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Mark Scheme (Results)

Summer 2014

Pearson Edexcel GCSE
Linked Pair Pilot in Mathematics
Methods in Mathematics (2MM01)
Higher 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If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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

PAPER: 5MM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
1	(a)		270 240	1	B1 cao
	(b)		0.27024	1	B1 cao
	(c)		11.26	2	M1 for 48 ÷ 24 (=2) or 270.24 ÷ 48 or 5.63 or 27024 ÷ 48 × 2 or 563 × 2 or digits 1126 A1 cao
2			4	3	M1 for any fraction equivalent to $\frac{3}{5}$, eg $\frac{9}{15}$ M1 for calculation to work out number of additional counters eg. '15' − 6 − 5 A1 cao **OR** M1 for $\frac{5}{11}$ or 6 : 5 M1 for $\frac{5+n}{11+n}$ or 6 : 5 + *n*, where *n* is a number A1 cao **OR** M1 for $\frac{5+x}{6+5+x}=\frac{3}{5}$ M1 for correct method to solve equation as far as isolating terms in *x* A1 cao **OR** M1 for p(green) = $\frac{2}{5}=\frac{6}{n}$ M1 for (*n* =) 5 × (6 ÷ 2) (=15) A1 cao

PAPER: 5MM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
3		$\frac{300 \times 40}{20}$	600	2	M1 for at least 2 of 300, 40 , 20 seen A1 for 596 – 615
*4			115 cm^2	4	M1 for correct method to find area of one part of shape M1 for a complete method to find area A1 for 115 C1 (dep on M1) for '115' cm^2 with the answer clearly identified
5	(a)	1 − (0.3 + 0.15 + 0.2)	0.35	2	M1 for 1 − (0.3 + 0.15 + 0.2) **or** 1 − 0.65 A1 for 0.35 oe
	(b)	60 × 0.2	12	2	M1 for 60 × 0.2 A1 cao (SC B1 for $\frac{12}{60}$)

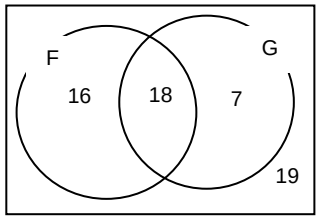
PAPER: 5MM1H_01

Question		Working	Answer	Mark	Notes
6		632 54 × 2528 31600 34128 Eg × | 60 | 3 | 0.2 50 | 3000 | 150 | 10 4 | 240 | 12 | 0.8 3000 + 150 + 10 + 240 + 12 + 0.8 = 3412.8 | 6 | 3 | 2 | 5 | 30 | 15 | 10 | 5 4 | 24 | 12 | 08 | 4 | 1 | 2 | 8 |	3412.8	3	M1 for complete method for multiplying 632 by 4 and 50 condone one error in multiplication M1 (dep) for addition, condone one addition error A1 cao **OR** M1 for complete method for multiplying 600, 30 and 2 by 4 and 50 condone one error in multiplication M1 (dep) for addition, condone one addition error A1 cao **OR** M1 for complete method for multiplying 6, 3 and 2 by 5 and 4 condone one error in multiplication M1 (dep) for addition, condone one addition error A1 cao

PAPER: 5MM1H_01

Question		Working	Answer	Mark	Notes
7	(i)	<table><tr><th>+</th><th>2</th><th>4</th><th>6</th></tr><tr><th>1</th><td>3</td><td>5</td><td>7</td></tr><tr><th>2</th><td>4</td><td>6</td><td>8</td></tr><tr><th>3</th><td>5</td><td>7</td><td>9</td></tr><tr><th>4</th><td>6</td><td>8</td><td>10</td></tr><tr><th>5</th><td>7</td><td>9</td><td>11</td></tr><tr><th>6</th><td>8</td><td>10</td><td>12</td></tr></table>	$\frac{3}{18}$	5	M1 for identifying 1+6 (=7) and 3+4 (=7) and 5+2 (=7) M1 for 18 seen **or** 18 outcomes **or** sample space with 18 possibilities **or** list of 18 ordered pairs A1 for $\frac{3}{18}$ oe **OR** M1 for $\frac{1}{6}\times\frac{1}{3}$ oe seen M1 for $3 \times \frac{1}{6}\times\frac{1}{3}$ oe A1 for $\frac{3}{18}$ oe
	(ii)		$\frac{4}{18}$		M1 ft from their ordered list in part (i) for identifying all four possible of 2+1(=3), 2+2(=4), 2+3(=5) and 4+1(=5), condone inclusion of 2+4(=6) and/or 4+2(=6) A1 for $\frac{4}{18}$ oe [SC If M0 scored B1 for $\frac{6}{18}$]

PAPER: 5MM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
8	(a)		Translation $\begin{pmatrix}1\\6\end{pmatrix}$	2	B1 for translation B1 for $\begin{pmatrix}1\\6\end{pmatrix}$ NB: no marks awarded for a combination of transformations
	(b)		Vertices at (−2, −1) (−2, −4) (−4, −1)	3	B3 fully correct (B2 correct orientation **and** correct size **or** 2 out of 3 vertices correct) (B1 correct size **or** correct orientation)
9	(a)	$\frac{e^7 \times e^8}{e^2} = \frac{e^{15}}{e^2}$	e^{13}	2	M1 for one correct simplification, eg $e^7 \times e^8 = e^{15}$ or $e^7 \div e^2 = e^5$ or $e^8 \div e^2 = e^6$ A1 cao
	(b)		g^{-20}	1	B1 for g^{-20} **or** $\frac{1}{g^{20}}$
10		$2 \times (4x - 3 + 2x + 5) = 46$ $2 \times (6x + 2) = 46$ $6x + 2 = 23$ $6x = 21$ $x = 3.5$ $4 \times 3.5 - 3 = 11$ $2 \times 3.5 + 5 = 12$ $11 \times 12 =$	132	5	M1 for $2 \times (4x - 3 + 2x + 5)$ oe **or** $4x - 3 + 2x + 5$ oe M1 for $2 \times (4x - 3 + 2x + 5) = 46$ oe **or** $4x - 3 + 2x + 5 = 23$ oe M1 (dep on M2) for correct processes to isolate terms in x or (x=) 3.5 oe M1 (dep on M1) for substituting '3.5' into $4x - 3$ **or** $2x + 5$ **or** 12 seen as length **or** 11 seen as width A1 cao

PAPER: 5MM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
11		168 = 2 × 84 = 2 × 2 × 42 = 2 × 2 × 2 × 21 =2 × 2 × 2 × 3 × 7	2 × 2 × 2 × 3 × 7	3	M1 for at least two correct divisions by a prime number, (maybe seen on a factor tree) M1 for full process with at most one calculation error **or** digits 2, 2, 2, 3, 7 seen A1 for 2 × 2 × 2 × 3 × 7 **or** $2^3 \times 3 \times 7$
12	(a)		Correct Venn diagram	4	M1 for two overlapping ovals M1 for 18 shown in the intersection M1 for 34 −18 (=16) **or** 25 − 18(=7) A1 for fully correct Venn diagram with correct labels
	(b)		$\frac{19}{60}$	2	M1 (ft part a) for $\frac{'19'}{a}$, $a >$ '19' or $\frac{b}{60}$, $b < 60$ A1 for $\frac{19}{60}$ oe or ft part a provided $b \neq 0$

PAPER: 5MM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
13	(a)		$h^2 - 3h$	1	B1 cao
	(b)		$3xy^2(2x + 3y)$	2	B2 cao (B1 for correct partial factorisation with at least two common factors, eg $3x(2xy^2 + 3y^3)$ **or** $xy^2(6x + 9y)$ **or** $3y^2(2x^2 + 3xy)$ **or** $xy(6xy + 9y^2)$ **or** $3y(2x^2y + 3xy^2)$ **or** $y^2(6x^2 + 9xy)$ **or** $3xy(2xy + 3y^2)$)
	(c)	$m^2 + 5m + 8m + 40$	$m^2 + 13m + 40$	2	M1 for all 4 terms correct (condone incorrect signs) **or** 3 out of 4 terms correct with correct signs A1 cao
14	(a)		8	1	B1 for 8 (accept ±8)
	(b)		$\frac{1}{9}$	1	B1 cao
	(c)		1	1	B1 cao
15	(a)	$\frac{5}{15} + \frac{6}{15}$	$\frac{11}{15}$	2	M1 for common denominator with at least one numerator correct A1 for $\frac{11}{15}$ oe (B2 for 0.73 recurring)
	(b)	$\frac{11}{4} \times \frac{8}{5} = \frac{88}{20}$	$\frac{22}{5}$	3	M1 for $\frac{11}{4}$ or $\frac{8}{5}$ M1 for $\frac{11}{4} \times \frac{8}{5}$ or $\frac{88}{20}$ oe A1 for $\frac{22}{5}$ or $4\frac{2}{5}$ or 4.4

PAPER: 5MM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
16	(a)	$6x + 5 = 2x + 3$ $6x - 2x = 3 - 5$ $4x = -2$	$-\frac{1}{2}$	2	M1 for correct processes to isolate terms in x A1 for $-\frac{1}{2}$ oe
	(b)	$\frac{3y-5}{4} = 2y+1$ $3y-5 = 4(2y+1)$ $3y-5 = 8y+4$ $-9 = 5y$	$-\frac{9}{5}$	3	M1 for intention to multiply all terms by 4 M1 (ft a four term linear equation) for correct processes to isolate terms in y A1 for $-\frac{9}{5}$ oe
	(c)	$(p - 11)(p + 5)$ $\frac{--6 \pm \sqrt{(-6)^2 - 4\times1\times-55}}{2\times1}$ $= \frac{6 \pm \sqrt{256}}{2}$	11, −5	3	M1 for $(p \pm 11)(p \pm 5)$ M1 for $(p - 11)(p + 5)$ A1 cao **Alternative method** M1 for $\frac{--6 \pm \sqrt{(-6)^2 - 4\times1\times-55}}{2\times1}$ condone one sign error in substitution M1 for $\frac{6 \pm \sqrt{256}}{2}$ A1 cao

PAPER: 5MM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
17	(a)		8.06×10^5	1	B1 cao
	(b)		0.004	1	B1 cao
	(c)	$12 \times 10^{9+-4} = 12 \times 10^5$	1.2×10^6	2	M1 for $12 \times 10^{9+-4}$ oe **or** 1 200 000 **or** 1.2×10^n A1 cao
18		$\frac{15}{12} \times 8$	10	2	M1 for $\frac{15}{12}$ oe **or** $\frac{12}{15}$ oe seen **or** a correct proportionality equation, eg $\frac{CE}{15} = \frac{8}{12}$ A1 cao
19		$3r - 11 = 109 - 2r$ $5r = 120$ $r = 24$ 107, 105, 103, 101, 99, ..., 63, 61	24	4	B1 for $3r - 11$ M1 for or $3r - 11 = 109 - 2r$ or '$3r + k$' = $109 - 2r$, $k \neq 0$ M1 for correct processes to isolate terms in r A1 cao (accept different letter in place of r) **OR** (Listing terms) M1 for at least 3 correct terms in sequence B M1 for at least 20 correct terms in either sequence M1 for two correct sequences each up to and including 24th terms (61) A1 cao

PAPER: 5MM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
*20		angle *EFG* = 148÷2 (=74) angle *EHG* = 180 − '74' **OR** reflex angle *EOG* = 360 − 148 (=212) angle *EHG* = '212'÷2	106	4	M1 for angle *EFG* = 148÷2 (=74) M1 for angle *EHG* = 180 − '74' (=106) C2 for *EHG* = 106^{o} with full reasons angle at centre is twice angle at circumference; opposite angles in a cyclic quadrilateral sum to 180^{o} (C1 (dep on M1) for one circle theorem stated and used correctly) **OR** M1 for reflex angle *EOG* = 360 − 148 (=212) M1 for angle *EHG* = '212' ÷ 2 C2 for *EHG* = 106^{o} with full reasons angle at centre is twice angle at circumference; angles at a point sum to 360^{o} (C1 (dep on M1) for circle theorem stated and used correctly)

PAPER: 5MM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
21		$x(2x - 4) = 3(x + 5)$ $2x^2 - 4x = 3x + 15$ $2x^2 - 7x - 15 = 0$ $(2x + 3)(x - 5) = 0$	5	5	M1 for $x \times (2x - 4) = 3 \times (x + 5)$ condone omission of brackets A1 for correct simplified quadratic, eg $2x^2 - 7x - 15(=0)$ or $2x^2 = 7x + 15$ oe M1 (dep on M1) for correct method to solve their 3 term quadratic, eg $(2x \pm 3)(x \pm 5)$ M1 for $(2x + 3)(x - 5)$ A1 for 5 **Alternative method** M1 (dep on M1) for $\frac{--7\pm\sqrt{(-7)^2-4\times2\times-15}}{2\times2}$ condone one sign error in substitution M1 for $\frac{7\pm\sqrt{169}}{4}$ A1 for 5
22			$\frac{1}{2}(5\mathbf{a} + \mathbf{b})$	3	M1 for a correct vector equation for MT eg $\overrightarrow{MT} = \overrightarrow{MP} + \overrightarrow{PT}$ (may be partially in terms of **a** and/or **b**) M1 for $\overrightarrow{AP} = -\mathbf{a} + \mathbf{b} + 2\mathbf{a}$ (= **a** + **b**) **or** $\overrightarrow{AM} = \frac{1}{2}(-\mathbf{a} + \mathbf{b} + 2\mathbf{a})$ oe **or** $\overrightarrow{MP} = \frac{1}{2}(-\mathbf{a} + \mathbf{b} + 2\mathbf{a})$ oe A1 for $\frac{1}{2}(5\mathbf{a} + \mathbf{b})$ oe simplified form

PAPER: 5MM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
23		$\frac{3(x+1)-2(x-5)}{(x-5)(x+1)}$ $=\frac{3x+3-2x+10}{(x-5)(x+1)}$ $=\frac{x+13}{(x-5)(x+1)}$	$\frac{x+13}{(x-5)(x+1)}$	3	M1 for common denominator of $(x-5)(x+1)$ oe M1 for $\frac{3(x+1)-2(x-5)}{(x-5)(x+1)}$ oe (may be as two separate fractions) A1 for $\frac{x+13}{(x-5)(x+1)}$ **or** $\frac{x+13}{x^2-4x-5}$
24		**yy + yy′ + y′y** $\frac{3}{9}\times\frac{2}{8}+\frac{3}{9}\times\frac{6}{8}+\frac{6}{9}\times\frac{3}{8}$ **OR** **yy + yr + yb + ry + by** $\frac{3}{9}\times\frac{2}{8}+\frac{3}{9}\times\frac{4}{8}+\frac{3}{9}\times\frac{2}{8}+\frac{4}{9}\times\frac{3}{8}+\frac{2}{9}\times\frac{3}{8}$ **OR** **1 - y′ y′** $1-\frac{6}{9}\times\frac{5}{8}$	$\frac{42}{72}$	4	B1 for $\frac{2}{8}$ **or** $\frac{3}{8}$ **or** $\frac{4}{8}$ **or** $\frac{6}{8}$ **or** $\frac{5}{8}$ seen as 2nd probability M1 for any one appropriate product (see working column) M1 for a complete method A1 for $\frac{42}{72}$ oe, eg $\frac{7}{12}$ **With replacement** B0 M1 for any one appropriate product M1 for a complete method A0

PAPER: 5MM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
*25 QWC		*BP* = *EP* (tangents from an external point are equal) *OP* is common (to both triangles) oe angle *OBP* = angle *OEP* = 90^o (angle between tangent and radius is 90^o) **RHS** oe so triangles *BOP* and *EOP* are congruent **OR** *BP* = *EP* (tangents from an external point are equal) *OP* is common (to both triangles) oe *OB* = *OE* as both radii (of the circle) **SSS** oe so triangles *BOP* and *EOP* are congruent **OR** *BP* = *EP* (tangents from an external point are equal) *OB* = *OE* as both radii (of the circle) angle *OBP* = angle *OEP* = 90^o (angle between tangent and radius is 90^o) **SAS** oe so triangles *BOP* and *EOP* are congruent **OR** angle *OBP* = angle *OEP* = 90^o angle between tangent and radius is 90^o) *OB* = *OE* as both radii (of the circle) *OP* is common (to both triangles) oe **RHS** oe so triangles *BOP* and *EOP* are congruent	Proof with reasons	3	C3 for fully correct proof with all reasons and statement for congruence present (C2 for any two correct statements (that together could be part of a proof) with reasons) (C1 for any one correct statement (that could be part of a proof) with reasons)

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: ±5º
Measurements of length: ±5 mm

PAPER: 5MM1H_01			
Question		**Modification**	**Notes**
Q8	(a)	2 cm grid. P & Q labelled as shape P, shape Q	B1 for translation B1 for $\begin{pmatrix}1\\6\end{pmatrix}$ NB: no marks awarded for a combination of transformations
	(b)	Transformation given. Triangle S at (−2, −1), (−4, −1) and (−2, −4). Candidates asked to describe the transformation	B1 for enlargement B1 for scale factor $-\frac{1}{2}$ oe B1 centre (0. 0) oe
Q10		*x* changed to *y*. Diagram labels top and left	M1 for $2 \times (4y - 3 + 2y + 5)$ oe **or** $4y - 3 + 2y + 5$ oe M1 for $2 \times (4y - 3 + 2x + 5) = 46$ oe **or** $4y - 3 + 2y + 5 = 23$ oe M1 (dep on M2) for correct processes to isolate terms in *y* or (*y*=) 3.5 oe M1 (dep on M1) for substituting '3.5' into $4y - 3$ **or** $2y + 5$ **or** 12 seen as length **or** 11 seen as width A1 cao
Q12		Diagram sheet put in Diagram Book instead of answer space in the paper.	Standard mark scheme

PAPER: 5MM1H_01			
Question		**Modification**	**Notes**
Q16	(a)	MLP *x* changed to *y*	M1 for correct processes to isolate terms in *y* A1 for $-\frac{1}{2}$ oe
Q21		MLP *x* changed to *y*	M1 for $y \times (2y - 4) = 3 \times (y + 5)$ condone omission of brackets A1 for correct simplified quadratic, eg $2y^2 - 7y - 15 (=0)$ or $2y^2 = 7y + 15$ oe M1 (dep on M1) for correct method to solve their 3 term quadratic, eg $(2y \pm 3)(y \pm 5)$ M1 for $(2y + 3)(y - 5)$ A1 for 5 **Alternative method** M1 (dep on M1) for $\frac{--7\pm\sqrt{(-7)^2-4\times2\times-15}}{2\times2}$ condone one sign error in substitution M1 for $\frac{7\pm\sqrt{169}}{4}$ A1 for 5
Q23		MLP *x* changed to *y*	M1 for common denominator of $(y - 5)(y + 1)$ oe M1 for $\frac{3(y+1)-2(y-5)}{(y-5)(y+1)}$ oe (may be as two separate fractions) A1 for $\frac{y+13}{(y-5)(y+1)}$ **or** $\frac{y+13}{y^2-4y-5}$

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