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Mark Scheme (Results)

January 2015

Pearson Edexcel International GCSE
Mathematics B (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** ○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: e.g. 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.

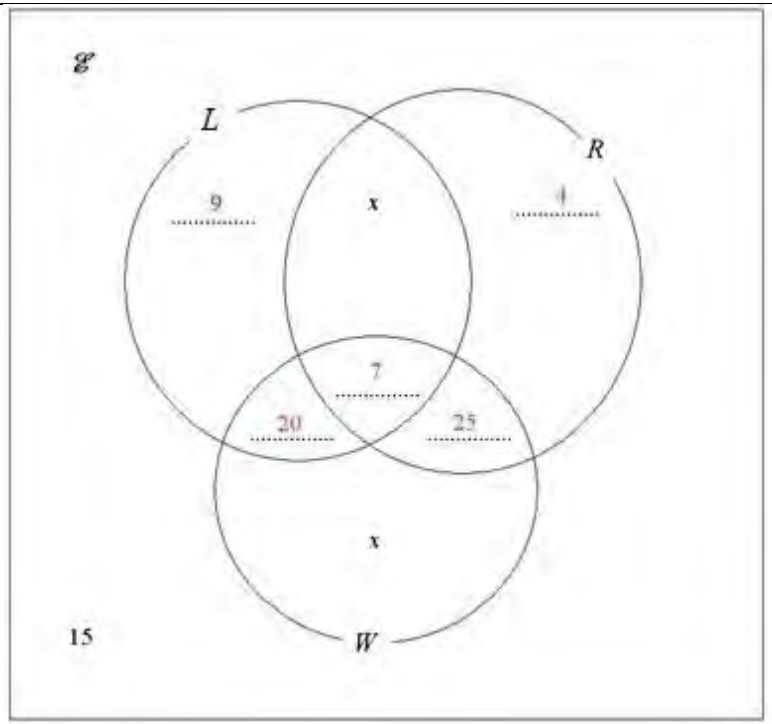
- **Parts of questions**
  Unless allowed by the mark scheme, the marks allocated to one part ofthe question CANNOT be awarded in another.

Question	Working	Answer	Mark	Notes
1. (a)	$\frac{365\times24\times60}{30}$			M1
		17 520 sales	2	A1
(b)	$\frac{"17520"}{120}\times100$ (oe)			M1
		14 600 sales	2	A1
(c)	$\frac{365\times x\times60}{"14600"}=27$ (oe)			M1
		$x = 18$ (cao)	2	A1
				Total 6 marks

Question	Working	Answer	Mark	Notes
2.				
	$0 < m \leq 25$: **FD=2.0 (1.0)**(drawn)			B1
	Finding a scale factor eg 75/25 If **no working for scale factor seen** then seeing one of $70 < m \leq 80$: **FD=8.8 (4.4)** (drawn) or $80 < m \leq 100$: **Freq. = 6** (entered in table)			M1
	Seeing both $70 < m \leq 80$: **FD=8.8 (4.4)** (drawn) and $80 < m \leq 100$: **Freq. = 6** (entered in table)			A1
	$\therefore 50 < m \leq 70$:**Freq.** = **70** (entered in table)			B1 ft on "6"
	$\therefore 50 < m \leq 70$**FD = 7.0 (3.5)**(drawn) **NB:** ft on "Freq. 70"		5	B1 ft
				Total 5 marks

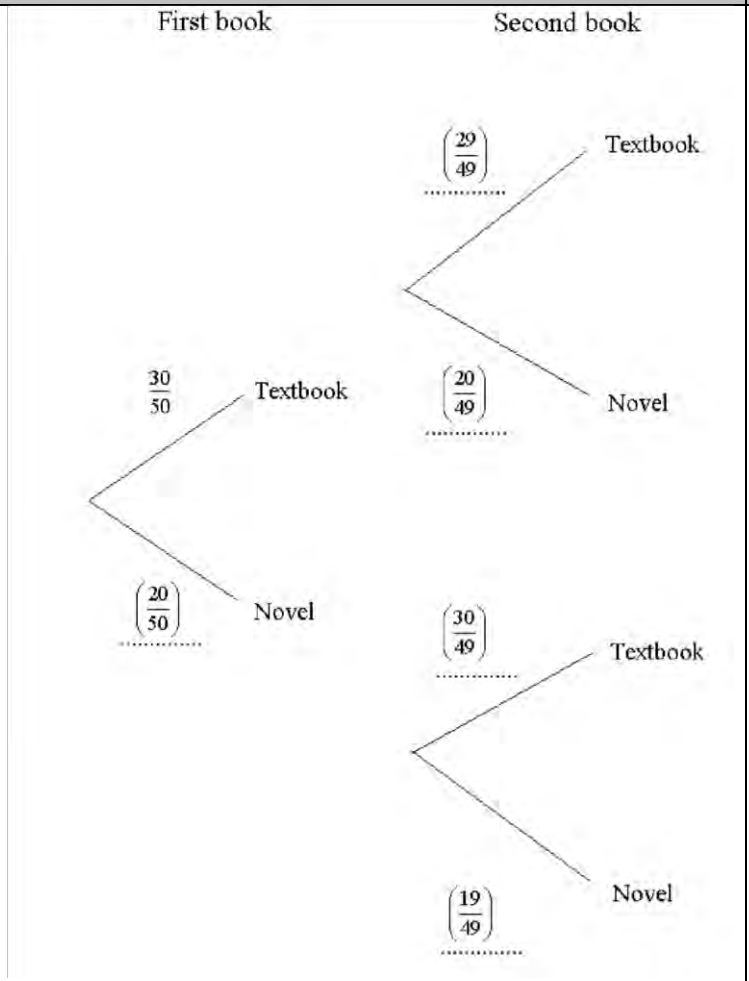
Question	Working	Answer	Mark	Notes
3. (i)	$3x(2x-5) - 6(x+2)$ (numerator, oe, allow 1 incorrect sign if expanded)			M1
	$(x+2)(2x-5)$ OR $2x^2-x-10$ (denominator)			B1
	$\frac{6x^2-21x-12}{(x+2)(2x-5)}$ OR $\frac{6x^2-21x-12}{2x^2-x-10}$ OR $\frac{3(2x+1)(x-4)}{(x+2)(2x-5)}$ (oe)		3	A1
(ii)	"$6x^2-21x-12$" = 0 (oe) **NB:** must be from a fraction answer in (i)			M1
	$3(2x+1)(x-4)$ (= 0) (solving "their" trinomial quadratic)			M1
		$x=-\frac{1}{2}$		A1
		$x=4$	4	A1
				Total 7 marks

Question	Working	Answer	Mark	Notes
4. (a)	$a\times(-1)+b=1$ (oe)			B1
	$a\times4+b=16$ **NB:** order of award of Bs for ePEN		2	B1
(b)	Rearranging so that coef of a or b is the same in both equations OR isolating a or b then adding or subtracting equations OR substitute expressions for a or b to obtain b or a			M1 ft on candidate's two linear simultaneous equations
		a = 3 (cao)		A1
	NB: Note order of award of A1s for ePEN	b = 4 (cao)	3	A1
(c)	"$y = 3x + 4$" and rearranged or after exchanging x and y (oe)			M1
		$f^{-1}: x\mapsto \frac{x-4}{3}$ $f^{-1}(x)=\frac{x-4}{3}$ (cao)	2	A1 ft
(d)	"$3x + 4$" = "$\frac{x-4}{3}$"			M1
		x = -2 (cao)	2	A1
				Total 9 marks

Question	Working	Answer	Mark	Notes
5. (a)	15 is the number of people in the survey who do not enjoy any of the three activities (oe) OR symbolic representation eg $n\left(\left[L \cup R \cup W\right]'\right) = 15$ (oe)		1	B1
(b)			2	B2 (-1 eeoo)
(c)	$100 =$ "$15 + x + x + 20 + 7 + 25 + 4 + 9$"			M1
		$x = 10$ (cao)	2	A1

(d)(i)		46		B1 ft
(d)(ii)		23		B1 ft
(d)(iii)		25	3	B1 cao
				Total 8 marks

Question	Working	Answer	Mark	Notes
6. (a)	$x = \sqrt{5^2 - 4^2}$			M1
		x = AD = 3	2	A1
(b)	$\frac{1}{2}(4+2x)(x+y) = 10 \times \left(\frac{1}{2} \times 4 \times x\right)$ (oe)			M1
	$\therefore \frac{1}{2}(4+2\times"3")("3"+y) = 10 \times \left(\frac{1}{2} \times 4 \times "3"\right)$			M1 DEP (Substitution for x)
	$\therefore DC = \frac{60-15}{5}$			M1 DEP (isolated y)
		y = DC = 9	4	A1
(c)	$EBCD$ = 10"ΔAED"(=ΔABC) - "ΔAED" (oe)			M1
		$EBCD$ = 54	2	A1
				Total 8 marks

Question	Working	Answer	Mark	Notes
7. (a)		Start deducting errors starting with the last B box in ePEN	3	B1, B1, , B1 (each pair)

(b)	$\frac{30}{50}\times"\frac{29}{49}"$ **OR** Complement $1-"\left(\frac{20}{50}\times\frac{19}{49}\right)"-"\left(\frac{20}{50}\times\frac{30}{49}\right)"-\left(\frac{30}{50}\times"\frac{20}{49}"\right)$			M1
		$\frac{870}{2450}$ (o.e), awrt (0.355) , 35.5%	2	A1
(c)	55 and 54 (eg 55x54) used as denominators in a probability product			M1
	$1-\frac{30}{55}\times\frac{29}{54}$ **OR** $\frac{25}{55}\times\frac{24}{54}+\frac{25}{55}\times\frac{30}{54}+\frac{30}{55}\times\frac{25}{54}$			M1 DEP
		$\frac{2100}{2970}, \frac{210}{297}, \frac{70}{99}$, awrt(0.707) , 70.7%	3	A1
				Total 8 marks

Question	Working	Answer	Mark	Notes
	Penalise labelling or no labelling ONCE only			
8. (a)	A drawn and labelled		1	B1
(b)		B = (-1, 0) (-3, 0) (1, -2)	2	B2 (-1 each incorrect coordinate pair) Accept column vectors and embedded coordinates in 2x3 matrices
(c)	B drawn and labelled		1	B1 ft on seen coordinates
(d)		(-1, -2) (-3, -6) (-1, -6)	2	B2 ft (-1 each incorrect coordinate pair) Accept column vectors and embedded coordinates in 2x3 matrices
(e)	C drawn and labelled		1	B1 ft on seen coordinates
(f)	Reflection in $y = -x$ **NB:** **SC:** $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$ seen on its own and no explanation scores B1 B0		2	B1 B1
				Total 9 marks

Question	Working	Answer	Mark	Notes
	Penalise ncc ONCE only in this question			
9. (a)	$\cos 15 = \frac{11}{OA}$			M1
		OA = 11.388->**11.4**	2	A1
(b)	$\tan 15 = \frac{OB}{11}$ $(OB = 2.947)$			M1
	$\therefore AP = "11.388" - "2.947"$			M1
	OR			
	$11^2 = AP \times ("11.388" + "2.947")$			(M1)
		AP = 8.441->**8.44**	3	A1
(c)	$BC^2 = "2.947"^2 + "2.947"^2 - 2 \times "2.947" \times "2.947" \times \cos(\angle BOC = 105)$			M1
	$BC = \sqrt{"21.865"}$ (= 4.676)			M1 DEP
	OR			
	(AC = "8.441" + "2.947" + "2.947" = 14.335) $BC^2 = "14.335"^2 + 11^2 - 2 \times "14.335" \times 11 \times \cos 15$			(M1)
	$BC = \sqrt{21.868}$ (=14.676)			(M1 DEP)
	OR ($\angle OCB$=37.5)			
	$\frac{11}{\sin "37.5"} = \frac{BC}{\sin 15}$			(M1)
	$BC = \frac{11 \times \sin 15}{\sin "37.5"}$			(M1 DEP)
	OR (ΔBOC is isos. Δ)			
	$\angle OBC = \frac{180 - (180 - 75)}{2}$ (=37.5)			(M1)

	$BC = 2\times"2.947"\times\cos"37.5"$			(M1 DEP)
		BC = 4.676, 4.677- >**4.68**	3	A1
(d)	($BCPQ$ = $\Delta ABC - \Delta APQ$ method): $PQ = "8.441"\times\tan 15$ (= 2.2618)			M1
	$\Delta APQ = \frac{1}{2}\times"8.441"\times"2.2618"$ (=9.5459)			M1 DEP
	$\Delta ABC = \frac{1}{2}\times 11\times("8.441"+2\times"2.947")\times\sin 15$ (= 20.406)			M1
	$BCPQ$ = $\Delta ABC - \Delta APQ$			M1 DEP
		$BCPQ$ = 10.86 -> **10.9** cm^2		A1
	OR ($BCPQ = \Delta BCP + \Delta BPQ$ method)			
	$PQ = "8.441"\times\tan 15$ (= 2.2618)			(M1)
	$\left(\begin{array}{l} PB^2 = 2.947^2 + 2.947^2 - 2\times 2.947\times 2.947\times\cos 75 \\ \therefore PB = 3.588 \end{array}\right)$			
	$\Delta BPQ = \frac{1}{2}\times"2.2618"\times"3.588"\times\sin 37.5$ (= 2.470)			(M1 DEP)
	$\Delta BCP = \frac{1}{2}\times"4.677"\times(2\times"2.947")\times\sin 37.5$ (= 8.3906)			(M1)
	$BCPQ = \Delta BCP + \Delta BPQ$			(M1 DEP)
		$BCPQ$ = 10.86 -> **10.9** cm^2		(A1)
	OR ($BCPQ = \Delta OCB + \Delta OPB + \Delta BPQ$ method)			
	$PQ = "8.441"\times\tan 15$ (= 2.2618)			(M1)

	($PB^2 = 2.947^2 + 2.947^2 - 2 \times 2.947 \times 2.947 \times \cos 75$ $\therefore PB = 3.588$ **)**			
	$\Delta BPQ = \frac{1}{2} \times "2.2618" \times "3.588" \times \sin 37.5 \quad (= 2.470)$			(M1 DEP)
	$\Delta OCB + \Delta OPB = \frac{1}{2} \times "2.947" \times "2.947" \times \sin 105$ $+ \frac{1}{2} \times "2.947" \times "2.947" \times \sin 75$ $(= 4.1944 + 4.1944)$			(M1)
	$BCPQ = \Delta OCB + \Delta OPB + \Delta BPQ$			(M1 DEP)
		$BCPQ$ = **10.9** cm^2	5	(A1)
				Total 13 marks

Question	Working	Answer	Mark	Notes
10. (a)	**Penalise ncc ONCE only in this question** $V = lh^2 - 2\times\left(\frac{1}{2}\times\frac{4}{3}\pi\left(\frac{h}{2}\right)^3\right)$ (3 correct volumes)			M1
		$V = h^2\left(l - \frac{\pi h}{6}\right)$ (oe)	2	A1
(b)	$V = "(10-h)h^2 - \frac{4}{3}\pi\left(\frac{h}{2}\right)^3"$ (substitution for l)			M1
		(cc)	2	A1
(c)		8.5, 48.9, 59.5 or 59.6	3	B1 B1 B1
(d)	**NB:** Accuracy for both plotting and	Curve drawn	3	B3 (-1 eeoo) **-1 mark for:** straight line segments, each point missed, each missed segment, each point not plotted, each point incorrectly plotted, tramlines,

	drawing is $\pm\frac{1}{2}$ ss			very poor curve
(e)	If using calculus, accept 64 only	$V = 64$	1	B1 ft
(f)	$V = 60$ line drawn OR inferred from values for h OR from intersection of vertical line from x-axis with c's curve at $V = 60$ OR seeing one of 3.7 or 5 (ft)			M1
	Allow "x" for h	$h > 3.7$ (+/- grid ss= $\pm$0.1)		A1 ft
		$h < 5.0$ (or better) (+/- grid ss = $\pm$0.1)		A1 ft
	NB: If the values "3.7" and/ or "5" are **not** explicitly identified as h in an inequality but appear in $l + h = 10$ (eg l + "3.7" = 10) award the A1 ft for each occurrence (ie of"3.7" and "5")	Accept weak inequalities or equalities		
		leading to $l < 6.3$		A1 ft
		$l > 5.0$ (accept "5")	5	A1 ft Note that 5.0 $< l <$ 6.3 scores A1ft A1ft
		Accept weak inequalities for l		
		NB: "5.0" $< l <$ "6.3" with no working scores full marks.		**Total 16 marks**

Question		Working	Answer	Mark	Notes
11.	(a)(i)		$\overrightarrow{AB} = 2\mathbf{b} - \mathbf{a}$		B1
	(a)(ii)		$\overrightarrow{OQ} = 2\mathbf{b} + k\mathbf{a}$	2	B1
	(b)		$\overrightarrow{AP} = \frac{1}{3}$("$2\mathbf{b} - \mathbf{a}$")	1	B1 ft
	(c)(i)	$\overrightarrow{OA} = \overrightarrow{OP} + \overrightarrow{PA}$ $= \frac{1}{\mu}$("$2\mathbf{b} + k\mathbf{a}$") + "$-\frac{1}{3}(2\mathbf{b} - \mathbf{a})$" (oe) **OR** $\overrightarrow{OA} = \overrightarrow{OQ} + \overrightarrow{QB} + \overrightarrow{BA}$ $= \frac{2}{3}\mu(\mathbf{a} + \mathbf{b}) - k\mathbf{a} - (2\mathbf{b} - \mathbf{a})$ (oe)			B1 ft
	(c)(ii)	$\overrightarrow{OA} =$ " $\left(\frac{k}{\mu} + \frac{1}{3}\right)\mathbf{a} + \left(\frac{2}{\mu} - \frac{2}{3}\right)\mathbf{b}$ "$= \mathbf{a}$ (oe) **OR** $\overrightarrow{OA} = \frac{2}{3}\mu(\mathbf{a} + \mathbf{b}) - k\mathbf{a} - (2\mathbf{b} - \mathbf{a}) = \mathbf{a}$ (oe)			M1
		comp of $\mathbf{b}$: $0 = \left(\frac{2}{\mu} - \frac{2}{3}\right)$ **OR** $\frac{2}{3}\mu = 2$			M1 DEP

		$\therefore \mu = 3$		A1
	comp of **a**: 1 = $\left(\frac{k}{\mu}+\frac{1}{3}\right)$ **OR** $1 = \frac{2}{3}\mu - k + 1$			M1 DEP
		$\therefore k = 2$	6	A1
(d)	$\therefore \lvert\Delta OPA\rvert = "\left(\frac{1}{2}\right)"^2 \times \lvert\Delta BPQ\rvert = "\left(\frac{1}{2}\right)"^2 \times 12$			M1
		$\Delta OPA = 3\ (\text{cm}^2)$	2	A1
				Total 11 marks

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