Mark Scheme (Results)

Summer 2017

Pearson Edexcel GCSE
Linked Pair Pilot in Mathematics
Methods in Mathematics (2MM01)
Higher: (Calculator) Unit 2

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If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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

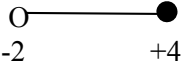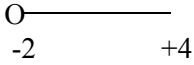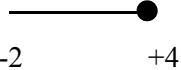| **Guidance on the use of codes within this mark scheme** |
|---|
| M1 – method mark
A1 – accuracy mark
B1 – Working mark
C1 – communication mark
QWC – quality of written communication
oe – or equivalent
cao – correct answer only
ft – follow through
sc – special case
dep – dependent (on a previous mark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

PAPER: 5MM2H_01				
Question	Working	Answer	Mark	Notes
1 (a)	52 × 4 = 208 52 × 5 = 260	208, 260	2	M1 for 468 ÷ (4 + 5) (= 52) A1 cao
(b)		65	3	M1 for $\frac{13}{7+13}$ or $\frac{7}{7+13}$ oe M1 for a complete method to find percentage, eg. $\frac{13 \ (or \ 7)}{7+13} \times 100$ A1 cao
2		19.80	2	M1 for 13.20 ÷ 8 (= 1.65) × 12 oe A1 for 19.80 (accept 19.8)

PAPER: 5MM2H_01				
Question	Working	Answer	Mark	Notes
*3		120° with reasons	4	M1 for 180 – 90 – 30 or an angle correctly identified as 60 (could be on the diagram) M1 for 180 – "60" oe (could be on the diagram) C2 for 120(°) and all reasons clearly given **e.g.** *ABG* = 90 (corresponding angles are equal) *AGB* = 180 – 90 – 30 = 60 (angles in a triangle add to 180) *FGD* = 60 (vertically opposite angles equal) *x* = 180 – 60 (allied angles or co-interior angles) add to 180 OR *ADC* = 180 – 90 – 30 = 60 (angles in a triangle add to 180) *FGD* = 60 (alternate angles are equal) *x* = 180 – 60 (allied angles or co-interior angles) add to 180 (C1 for one appropriate reason for candidates working) QWC: Reasons written out clearly with correct geometrical language used

Question	Working	Answer	Mark	Notes
4 (a)		$x \geq -3$	1	B1 for $x \geq -3$ or $-3 \leq x$
(b)		-2 +4	2	M1 for: -2 +4 Accept this line drawn with any length OR -2 +4 Accept this line drawn with any length OR -2 +4 OR -2 +4 A1 for a fully correct diagram
(c)		-1, 0, 1, 2, 3, 4	2	B2 for all 6 values and no others (B1 for 5 correct values and no others or all 6 correct values and one additional incorrect value)

Question	Working	Answer	Mark	Notes
5		1810 cm^3	3	M1 for $\pi \times 8^2 \times 9$ A1 for an answer in the range 1808 to 1811 B1 (indep) for cm^3
6 (a)	$x + x + 5 + 4x = T$	$T = 6x + 5$ oe	3	B3 for $T = 6x + 5$ oe (B2 for $6x + 5$ oe or $T = 6x + a$ oe, $a \neq 0$ or $T = bx + 5$ oe, $b \neq 0$ B1 for $x + 5$ or $4x$ or $T =$ a linear expression in x or $6x + a$ oe, $a \neq 0$ or $bx + 5$ oe, $b \neq 0$)
(b)	$5w + 5x = 3x + 9$ $5w = 3x - 5x + 9 = 9 - 2x$	$w = \frac{9-2x}{5}$	3	M1 for a correct first step, either expansion of the bracket or dividing both sides by 5, eg. $5w + 5x = 3x + 9$ or $w + x = \frac{3x+9}{5}$ M1 for isolating term in w, eg. $5w = 3x - 5x + 9$ oe A1 for $\frac{9-2x}{5}$

PAPER: 5MM2H_01				
Question	**Working**	**Answer**	**Mark**	**Notes**
7	$2x + 2(x \pm 7) < 152$ $2x + 2x \pm 14 < 152$ $4x \pm 14 < 152$ $4x < 138$ (or 166) $x < 34.5$ ($x < 34.5$, so width < 34.5) OR $152 \div 4 = 38$ $(7 + 7) \div 4 = 3.5$ $38 - 3.5 = 34.5$ OR $152 - 14 = 138$ $138 \div 4 = 34.5$	34	4	B1 for $x \pm 7$ oe seen (it could just be on a diagram) or a rectangle with length 7 cm greater than the width M1 for $2x + 2(x \pm 7)$ oe A1 for 34.5 B1 for answer of 34 OR M1 for $152 \div 4$ (=38) M1 for $(7 + 7) \div 4$ (=3.5) A1 for 34.5 B1 for answer of 34 OR M1 for $152 - 14$ (= 138) M1 for $138 \div 4$ A1 for 34.5 B1 for answer of 34 [SC: B3 for 34.5 seen from any method]

Question	Working	Answer	Mark	Notes
8		142	4	M1 for correct method to find sum of interior angles of a hexagon A1 for 720 M1 (dep on M1) for ['720' – (150 + 140 + 56 + 90)] ÷ 2 oe A1 cao OR M1 for 360 – (30 + 90 +124 + 40) condone one incorrect exterior angle A1 for 76 M1 (dep on M1) for 180 – ('76' ÷ 2) A1 cao
*9		Yes (= 333)	5	M1 for finding the area of one section (blue or yellow), eg. 1480 × 0.4 (= 592) oe or 1480 ÷ 8 (= 185) oe M1 for finding the area of the second section (yellow or blue) or award M2 for finding the combined area of blue and yellow), Eg. $(\frac{4}{10} + \frac{1}{8}) \times 1480$ (= 777) M1 for finding the total area of three sections **or** four sections using white as 330 **or** subtracting the 3 sections from 1480 A1 1147 or 333 or 1477 C1 (dep on at least M1) for correct conclusion based on their calculations relating their white area to 330 or "1147" to 1150 or "1477" to 1480

PAPER: 5MM2H_01				
Question	Working	Answer	Mark	Notes
10	$\pi \times (10 \div 2)^2 - 0.5 \times 8 \times 6$	54.5	5	M1 for $10 \div 2$ (=5) M1 for $\pi \times "5"^2$ (=78.539....) M1 for $0.5 \times 8 \times 6$ (=24) M1(dep on at least one previous M1) for'78.539…' – '24' [ie their area of the circle – their area of the triangle] A1 for an answer in the range 54 to 55
11 (a)		0.6575(62462....)	2	M1 for 3.4785..... seen or 5.29 seen A1 for 0.6575(62462....)
(b)		512	1	B1 cao
(c)		1	2	M1 for $(\sin 45^\circ)^2 = 0.5$ **or** $(\cos 135^\circ)^2 = 0.5$ A1 cao

Question		Working	Answer	Mark	Notes
12	(a)		−1, −5, −4, 4	2	B2 for all correct (B1 for 2 or 3 correct)
	(b)		Correct graph	2	B2 for fully correct graph Or M1 ft for 6 or 7 of their points plotted correctly A1 for correct graph
	(c)		2.2, −2.2	2	B1ft graph for 2 to 2.4 B1ft graph for −2.4 to −2 **SC:** B1 ft for (2.2, 0), (−2.2, 0)
	(d)		−1.8, 2.8	2	B1ft graph for 2.6 to 3 B1ft graph for −2 to −1.6 **SC:** B1 ft for (2.8, 0), (−1.8, 0)
13			240	3	M2 for $(324 \div 135) \times 100$ oe (M1 for sight of 1.35 or 135%) A1 cao

PAPER: 5MM2H_01				
Question	Working	Answer	Mark	Notes
14		23.7	5	M1 for method to find BC, eg $\tan 50 = \frac{3.4}{BC}$ or $\frac{BC}{\sin 40} = \frac{3.4}{\sin 50}$ M1 for $(BC=)\frac{3.4}{\tan 50}$ or $(BC=)\frac{3.4 \times \sin 40}{\sin 50}$ $(= 2.85$ to $2.86)$ M1 for complete method to find BDC, eg $\sin BDC = \frac{'BC'}{7.1}$ oe M1 for $\sin^{-1}\frac{'BC'}{7.1}$ A1 for $23.6(^\circ)$ to $23.7(^\circ)$ OR M1 for method to find BF, eg $\frac{BF}{\sin 90} = \frac{3.4}{\sin 50}$ M1 for $(BF =)\frac{3.4 \times \sin 90}{\sin 50}$ $(= 4.44)$ M1 for $\frac{'4.44'}{\sin BDC} = \frac{7.1}{\sin 40}$ M1 for $\sin^{-1}('4.44' \times \sin 40 \div 7.1)$ A1 for $23.6(^\circ)$ to $23.7(^\circ)$

PAPER: 5MM2H_01				
Question	**Working**	**Answer**	**Mark**	**Notes**
15 (a)		21012.5(0)	3	M2 for complete method to find value after 2 years, eg. $20\,000 \times 1.025^2$ [M1 for method to find interest after one year, eg. $20\,000 \times 0.025$ (= 500) or value after one year, eg. $20\,000 \times 1.025$ (= 20500)] A1 cao
(b)		$V = 20\,000 \times 1.025^n$	2	B2 for $V = 20\,000 \times 1.025^n$ [B1 for $20\,000 \times 1.025^n$ or $V = 20\,000 \times 1.025$ or $V = P \times 1.025^n$]
(c)	$20\,000 \times 1.025 \times 1.025 \times 1.025 \times 1.025 \ldots..$ OR $1.025 = \sqrt[n]{1.25}$	10	2	M1 for $20\,000 \times 1.025^n$ where $n \geq 3$ A1 cao OR M1 for $1.025 = \sqrt[n]{1.25}$ A1 cao
16		38.9 or 3.89×10^1	2	M1 for 3.38×10^5 (or 338000) A1 for 38.8(50574...) or 3.88(50574...) $\times 10^1$
*17		Proof	3	M1 for $x = 0.16363.....$ or $10x = 1.636363...$ or $1000x = 163.6363...$ oe M1 for $1000x - 10x$ (= 990x) and $163.6363... - 1.6363.... $ (=162) C1 (dep on M2) for $(x=)\dfrac{9}{55}$ with full algebraic proof

Question	Working	Answer	Mark	Notes
18 (a)		$y = -\frac{1}{2}x + 4$	3	M1 for gradient of perpendicular $= -\frac{1}{2}$ or a line drawn perpendicular to the given line and a y-intercept of 4 M1 for $5 = " -\frac{1}{2} " \times -2 + c$ or $y = mx+4$ oe with $m \neq -\frac{1}{2}$, $m \neq 2$, $m \neq 0$ or $y = = -\frac{1}{2}x + a$ oe with $a \neq 4$ A1 for $y = -\frac{1}{2}x + 4$ oe
(b)		$x = 0$ $y = 1$	3	M1 for correct process to eliminate x or y (condone one arithmetic error) M1 (dep) for correct substitution of their found variable or for correct process to eliminate the other variable (condone one arithmetic error) A1 for both $x = 0$ and $y = 1$ OR M2 for $2y - 5x = 2$ drawn (M1 for a line drawn with gradient 2.5 or y-intercept of 1 A1 for both $x = 0$ and $y = 1$

Question		Working	Answer	Mark	Notes
19	(a)		F	1	B1 cao
	(b)		D	1	B1 cao
	(c)		H	1	B1 cao
20	(a)		35.5	2	M1 $\frac{1}{2} \times 12.4 \times 9.3 \times \sin 38°$ or complete method to find area using trig and/or Pythagoras and ½ base × height A1 35.4 to 35.5
	(b)		7.65	3	M1 $9.3^2 + 12.4^2 - 2 \times 9.3 \times 12.4 \times \cos 38°$ M1 for correct order of evaluation or 58.503.... A1 7.64 – 7.65
21	(a)		$y = 6x^2$	3	M1 for $y \propto x^2$ or $y = kx^2$ M1 for $96 = k \times 4^2$ oe A1 for $y = 6x^2$
	(b)		294	1	B1 for 294 or ft "k" $\times 7^2$
	(c)		5 and –5	2	M1 for 150 ÷ "k" (dependent upon a quadratic equation) A1 for 5 and –5

Question	Working	Answer	Mark	Notes
*22 (a)		Proof	3	M1 for a correct statement with correct reason M1 for a second correct statement with correct reason C1 for complete proof justifying congruency, eg. SAS Reasons: Angle *DAM* = angle *BCN*, <u>opposite angles</u> of a <u>parallelogram</u> are <u>equal</u> *AM = NC*, *M* and *N* are midpoints of lines of equal length AD = BC, <u>opposite sides</u> of a <u>parallelogram</u> are <u>equal</u> *AMD* ≡ *CNB* (SAS)
(b)		Proof	1	C1 for relevant statement using congruency eg. *MD* and *BN* are corresponding sides of congruent triangles