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Mark Scheme (Results)

Summer 2014

Pearson Edexcel GCSE
Linked Pair Pilot in Mathematics
Methods in Mathematics (2MM01)
Higher Paper 2H

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Summer 2014
Publications Code UG039538

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If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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: 5MM2H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
1			1.1	2	M1 for 2.75 ÷ 55 × 22 oe, eg $\frac{2}{5} \times 2.75$ A1 cao
2	(a)		724.52	2	M1 for 614 × 18 ÷ 100 oe or 110.52 seen or 614 × 1.18 A1 cao
	(b)		75	2	M1 for 36 ÷ 48 × 100 oe A1 cao
3	(a)		3.148491702	1	B1 for 3.148(491702)
	(b)		1.170398496	2	M1 for 75.15 or 61.3... or 64.2... A1 for 1.17(0398496)
4			450 cm^3	3	M1 for $\frac{1}{2}(5 \times 12) \times 15$ oe A1 cao B1 (indep) for cm^3

PAPER: 5MM2H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
5		$x + x + 7 + 3x = T$	$T = 5x + 7$	3	B3 for $T = 5x + 7$ oe (B2 for $5x + 7$ oe or $T = 5x + a$ oe, $a \neq 0$ or $T = bx + 7$ oe, $b \neq 0$ B1 for $x + 7$ or $3x$ or T = a linear expression in x or $5x + a$ oe, $a \neq 0$ or $bx + 7$ oe, $b \neq 0$)
*6		$\sqrt{0.12} = 0.346...$	square root of 0.12 + working	3	M1 for $\frac{1}{2.9}$ or $1 \div 2.9$ (=0.3448…) M1 for $0.7 \times 0.7 \times 0.7$ oe (= 0.343) C1 for square root of 0.12 identified as biggest **and** all 3 evaluated correctly truncated or rounded to at least 3 decimal places
7			147	4	M1 for correct method to find sum of interior angles of a hexagon A1 for 720 M1 (dep on M1) for ['720' – (100 + 120 + 116 + 90)] ÷ 2 oe A1 cao OR M1 for 360 – (80 + 90 +64 + 60) condone one incorrect exterior angle A1 for 66 M1 (dep on M1) for 180 – ('66' ÷ 2) A1 cao
8			17.2	2	M1 for $54 \div \pi$ A1 for 17.1 – 17.2

PAPER: 5MM2H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
9			30	4	M1 for Y: 600 ÷ 5 × 3 oe (= 360) M1 for R: 600 × 25 ÷ 100 oe (= 150) M1 (dep on M2) for (600 – '360' – '150') × 2 – '150' oe A1 cao OR M1 for Y: 3 ÷ 5 × 100 (= 60%) M1 for G: 100 – '60' – 25 (= 15) **and** '15' ÷ 100 × 600 (= 90) M1 (dep on M2) for '90' × 2 − 150 A1 cao OR M1 for $\frac{12}{20}+\frac{5}{20}$ $(=\frac{17}{20})$ oe M1 for $\left(1-'\frac{17}{20}'\right)\times 600$ (= 90) M1 (dep on M2) for '90' × 2 − 150 A1 cao
10	(a)		$x \geq -1$	1	B1 cao
	(b)		−4,−3,−2	2	B2 for all 3 values and no extras (ignore repeats) (B1 for 2 correct values and no extras or all 3 correct values and −5)
	(c)		$y < 4$	2	M1 for clear intention to add 2 onto each side of an inequality (or equation) or clear intention to divide all terms by 5 as a first step or (y =) 4 A1 cao

PAPER: 5MM2H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
11	(a)	<table><tr><td>*x*</td><td>–2</td><td>–1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>*y*</td><td>**3**</td><td>–1</td><td>**–3**</td><td>–3</td><td>–1</td><td>**3**</td></tr></table>	3, –3, 3	2	B2 for all 3 correct (B1 for 2 correct)
	(b)		graph	2	M1 for 5 or 6 of 'points' plotted correctly (provided B1 is awarded in part a) A1 for correct graph
	(c)		–1.3, 2.3	2	B1 ft for '–1.3' ± 0.2 B1 ft for '2.3' ± 0.2
12			160	3	M1 for 360 ÷ (1 + 3 + 5) (= 40) M1 (dep) for 5 × '40' (= 200) A1 cao OR M1 for 360 ÷ (1 + 3 + 5) (= 40) M1 (dep) for 5 – 1 (= 4) A1 cao

PAPER: 5MM2H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
*13			$x = 83°$ and reasons	4	M2 for 180 – 62 – 35 (=83) (M1 for angle *ACB* = 35° (could be on the diagram)) C2 for $x = 83°$ **and** alternate angles are equal **and** angles in a triangle add up to 180° (C1 (dep on M1) for 1 relevant reason) OR M2 for 180 – 62 – 35 (=83) (M1 for angle *DAE* = 62° (could be on the diagram)) C2 for $x = 83°$ **and** corresponding angles are equal **and** angles on a straight line add up to 180° (C1(dep on M1) for 1 relevant reason) OR M2 for 180 – 62 – 35 (=83) C2 for $x = 83°$ **and** co-interior (allied) angles add up to 180° (C1 for co-interior (allied) angles add up to 180°)

PAPER: 5MM2H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
14	(a)		$e = \frac{f+3}{5}$	2	M1 for $f + 3 = 5e - 3 + 3$ oe A1 for $e = \frac{f+3}{5}$ oe (SC B1 for $e = \frac{f-3}{5}$ oe)
	(b)		g = $c(h - d)$	2	M1 for correct first step A1 for $g = ch - cd$ oe
15			8998.91	3	M1 for $\frac{4}{100} \times 8000$ (= 320) oe or 1.04 × 8000 (=8320) oe M1 for complete method A1 for 8998.91(2) OR M2 for 8000×1.04^3 oe A1 for 8998.91(2)
16			4760	3	M1 for 100 + 25 or 125 or 1 + 0.25 or 1.25 M1 for 5950 ÷ '1.25' or 5950 ÷ '125' × 100 A1 cao

PAPER: 5MM2H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
17			34.3	5	M1 for method to find *BC*, eg $\tan 30 = \frac{2.7}{BC}$ or $\frac{BC}{\sin 60} = \frac{27}{\sin 30}$ A1 for (*BC*=) 4.67 − 4.68 M1 for complete method to find *BDC*, eg sin *BDC* = $\frac{'BC'}{8.3}$ oe M1 for $\sin^{-1}\frac{'BC'}{8.3}$ A1 for 34.2 – 34.3 OR M1 for method to find BF, eg $\frac{BF}{\sin 90} = \frac{27}{\sin 30}$ A1 for 5.4 M1 for $\frac{'5.4'}{\sin BDC} = \frac{8.3}{\sin 60}$ M1 for $\sin^{-1}('5.4' \times \sin 60 \div 8.3)$ A1 for 34.2 – 34.3
18		$12x - 9y = 33$ $\underline{12x + 4y = -6}$ $-13y = 39$ $\quad y = -3$ $4x - -9 = 11$ $4x = 11 - 9 = 2$ OR $8x - 6y = 22$ $\underline{18x + 6y = -9}$ $26x = 13$ $\quad x = {}^1/_2$ $2 - 3y = 11$ $3y = -9$	$x = \frac{1}{2}$ $y = -3$	4	M1 for correct process to eliminate either *x* or *y* (condone 1 arithmetic error) A1 for either $x = \frac{1}{2}$ or $y = -3$ M1 (dep) for correct substitution of their found variable or for correct process to eliminate the other variable (condone 1 arithmetic error) A1 for both $x = \frac{1}{2}$ and $y = -3$

PAPER: 5MM2H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
*19		Area of rectangle = 5 × 5 =25 Area of sector = 0.25 × π × 5^2 = 19.634… Semi area shaded = 7.134… (eg 0.25 × π × 5^2 – 0.5 × 5 × 5) Semi area not shaded = 5.365… (eg 0.5 × 5 × 5 – 7.134…) Area shaded = 14.269… (eg 2 × 7.134…) Area not shaded = 10.730… (eg 2 × 5.365…)	Yes with working	5	M1 for correct method to find area of rectangle or triangle M1 for correct method to find area of sector or part of sector M1 (dep on M2) for correct method to find area shaded or not shaded A1 for correct area shaded or not shaded C1 for Yes with correct figures to compare, eg 7.13… and 5.36… or 14.26…and 10.73…or 14.26…and 12.5 or 10.73 and 12.5 or 39.26…and 25
20		$y = 3x + c$ 10 = 6 + c $c = 4$	$y = 3x + 4$	3	B1 for (y =) $3x + c$, $c \neq 1$ or gradient identified as 3 M1 for 10 = '3' × 2 + c, oe or (y =) $3x + 4$ A1 for $y = 3x + 4$ oe

PAPER: 5MM2H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
*21			correct proof	3	M1 for (x =) 0.433(...) or correct first step, eg $1000x = 433.33(\ldots)$ or $100x = 43.33(...)$ or $10x = 4.33(\ldots)$ M1 for method as far as subtracting, eg $10x - x = 4.33\ldots - 0.433\ldots (= 3.9)$ C1 (dep on M2 scored) for completing the proof, eg $\frac{3.9}{9} = \frac{13}{30}$ or $\frac{42.9}{99} = \frac{13}{30}$
22			0.36	4	M1 for $y = \frac{k}{x^2}$ or $y \propto \frac{1}{x^2}$ M1 for $4 = \frac{k}{3^2}$ oe or (k =) 36 M1 for $\frac{'36'}{10^2}$ oe A1 for 0.36 oe **Alternative method** M1for $y = \frac{k}{x^2}$ or $y \propto \frac{1}{x^2}$ M1 for $\frac{y}{3^2} = \frac{4}{10^2}$ oe M1 for (y =) $3^2 \times \frac{4}{10^2}$ A1 for 0.36 oe
23		$\frac{x}{\sin 65} = \frac{20}{\sin 82}$ $x = \frac{20\sin 65}{\sin 82} = \frac{18.12615...}{0.990268...}$ = 18.30429...	18.3	3	M1 for $\frac{x}{\sin 65} = \frac{20}{\sin 82}$ oe M1 for (x =) $\frac{20\sin 65}{\sin 82}$ oe A1 for 18.3 – 18.31

PAPER: 5MM2H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
24			641	5	M1 for area base = $\pi \times 5^2$ (= 25π = 78.5...) M1 for curved SA cylinder = $2\pi \times 5 \times 14$ (=140π = 439.8...) M1 for $l = \sqrt{5^2 + 6^2}$ (= 7.80...) M1 (dep) for curved SA cone = $\pi \times 5 \times \sqrt{5^2 + 6^2}$ (= 122.6...) A1 for 641 – 642
25			BEDCAF	3	B3 for all 6 correct (B2 for 4 or 5 correct B1for 2 or 3 correct)

PAPER: 5MM2H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
26	(a)	½(3x + 1 + 5x + 3)(2x + 3) = ½ (8x + 4)(2x + 3) So, (4x + 2)(2x + 3) – 46 = 0 $8x^2 + 16x + 6 - 46 = 0$ $8x^2 + 16x - 40 = 0$ $x^2 + 2x - 5 = 0$	Proof	3	M1for correct method to find area of trapezium M1 (dep) for expanding all brackets to get a correct expression for the area C1 for complete correct proof
	(b)	$x = \frac{-2 \pm \sqrt{2^2 - 4(1)(-5)}}{2 \times 1}$ $= \frac{-2 \pm \sqrt{24}}{2}$ **OR** $(x + 1)^2 - 1^2 - 5$ $= (x + 1)^2 - 6$ $x + 1 = \pm \sqrt{6}$	1.45, –3.45	3	M1 for $\frac{-2 \pm \sqrt{2^2 - 4(1)(-5)}}{2 \times 1}$ condone one sign error in substitution M1for $\frac{-2 \pm \sqrt{24}}{2}$ A1for 1.44 to 1.45 (and –3.44 to –3.45) **OR** M1 for $(x + 1)^2 - 1^2 - 5$ oe M1 for $x + 1 = (\pm)\sqrt{6}$ A1 for 1.44 to 1.45 (and –3.44 to –3.45)
27	(a)		$x^2 + y^2 = 16$	1	B1 for $x^2 + y^2 = 16$ oe
	(b)	$x^2 + (-x)^2 = 16$ $2x^2 = 16 \quad x^2 = 8$	$-2\sqrt{2}$	2	M1 for $x^2 + (-x)^2$ = '16' oe or $2x^2 = 16$ or $4 \times \cos 45$ A1 for $-2\sqrt{2}$ or $-\sqrt{8}$ or –2.82 to –2.83 or $-\frac{4}{\sqrt{2}}$ oe

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: 5MM2H_01			
Question		**Modification**	**Notes**
Q4		Model provided as well as diagram.	Standard mark scheme
Q7		In text, *x* is replaced by "the angle marked *x*°"	Standard mark scheme
Q10		Number line – line and arrow extended so it obviously goes past 2	Standard mark scheme
Q11		2 cm grid	Mark as main scheme with following amendment to part (c) B1 ft for '–1.3' ± 0.25 B1 ft for '2.3' ± 0.25
Q19		Labels moved to top and left side	Standard mark scheme

PAPER: 5MM2H_01			
Question		**Modification**	**Notes**
Q24		Model provided as well as diagram	Standard mark scheme
Q26		MLP *x* changed to *y*	Mark as main scheme with following amendment M1 for $(y + 1)^2 - 1^2 - 5$ oe M1 for $y + 1 = (\pm)\sqrt{6}$ A1 for 1.44 to 1.45 (and –3.44 to –3.45)

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