



Mark Scheme (Results)

Summer 2013

International GCSE Mathematics
(4MB0) Paper 02

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- 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.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.
- **Types of mark**
 - M marks: method marks
 - A marks: accuracy marks
 - B marks: unconditional accuracy marks (independent of M marks)
- **Abbreviations**
 - awrt – answers which round to....
 - cao – correct answer only
 - ft – follow through
 - isw – ignore subsequent working
 - SC - special case
 - oe – or equivalent (and appropriate)
 - dep – dependent
 - indep – independent
 - eeoo – each error or omission

- **No working**

If no working is shown then correct answers normally score full marks

If no working is shown then incorrect (even though nearly correct) answers score no marks.

- **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 it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks.

Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks.

If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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

If there is no answer on the answer line then check the working for an obvious answer.

- **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: eg. Incorrect cancelling 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 eg algebra.

Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

- **Parts of questions**

Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.

International GCSE Maths
Summer 2013 – Paper 02
Mark Scheme

| Question Number | Working | Notes | | Mark |
|-----------------|---|--------------------------|---|------|
| 1 | $15 \times EC = 18 \times 24$ (o.e.) $EC = 28.8 \text{ cm}, \frac{432}{15} \text{ cm}$ $15 + "28.8"$ (43.8) | M1 A1 A1ft | 3 | 3 |

| Question Number | Working | Notes | | Mark |
|--|---|--------------|---|------|
| 2(a) | $\frac{1 \times 4 + 2 \times 10 + 3 \times 15 + 4 \times x + 5 \times 17}{4 + 10 + 15 + x + 17} = 3.5$ (o.e.) | B1 | 1 | |
| 2(b) | "correctly removing denominator and gathering constants in their eqn" $4x - 3.5x = 161 - 154$ (o.e.) $x = 14$ | M1 A1 | 2 | |
| 2(c) | 5 | B1ft | 1 | 4 |
| NB (1)Dep on using cand.'s x in (b) (2)If using negative value for x, then BO | | | | |

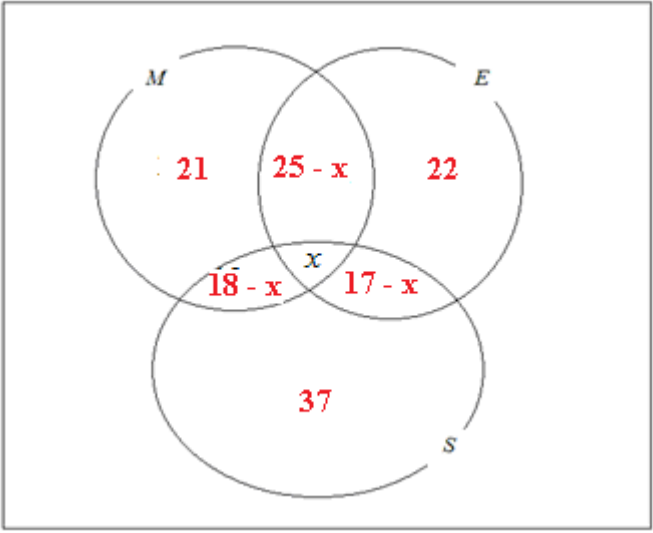
| Question Number | Working | Notes | | Mark |
|-----------------|--|--------------|---|------|
| 3(a) | $\sqrt{(17^2 - 15^2)}$ 8 cm | M1 A1 | 2 | |
| 3(b) | $\pi "8"{}^2 + \pi "8" \times 17$ (both areas involving π added) Correct conclusion | M1 A1 | 2 | 4 |

| Question Number | Working | Notes | | Mark |
|-----------------|---|----------------|---|------|
| 4(a) | $9a + b = 21$ $25a + b = 69$ NB: Note the order of the above award of Bs for ePEN | B1 B1 | 2 | |
| 4(b) | correct attempt to solve their sim. equations (no slips) Eg: see $16a = 48$ (M1) then $a = 3$ (A1) then $b = -6$ (A1) OR see $16b = -96$ (M1) then $b = -6$ (A1) then $a = 3$ (A1) $a = 3$ $b = -6$ NB: Note the order of the above award of As for ePEN | M1 A1 A1 | 3 | |
| 4(c) | $"3(-1)^2 + "-6"$ -3 | M1 A1 ft | 2 | 7 |

| Question Number | Working | Notes | | Mark |
|---|---|--------------------------|---|------|
| penalise incorrect/missing labels once only in the question eg for $\triangle ABC$, the vertices A, B and C must be labelled. | | | | |
| 5(a) | $\triangle ABC$ | B1 | 1 | |
| 5(b) | $\begin{pmatrix} 1 & -1 & -1 \\ 5 & 3 & 5 \end{pmatrix}$ | B2(-1eeoo) | 2 | |
| 5(c) | $\triangle A'B'C'$ | A1ft | 1 | |
| 5(d) | $\begin{pmatrix} 1 & -1 \\ 3 & -1 \end{pmatrix}$ " $\begin{pmatrix} 1 & -1 & -1 \\ 5 & 3 & 5 \end{pmatrix}$ " $\begin{pmatrix} -4 & -4 & -6 \\ -2 & -6 & -8 \end{pmatrix}$ OR $(-4, -2), (-4, -6), (-6, -8)$ (cao) $\triangle A''B''C''$ | M1 A1 A1ft | 3 | |
| 5(e) | enlargement -2 centre (0,0) <i>Note: Please note the order of B marks above when entering marks onto ePen</i> <i>Note: The candidate's answer must be a SINGLE transformation, otherwise award ZERO marks</i> | B1 B1 B1 | 3 | 10 |

| Question Number | Working | Notes | | Mark |
|-----------------|--|--------------------------|---|------|
| 6(a) | 800×49.22 39376 | M1 A1 | 2 | |
| 6(b) | $\frac{39376}{60.05}$ awrt £656 or better e.g. £655.72 $\pounds 800 - \text{"655.72"} = \pounds 144$ | M1 A1 A1ft | 3 | 5 |

| Question Number | Working | Notes | | Mark |
|-----------------|---|----------------|---|------|
| 7(a) | $\overrightarrow{AB} = 18\mathbf{b} - 3\mathbf{a}$ | B1 | 1 | |
| 7(b) | $2\mathbf{a}$ and $6\mathbf{b}$ $\overrightarrow{CD} = 6\mathbf{b} - 2\mathbf{a}$ | B1 B1 | 2 | |
| 7(c) | $\overrightarrow{OX} = \overrightarrow{OC} + \overrightarrow{CX} = "2\mathbf{a}" + \frac{1}{2}("6\mathbf{b}-2\mathbf{a}")$ OR $\overrightarrow{OX} = \overrightarrow{OD} + \overrightarrow{DX} = "6\mathbf{b}" - \frac{1}{2}("6\mathbf{b}-2\mathbf{a}")$ $\overrightarrow{OX} = 3\mathbf{b} + \mathbf{a}$ (cao) | M1 A1 | 2 | |
| 7(d) | $\overrightarrow{OY} = \mu("3\mathbf{b} + \mathbf{a}")$ | B1ft | 1 | |
| 7(e) | $\overrightarrow{OY} = "2\mathbf{a}" + \lambda \cdot 18\mathbf{b}$ | B1ft | 1 | |
| 7(f) | $\mu = 2$ and $3\mu = 18\lambda$ (equating "coefs" of \mathbf{a} and \mathbf{b}) $\mu = 2$ (cao) $\lambda = 1/3$ (cao) <i>Note: Please note the order of the A marks in part (f) when entering your marks on ePen</i> <i>Note: The A marks are dependent on the M mark having been awarded and also from correct equations for μ and λ</i> | M1 A1 A1 | 3 | |
| 7(g) | 1 : 3 (o.e.) | B1 | 1 | 11 |

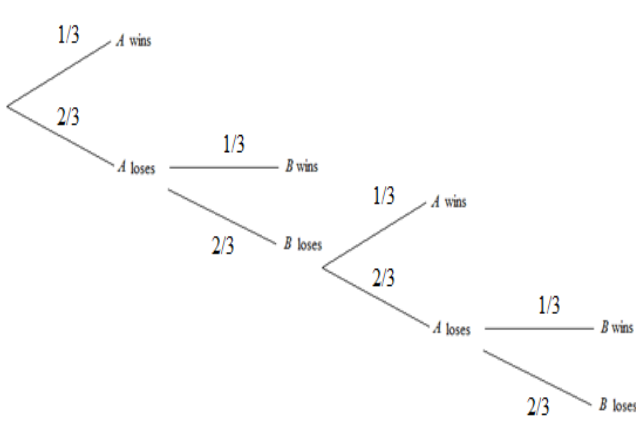
| Question Number | Working | Notes | | Mark |
|---|--|----------------------|---|------|
| 8(a) | $25 - x$ | B1 | 1 | |
| 8(b) |  <p>any TWO of $18 - x$, $17 - x$, "$25 - x$"</p> <p>all THREE of $18 - x$, $17 - x$, "$25 - x$"</p> <p>21, 22, 37</p> | B1ft B1ft B1ft | 3 | |
| NB: In parts (c) and (d) below, treat missing or deleted "$25 - x$" in the diagram as zero. | | | | |
| 8(c) | a correct and complete expression from their diagram = 120 (i.e. " $21 + (25 - x) + 22 + (18 - x) + x + (17 - x) + 37$ " = 120 $x = 10$) | M1 A1 | 2 | |
| 8(d) | (i) $120 - "22"$ (ft from their (b) and (c)) (ii) " $(25 - "10")$ " (ft from their (a) and (c)) OR $21 + (25 - "10") + (18 - "10") + "10" + (17 - "10") + 37$ | B1ft B1ft | 2 | |
| 8(e) | 17 (numerator) <i>ie</i> $n(S \cap E) = x + "17 - x"$ or identified 62 (denominator) <i>ie</i> $n S = "18 - x" + "17 - x" + x + 37$ or identified $\frac{17}{64}$, 0.274 (cao) | B1ft B1ft B1 | | |

| | | | | |
|--|--|--|--|--|
| | <p><i>Note: If no fraction given then B0, B0, B0</i></p> <p><i>Note: If no working seen, but a correct answer is seen (fraction or decimal) then award B1, B1, B1</i></p> <p><i>Note: If an incorrect decimal answer, then check for 17 as numerator and/or 62 as denominator to award the initial B marks</i></p> | | | |
|--|--|--|--|--|

| Question Number | Working | Notes | | Mark |
|---|--|--|--|------|
| Only penalise final answer not corrected to the required degree of accuracy the first time it occurs in the question | | | | |
| 9(a) | 30° and 40° correctly identified conclusion | M1 A1 | | 2 |
| 9(b) | <p>(i) $\frac{200}{\sin 70^\circ} = \frac{150}{\sin C}$</p> <p>$\angle C = \sin^{-1}\left(\frac{150 \times \sin 70^\circ}{200}\right)$</p> <p>44.8°</p> <p>(ii) 40 + "44.8"</p> <p>84.8</p> <p>Alternative for (ii) 180 - 30 - "65.2" (65.2=180-70-"44.8") = 84.8</p> <p>Alternative for (ii) $\angle BCN = 360 - ("44.8" + 220) = 95.2$ $\therefore \angle NBC = 180 - "95.2"$ (iii) ($\angle ABC = 65.2$ (= 180-70-"44.8") or eg seen on diagram) $AC^2 = 150^2 + 200^2 - 2 \times 150 \times 200 \times \cos "65.2"$</p> <p>$AC = \sqrt{62500 - 60000 \times \cos "65.2"} =$ $\sqrt{37332.9}$</p> <p>193m (cao)</p> <p>Alternative for (iii) $\frac{AC}{\sin 65.2} = \frac{200}{\sin 70} = \frac{150}{\sin 44.8} = M1$</p> <p>$AC = \frac{200 \times \sin 65.2}{\sin 70}$ OR $\frac{150 \times \sin 65.2}{\sin 44.8} = M1dep$</p> | M1 M1dep A1 M1 A1ft M1 M1dep A1 | | 8 |
| 9(c) | total distance travelled = 4x(150+200+"193") (=2172) | M1 M1dep | | 3 |

| | | | | |
|------|--|---------------------------------|---|--|
| | $\text{time} = \frac{4 \times (150 + 200 + "193")}{1.5} \quad (1448 \text{ secs})$ | A1 | | |
| | 1448 secs, 1449 secs | | | |
| 9(d) | <p>journey time = "1448"-180 (=1268 secs)</p> $\text{average speed} = \frac{4 \times (150 + 200 + "193")}{"1268"}$ <p>= awrt 1.7 m/s (i.e. from 1.71, 1.72)</p> <p><i>Note: for parts (c) and (d), if the factor 4 is missing in both (c) and (d) then the maximum score would be:</i> (c) M0, M0, A0 (d) M1, M1, A0</p> <p><i>Note: The A mark in part (d) is dependent on the A mark in (c) having been obtained</i></p> | <p>B1ft</p> <p>M1</p> <p>A1</p> | 3 | |

| Question Number | Working | Notes | | Mark |
|---|---|-------------------------------|---|------|
| 10(a) | $2x^2y = 16$ $y = \frac{8}{x^2}$ | M1 A1 | 2 | |
| 10(b) | $2 \times 2x \times \frac{8}{x^2} + 2 \times x \times \frac{8}{x^2} + 2x \times x$ correct conclusion | M1 A1 | 2 | |
| 10(c) | 32, 34, 59.6 <i>Note: Please note the order of the Bs when entering marks on ePen</i> | B1 B1 B1 | 3 | |
| 10(d) | graph penalties (-1) <ul style="list-style-type: none"> • straight line segments • each point missed ($\pm \frac{1}{2}$ small square ie ± 0.05) • each missed segment • each point not plotted • each point incorrectly plotted ($\pm \frac{1}{2}$ small square ie ± 0.05) • tramlines • very poor curve (e.g. line too thick) <i>Note: Deduct marks for errors as they appear starting at $x=1$ through to $x=5$. Ignore any curve drawn from $x=0$ to $x=1$ (i.e. start checking from 1,50)</i> | B3 | 3 | |
| In parts (e) and (f), penalise 1dp ONCE ONLY | | | | |
| 10(e) | 1.3 ($\pm \frac{1}{2}$ small square ft) 3.7 | B1ft B1ft | 2 | |
| 10(f) | indication on graph of attempt at minimum 2.3 $y = \frac{8}{2.3^2}$ 1.5 <i>Note: for M1dep, dependent on candidate using their graph (ie reading off x for S_{min} and not using calculus)</i> | M1 A1ft M1"dep" A1ft | 4 | 16 |

| Question Number | Working | Notes | | Mark |
|---|--|----------------------------|---|------|
| 11(a) | 3, 6, 9, 12 | B1 | 1 | |
| 11(b) | $4/12, 1/3, 0.333$ | B1 | 1 | |
| 11(c) |  <p>(1/3, 2/3) or (4/12, 8/12) twice on each pair of given branches</p> <p>correct branching added (penalise labelling)</p> <p>correct probabilities added</p> | B1, B1 B1 B1 | 4 | |
| <p>Special case for parts (a), (b) and (c): If only three multiples are given in the answer to part (a), this would score B0. All FOUR must be present to obtain the mark.</p> <p>However, a ft mark would be awarded in part (b) if 3/12, 1/4 or 0.25 is seen.</p> <p>A ft would also be allowed in part (c) on the first two B1 marks and on the final B1 mark if 3/12, 1/4 or 0.25 is seen.</p> | | | | |
| 11(d) | $\frac{2}{3} \times \frac{1}{3}$ or $\frac{8}{12} \times \frac{4}{12}$ (o.e.) ft errors from <i>their</i> diagram probabilities $\frac{32}{144}, \frac{2}{9}, 0.222$ | M1 A1ft | 2 | |
| 11(e) | $P(A \text{ wins}) = \frac{1}{3} + \frac{2}{3} \times \frac{2}{3} \times \frac{1}{3}$ ft errors from <i>their</i> diagram probabilities $= \frac{13}{27}, 0.481$ | M1 A1 M1 | | |

| | | | | |
|--|--|----|---|----|
| | <p> $P(\text{B wins}) = \left(\frac{2}{3} \times \frac{1}{3} + \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3} \times \frac{1}{3} \right) = \frac{13}{27}$ ft errors from <i>their</i> diagram probabilities $= \frac{26}{81}, 0.321$ comparing two fractions or their decimal values and correct conclusion </p> | A1 | | |
| | | A1 | 5 | 13 |

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