

Mark Scheme (Results)

Summer 2014

Pearson Edexcel International GCSE in
Mathematics B Paper 2R
(4MB0/02R)

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If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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

| Question Number | Answer | Notes | Marks | Total |
|-----------------|--|---|-------------------|-------|
| 1 | <p>(a) $\sqrt{(5-(-3))^2 + (-8-7)^2}$ (oe)</p> <p>17 (cao)</p> <p>(b) $\frac{-8-7}{5-(-3)}$ (oe)</p> <p>$-\frac{15}{8}, \frac{15}{-8}$, (oe) (awrt -1.88)</p> | <p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> | <p>2</p> <p>2</p> | 4 |
| 2 | <p>$\mathbf{A}^2 = \begin{pmatrix} 11 & -14 \\ -7 & 18 \end{pmatrix}$</p> <p>One term correct</p> <p>All correct</p> <p>$\begin{pmatrix} 11 & -14 \\ -7 & 18 \end{pmatrix} - \begin{pmatrix} 3 & -2 \\ -1 & 4 \end{pmatrix}$</p> <p>$2\mathbf{B} = \begin{pmatrix} 8 & -12 \\ -6 & 14 \end{pmatrix}$ (cao)</p> <p>$\mathbf{B} = \begin{pmatrix} 4 & -6 \\ -3 & 7 \end{pmatrix}$</p> <p>NB: ft on their $2\mathbf{B}$</p> <p>OR</p> <p>$\begin{pmatrix} 3 & -2 \\ -1 & 4 \end{pmatrix} + 2\begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} 11 & -14 \\ -7 & 18 \end{pmatrix}$</p> <p>4 eqⁿs for a, b, c and d from above equation, Max. 2 slips allowed in their eqⁿs</p> | <p>M1</p> <p>A1</p> <p>M1(DEP)</p> <p>A1</p> <p>B1 ft</p> <p>M1 (DEP)</p> <p>A1 (cao)</p> | | |

| | | | | |
|----------|--|--|-------------|----------|
| | $\begin{array}{l} 2a = 8 \\ 2b = -12 \\ 2c = -6 \\ 2d = 14 \end{array}$ <p style="text-align: center;">OR</p> $\begin{array}{l} a = 4 \\ b = -6 \\ c = -3 \\ d = 7 \end{array}$ $\mathbf{B} = \begin{pmatrix} 4 & -6 \\ -3 & 7 \end{pmatrix}$ | B1 ft | 5 | 5 |
| 3 | $220 \times 2.40 + 140 \times 1.60 + (400 - 220 - 140) \times 0.55$ <p style="text-align: center;">(£) 774 (cao)</p> $\frac{"774" - 360}{360} \times 100$ <p>OR</p> $\frac{\pounds 360}{400} (= \pounds 0.9) \quad \text{and}$ $220 \times (2.40 - 0.9) + 140 \times (1.60 - 0.9) + 40 \times (0.55 - 0.9)$ <p>(can be embedded within working)</p> <p>£414 (cao)</p> $\frac{\pounds 414}{\pounds 360} \times 100$ <p>115% (cao)</p> | M1 A1 M1 (DEP) M1 A1 M1 (DEP) A1 | 4 | 4 |
| 4 | (a) $19 - x$ $35 - x$ (b) (i) $"(19 - x)" + "(35 - x)" + x + 16 = 62$ (ii) $x = 8$ (cwo) (c) $\frac{"8"}{19}$ $\frac{8}{19}$, 0.421 (or better), 42.1% (cao) | B1 B1 M1 A1 B1ft B1 | 2 2 2 | 6 |

| Question Number | Answer | Notes | Marks | Total |
|-----------------|---|--|----------------------------|----------|
| 5 | $\frac{3}{10}$ <p>(a) $\frac{6}{9}, \frac{3}{9}$ (o.e)</p> $\frac{7}{9}, \frac{2}{9}$ <p>(b) $\frac{7}{10} \times \frac{3}{9}$ or $\frac{3}{10} \times \frac{7}{9}$</p> $\frac{7}{10} \times \frac{3}{9} + \frac{3}{10} \times \frac{7}{9}$ (o.e.) <p>OR</p> $\frac{7}{10} \times \frac{6}{9}$ or $\frac{3}{10} \times \frac{2}{9}$ $1 - \frac{7}{10} \times \frac{6}{9} - \frac{3}{10} \times \frac{2}{9}$ (o.e) $\frac{42}{90}, \frac{14}{30}, \frac{7}{15}$ (awrt 0.467, 46.7%) | <p>B1</p> <p>B1</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>A1</p> | <p>3</p> | <p>6</p> |
| 6 | <p>(a) (i) $\frac{7}{3}$, awrt 2.33 (ii) 9</p> <p>(b) $y + 2x = 1$ OR $2x = 1 - y$ OR $2y = 1 - x$ OR $x = 1 - 2y$ (No slips)</p> $\frac{1-x}{2}, -\frac{x-1}{2}, \frac{1}{2} - \frac{x}{2}$ (cao) <p>(c) $2(1-2x)^2 - 5$</p> $2(4x^2 - 4x + 1) - 5$ $8x^2 - 8x - 3$ (cwo) <p>NB: Answer given (ag)</p> <p>(d) $"8x^2 - 8x - 3" = 45$ (oe)</p> <p>Attempt to solve a trinomial quadratic</p> | <p>B1, B1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>B1 ft</p> <p>M1 (INDEP)</p> | <p>2</p> <p>2</p> <p>2</p> | |

| | | | | | |
|--|---------------------|----------------|----------|---|-----------|
| | $x = 3$ $x = -2$ | (cwo) (cwo) | A1 A1 | 4 | 10 |
|--|---------------------|----------------|----------|---|-----------|

| Question Number | Answer | Notes | Marks | Total |
|--|---|------------|-------|-----------|
| 7 | (a) $\frac{400}{x}$ | (o.e.) | B1 | 1 |
| | (b) $\frac{400}{x-60}$ | (o.e.) | B1 | 1 |
| | (c) $\frac{1}{3}$ (oe) | | B1 | 1 |
| | (d) " $\frac{400}{x-60} - \frac{400}{x} = \frac{1}{3}$ " | (o.e.) | B1 ft | 1 |
| | (e) " $3 \times x \times 400 - 3 \times 400 \times (x - 60) = x(x - 60)$ " | | M1 | |
| | (removal of denominator(s), but denominators must involve x , 1 slip allowed when expanding brackets) | | | |
| | $x^2 - 60x - 72000 = 0$ | (cwo) | A1 | |
| Attempt to factorise a trinomial quadratic | | M1 (INDEP) | | |
| $x = 300$ | (cao) | A1 | 4 | |
| (f) $\frac{28300}{92.35}$ | (oe) | M1 | | |
| 306.4.... | | A1 | | |
| \$306 | | B1 ft | 3 | |
| (to their 'correct' nearest dollar) | | | | 11 |

| Question Number | Answer | Notes | Marks | Total |
|--|---|--------|-------|-------|
| 8 | (a) (i) $4\mathbf{b}$ (ii) $\mathbf{a} - \mathbf{b}$ | B1, B1 | | |
| | (iii) $\overrightarrow{BE} = \overrightarrow{BA} + \overrightarrow{AE} = (\mathbf{a} - \mathbf{b}) + \frac{1}{2}(4\mathbf{b} - \mathbf{a})$ | M1 | | |
| | OR $\overrightarrow{BE} = \overrightarrow{BC} - \overrightarrow{EC} = 3\mathbf{b} + \frac{1}{2}(\mathbf{a} - 4\mathbf{b})$ | | | |
| | $\frac{\mathbf{a}}{2} + \mathbf{b}$ (cao, oe) | A1 | | |
| | (iv) $\overrightarrow{CD} = \overrightarrow{CB} + \overrightarrow{BD} = -3\mathbf{b} + \frac{1}{2}(\mathbf{a} - \mathbf{b})$ | | | |
| | OR | | | |
| | $\overrightarrow{CD} = \overrightarrow{CA} + \overrightarrow{AD} = -(4\mathbf{b} - \mathbf{a}) + \left(-\frac{1}{2}(\mathbf{b} - \mathbf{a})\right)$ | M1 | | |
| | $\frac{1}{2}\mathbf{a} - \frac{7}{2}\mathbf{b}$ (cao, oe) | A1 | 6 | |
| | (b) $\mu\left(\frac{\mathbf{a}}{2} + \mathbf{b}\right)$ | B1 ft | 1 | |
| | (c) $\overrightarrow{BX} = \overrightarrow{BC} + \overrightarrow{CX} = 3\mathbf{b} + \lambda\left(\frac{1}{2}\mathbf{a} - \frac{7}{2}\mathbf{b}\right)$ | M1 | | |
| $\frac{1}{2}\lambda\mathbf{a} + (3 - \frac{7}{2}\lambda)\mathbf{b}$ OR $\frac{1}{2}\lambda\mathbf{a} + 3\mathbf{b} - \frac{7}{2}\lambda\mathbf{b}$ | A1 | 2 | | |
| (d) $\mu = 3 - \frac{7}{2}\lambda$ or $\frac{1}{2}\mu = \frac{1}{2}\lambda$ (from equating <i>their</i> components of \mathbf{a} AND equating <i>their</i> components of \mathbf{b} of 2 vector versions of their \overrightarrow{BX}) | M1 | | | |
| $\lambda = \frac{2}{3}$ | A1 | | | |
| $\mu = \frac{2}{3}$ (cwo) | A1 | 3 | 12 | |

| Question Number | Answer | Notes | Marks | Total |
|----------------------------|---|---|-----------|-------|
| 9 | <u>Penalise LABELLING ONCE only</u> | | | |
| | (a) Triangle P drawn and labelled | B1 | 1 | |
| | (b) $y = -1$ drawn and labelled (ie $y = -1$ Or “line of reflection”) | B1 | 1 | |
| | (c) Triangle Q drawn and labelled (coords: $(-5, 2), (-5, 4), (-2, 2)$) | B1 | 1 | |
| | (d) $\begin{pmatrix} -1 & -1 \\ 1 & 3 \end{pmatrix} \times c$'s coords in (c) Triangle R drawn and labelled (coords: $(3, 1), (1, 7), (0, 4)$) | M1 (seen or implied) A2 ft (-1 ee) | 3 | |
| | (e) Triangle S drawn and labelled (coords: $(7, -11), (5, -5), (4, -8)$) $\begin{pmatrix} \frac{3}{2} & -\frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} \end{pmatrix} \times c$'s coords in (e) | B2 ft (-1 ee) M1 (seen or implied) | 2 | |
| | (f) Triangle T drawn and labelled (coords: $(-5, -2), (-5, 0), (-2, -2)$) (cao) | A2 (- 1ee) | 3 | |
| (g) Reflection $y = -3$ | B1 B1 | 2 | 13 | |

| Question Number | Answer | Notes | Marks | Total |
|-----------------|--|---|-------------------|-------|
| 10 | <p>NB: Penalise not corrected ONCE only in the question.</p> <p>(a) $AC^2 = 18^2 + 24^2 - 2 \times 18 \times 24 \times \cos 65$</p> <p>$AC = \sqrt{(18^2 + 24^2 - 2 \times 18 \times 24 \times \cos 65)}$</p> <p>OR</p> <p>$AC^2 = (18 \times \sin 65)^2 + (24 - 18 \times \cos 65)^2$</p> <p>$AC = \sqrt{(18 \times \sin 65)^2 + (24 - 18 \times \cos 65)^2}$</p> <p>$AC = 23.1 \text{ m}$</p> <p>(b) $\frac{18}{\sin ACD} = \frac{23.1}{\sin 65}$</p> <p>$\angle ACD = \sin^{-1}\left(\frac{18 \times \sin 65}{23.1}\right)$</p> <p>OR</p> <p>$\tan \angle ACD = \frac{18 \times \sin 65}{24 - 18 \times \cos 65}$</p> <p>$\angle ACD = \tan^{-1}\left(\frac{18 \times \sin 65}{24 - 18 \times \cos 65}\right)$</p> <p>NB: Other right-angled trig. solutions possible.</p> <p>OR</p> <p>$18^2 = 24^2 + 23.1^2 - 2 \times 24 \times 23.1 \times \cos \angle ACD$</p> <p>$\angle ACD = \cos^{-1}\left(\frac{24^2 + 23.1^2 - 18^2}{2 \times 24 \times 23.1}\right)$</p> <p>$\angle ACD = 44.9^\circ$</p> <p>NB: Watch for the incorrect assumption that AC bisects $\angle BCD$ so that $\angle ACD = 45^\circ$. This scores M0 M0 A0</p> <p>(c) $\angle BCA = 90 - 44.9$</p> | <p>M1</p> <p>M1 (DEP)</p> <p>M1 M1 (DEP)</p> <p>A1</p> <p>M1</p> <p>M1 (DEP)</p> <p>M1 (DEP)</p> <p>M1</p> <p>M1 (DEP)</p> <p>M1</p> <p>A1</p> <p>B1 ft</p> | <p>3</p> <p>3</p> | |

| | | | | |
|--|--|---|--------------------------------------|--|
| | $\therefore \Delta ABC = \frac{1}{2} \times 20 \times "23.1" \times \sin(90 - "44.9")$ <p style="text-align: center;">164 m²</p> <p>NB: Assumption that <i>ABCD</i> is a cyclic quadrilateral scores B0 M0 A0</p> <p>(d) $\Delta ADB = \Delta ADC + \Delta ABC - \Delta BCD$ route:</p> <p>Area of $\Delta ADC = \frac{1}{2} \times 18 \times 24 \times \sin 65$</p> <p style="text-align: center;">awrt 196 m²</p> <p style="text-align: center;">Area of $\Delta ADB = "196" + "164" - \frac{1}{2} \times 24 \times 20$</p> <p>OR</p> <p>$\Delta ADB = \frac{1}{2} \times AD \times AB \times \sin \angle DAB$ route:</p> <p>$AB^2 = 20^2 + "23.1"{}^2 - 2 \times 20 \times "23.1" \times \cos "45.1"$</p> <p>$AB = \sqrt{(20^2 + "23.1"{}^2 - 2 \times 20 \times "23.1" \times \cos "45.1")}$</p> <p>($AB = 16.802$)</p> <p>$AB =$ awrt 16.8</p> <p>then</p> <p>-----</p> <p>$\angle DAC = 180 - (65 + "44.861") = 70.139$</p> <p>$\frac{20}{\sin \angle CAB} = \frac{"16.802"}{\sin "45.1"}$</p> <p>($\angle CAB = 57.536$)</p> <p>$\therefore \angle DAB = "70.139" + "57.536" = 127.68$</p> <p>OR</p> <p>$BD = \sqrt{(20^2 + 24^2)} = 31.24, 4\sqrt{61}$</p> <p>$\therefore \angle DAB = \cos^{-1} \left(\frac{"16.802"{}^2 + 18^2 - "31.24"{}^2}{2 \times "16.802" \times 18} \right)$</p> <p style="text-align: center;">$= 127.67$</p> <p>-----</p> | <p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>M1 (DEP)</p> <p>M1</p> <p>A1</p> | <p style="text-align: center;">3</p> | |
|--|--|---|--------------------------------------|--|

| | | | | |
|--|---|---|----------|-----------|
| | <p>Finally ($\Delta ADB = \frac{1}{2} \times AD \times AB \times \sin \angle DAB$ route:))</p> <p>Area of $\Delta ADB = \frac{1}{2} \times 18 \times 16.802 \times \sin 127.68^\circ$</p> <p>OR</p> <p>$\Delta ADB = \frac{1}{2} \times AD \times BD \times \sin \angle ADB$ route:</p> <p>$BD = \sqrt{(20^2 + 24^2)} = 31.24$</p> <p>$BD = \text{awrt } 31.2, 4\sqrt{61}$</p> <p>$\angle BDC = \tan^{-1}\left(\frac{20}{24}\right) (= 39.8056)$</p> <p>$\therefore \angle BDA = 65 - 39.8056 (= 25.19)$</p> <p>Finally ($\Delta ADB = \frac{1}{2} \times AD \times BD \times \sin \angle ADB$ route:))</p> <p>Area of $\Delta ADB = \frac{1}{2} \times 18 \times 31.24 \times \sin 25.19^\circ$</p> <p>$\Delta ADB = 120 \text{ m}^2$</p> | <p>M1 (DEP on correct method for $\angle DAB$ and AB)</p> <p>M1</p> <p>A1</p> <p>M1 (DEP on method for $\angle ADB$ and BD)</p> <p>A1</p> | <p>4</p> | <p>13</p> |
|--|---|---|----------|-----------|

| Question Number | Answer | Notes | Marks | Total |
|--|--|--------------------|-----------|-------|
| 11 | (a) $4y + x$ | B1 | 1 | |
| | (b) $x(4y + x)$ | B1 ft | 1 | |
| | (c) $y = \frac{40}{x^2}$ | M1 | | |
| | $S = x^2 + 4x\left(\frac{40}{x^2}\right)$ (cwo) (ag) | A1 | 2 | |
| | (d) One term correctly differentiated | M1 | | |
| | $2x - \frac{160}{x^2}$ | A1 | | |
| | $"2x - \frac{160}{x^2}" = 0$ | M1 (DEP) | | |
| | 4.3 (cao) | A1 | 4 | |
| | (e) 84 62.3 57 | B1 B1 B1 | 3 | |
| | (f) graph penalties (-1) straight line segment(s) each point missed ($\pm \frac{1}{2}$ small sq.) each missed segment each point not plotted each point incorrectly plotted ($\pm \frac{1}{2}$ small sq.) tramlines very poor curve i.e. line too thick | B3 ft (-1 eeoo) | 3 | |
| (g) line drawn at $S = 75$ accept any $x \in [2.2, 2.4]$ NB: "Drawing $S = 75$ " may be implied by answer $x \in [2.2, 2.4]$ | M1 A1 | 2 | 16 | |

