

# Mark Scheme (Results)

November 2012

GCSE Mathematics Linked Pair Pilot  
Methods in Mathematics (2MM01)  
Higher (Non Calculator) Paper 1H

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If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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

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Question		Working	Answer	Mark	Notes
1	(i)		218.94	3	B1 cao
	(ii)		2.1894		B1 cao
	(iii)		2460		B1 cao
2		$1 - (0.5 + 0.2)$ $0.3 \div 2$	0.15	3	M1 for $1 - (0.5 + 0.2)$ or 0.3 oe seen M1 for $”(1 - (0.5 + 0.2))” \div 2$ A1 for 0.15 oe

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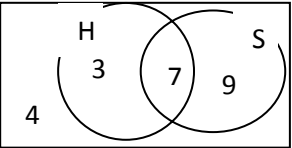
Question	Working	Answer	Mark	Notes
*3	$10 - 4 = 6$ $8 \times 4 = 32$ $(6 \times 3)/2 = 9$ $32 + 9$ $8 - 3 = 5$ $\frac{1}{2} (10 + 4) \times 3 = 21$ $4 \times 5 = 20$ $21 + 20$	41 cm <sup>2</sup>	4	<p>M1 for <math>8 \times 4 (= 32)</math> or <math>(6 \times 3)/2 (= 9)</math>  M1 for <math>8 \times 4 (= 32)</math> and <math>(6 \times 3)/2 (= 9)</math>  A1 for 41  C1 (dep M1) for '41' cm<sup>2</sup></p> <p>OR</p> <p>M1 for <math>4 \times 5 (= 20)</math> or <math>\frac{1}{2} (10 + 4) \times 3 (= 21)</math>  M1 for <math>4 \times 5 (= 20)</math> and <math>\frac{1}{2} (10 + 4) \times 3 (= 21)</math>  A1 for 41  C1 (dep M1) for '41' cm<sup>2</sup></p> <p>OR</p> <p>M1 for <math>10 \times 8 (= 80)</math> or <math>\frac{1}{2} (5 + 8) \times 6 (= 39)</math>  M1 for <math>10 \times 8 (= 80)</math> and <math>\frac{1}{2} (5 + 8) \times 6 (= 39)</math>  A1 for 41  C1 (dep M1) for '41' cm<sup>2</sup></p> <p>OR</p> <p>M1 for <math>4 \times 5 (= 20)</math> or <math>3 \times 4 (= 12)</math> or <math>(6 \times 3)/2 (= 9)</math>  M1 for <math>4 \times 5 (= 20)</math> and <math>3 \times 4 (= 12)</math> and <math>\frac{1}{2} (3 \times 6) (= 9)</math>  A1 for 41  C1 (dep M1) for '41' cm<sup>2</sup></p>

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Question	Working	Answer	Mark	Notes													
4	(a)		27	1	B1 cao												
	(b)		42	1	B1 cao												
	(c)		$5n + 2$	2	B2 for $5n + 2$ (oe, including un-simplified) (B1 for $5n + k$ , $k \neq 2$ or $k$ absent, or $n = 5n + 2$ )												
	(d)	$60 - 2 = 58$ $58 \div 5 = 11.6$ (or 11 r 3)	11	2	M1 for $(60 - 2) \div 5$ ft evidence of using formula from part (c) or repeated addition of 5 (at least 3) or 57 seen A1 for 11 cao												
5			$y = 2x + 3$ drawn	4	<p><b>(Table of values)</b> C1 for axes scaled and labelled M1 for at least 2 correct attempts to find points by substituting values of <math>x</math>. M1 ft for plotting at least 2 of their points (any points plotted from their table must be plotted correctly) A1 for correct line</p> <p><b>(No table of values)</b> C1 for axes scaled and labelled M2 for at least 2 correct points (and no incorrect points) plotted OR line segment of <math>y = 2x + 3</math> drawn (ignore any additional incorrect segments) (M1 for at least 3 correct points with no more than 2 incorrect points) A1 for correct line</p> <p><b>(Use of <math>y = mx + c</math>)</b> C1 for axes scaled and labelled M2 for at least 2 correct points (and no incorrect points) plotted OR line segment of <math>y = 2x + 3</math> drawn (ignore any additional incorrect segments) (M1 for line drawn with gradient of 2 OR line drawn with a <math>y</math> intercept of 3 and a positive gradient) A1 for correct line</p>												
		<table border="1"> <tr> <td><math>x</math></td> <td>-2</td> <td>-1</td> <td>0</td> <td>1</td> <td>2</td> </tr> <tr> <td><math>y</math></td> <td>-1</td> <td>1</td> <td>3</td> <td>5</td> <td>7</td> </tr> </table>	$x$	-2	-1	0	1	2	$y$	-1	1	3	5	7			
$x$	-2	-1	0	1	2												
$y$	-1	1	3	5	7												



5MM1H/01				
Question	Working	Answer	Mark	Notes
6	$\frac{300 \times 20}{0.5} = \frac{6000}{0.5}$	12 000 or 12 800	3	M1 for any two of 300, 20 or 0.5  M1 for $\frac{6000}{0.5}$ or $300 \times 40$ or $600 \times 20$ or $\frac{6400}{0.5}$  or $320 \times 40$ or $640 \times 20$ A1 for 12 000 or 12 800  SC: B2 for answer of 3000 or 3200 Do not accept attempts at full working out
7	(a)	$12w^2$	1	B1 cao
	(b)	$7h + 5r + 5$	2	B2 cao (B1 for $7h$ or $5r$ )
	(c)	$x^2 + 7x - 3x - 21$	2	M1 for 3 out of 4 terms correct including signs, or 4 terms excluding signs A1 for $x^2 + 4x - 21$ cao
8	(a)	Rotation Centre (0,0) 90° clockwise	3	B1 for rotation B1 for 90° clockwise or 270° anti-clockwise B1 for (0,0) or O or origin NB: a combination of transformations gets B0
	(b)	Shape with vertices (-5,5), (-5,2), (-7,2), (-7,3), (-6,3), (-6,5)	2	M1 for reflection in any line parallel to y axis A1 cao
9	(a)	1 - 0.37	1	B1 for 0.63 oe
	(b)	$0.37 \times 500$	2	M1 for $0.37 \times 500$ A1 cao SC B1 for 200

5MM1H/01				
Question	Working	Answer	Mark	Notes
10	(a) $\frac{5}{8} \times \frac{4}{3}$	$\frac{20}{24}$	2	M1 for $\times \frac{4}{3}$ A1 for $\frac{20}{24}$ oe
	(b) $\frac{9}{2} \times \frac{8}{5}$  4.5 × 1.6	$\frac{72}{10}$	3	M1 for $\frac{9}{2}$ or $\frac{8}{5}$ oe  M1 for $\frac{9}{2} \times \frac{8}{5}$  A1 for $\frac{72}{10}$ oe  OR M1 for 4.5 and 1.6 M1 for digits 72 A1 for 7.2 oe
11	HCF: The numbers must be 3n and 3m where n and m are co-prime and at most one is a multiple of 3 LCM: Factors of 36 are 1, 2, 3, 4, 6, 9, 12, 18, 36	9, 12	2	B2 cao (B1 for two numbers with HCF of 3 or LCM of 36)
12	(a)	C	1	B1 cao
	(b)	B and C	1	B1 cao

5MM1H/01				
Question	Working	Answer	Mark	Notes
13	(a)		4	B1 for 4 in correct place B1 for 7 in intersection B1 for 3 in correct place B1 for 9 in correct place
	(b)	$10 + 16 + 4 - 7$	2	M1 for $10 + 16 + 4 - 7$ or $4 + '3' + 7 + '9'$ (ft from 'Venn diagram' or other valid method) A1 for 23 cao
	(c)	$\frac{7}{10}$	2	M1 for $\frac{a}{10}$ , $a < 10$ or $\frac{7}{b}$ , $b > 7$ (ft their diagram) A1 for $\frac{7}{10}$ oe
14	(a)	$\frac{AC}{7.5} = \frac{20}{15}$ $AC = \frac{20 \times 7.5}{15}$	2	M1 for $\frac{20}{15}$ (= 1.33...) or $\frac{15}{20}$ (= 0.75) or $\frac{7.5}{15}$ or $\frac{15}{7.5}$ oe A1 for 10 cao
	(b)	$\frac{DC}{15} = \frac{12}{20}$ OR $\frac{DC}{12} = \frac{7.5}{10}$ $9 + 12$	2	M1 for $(DC =) \frac{15 \times '12}{20'}$ oe or $\frac{12 \times 7.5}{'10'}$ oe or $\frac{12 \div '20}{15'}$ oe ft their values part (a) or 9 seen A1 for 21

5MM1H/01					
Question		Working	Answer	Mark	Notes
15	(a)	$11+3 = 6y + 4y$ $14 = 10y$	1.4	2	M1 for collecting the y terms or the numbers on one side of equation, eg $11 = 6y - 3 + 4y$ or $11 - 4y + 3 = 6y$ $\frac{14}{10}$ A1 for 1.4 or $\frac{14}{10}$ oe
	(b)	$(x-8)(x+5)$  OR $\frac{-(-3) \pm \sqrt{(-3)^2 - 4 \times 1 \times -40}}{2 \times 1}$ $\frac{3 \pm \sqrt{169}}{2} = \frac{3 \pm 13}{2}$	8, -5	3	M2 for $(x-8)(x+5)$ (M1 for $(x \pm 8)(x \pm 5)$ A1 cao 8 and -5  OR M1 for correct substitution in formula of $a = 1, b = \pm 3$ and $c = \pm 40$ $\frac{3 \pm \sqrt{169}}{2}$ M1 for reduction to $\frac{3 \pm \sqrt{169}}{2}$ A1 cao 8 and -5
16	(a)		820 000	1	B1 cao
	(b)		$7.6 \times 10^{-4}$	1	B1 cao
	(c)	$7 \times 8 \times 10^{3+9}$	$5.6 \times 10^{13}$	2	M1 for $56 \times 10^{3+9}$ or $5.6 \times 10^n, n \neq 13$ A1 cao (B1 for 56 000 000 000 000)
17		$6 \times \left(\frac{1}{6}\right)^4$	$\frac{1}{216}$	3	M1 for $\left(\frac{1}{6}\right)^n, n \geq 3$ oe  M1 for or $6 \times$ their $\left(\frac{1}{6}\right)^n, n \geq 3$ or $\left(\frac{1}{6}\right)^3$  A1 for $\frac{6}{1296}$ oe

5MM1H/01				
Question	Working	Answer	Mark	Notes
18	$6 + 3 = n + 5$ OR $64 \times 8 = 32 \times 2^n$	4	2	M1 for $6 + 3 - n = 5$ oe or $(64 \times 8) \div 2^n = 32$ oe or $2^{6+3}$ oe seen A1 cao
19		$3xy(y - 2x^2)$	2	M1 for $3x \times (y^2 - 2x^2y)$ or $3y \times (xy - 2x^3)$ or $xy \times (3y - 6x^2)$ or $3xy \times$ (a 2 term expression in $x$ and $y$ , with just one error) A1 cao
20	(i)	3	1	B1 for 3 or $\pm 3$
	(ii)	$\frac{1}{8}$	1	B1 for $\frac{1}{8}$ or 0.125 oe
	(iii)	125	2	M1 for $25\frac{1}{2}$ or $\sqrt{25}$ or 5 or $25^3$ or $(\sqrt{25})^3$ or $\sqrt{25^3}$ oe A1 for 125 cao

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Question	Working	Answer	Mark	Notes
21	$\frac{8}{20} \times \frac{12}{19} + \frac{12}{20} \times \frac{8}{19}$ <p>OR</p> $1 - \left( \frac{8}{20} \times \frac{7}{19} + \frac{12}{20} \times \frac{11}{19} \right)$  $\frac{8}{20} \times \frac{12}{20} + \frac{12}{20} \times \frac{8}{20} =$ $= \frac{192}{400} (= 0.48)$ <p>OR</p> $1 - \left( \frac{8}{20} \times \frac{7}{20} + \frac{12}{20} \times \frac{11}{20} \right)$ $= \frac{212}{400} (= 0.53)$	$\frac{192}{380}$	4	<p>B1 for <math>\frac{8}{19}</math> or <math>\frac{12}{19}</math></p> <p>M1 for <math>\frac{8}{20} \times \frac{12}{19}</math> or <math>\frac{12}{20} \times \frac{8}{19}</math></p> <p>M1 for <math>\frac{8}{20} \times \frac{12}{19} + \frac{12}{20} \times \frac{8}{19}</math> or <math>2 \times \frac{8}{20} \times \frac{12}{19}</math></p> <p>A1 for <math>\frac{192}{380}</math> oe</p> <p>OR</p> <p>B1 for <math>\frac{7}{19}</math> or <math>\frac{11}{19}</math></p> <p>M1 for <math>\frac{8}{20} \times \frac{7}{19} + \frac{12}{20} \times \frac{11}{19}</math></p> <p>M1 for <math>1 - \frac{188}{380}</math></p> <p>A1 for <math>\frac{192}{380}</math> oe</p> <p><b>With replacement</b></p> <p>M1 for <math>\frac{8}{20} \times \frac{12}{20}</math> or <math>\frac{12}{20} \times \frac{8}{20}</math></p> <p>M1 for <math>\frac{8}{20} \times \frac{12}{20} + \frac{12}{20} \times \frac{8}{20}</math> or <math>2 \times \frac{8}{20} \times \frac{12}{20}</math></p> <p>OR</p> <p>M1 for <math>\frac{8}{20} \times \frac{7}{20} + \frac{12}{20} \times \frac{11}{20}</math></p> <p>M1 for <math>1 - \frac{188}{400}</math></p>

5MM1H/01					
Question	Working	Answer	Mark	Notes	
22		Vertices at (3, 2), (3, 4) and (4, 2)	3	M1 for centre (2, 0) marked M1 for all sides $\times \frac{1}{2}$ A1 cao  SC B2 for correct enlargement from (2, 0), sf $\neq 0.5$ or for correct enlargement from (0, 2), sf = 0.5	
23	(a)	$1 - 0.3$	0.7	1	B1 0.7 oe
	(b)	$0.3 + 0.5$	0.8	1	B1 0.8 oe
	(c)	$0.2 \times 0.4 = 0.08$ $0.08 \neq 0.06$	Not independent with reason	2	M1 for $0.2 \times 0.4 (= 0.08)$ C1 for 0.08 and stating events not independent
*24	$\frac{180 - 72}{2} = 54$ $90 - 54$ OR $360 - 90 - 90 - 72 = 108$ $\frac{180 - 108}{2}$	36	5	M1 for $\frac{180 - 72}{2}$ M1 (dep) for $90 - '54'$ A1 for 36 cao C1 for $OBP$ or $OAP = 90^\circ$ as <u>tangent</u> to circle is <u>perpendicular (oe)</u> to <u>radius</u> C1 for $AP = BP$ as <u>tangents</u> from external <u>point</u> are <u>equal</u> in length or <u>angles</u> in an <u>isosceles</u> triangle are <u>equal</u>  OR M1 for $360 - 90 - 90 - 72$ or $180 - 72 (=108)$ M1 (dep) for $\frac{180 - '108'}{2}$ A1 for 36 cao C1 for $OBP$ or $OAP = 90^\circ$ as <u>tangent</u> to circle is <u>perpendicular (oe)</u> to <u>radius</u> C1 for <u>angles</u> in an <u>isosceles</u> triangle are equal or $AO = BO$ as (both) radii	

5MM1H/01				
Question	Working	Answer	Mark	Notes
25	$\frac{(2x-1)(x-3)}{(x+3)(x-3)}$	$\frac{(2x-1)}{(x+3)}$	3	M1 for $(2x-1)(x-3)$ M1 for $(x+3)(x-3)$ A1 cao
*26	Eg $(2n-1)^2 + (2n+1)^2$ $4n^2 - 4n + 1 + 4n^2 + 4n$ $+ 1$ $8n^2 + 2$ OR $(2n+1)^2 + (2n+3)^2$ $4n^2 + 4n + 1 + 4n^2 + 12n$ $+ 9$ $8n^2 + 16n + 10$ $8(n^2 + 2n) + 10$	Proof	4	B1 for an odd number expressed algebraically, $2n + 1$ M1 for expanding and adding the squares of two consecutive odd numbers at least one expansion correct, eg $4n^2 - 4n + 1$ or $4n^2 + 4n + 1$ A1 for correct simplification, eg $8n^2 + 2$ C1 (dep on M) for correct reasoning for expression not being a multiple of 8





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