Mark Scheme (Results)

November 2013

Pearson Edexcel GCSE
Linked Pair Pilot in Mathematics
Methods in Mathematics (2MM01)
Higher 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If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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<br>A1 – accuracy mark<br>B1 – Working mark<br>C1 – communication mark<br>QWC – quality of written communication<br>oe – or equivalent<br>cao – correct answer only<br>ft – follow through<br>sc – special case<br>dep – dependent (on a previous mark or conclusion)<br>indep – independent<br>isw – ignore subsequent working |

| Paper 5MM2H_01 | | | | | |
|---|---|---|---|---|---|
| Question | | Working | Answer | Mark | Notes |
| 1 | | | 0.64475 (2…) | 2 | M1 for $\dfrac{11.18}{17.34}$ or $\dfrac{1118}{1734}$ or 11.18 or 17.34<br><br>A1 for 0.644 – 0.645 or $\dfrac{559}{867}$ |
| 2 | (a) | | 216 | 3 | M2 for a correct method to increase 180 by 20%<br>(M1 for a correct method to find 20% of 180)<br>A1 cao |
| | (b) | | 65 | 2 | M1 for —      oe<br>A1 cao |
| 3 | | | 480 | 3 | M1 for correct method to find the area of cross-section, eg $9 \times 7 - (9 - 6) \times (7 - 2)$ (=48)<br>M1 (dep) for their cross-section × 10<br>A1 cao<br><br>OR<br>M1 for a correct method to find volume of any cuboid, eg 9×7×10 (=630)<br>M1 (dep) for correct method to find total volume, eg $9 \times 7 \times 10$ (=630) − (9 − 6) × (7 − 2) × 10 (=150)<br>A1 cao |

| Paper 5MM2H_01 | | | | |
|---|---|---|---|---|
| **Question** | **Working** | **Answer** | **Mark** | **Notes** |
| 4 | | 30 | 4 | M2 for correct method to find fraction of blue counters, eg $—$ $—$ or $\frac{6}{10}$ oe seen<br><br>(M1 for correct method to add $\frac{3}{10}, \frac{1}{10}$ or $\frac{4}{10}$ oe seen)<br><br>M1 (dep on M2) for equating "$\frac{6}{10}$" with 60 blue counters (may be implied by correct answer)<br>A1 cao<br><br>OR (starting with $n$ counters in bag stated, eg $n = 100$)<br>M2 for correct method to find number of blue counters in bag, eg $—$ $—$ (=60)<br>(M1 for $—$ (=30) and $—$ (=10) or $—$ (=40))<br>M1 (dep on M2) for equating $—$ (=60) with 60 blue counters (may be implied by correct answer)<br>A1 cao<br><br>[NB accept equivalent calculations involving percentages or decimals] |
| 5 | (a) | 38 | 2 | M1 for $5 \times 9 - 7$ or $5 \times 9 + -7$<br>A1 cao |
| | (b) | $3c + 7d$ | 2 | M1 for $3 \times c$ or $7 \times d$ oe<br>A1 for $3c + 7d$ oe |

| Question | | Working | Answer | Mark | Notes |
|---|---|---|---|---|---|
| 6 | (a) | | 19.6 | 2 | M1 for $\pi \times 5^2$ (=78.5...) (accept — oe)<br><br>A1 for 19.6–19.7 |
| | (b) | | 17.9 | 3 | M1 for $2 \times \pi \times 5$ (=31.4...)<br>M1 for $2 \times \pi \times 5 \div 4$ (=7.8...)<br>A1 for 17.8 – 17.9 |
| 7 | (a) | | 1, –2, –3, –2, 1 | 2 | B2 all five correct<br>(B1 for 3 or 4 correct) |
| | (b) | | graph | 2 | M1 (dep on at least B1 scored) for all 7 of "points" plotted correctly<br>A1 for correct graph<br>(NB Do not accept points joined with line segments) |
| | (c) | | 2.3 to 2.5<br>–0.5 to –0.3 | 2 | B1 for 2.3 to 2.5 or ft their graph<br>B1 for –0.5 to –0.3 or ft their graph |
| 8 | (a) | | –1, 0, 1, 2, 3 | 2 | B2 for –1, 0, 1, 2, 3<br>(B1 for one error or one omission or one addition) |
| | (b) | | $x < 2.5$ | 2 | M1 for subtracting 3 from both sides or dividing both sides by 2 condone equality or incorrect inequality signs or ($x=$) 2.5<br>A1 for $x < 2.5$ oe |

| Paper 5MM2H_01 | | | | |
|---|---|---|---|---|
| Question | Working | Answer | Mark | Notes |
| 9 | | 15 | 3 | M1 for $180 - 156$ (=24)<br>M1 for $360 \div$ "24"<br>A1 cao<br><br>OR<br><br>M1 for $156 = \dfrac{180}{n}(n-2)$ oe<br>M1 for $180n - 156n = 360$ oe<br>A1 cao |
| 10 | | 308 | 5 | M1 $50^2 + 40^2$ or $2500 + 1600$ or $4100$<br>M1 for $\sqrt{2500+1600}$ or $\sqrt{4100}$<br>A1 for 64 (.03…) seen or implied by answer<br>M1(dep on M1) for $2 \times 50 + 2 \times 40 + 2 \times$ "64(.03…)"<br>A1 for $308 - 308.1$ |
| 11 | | $1.2 \times 10^5$ | 2 | M1 for $1.2 \times 10^n$, $n \neq 5$ or $a \times 10^5$, $a \neq 1.2$ or 120 000 oe<br>A1 cao |

| Paper 5MM2H_01 | | | | | |
|---|---|---|---|---|---|
| **Question** | | **Working** | **Answer** | **Mark** | **Notes** |
| 12 | (a) | | $\dfrac{5}{14}$ | 1 | B1 for $\dfrac{5}{14}$ oe fraction |
| | (b) | | 54 | 3 | M1 for 84 ÷ (5 + 9) (=6) or 1 – "(a)" (= —) <br><br> M1 for 84 ÷ (5 + 9) × 9 oe or  — <br> A1 cao |
| | *(c) | | eg 6 green | 3 | M1 for correct method to find twice as many green beads as red beads, eg $2 \times 30$ (=60) or 2 × (84 – "54") or "54" + "6" (=60) <br> A1 for 6 (green) OR if $n$ reds are added then $2n + 6$ (greens), where $n$ and $2n$ could be numbers OR 30 (red) and 60 (green) <br> C1 (dep on M1) for showing correct relevant working and clear conclusion stating number of green beads or stating total numbers of red beads and green beads |

| Paper 5MM2H_01 | | | | |
|---|---|---|---|---|
| **Question** | **Working** | **Answer** | **Mark** | **Notes** |
| *13 | | 110 | 4 | M1 for identifying $EBC = 35$ or $AFC = 75$<br>M1 (dep) for ($ECB =$) $180 - 75 - 35$ (=70) or ($ECD =$) $35 + 75$<br>C2 for $x = 110$ oe from correct working and all reasons stated clearly (see below)<br>(C1 (dep on M1) for appropriate reason)<br><br>OR<br>M1 for identifying $EBA = 180 - 35$ (=145)<br>M1 (dep) ($ECB =$) "145" $- 75$ (=70)<br>C2 for $x = 110$ oe from correct working and all reasons stated clearly (see below)<br>(C1 (dep on M1) for appropriate reason)<br><br>(SC B1 for $x = 110$ oe if M0 scored)<br><br>Correct reasons:<br>$EBC = 35$ or $AFC = 75$ (<u>corresponding</u> <u>angles</u> are equal)<br>$ECB = 180 - 75 - 35$ (<u>angles</u> in a <u>triangle</u> add up to <u>180</u>$^o$)<br>$x = 110$ (<u>angles</u> on a straight <u>line</u> add up to <u>180</u>$^o$)<br><br>OR<br>$EBC = 35$ or $AFC = 75$ (<u>corresponding</u> <u>angles</u> are equal)<br>$x = 110$ (<u>exterior angle</u> of a triangle is <u>equal</u> to the <u>sum</u> of the <u>interior opposite</u> <u>angles</u>)<br><br>OR<br>$EBA = 145$ (<u>allied angles</u> / <u>co-interior</u> <u>angles</u> add up to <u>180</u>$^o$)<br>$ECB =$ "145" $- 75$ (=70) (<u>exterior angle</u> of a triangle is <u>equal</u> to the <u>sum</u> of the <u>interior opposite angles</u>)<br>$EDC = 110$ (<u>angles</u> on a straight <u>line</u> add up to <u>180</u>$^o$) |

| Paper 5MM2H_01 | | | | |
|---|---|---|---|---|
| **Question** | **Working** | **Answer** | **Mark** | **Notes** |
| 14 | | 240 | 3 | M1 for 1 − 0.15 (=0.85) or 85% seen<br>M1 for 204 ÷ "0.85" oe<br>A1 cao |
| 15 | | $y = -2x + 6$ | 4 | M1 for (gradient =) $\dfrac{4 - -6}{-4 - 1}$ oe or  —<br><br>A1 for −2<br>M1 for (y =) "m"x + 6 or (y =) −2x + "c" or L = −2x + 6<br>A1 cao |
| 16 | | $w = \dfrac{x + 7}{3}$ | 3 | M1 for expanding brackets, eg 3×w+3×x or dividing each term by 3<br>M1 (dep on M1) for correct method to isolate *w* on one side of equation<br><br>A1 for $w = \dfrac{x + 7}{3}$ oe |
| 17 | | 19.5 | 4 | B1 for (AB =) 12 or (CBD =) 38<br><br>M1 for            —<br><br><br>M1 for        ——     ——<br><br><br>A1 for 19.4 – 19.5<br><br>OR<br>B1 for (AB =) 12 or (DCB or DAB =) 52<br>M1 for            —<br><br><br>M1 for        —— = ——<br><br><br>A1 for 19.4 – 19.5 |

| Paper 5MM2H_01 | | | | |
|---|---|---|---|---|
| Question | Working | Answer | Mark | Notes |
| 18 | | 0, 1, 2 | 2 | B2 for 0, 1, 2<br>(B1 for one error or one omission or one addition<br>OR<br>B1 for (x =) –2, –1, 0, 1, 2 and (y =) 0, 1, 2, 3, 4 oe, eg number lines) |
| 19 | | 9.22<br>and<br>–0.217 | 3 | M1 for substituting $a = 1$, $b = –9$ and $c = –2$ into quadratic formula condone sign errors<br><br>M1 for $\dfrac{\quad\overline{\phantom{xx}}\quad}{\quad}$<br>A1 for 9.21 to 9.22 and –0.21 to –0.22<br><br>OR<br>M1 for $\dfrac{\phantom{xxxxx}}{\phantom{xx}}$ (= 0)<br>M1 for (x =)<br>A1 for 9.21 to 9.22 and –0.21 to –0.22 |
| *20 | | 64% | 4 | M1 for 0.8×8000 (= 6400) oe<br>M1 for 0.8×0.8×8000 (=5120) oe<br>M1 (dep on M2) for $\dfrac{\phantom{xxx}}{\phantom{x}}$ (=64)<br>C1 for 64% from correct working<br><br>OR<br>M1 for 100% − 20% (=80%) or 1 − 0.2 (=0.8) oe seen<br>M1 for 80% × 80% or 0.8 × 0.8 (=0.64) oe<br>M1 (dep on M2) for "0.64"×100 (=64) or $\dfrac{\phantom{xx}}{\phantom{x}}$<br>C1 for 64% from correct working<br><br>(SC B1 for 64% with no working) |

| Paper 5MM2H_01 | | | | | |
|---|---|---|---|---|---|
| **Question** | | **Working** | **Answer** | **Mark** | **Notes** |
| 21 | (a) | | $y = 5x^2$ | 3 | M1 for or $y = kx^2$<br>M1 for $80 = k \times 4^2$ oe<br>A1 for $y = 5x^2$ |
| | (b) | | 245 | 1 | B1 for 245 or ft "$k$" $\times 7^2$ |
| | (c) | | 3 and –3 | 2 | M1 for $45 \div$ "$k$" (dependent on quadratic equation)<br>A1 for 3 and –3 |
| *22 | | | Algebraic proof | 3 | M1 for $(100x =) 100 \times 0.45...$ (=45.45…)<br>M1 for $100x - x$ (=99x) and $45.45... - 0.45...$ (=45)<br>C1 (dep on M2) for $(x =) \dfrac{5}{11}$ cao with full and correct algebraic proof |
| 23 | | | 9.54 | 3 | M1 for $(BC^2=) 5^2 + 6^2 - 2 \times 5 \times 6 \times \cos 120$<br>M1 for correct order of evaluation or 91<br>A1 for 9.53 – 9.54 |
| *24 | | | Proof | 3 | M1 for $49n^2 + 21n + 21n + 9$ or $49n^2 - 21n - 21n + 9$ oe<br>or $[(7n+3) - (7n-3)][(7n+3) + (7n-3)]$ oe<br>A1 for $84n$ oe from a correct expansion of both brackets<br>C1 (dep on M1) for correct statement of proof, eg $(84 =) 12 \times 7$ or — or<br> — oe |

| Question | | Working | Answer | Mark | Notes |
|---|---|---|---|---|---|
| 25 | (a) | | translation $\begin{pmatrix} -1 \\ 0 \end{pmatrix}$ | 2 | M1 for a translation parallel to *x*-axis<br>A1 for correct graph |
| | (b) | | stretch parallel to *y*-axis sf 2 | 2 | M1 for a stretch parallel to *y*-axis<br>A1 for correct graph |
| *26 | (a) | | congruency proved | 3 | M1 for correct statement with correct reason<br>M1 for a second correct statement with correct reason<br>C1 for complete proof justifying congruency, eg SAS or AAS<br><br>Eg<br>$DAE = BCF$ (opposite angles of parallelogram are equal)<br><br>$AE = FC$ (*E* and *F* are midpoints of lines of equal length)<br><br>$AD = BC$ (opposite sides of parallelogram are equal)<br><br>$AED \equiv CFB$ (SAS) |
| | (b) | | explains why $DE = FB$ | 1 | C1 for relevant statement using congruency<br><br>Eg<br>*DE* and *FB* are corresponding sides of congruent triangles |