

Mark Scheme (Results)

Summer 2015

Pearson Edexcel International GCSE
Mathematics B (4MB0)
Paper 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.
- 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**
 - cao – correct answer only
 - ft – follow through
 - isw – ignore subsequent working
 - SC - special case
 - oe – or equivalent (and appropriate)
 - dep – dependent
 - indep – independent
 - eeo – each error or omission
 - awrt – answer which rounds to

- **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	Working	Marks				
1	<p>Any one of $3p-6=-12$, $-9-8=r$, $-3q-12=-24$ (o.e.)</p> <p>Note: Nothing, as yet, for $pq-9=r$</p> $p=-2, q=4, r=-17$ <p>Note: The first A mark is for the value of p, the second for the value of q.</p>	<p>M1</p> <p>A1.A1.A1</p> <p>[4]</p>				
2	$\frac{x^2-11x+24}{x+5} \times \frac{2x^2+9x-5}{x-3}$ <p>Attempt at factorising a quadratic</p> <p>Note: For method, the two bracketed terms, when multiplied out, must give at least two of the three terms from the trinomial quadratic.</p> $(x-8)(x-3)$ $(2x-1)(x+5)$ $(x-8)(2x-1) \text{ or } 2x^2-17x+8$ <p>Note: If extra factors appear, do not penalise but apply the scheme as stated.</p> <p>Isw Accept (o.e.) i.e. $2(x-8)(x-0.5)$</p>	<p>M1</p> <p>M1</p> <p>A1</p> <p>A1</p> <p>A1</p> <p>[5]</p>				
3	<p>(a) $2 \times 1.5 \times 0.5 \times 1000000$ (o.e.)</p> <p>1500000 (o.e.)</p> <p>SC: Allow (M1)(A0) for 1.5 m^3 (as long as units given & this is their final answer to part (a). An incorrect conversion to cm earns no marks here.)</p> <table border="1" data-bbox="288 1518 1291 1787"> <tr> <td data-bbox="288 1518 791 1599">(b) $\frac{"1500000"}{12500}$ (M1)</td> <td data-bbox="791 1518 1291 1599">12500 × 60 (750000)</td> </tr> <tr> <td data-bbox="288 1599 791 1787">$\frac{"1500000"}{12500} \div 60$ (M1)</td> <td data-bbox="791 1599 1291 1787">$\frac{"1500000"}{"750000"}$</td> </tr> </table> <p>2 hours</p>	(b) $\frac{"1500000"}{12500}$ (M1)	12500 × 60 (750000)	$\frac{"1500000"}{12500} \div 60$ (M1)	$\frac{"1500000"}{"750000"}$	<p>M1</p> <p>A1</p> <p>M1</p> <p>M1 dep</p> <p>A1</p> <p>[5]</p>
(b) $\frac{"1500000"}{12500}$ (M1)	12500 × 60 (750000)					
$\frac{"1500000"}{12500} \div 60$ (M1)	$\frac{"1500000"}{"750000"}$					

<p>4</p>	<p>(a) 11, 16, 26, 7</p> <p>Note: Order of B marks is important If the diagram is not marked in anyway, allow acceptable answers, provided the correct sets are identified.</p> <p>(b) "7"+"11" (18) or 60 – "16" – "26"</p> <p>Note: Ignore notation (i.e. {})</p>	<p>B1, B1, B1, B1</p> <p>B1 ft</p> <p>[5]</p>
<p>5</p>	<p>(a) one term correctly differentiated</p> $1 + \frac{4}{x^2} \text{ (o.e.)}$ <p>Note: Do not isw here</p> <p>(b) "$1 + \frac{4}{x^2} = 17$"</p> <p>Note: ft from their answer to part (a)</p> $16x^2 = 4 \text{ OR } x^2 = \frac{1}{4} \text{ OR } 4x^2 = 1 \text{ (o.e.)}$ <p>Note: This M (dep) mark is for re-arranging their equation, removing any denominators or negative indices. The original equation however must have a negative index in it.</p> <p>(0.5, -7.5)</p> <p>Notes: Accept $x = 0.5, y = -7.5$ Missing bracket scores, at most, (A1)(A0) i.e. 5, -7.5 scores (A0)(A0) Extra coordinate(s) loses some mark(s), at most (A1)(A0) i.e. (5, -7.5) plus an extra coordinate pair scores (A0)(A0)</p>	<p>M1</p> <p>A1</p> <p>M1</p> <p>M1 dep</p> <p>A1. A1</p> <p>[6]</p>

<p>6</p>	<p>(a) each correct section of journey</p> <p>Note: 2nd B1ft is for a correct horizontal line, of the correct length drawn from the point of the end of the 1st line segment 3rd B1 ft is for their line, starting where their horizontal line finishes and terminates at Nevers at 11:45</p> <p>(b) 11:45 – "10:09" (96 mins)</p> <p>Note: For method, the mark is awarded for 11:45 – their start time from Autun Accept $1\frac{3}{5}$ hours (o.e.) but not 1.36 (hrs)</p> <p>70 km/h</p> <p>(c) one straight line, correct starting point</p> <p>Correct finishing point</p> <p>Note: For ft, must finish at Beaune, 2 hours after leaving Nevers</p> <p>SC: (B1)(B0) for the correct 'reverse' journey</p> <p>(d) (i) 10:33 (± 2 min)</p> <p>(ii) 28 km (± 1 km)</p> <p>Note: Do not accept 0</p>	<p>B1,B1ft,B1ft</p> <p>M1</p> <p>A1</p> <p>B1</p> <p>B1 ft</p> <p>B1 ft</p> <p>B1 ft</p> <p>[9]</p>
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<p>7</p> <p>(a) $\frac{4}{11}; \frac{6}{10}, \frac{4}{10}; \frac{7}{10}, \frac{3}{10}$</p> <p>(b) (i) $\frac{7}{11} \times \frac{4}{10}$</p> <p>$\frac{28}{110}$ (o.e.) $(\frac{14}{55}, 0.255, 25.5\%)$</p> <p>(ii) At least two of $\frac{7}{11} \times \frac{4}{10}$, $\frac{4}{11} \times \frac{7}{10}$, $\frac{4}{11} \times \frac{3}{10}$ added together</p> <p>All 3 correct products from c's diagram added together</p>	<p>B1,B1,B1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>M1 dep</p>
<p>Alternative for (b)(ii) M2</p> <p>$1 - \frac{7}{11} \times \frac{6}{10}$</p>	<p>M2</p>
<p>$\frac{68}{110}$ $(\frac{34}{55}, 0.618..., 61.8\%)$</p> <p>(c) $\frac{4}{11} \times \frac{3}{10} + \frac{7}{11} \times \frac{4}{10}$</p> <p>$\frac{\frac{4}{11} \times \frac{3}{10}}{\frac{4}{11} \times \frac{3}{10} + \frac{7}{11} \times \frac{4}{10}} \left(\frac{6/55}{20/55} \right)$</p> <p>$= 12/40 = 0.3$ (correct conclusion) *</p> <p>Note: A candidate who uses with replacement gains, at most, the method marks within the question.</p>	<p>A1</p> <p>M1</p> <p>M1 dep</p> <p>A1 cso</p> <p>[11]</p>

8	<p>(a) $\frac{60}{x}$</p> <p>(b) $\frac{60}{x-27}$</p> <p>(c) "$\frac{60}{x-27}$" - "$\frac{60}{x}$" = 2 (o.e.)</p> <p>(d) Removing denominators and brackets from their equation (allow one sign slip)</p> <p>Note: Must be two denominators removed which both involve an expression in x.</p> $60x - 60x + 1620 = 2x^2 - 54x + 1620 \text{ (o.e.)}$ <p>completely correct working</p> <p>(e) Attempt to solve quadratic</p> <p>Note: Either Attempt to factorise (see Question 2)</p> <p>Or correct substitution into a correct formula</p> <p>Or completing the square as far as:</p> $\left(x - \frac{27}{2}\right)^2 - \left(\frac{27}{2}\right)^2 = 810$ $(x - 45)(x + 18) (= 0)$ $x = 45$ <p>Note: Ignore $x = -18$ as a solution</p> <p>(f) $\frac{10.80}{"45" - 27}$</p> <p>Note: "45" must be positive Accept $\frac{60}{10/3} = \frac{10.80}{x}$ (o.e.) for method</p> <p>(£) 0.60 or 60 (pence)</p> <p>Note: Accept £ 0.6 with the '£' sign</p>	<p>B1</p> <p>B1</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>[11]</p>
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<p>9</p>	<p>Penalise incorrect rounding once only in the question, the first time it occurs</p>		<p>M1</p> <p>M1 dep</p> <p>A1</p>
	<p>(a) $AC^2 = 12^2 + 9^2 - 2 \times 12 \times 9 \times \cos 100$</p> <p>$AC^2 = 225 + 37.5\dots$</p> <p>16.2 m (16.2020...)</p>		<p>M1</p> <p>M1 dep</p> <p>A1</p>
	<p>(b) $\frac{9}{\sin CAB} = \frac{16.2}{\sin 100}$</p> <p>$\sin CAB = \frac{9 \times \sin 100}{16.2}$</p> <p>33.2° (33.164492...)</p>	<p>$9^2 = 12^2 + 16.2^2 - 2 \times 12 \times 16.2 \times \cos \angle BAC$</p> <p>$\cos \angle BAC = \frac{12^2 + 16.2^2 - 9^2}{2 \times 12 \times 16.2}$</p> <p>33.2° (33.164492...)</p>	<p>M1</p> <p>M1 dep</p> <p>A1</p>
	<p>(c) $\angle BDA = 180 - 50 - 33.2$ (96.8°)</p> <p>OR</p> <p>$\angle BCD = 180 - 100 - 33.2$ (46.8°)</p> <p>OR</p> <p>$\angle BDC = 50 + 33.2$ (83.2°)</p>		<p>B1 ft</p>
	<p>$\frac{BD}{\sin 33.2} = \frac{12}{\sin 96.8}$</p> <p>$BD = \frac{12 \times \sin 33.2}{\sin 96.8}$</p> <p>$BD = 6.61 \rightarrow 6.62$ (awrt)</p> <p>Area $\triangle BDC = \frac{1}{2} \times 9 \times 6.62 \times \sin 50$</p>	<p>$\frac{DC}{\sin 50} = \frac{9}{\sin 83.2}$</p> <p>$DC = \frac{9 \times \sin 50}{\sin 83.2}$</p> <p>$DC = 6.94$ (6.94756...) (awrt)</p> <p>Area $\triangle BDC = \frac{1}{2} \times 9 \times 6.94 \times \sin 46.8$</p>	<p>M1</p> <p>M1 dep</p> <p>A1</p> <p>M1 ind</p>
<p>Note: Apply an equivalent scheme to:</p> <p>Finding $AD = 9.26$ (9.25834...) leading to Area $\triangle BAD = \frac{1}{2} \times 12 \times 9.26 \times \sin 33.2$</p> <p>Note: Applying the formula $\frac{1}{2} bc \sin A$ for the area of any triangle earns an independent method mark</p> <p style="text-align: center;">22.8 (m²)</p>			<p>A1</p>
			<p>[12]</p>

<p>10</p>	<p>(a) (i) $\frac{1}{3}\mathbf{a}$ (ii) $\frac{3}{4}\mathbf{b}$ (iii) $\frac{1}{3}\mathbf{a} - \frac{3}{4}\mathbf{b}$ (iv) $\mathbf{a} - \mathbf{b}$</p> <p>(b) $\overrightarrow{AP} = \lambda\left(\frac{1}{3}\mathbf{a} - \frac{3}{4}\mathbf{b}\right)$</p> <p>$\overrightarrow{XP} = \frac{3}{4}\mathbf{b} + \lambda\left(\frac{1}{3}\mathbf{a} - \frac{3}{4}\mathbf{b}\right)$</p> <p>Correct conclusion from correct working</p> <p>(c) $-\mathbf{a} + \mu(\mathbf{a} - \mathbf{b})$ (o.e.)</p> <p>(d) comparing one of c's coefficients of their components</p> <p>Note: Do not penalise method if the vector(s) are left in the comparison</p> <p>A correct equation in one parameter from c's equations</p> <p>Note: $\frac{1}{3}\lambda = \mu - 1, \quad \frac{3}{4}(\lambda - 1) = \mu$</p> <p>$\mu = \frac{12}{5}, \quad \lambda = \frac{21}{5}$ (o.e.)</p> <p>(e) 2 (cm)</p> <p>(f) $\frac{3}{4}y$ seen</p> <p>Note: Accept $\frac{3}{4} \mathbf{b}$ for $\frac{3}{4}y$ for (B1)</p> <p>$y \times \frac{3}{4}y = 6 \times 2$</p> <p>Note: Must be an equation in y.</p> <p>$y = 4$</p>	<p>B1, B1 B1ft, B1</p> <p>M1</p> <p>M1 dep</p> <p>A1</p> <p>B1ft</p> <p>M1</p> <p>M1</p> <p>A1, A1</p> <p>B1</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>[16]</p>
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<p>11</p>	<p>(a) $\frac{1}{2} \times 3x \times 4x$ (isw)</p> <p>(b) $(AC^2 =) (3x)^2 + (4x)^2$ $3x + 4x + "5x"$ Note: Do not accept $\sqrt{25x^2}$</p> <p>(c) $60 - "12x"$ $y = \frac{60 - 12x}{6} \quad (10 - 2x)$</p> <p>(d) area of rectangle = $2 \times ("10 - 2x")("10 - 2x")$ Total area = $\frac{1}{2} \times 3x \times 4x + 2 \times ("10 - 2x")("10 - 2x")$ correct conclusion</p> <p>(e) 134, 86</p> <p>(f) -1 mark for straight line segments each of their points missed each missed segment each of their points not plotted each of their points incorrectly plotted tramlines very poor curve</p> <p>Notes: ft from their table values Accuracy: ± 1 s.s. If a point is not plotted, it can be inferred from their curve passing through (within tolerance) the required point.</p> <p>(g) line drawn on graph at $A = 120$</p> <p>Note: The line may be implied from their value(s) of x or simply from two points marked at the intersection of their curve and $A = 120$ $x = 4.4/4.5$ (awrt)</p> <p>Note: Ignore the second answer Accept answer in range 116 – 122 (must be an integer)</p>	<p>B1</p> <p>M1</p> <p>A1 ft</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>M1 dep</p> <p>A1</p> <p>B1,B1</p> <p>B3</p> <p>M1</p> <p>A1</p>
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	<p>Alternative to part (g)</p> <p>attempt to solve $14x^2 - 80x + 80 (= 0)$</p> <p>Note: Either correct substitution into a correct formula</p> <p>Or Attempt to factorise (see Question 2)</p> <p>Or completing the square as far as:</p> $\left(x - \frac{80}{28}\right)^2 - \left(\frac{80}{28}\right)^2 = \frac{-80}{14}$ <p>$x = 4.4$ (or better)</p> <p>answer 117</p>	<p>A1</p> <p>M1</p> <p>A1</p> <p>A1</p> <p>[16]</p>
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