+ 2 \times (40 \times 20) = 5200$ $5200 \times 3 = 15\,600$	yes with reason	4	M1 for an attempt to add the areas of 5 or 6 correct faces M1 for $3 \times$ 'surface area' or $20\,000 \div$ 'surface area' A1 for 15 600 or 3.8 or better C1 (dep on M1) for correct decision based on their figures and a comparison with 20 000, eg yes and '15 600' < 20 000 or can paint more than '3' blocks oe
5	(a)		1,5 1,6 1,7 1,8 2,5 2,6 2,7 2,8 3,5 3,6 3,7, 3,8 4,5 4,6 4,7 4,8	2	B2 for all 16 combinations (accept 1,5 etc, ignore repeats) (B1 for at least 4 correct combinations)
	(b)	$P(\text{Jean wins}) = \frac{6}{16}$ $\frac{6}{16} \times 80$	30	3	B1 for $\frac{6}{16}$ oe M1 for $\frac{6}{16} \times 80$ A1 cao SC B2 for $\frac{30}{80}$

5AM2H_01				
Question	Working	Answer	Mark	Notes
*7			3	<p>M1 for an arc drawn, centre A or B, radius 5 cm M1 for two intersecting correct arcs drawn A1 for identifying the correct region</p> <p>SC B2 for two hand drawn arcs within tolerance and region identified SC B1 for two hand drawn arcs within tolerance only</p>
8	<p>(a) length of net = $18 + 7 + 18 + 7 = 50$ $100 \div 50 = 2$ $100 \div 32 = 3.125$ 2×3</p> <p>OR $10000 \div (50 \times 30) = 6.25$</p> <p>(b) layer = $(18 \div 2) \times (18 \div 2) = 81$ 3 layers = 81×3</p> <p>OR $(18 \times 18 \times 6) \div (2 \times 2 \times 2)$ = $1944 \div 8$</p>	<p>6</p> <p>243</p>	<p>3</p> <p>3</p>	<p>M1 for $32 - 2 \times 7$ or 18 or 50 seen M1 for $100 \div '18+7+18+7'$ oe and $100 \div 32$ oe (=3.125) or $10000 \div ('18+7+18+7' \times 32)$ oe or 6.25 seen A1 cao SC B1 for drawing of 2 or more connecting nets or rectangles with width 32cm if M0 scored</p> <p>M1 for $18 \div 2$ or 9 seen or $7 \div 2$ or 3.5 or 3 seen M1 for $('9' \times '9') \times 3$ or $('9' \times '9') \times 3.5$ A1 cao</p> <p>OR M1 for $18 \times 18 \times 6$ (=1944) or $18 \times 18 \times 7$ (=2268) or $2 \times 2 \times 2$ (=8) M1 for $(18 \times 18 \times 6) \div (2 \times 2 \times 2)$ or $(18 \times 18 \times 7) \div (2 \times 2 \times 2)$ A1 cao</p>

5AM2H_01					
Question		Working	Answer	Mark	Notes
9	(a)	$A = x + 5$	$2x + 5 < 50$	2	M1 for $x + x + 5$ or $x + 5 < 50$ A1 for $x + x + 5 < 50$ or better
	(b)	$2x < 50 - 5$ $x < 22.5$	22	3	M1 for an attempt to isolate x , or a term in x , on one side of 'equation' or 'inequality', eg $2x+5-5=50-5$ M1 for $x < 22.5$ oe A1 cao SC B2 for 44 from $x + 5 < 50$ in (a)
10	(a)	$1 - \frac{1}{250}$ OR $1 - 0.004$	0.996	3	M1 for $1 - \frac{1}{250}$ or $\frac{250-1}{250}$ M1 for $249 \div 250$ or $\frac{249}{250}$ seen A1 cao OR M1 for $\frac{1}{250}$ or $1 \div 250$ or 0.004 seen M1 for $1 - '1 \div 250'$ A1 cao
	(b)	0.06×250 OR $0.06 \div 0.004$	15	2	M1 for 0.06×250 oe or $0.06 \div '0.004'$ A1 cao SC B1 for $\frac{15}{250}$

5AM2H_01

Question	Working	Answer	Mark	Notes
11	(a) 360 – 40 (b) (c) $\pi \times 8^2$ (d) $\tan^{-1}(2.5 \div 1.6) = 57.38..$ OR $\tan^{-1}(1.6 \div 2.5) = 32.61$ OR (cosine formula) $\cos^{-1}[(2.5^2 + h^2 - 1.6^2) \div (2 \times 2.5 \times h)]$ where $h^2 = 2.5^2 + 1.6^2$ OR (sine ratio) $\sin^{-1}(1.6 \div h)$ where $h^2 = 2.5^2 + 1.6^2$ $h = 2.96(8...)$	320  201 237	1 2 2 4	B1 for an answer in range 318 to 322 M1 for an angle of 40° from radio mast A1 for position of x , east of Gill's house M1 for $\pi \times 8^2$ A1 for an answer in the range 199 to 202 M1 for $(\tan =) 2.5 \div 1.6 (=1.5625)$ M1 (dep) for $\tan^{-1}(2.5 \div 1.6)$ A1 for 57° or better A1 for 237 or ft 180 + '57' OR M1 for $(\tan =) 1.6 \div 2.5 (=0.64)$ M1 (dep) for $\tan^{-1}(1.6 \div 2.5)$ A1 for 33° or better A1 for 237 or ft 270 – '33' OR M1 for $(\cos =) [(2.5^2 + h^2 - 1.6^2) \div (2 \times 2.5 \times h)]$ M1 (dep) for $\cos^{-1} [(2.5^2 + h^2 - 1.6^2) \div (2 \times 2.5 \times h)]$ where $h = \sqrt{2.5^2 + 1.6^2}$ A1 for 57° or better A1 for 237 or ft 180 + '57' OR M1 for $(\cos =) (1.6 \div h)$ M1 (dep) for $\cos^{-1}(1.6 \div h)$ where $h = \sqrt{2.5^2 + 1.6^2}$ A1 for 57° or better A1 for 237 or ft 180 + '57'

5AM2H_01					
Question		Working	Answer	Mark	Notes
12	(a)		0.95 0.98 0.05 0.95	2	M1 for $1 - 0.02 (= 0.98 \text{ oe})$ or $1 - 0.05 (= 0.95)$ A1 for all 4 correct probabilities shown
	*(b)	$0.98 \times 0.95 = 0.931$	Icetown	3	M1 for '0.98' \times '0.95' A1 for 0.931 C1 (dep on M1) for correct comparison, selecting their greater probability of no faults and naming company
13		$4 - 1.8$ OR $5t^2 - 29t + 36 = 0$ $(5t - 9)(t - 4) = 0$ $4 - 1.8$	2.2	3	M1 for $h = 36$ line drawn or point(s) marked on graph or 1.8 or 4 seen M1 for the difference of two values of t for their $h = 36$ A1 for $2 - 2.4$ OR M1 for $36 = 5t^2 - 29t + 36$ M1 for '4' - '1.8' A1 cao
14	(a)	$\pi \times 180^2 \times 140 \div 1000$	14 250	3	M1 for $\pi \times 180^2 \times 140$ M1 for $\pi \times 'r'^2 \times 140 \div 1000 \text{ oe}$ A1 for 14 243 - 14 253
	(b)	$350 + 0.58 \times 1000$	930	2	M1 for 0.58×1000 or 580 A1 cao
15		$\sqrt{(302 + 402 + 1202)}$	130	4	M2 for $302 + 402 + 1202$ or 16 900 seen (M1 for $302 + 402 (=2500)$ or $1202 + 402 (=16\ 000)$ or $302 + 1202 (=15\ 300)$) M1 for $\sqrt{(302 + 402 + 1202)}$ A1 cao

5AM2H_01				
Question	Working	Answer	Mark	Notes
16	(a)	2500	1	B1 for 2400 – 2600
	(b)	2	1	B1 cao
	(c)	eg ($k=$) 8000, ($a=$) $\sqrt{2}$	4	M1 for substituting a value of g and a corresponding value of t M1 for substituting a different value of g and t M1 (dep on M2) for correct attempt to solve the equations to find a value for a A1 for 8000 and $\sqrt{2}$ (=1.4...or better) or ft their values of t and g , eg for (1, 5500) and (2, 4000), $k = 7562.5$ and $a = 1.375$

eg
 $8000 = k \times 1$
 $4000 = 8000 \times a^{-2}$
 $\frac{1}{2} = 2^{-1} = a^{-2}$

OR
 $5500 = k \times a^{-1}$
 $4000 = k \times a^{-2}$
 (dividing equations)
 $1.375 = a$
 so, $5500 = k \times (1.375)^{-1}$
 $k = 7562.5$

Common substitutions for (t, g):
 (0, 7800–8000)
 (1, 5400–5600)
 (2, 3800–4000)
 (3, 2800–3000)
 (4, 1800–2000)

5AM2H_01

Question	Working	Answer	Mark	Notes
17	$1 - \frac{7}{16} \times \frac{6}{15} - \frac{5}{16} \times \frac{4}{15} - \frac{4}{16} \times \frac{3}{15}$ $= 1 - \frac{74}{240}$ <p>OR</p> $\frac{7}{16} \times \frac{5}{15} + \frac{7}{16} \times \frac{4}{15} + \frac{5}{16} \times \frac{7}{15}$ $+ \frac{5}{16} \times \frac{4}{15} + \frac{4}{16} \times \frac{7}{15} + \frac{4}{16} \times \frac{5}{15}$ $= \frac{35+28+35+20+28+20}{240}$	$\frac{83}{120}$ <p style="text-align: center;">—</p>	5	<p>M1 for use of 15 as denominator for 2nd probability</p> <p>M1 for $\frac{7}{16} \times \frac{6}{15}$ or $\frac{5}{16} \times \frac{4}{15}$ or $\frac{4}{16} \times \frac{3}{15}$</p> <p>M1 for $\frac{7}{16} \times \frac{6}{15} + \frac{5}{16} \times \frac{4}{15} + \frac{4}{16} \times \frac{3}{15}$</p> <p>M1 for $1 - \frac{74}{240}$</p> <p>A1 for $\frac{166}{240}$ or 0.69... oe</p> <p>OR</p> <p>M1 for use of 15 as denominator for 2nd probability</p> <p>M1 for $\frac{7}{16} \times \frac{5}{15}$ or $\frac{7}{16} \times \frac{4}{15}$ or $\frac{5}{16} \times \frac{4}{15}$ oe</p> <p>M2 for $\frac{7}{16} \times \frac{5}{15} + \frac{7}{16} \times \frac{4}{15} + \frac{5}{16} \times \frac{7}{15} + \frac{5}{16} \times \frac{4}{15} + \frac{4}{16} \times \frac{7}{15} + \frac{4}{16} \times \frac{5}{15}$</p> <p>(M1 for the sum of at least 3 correct products from no more than 6 products)</p> <p>A1 for $\frac{166}{240}$ or 0.69... oe</p> <p>SC B3 for $2 \times (\frac{7}{16} \times \frac{7}{16} + \frac{5}{16} \times \frac{5}{16} + \frac{4}{16} \times \frac{4}{16})$ or $\frac{180}{256}$ oe</p> <p>or $1 - (\frac{7}{16} \times \frac{6}{16} + \frac{5}{16} \times \frac{4}{16} + \frac{4}{16} \times \frac{3}{16})$ or $\frac{182}{256}$ oe</p> <p>or $1 - (\frac{7}{16} \times \frac{7}{16} + \frac{5}{16} \times \frac{5}{16} + \frac{4}{16} \times \frac{4}{16})$ or $\frac{166}{256}$ oe</p> <p>B2 for $\frac{7}{16} \times \frac{7}{16} + \frac{5}{16} \times \frac{5}{16} + \frac{4}{16} \times \frac{4}{16}$ or $\frac{90}{256}$ oe</p> <p>or $\frac{7}{16} \times \frac{6}{16} + \frac{5}{16} \times \frac{4}{16} + \frac{4}{16} \times \frac{3}{16})$ or $\frac{74}{256}$ oe</p> <p>B1 for $\frac{7}{16} \times \frac{7}{16}$ or $\frac{5}{16} \times \frac{5}{16}$ or $\frac{4}{16} \times \frac{4}{16}$</p> <p>or $\frac{7}{16} \times \frac{6}{16}$ or $\frac{5}{16} \times \frac{4}{16}$ or $\frac{4}{16} \times \frac{3}{16}$</p>

5AM2H_01					
Question		Working	Answer	Mark	Notes
18	(a)(i)	$3 = k \times \sqrt{2.25}, \quad 3 = k \times 1.5, \quad k = 2$ $T = 2\sqrt{d}$	$T = 2\sqrt{d}$	4	B2 for $T = 2\sqrt{d}$ oe (B1 for $T \propto \sqrt{d}$ or $T = '2'\sqrt{d}$ or $T = k\sqrt{d}$ oe)
	(ii)	$2 \times \sqrt{5.76}$	4.8		M1 for $'2' \times \sqrt{5.76}$ A1 cao
	(b)	$1.2 = 2\sqrt{d}$ $d = (1.2 \div 2)^2$	0.36	2	M1 for $(1.2 \div 'k')^2, k \neq 1$ A1 for 0.36 or ft their k
19	(i)	$h(\text{ub}) = 70.5 \times \tan 37 = 53.1255\dots$ $h(\text{lb}) = 69.5 \times \tan 35 = 48.6644\dots$	(UB =) 53.1 (LB =) 48.7	6	B1 for 69.5 or 70.5 seen or 35 or 37 seen M3 for $h(\text{ub}) = 70.5 \times \tan 37$ and $h(\text{lb}) = 69.5 \times \tan 35$ (M2 for $h(\text{ub}) = 70.5 \times \tan 37$ or $h(\text{lb}) = 69.5 \times \tan 35$ M1 for $h(\text{ub}) = \text{'ub of 70'} \times \tan(\text{'ub of 36'})$ or $h(\text{lb}) = \text{'lb of 70'} \times \tan(\text{'lb of 36'})$ A1 for 53.1... or better and 48.6... or better
	(ii)		50		A1 (dep on M2) for 50

5AM2H_01					
Question		Working	Answer	Mark	Notes
20	(a)		1.6 – 2.4	3	M1 for tangent drawn at time = 3 M1 (dep) for 'diff y' ÷ 'diff x' A1 for 1.6 – 2.4
	*(b)	<p>Example:</p> $2(0 + 7) \div 2 = 7$ $2(7 + 11) \div 2 = 18$ $2(11 + 12) \div 2 = 23$ $2(12 + 12) \div 2 = 24$ $2(12 + 12) \div 2 = 24$ <p>Total = 96</p> <p>OR</p> <p>Area \approx 50 squares 1 square = $2 \times 1 = 2$ m $50 \times 2 = 100$</p>	<p>96 – 102 plus comparison</p>	3	<p>M1 for division of area into trapezia or counting squares M1 for use of at least one trapezium (oe) to calculate area or totalling all squares and part squares C1 (dep on M1) for answer in range 96 – 102 and positive comment to compare 'area' with 100 (SC B1 for area of 84 if M1 not scored)</p>

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