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Mark Scheme (Results)

Summer 2014

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

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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.
- 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  If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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
1(a)	{4, 6, 8, 9, 10}	B1 1	
1(b)	{4, 6, 8}	B1 1	
1(c)	$(A \cap C)' \cap B' = \{9,10\}$ (cao)	B1	
	$n([A \cap C]' \cap B') = 2$	B1 ft 2	**4**
2(a)	$x^2 = 4$	M1	
	$x = +2$ $x = -2$ **NB:** If we see just $\begin{pmatrix} 1 & 3 \\ "2" & 0 \end{pmatrix}\begin{pmatrix} "2" \\ 2 \end{pmatrix} = \begin{pmatrix} 8 \\ 4 \end{pmatrix}$ then score M1 A0 A0	A1 A1 3	
2(b)	subst "$x = 2$ or $x = -2$" for x in "$x + 6 = y$" **OR** subst "$x = 2$ or $x = -2$" in given matrix eq^n eg $\begin{pmatrix} 1 & 3 \\ "2" & 0 \end{pmatrix}\begin{pmatrix} "2" \\ 2 \end{pmatrix} = \begin{pmatrix} 8 \\ 4 \end{pmatrix}$ and only award the A1 for $x = 2$ if the cand. explicitly states "$x = 2$"	M1	
	$y = 8$	A1	
	$y = 4$ **NB:** In (b), the A marks are only available from using $x + 6 = y$	A1 3	**6**

	OR from seeing $\begin{pmatrix} 8 \\ 4 \end{pmatrix}$ or $\begin{pmatrix} 4 \\ 4 \end{pmatrix}$ correctly resulting from substituting $x = 2$ or $x = -2$" in given matrix eq^{n} (as shown above) and $y = 8$ and $y = 4$ stated.		
3(a)	$6t - 4$ (1 term correct ie $6t$ or -4)	M1	
	fully correct **NB:** Condone $6t - 4 + 0$	A1 2	
3(b)	"$6t - 4$" = 0	M1	
	$\frac{4}{6}$, $\frac{2}{3}$, awrt 0.667 (cao)	A1 2	
3(c)	$\left(3\times5^2-4\times5+10\right)$ - $\left(3\times4^2-4\times4+10\right)$ **NB: (1)** Allow $s(4) - s(5)$ for M1 **(2)** Allow at total of 1 sign slip within the brackets	M1	
	23 m (cao)	A1 2	**6**

4(a)	$p + t = 50$ (o.e)	B1 1	
4(b)	$p = 4t$, $4t + \frac{p}{4} = 50$ **NB(1)** $4t + t = 50$ collects B0 in (b) and then possibly M1, A1, A1 in (c) **(2)**Watch for $t = 4p$ leading to $t = 40$ and $p = 10$ (Ms, though **not** the A marks, in (c) and (d) are still available though)	B1 1	
4(c)	"$4t$" $+ t = 50$ **OR** Ratio method: $\frac{50}{4+1}$ or $4 \times \frac{50}{4+1}$	M1	
	$t = 10$ (cao)	A1	
	($p = 4t = 4 \times$ "10")		
	$p = 40$ (cao) **NB:** The M mark here is for a correct attempt at solving 2 linearly independent equations.	A1 3	
4(d)	No. of teachers = "10" – 1 and		

	No. of pupils = "40" – 5	M1	
	£3 × "35" + £10 × "9"	M1 (DEP)	
	£195 (cao)	A1 3	**8**
	OR "10"x£10 + "40"x£3 (= £220) **"**£220" - (1x£10 + 5x£3) £195	M1 M1 (DEP) A1	
5(a)	(i) $x < \frac{5}{2}$ or $\frac{10}{4}$ or 2.5	B1	
	(ii) number line drawn from $x = \frac{5}{2}$ in the negative dir^{n} (ie line drawn to at least x = -5 or line with arrow pointing to the left)	B1	
	open circle around $x = \frac{5}{2}$	B1 3	
5(b)	(i) $9 - 12 \leq 3x - x$ (oe) or $-3 \leq 2x$ or $-2x \leq 3$	M1	
	$x \geq -\frac{3}{2}$ or −1.5	A1	
	(ii) number line drawn from $x = -\frac{3}{2}$ in the positive dir^{n} (ie line drawn to at least x = 5 or line with an arrow pointing to the right)	B1	

	closed circle around $x = -\frac{3}{2}$	B1 4	
5(c)	One of $x \geq -\frac{3}{2}$ $\left(\text{or } x \leq -\frac{3}{2} \ (ft \text{ from (b)})\right)$ or $x < \frac{5}{2}$	B1	
	$-\frac{3}{2} \leq x < \frac{5}{2}$ OR $x \geq -\frac{3}{2}$ and $x < \frac{5}{2}$ OR $\left[-\frac{3}{2}, \frac{5}{2}\right)$	B1 2	**9**
6(a)	(i) 7	B1	
	(ii) Attempt at arranging houses in order of increasing # of people living in them and indicating the mid-house OR Cumulative frequencies of 13 and 19 houses seen or with sight of (30+1)/2 or 30/2	B1	
	6 (cwo) ("cwo" = from correct working only)	B1	
	(iii) $\frac{"(2+6+3+16+15+36+56+16+9)"}{30}$ (= 159/30) (allowing 1 numerical error in numerator)	M1	
	awrt 5.3, $\frac{159}{30}$(o.e), $5\frac{3}{10}$	A1 5	
6(b)	$\frac{4}{30} \times \frac{3}{29}$ or $\frac{3}{30} \times \frac{4}{29}$	M1	
	$\frac{24}{870}$ (oe), awrt 0.0276, 27.6%	A1 2	
6(c)	P(5)+P(6)+P(7)+P(8)+P(9) =		

	$\frac{15}{159}+\frac{36}{159}+\frac{56}{159}+\frac{16}{159}+\frac{9}{159}$ OR $1 - P(1) - P(2) - P(3) - P(4) =$ $1-\frac{2}{159}-\frac{6}{159}-\frac{3}{159}-\frac{16}{159}\left(=1-\frac{27}{159}\right)$ **NB:** Allow 1 slip in the numerators.	M1	
	$\frac{132}{159}$ (oe), awrt 0.83, 83%	A1 2	**9**
7(a)	**Penalise lack of labelling ONCE only in this question** Triangle *A* drawn and labelled.	B1 1	
7(b)	Triangle $B = \begin{pmatrix} 2 & 4 & 4 \\ -2 & -2 & -1 \end{pmatrix}$ drawn and labelled.	B1 1	
7(c)	Triangle $C = \begin{pmatrix} -4 & -8 & -8 \\ 4 & 4 & 2 \end{pmatrix}$ $(-4, 4)$, $(-8, 4)$, $(-8, 2)$ **SC:** Answer left as matrix: B1 B0	B2 ft (-1eeoo) 2	
7(d)	Triangle *C* drawn and labelled **NB:** ft on coords or matrix (if it is a SC) in (c)	B1 ft 1	
7(e)	Scale factor = 2	B1 1	
7(f)	Triangle $D = \begin{pmatrix} -4 & -8 & -8 \\ 9 & 9 & 7 \end{pmatrix}$ drawn and labelled	B1 ft (on (d)) 1	

7(g)	Enlargement **centre (0, 5)**	B1	
	with **scale factor -2**	B1 2	**9**
8(a)	**Penalise ncc ONCE only in this question** $BD^2 = 6^2 + 8^2 - 2 \text{ x } 6 \text{ x } 8 \text{ x } \cos(110)$	M1	
	$BD = \sqrt{6^2 + 8^2 - 2 \times 6 \times 8 \times \cos(110)}$ **NB:** $\sqrt{(100-96)\cos 110}$ scores M0	M1 (DEP)	
	$BD = 11.525$ -> **11.5**	A1 3	
8(b)	$\frac{BC}{\sin 40^o} = \frac{"11.525"}{\sin 60^o}$	M1	
	$BC = \frac{"11.525" \times \sin 40^o}{\sin 60^o}$	M1 (DEP)	
	$BC = 8.554$ -> **8.55 or 8.54** (from "11.5")	A1 3	
8(c)	**ΔABC Route:** $\frac{8}{\sin \angle ABD} = \frac{"11.525"}{\sin 110^o}$	M1	
	$\angle ABD = \sin^{-1}\left(\frac{8 \times \sin 110}{"11.525"}\right) \quad \left(= 40.71^o, 40.821^o \left(from 11.5\right)\right)$	M1 (DEP)	
	$AC^2 = 6^2 + "8.554"^2 - 2 \times 6 \times "8.554" \times \cos\left("40.71" + 80\right)$	M1 (DEP)	
	$AC = \sqrt{6^2 + "8.554"^2 - 2 \times 6 \times "8.554" \times \cos\left("40.71" + 80\right)}$	M1 (DEP)	
	$AC = 12.712$ -> **12.7**	A1 5	**11**
	NB: $AC = 12.706$ (from 8.54 and 40.821^o)		

	AC = 12.715 (from 8.55 and 40.821°)		
	OR **Δ*ADC* Route:** $\frac{DC}{\sin 80} = \frac{"8.554"}{\sin 40}$ OR $= \frac{"11.525"}{\sin 60}$ leading to DC = 13.105 $\frac{6}{\sin \angle ADB} = \frac{"11.525"}{\sin 110}$ $\angle ADB = \sin^{-1}\left(\frac{6 \times \sin 110}{"11.525"}\right) \left(= 29.29^{o}\right)$ $AC^2 = "13.105"^2 + 8^2 - 2 \times "13.105" \times 8 \times \cos(40 + "29.29")$ $AC = \sqrt{"13.105"^2 + 8^2 - 2 \times "13.105" \times 8 \times \cos(40 + "29.29")}$ AC = 12.712 → **12.7**	M1 M1 (DEP) M1(DEP on method for DC **and** $\angle ADB$) M1 (DEP) A1 5	**11**

9(a)	-2.75, 0.25, 1.25 OR $-2\frac{3}{4}, \frac{1}{4}, 1\frac{1}{4}$	B1, B1, B1 3	
	SC: -2.8, 0.3, 1.3 scores B0 B1 B1		
9(b)	Curve -1 mark for straight line segments each point missed each missed segment each point not plotted each point incorrectly plotted tramlines very poor curve **NB:** Accuracy for both plotting and drawing is $\pm\frac{1}{2}ss$	B3 ft (-1 eeoo) 3	
9(c)	x = 1.65 (± 0.05) (from "graph")	B1 ft	
	x = 4.85 (± 0.05) (from "graph") **NB:** Accept (1.65, -2.18) B1 ft and (4.85, -0.57) B1 ft **SC:** 1.65 < x < 4.85 scores B1 B0	B1 ft 2	
9(d)	Reading off y values at x = "1.65" and "4.85" **OR** choosing two points on AB and reading off the corresponding Δx and Δy	M1	
	gradient = $\frac{\Delta y}{\Delta x} = \frac{"(-0.57)" - "(-2.18)"}{"4.85" - "1.65"}$ ($\pm\frac{1}{2}ss$ for each coord. element)	M1 (DEP)	
	gradient = 0.5 (+/- 0.05 allowing $\pm\frac{1}{2}ss$) (cao)	A1 3	**11**
10(a)	-2	B1 1	

10(b)	$y\,(x-1) = 2$ OR $x-1=\frac{2}{y}$ OR x and y swapped	M1	
	$\left(\mathrm{f}^{-1}(x) =\right)$ $\frac{2+x}{x}$ OR $\frac{2}{x}+1$	A1 2	
10(c)	$"\left(\frac{2+x}{x}\right)^2"-3$ (subst.)	M1	
	$\frac{4+4x+x^2-3x^2}{x^2}$ " (1 fraction)" OR $\frac{4}{x^2}+\frac{4}{x}-2$ **NB:** Their (b) must be of the form $\frac{ax+b}{x}$ to be able to collect the M1 (DEP) above	M1 (DEP)	
	$\mathrm{gf}^{-1}(x) = \frac{4+4x-2x^2}{x^2}$ (cc)	A1 3	
10(d)	$x = 0$ OR $x \neq 0$ OR 0/ zero (by itself)	B1 1	
10(e)	$"\frac{4+4x-2x^2}{x^2}"=1$	M1	
	$3x^2 - 4x - 4 \ (= 0)$ (oe, ie $\times$ (-1))	A1	
	$(3x + 2)(x - 2)$ (solving trinomial quad.)	M1	
	$-\frac{2}{3}$ (oe) or awrt (-0.667), 2 (cso)	A1, A1 5	**12**

	OR $(1 + 2/x)^2 - 3 = 1$ M1 (starting anew) $(1 + 2/x)^2 = 4$ A1 $1 + 2/x = \pm 2$ M1 $-\frac{2}{3}$ or awrt (-0.667), 2 (cao) A1, A1		
11(a)	(i) $\overrightarrow{AB} = 2\mathbf{b} - \mathbf{a}$	B1	
	(ii) $\overrightarrow{BC} = -\ \mathbf{b}$	B1	
	(iii) $\overrightarrow{FB} = \frac{1}{3}"\overrightarrow{AB}" = \frac{1}{3}"(2\mathbf{b} - \mathbf{a})"$, "$\frac{2\mathbf{b}}{3} - \frac{\mathbf{a}}{3}$"	B1 ft	
	(iv) $\overrightarrow{FC} =$ "$\frac{1}{3}(2\mathbf{b} - \mathbf{a})$" +"- **b"**	M1	
	$\overrightarrow{FC} = -\frac{1}{3}(\mathbf{a} + \mathbf{b})$ (o.e)	A1 5	
11(b)	(i) $\overrightarrow{OD} = \frac{1}{4}\overrightarrow{OB} = \frac{1}{2}\mathbf{b}$	B1	
	(ii) $\overrightarrow{AD} = -\mathbf{a} + "\frac{1}{2}\mathbf{b}"$	M1	
	$\overrightarrow{AD} = -\mathbf{a} + \frac{1}{2}\mathbf{b}$	A1 3	
11(c)	$\overrightarrow{FE} = -\frac{\lambda}{3}(\mathbf{a} + \mathbf{b})$ (o.e)	B1 ft 1	
11(d)	$\overrightarrow{FE} = \overrightarrow{FA} + \overrightarrow{AE}$ **r**oute:		

	$\overrightarrow{AE} = \frac{4}{3}\overrightarrow{AD} = \frac{4}{3}"\left(-\mathbf{a} + \frac{1}{2}\mathbf{b}\right)"$	M1	
	$\overrightarrow{FE} = \frac{2}{3}\left(-"\left(2\mathbf{b}-\mathbf{a}\right)"\right) + \frac{4}{3}"\left(-\mathbf{a} + \frac{1}{2}\mathbf{b}\right)"$	M1 (DEP)	
	OR $\overrightarrow{FE} = \overrightarrow{FB} + \overrightarrow{BD} + \overrightarrow{DE}$ route: $\overrightarrow{DE}\ \left(= \frac{1}{3}\overrightarrow{AD}\right) = \frac{1}{3}"\left(-\mathbf{a} + \frac{1}{2}\mathbf{b}\right)"$ $\overrightarrow{FE} = \frac{1}{3}"\left(2\mathbf{b}-\mathbf{a}\right)" + \frac{3}{4}\left(-2\mathbf{b}\right) + "\left(\frac{1}{3}\left(-\mathbf{a}+\frac{1}{2}\mathbf{b}\right)\right)"$ **OR** $\overrightarrow{FE} = \overrightarrow{FA} + \overrightarrow{AO} + \overrightarrow{OE}$ route: $\overrightarrow{DE}\ \left(= \frac{1}{3}\overrightarrow{AD}\right) = \frac{1}{3}"\left(-\mathbf{a} + \frac{1}{2}\mathbf{b}\right)"$ $\overrightarrow{FE} = \frac{2}{3}\left(-"\left(2\mathbf{b}-\mathbf{a}\right)"\right) + \left(-\mathbf{a}\right) + \left\{"\frac{1}{2}\mathbf{b}" + \frac{1}{3}"\left(-\mathbf{a} + \frac{1}{2}\mathbf{b}\right)"\right\}$ $\therefore \overrightarrow{FE} = -\frac{2}{3}\left(\mathbf{a}+\mathbf{b}\right)$ (o.e)	M1 M1 (DEP) M1 M1 (DEP) A1 3	

11(e)	$\therefore \overrightarrow{FE} = "-\frac{2}{3}(\mathbf{a}+\mathbf{b})" = "-\frac{\lambda}{3}(\mathbf{a}+\mathbf{b})"$	M1	
	Equating their coef of **a** or their coef of **b** in above	M1 (DEP)	
	$\lambda = 2$ (cwo)	A1 3	**15**
	TOTAL 100 MARKS		

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