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.

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

Question Number	Working	Notes		Mark
2(a)	$\dfrac{1 \times 4 + 2 \times 10 + 3 \times 15 + 4 \times x + 5 \times 17}{4 + 10 + 15 + x + 17} = 3.5$ (o.e.)	B1	1	
2(b)	"correctly removing denominator and gathering constants in their eqn"			
	$4x - 3.5x = 161 - 154$ (o.e)	M1		
	$x = 14$	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 B0				

Question Number	Working	Notes		Mark
3(a)	$\sqrt{(17^2 - 15^2)}$	M1		
	8 cm	A1	2	
3(b)	$\pi "8"^2 + \pi "8" \times 17$ (*both* areas involving π added)	M1		
		A1		
	Correct conclusion		2	4
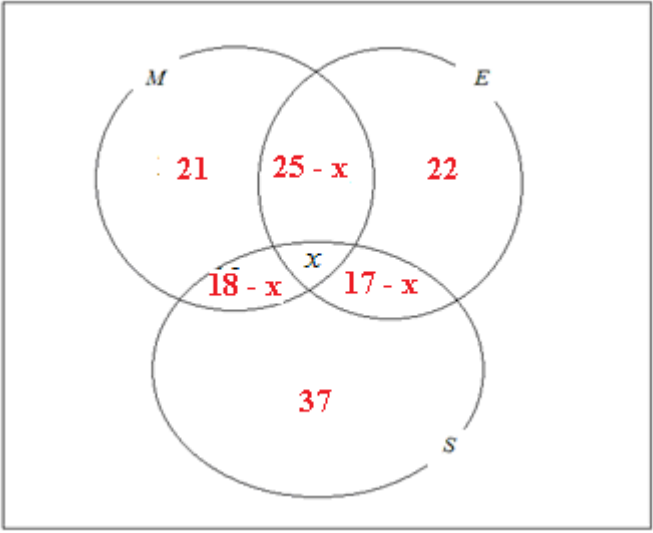
Question Number	Working	Notes		Mark
4(a)	$9a+b=21$	B1		
	$25a+b=69$	B1		
	NB: Note the order of the above award of Bs for ePEN		2	
4(b)	correct attempt to solve their sim. equations (no slips) Eg: see 16a = 48 (M1) then a = 3 (A1) then b = -6 (A1) OR see 16b = -96 (M1) then b = -6 (A1) then a = 3 (A1)	M1		
	a = 3	A1		
	b = -6	A1		
	NB: Note the order of the above award of As for ePEN		3	
4(c)	$"3"(-1)^2 +"-6"$	M1		
	-3	A1 ft	2	7

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

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

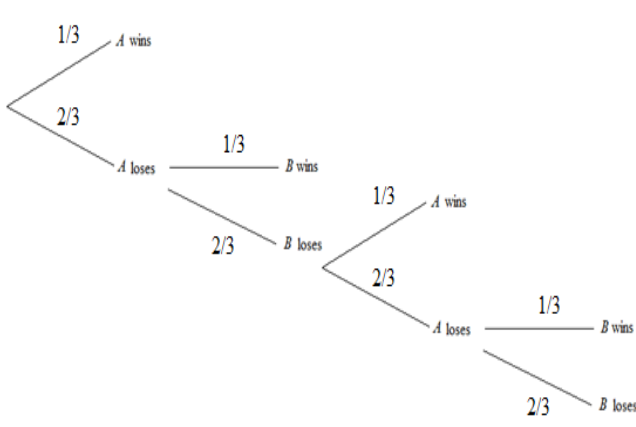| Question Number	Working	Notes		Mark
7(a)	$\overrightarrow{AB} = 18\mathbf{b} - 3\mathbf{a}$	B1	1	
7(b)	2**a** and 6**b**	B1		
	$\overrightarrow{CD} = 6\mathbf{b} - 2\mathbf{a}$	B1	2	
7(c)	$\overrightarrow{OX} = \overrightarrow{OC} + \overrightarrow{CX} = $ "2**a**"$+ \dfrac{1}{2}$ ("6**b**-2**a**")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

Question Number	Working	Notes		Mark
8(a)	$25-x$	B1	1	
8(b)				
	any TWO of $18-x$, $17-x$, "$25-x$"	B1ft		
	all THREE of $18-x$, $17-x$, "$25-x$"	B1ft		
	21, 22, 37	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. "$21+(25-x)+22+(18-x)+x+(17-x)+37$"$=120$	M1		
	$x=10$	A1	2	
8(d)	(i) 120-"22" (ft from their (b) and (c))	B1ft		
	(ii) "(25-"10")" (ft from their (a) and (c))	B1ft		
	OR 21 + (25-"10") + (18-"10") + "10" + (17-"10") + 37		2	
8(e)	17 (numerator) $ie\ \mathrm{n}(S\cap E)=x+$" $17-x$ " or identified	B1ft		
	62 (denominator) $ie\ \mathrm{n}\ S\ =$" $18-x$ "+" $17-x$ "$+x+37$ or identified	B1ft		
	$\dfrac{17}{64}$, 0.274 (cao)	B1		

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

Question Number	Working	Notes		Mark
Only penalise final answer not corrected to the required degree of accuracy <u>the first time it occurs</u> in the question			
9(a)	30° and 40° correctly identified	M1		
	conclusion	A1	2	
9(b)	(i) $\dfrac{200}{\sin"70"}=\dfrac{150}{\sin C}$	M1		
	$\angle C=\sin^{-1}\left(\dfrac{150\times\sin"70"}{200}\right)$	M1dep		
	44.8°	A1		
	(ii) 40 + "44.8"	M1		
	84.8	A1ft		
	Alternative for (ii) 180 − 30 − "65.2" (65.2=180-70-"44.8") = 84.8			
	Alternative for (ii) $\angle BCN=360-("44.8"+220)\quad=95.2$ $\therefore\ \angle NBC=180-"95.2"$ (iii) ($\angle ABC$ = 65.2(= 180-70-"44.8") or eg seen on diagram) $AC^2=150^2+200^2-2\times150\times200\times\cos"65.2"$	M1		
	$AC=\sqrt{62500-60000\times\cos"65.2"}\ =$ $\sqrt{37332.9}$	M1dep		
	193m (cao)	A1		
	Alternative for (iii) $\dfrac{AC}{\sin65.2}=\dfrac{200}{\sin70}=\dfrac{150}{\sin44.8}\qquad=$ M1			
	$AC=\dfrac{200\times\sin65.2}{\sin70}$ OR $\dfrac{150\times\sin65.2}{\sin44.8}$ = M1dep		8	
9(c)	total distance travelled = 4x(150+200+"193") (=2172)	M1		
		M1dep	3	

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

Question Number	Working	Notes		Mark
10(a)	$2x^2y = 16$	M1		
	$y = \dfrac{8}{x^2}$	A1	2	
10(b)	$2 \times 2x \times "\dfrac{8}{x^2}" + 2 \times x \times "\dfrac{8}{x^2}" + 2x \times x$	M1		
	correct conclusion	A1	2	
10(c)	32, 34, 59.6 *Note: Please note the order of the Bs when entering marks on ePen*	B1 B1 B1	3	
10(d)	graph penalties (-1) • straight line segments • each point missed ($\pm$ ½ small square ie $\pm$ 0.05) • each missed segment • each point not plotted • each point incorrectly plotted ($\pm$ ½ small square ie $\pm$ 0.05) • tramlines • very poor curve (e.g. line too thick) *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)*	B3	3	
In parts (e) and (f), penalise 1dp ONCE ONLY				
10(e)	1.3 ($\pm$ ½ small square ft) 3.7	B1ft B1ft	2	
10(f)	indication on graph of attempt at minimum 2.3 $y = \dfrac{8}{"2.3"^2}$ 1.5 *Note: for M1dep, dependent on candidate using their graph (ie reading off x for S_{min} and not using calculus)*	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)				
	(1/3, 2/3) or (4/12, 8/12) twice on each pair of *given* branches	B1, B1		
	correct branching added (penalise labelling)	B1		
	correct probabilities added	B1	4	

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.

However, a ft mark would be awarded in part (b) if 3/12, 1/4 or 0.25 is seen.

A ft would also be allowed in part (c) on the first two B1 marks and on the final B1 mark if 3/12, ¼ or 0.25 is seen.

Question Number	Working	Notes		Mark
11(d)	$"\dfrac{2}{3}\times\dfrac{1}{3}"$ or $"\dfrac{8}{12}\times\dfrac{4}{12}"$ (o.e.)	M1		
	ft errors from *their* diagram probabilities			
	$\dfrac{32}{144}, \dfrac{2}{9}$ 0.222	A1ft	2	
11(e)	P(A wins) = " $\dfrac{1}{3}+\dfrac{2}{3}\times\dfrac{2}{3}\times\dfrac{1}{3}$ "	M1		
	ft errors from *their* diagram probabilities			
	= $\dfrac{13}{27}$,0.481	A1		
		M1		

P(B wins) = $\,{}^{\text{"}}\dfrac{2}{3}\times\dfrac{1}{3}+\dfrac{2}{3}\times\dfrac{2}{3}\times\dfrac{2}{3}\times\dfrac{1}{3}\,{}^{\text{"}}$ = $\dfrac{13}{27}$

ft errors from *their* diagram probabilities

= $\dfrac{26}{81}$, 0.321

comparing two fractions or their decimal values
and correct conclusion

	A1		
	A1	5	13

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