OCR
RECOGNISING ACHIEVEMENT

GCSE

Mathematics B (Linear)

General Certificate of Secondary Education

Component **J567/03:** Mathematics Paper 3 (Higher)

Mark Scheme for June 2012

Oxford Cambridge and RSA Examinations

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Annotations used in the detailed Mark Scheme.

Annotation	Meaning
✓	Correct
×	Incorrect
BOD	Benefit of doubt
FT	Follow through
ISW	Ignore subsequent working (after correct answer obtained), provided method has been completed
M0	Method mark awarded 0
M1	Method mark awarded 1
M2	Method mark awarded 2
A1	Accuracy mark awarded 1
B1	Independent mark awarded 1
B2	Independent mark awarded 2
MR	Misread
SC	Special case
∧	Omission sign

These should be used whenever appropriate during your marking.

The **M**, **A, B**, etc annotations must be used on your standardisation scripts for responses that are not awarded either 0 or full marks.
It is vital that you annotate these scripts to show how the marks have been awarded.
It is not mandatory to use annotations for any other marking, though you may wish to use them in some circumstances.

Subject Specific Marking Instructions

1. **M** marks are for using a correct method and are not lost for purely numerical errors.
   A marks are for an accurate answer and depend on preceding **M** (method) marks. Therefore **M0 A1** cannot be awarded.
   B marks are independent of **M** (method) marks and are for a correct final answer, a partially correct answer, or a correct intermediate stage.
   SC marks are for special cases that are worthy of some credit.

2. Unless the answer and marks columns of the mark scheme specify **M** and **A** marks etc, or the mark scheme is 'banded', then if the correct answer is clearly given and is not from wrong working **full marks** should be awarded.

   Do not award the marks if the answer was obtained from an incorrect method, ie incorrect working is seen and the correct answer clearly follows from it.

3. Where follow through (**FT**) is indicated in the mark scheme, marks can be awarded where the candidate's work follows correctly from a previous answer whether or not it was correct.

   Figures or expressions that are being followed through are sometimes encompassed by single quotation marks after the word *their* for clarity, eg FT 180 × (*their* '37' + 16), or FT 300 – √(*their* '$5^2 + 7^2$'). Answers to part questions which are being followed through are indicated by eg FT 3 × *their* (a).

   For questions with FT available you must ensure that you refer back to the relevant previous answer. You may find it easier to mark these questions candidate by candidate rather than question by question.

4. Where dependent (**dep**) marks are indicated in the mark scheme, you must check that the candidate has met all the criteria specified for the mark to be awarded.

5. The following abbreviations are commonly found in GCSE Mathematics mark schemes.

   - **figs 237**, for example, means any answer with only these digits. You should ignore leading or trailing zeros and any decimal point eg
   - 237000, 2.37, 2.370, 0.00237 would be acceptable but 23070 or 2374 would not.
   - **isw** means **ignore subsequent working** (after correct answer obtained).
   - **nfww** means **not from wrong working**.
   - **oe** means **or equivalent**.
   - **rot** means **rounded or truncated**.
   - **seen** means that you should award the mark if that number/expression is seen anywhere in the answer space, including the answer line,
   - even if it is not in the method leading to the final answer.
   - **soi** means **seen or implied**.

6. Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise, indicated for example by the instruction 'mark final answer'.

7. As a general principle, if two or more methods are offered, mark only the method that leads to the answer on the answer line. If two (or more) answers are offered, mark the poorer (poorest).

8. When the data of a question is consistently misread in such a way as not to alter the nature or difficulty of the question, please follow the candidate's work and allow follow through for **A** and **B** marks. Deduct 1 mark from any **A** or **B** marks earned and record this by using the MR annotation. **M** marks are not deducted for misreads.

9. Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures even if this is rounded or truncated on the answer line. For example, an answer in the mark scheme is 15.75, which is seen in the working. The candidate then rounds or truncates this to 15.8, 15 or 16 on the answer line. Allow full marks for the 15.75.

10. If the correct answer is seen in the body and the answer given in the answer space is a clear transcription error allow full marks unless the mark scheme says 'mark final answer'. Place the annotation ✓ next to the correct answer.

    If the answer space is blank but the correct answer is seen in the body allow full marks. Place the annotation ✓ next to the correct answer.

    If the correct answer is seen in the working but a completely different answer is seen in the answer space, then accuracy marks for the answer are lost. Method marks would still be awarded. Use the M0, M1, M2 annotations as appropriate and place the annotation × next to the wrong answer.

11. Ranges of answers given in the mark scheme are always inclusive.

12. For methods not provided for in the mark scheme give as far as possible equivalent marks for equivalent work. If in doubt, consult your Team Leader.

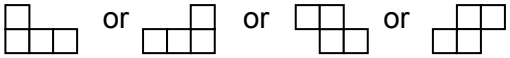
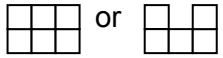
13. Anything in the mark scheme which is in square brackets […] is not required for the mark to be earned, but if present it must be correct.

Question			Answer	Marks	Part Marks and Guidance	
1	(a)	(i)	[0].06	1		
		(ii)	$0.\dot{2}$ or 0.222[…]	1		Condone poor notation eg $0.2\dot{2}$
	(b)	(i)	125	2	**M1** for 5^3 **Or** **SC1** for $\frac{25\times3125}{625}$ or $\frac{78125}{625}$ or $\frac{5\times5\times5\times5\times5\times5\times5}{5\times5\times5\times5}$ soi	For **SC1** the full method may be done in stages but must all be present Note 12.5 is a possible wrong answer and scores **0 marks**
		(ii)	$\frac{3}{2}$ or $1\frac{1}{2}$ or 1.5	3	**M2** for $\frac{9}{6}$ or other equivalent unsimplified fraction or mixed number Or **M1** for $\frac{20}{6}$ and $\frac{11}{6}$ or $3\frac{2}{6}$ and $1\frac{5}{6}$ or other conversion to common denominator with at least one correct numerator After **M0**, **SC1** for conversion of the result of *their* subtraction to lowest terms if improper fraction or mixed number	If $1\frac{3}{6}$ then $1\frac{1}{2}$ on answer line award **3 marks** $\frac{10}{3}-\frac{11}{6}$ scores **0 marks**

Question			Answer	Marks	Part Marks and Guidance	
2			Correct arcs and bisector of angle DAB 53° ± 2°	2	**B1** for bisector, without correct arcs	Use overlay Line from A to minimum 5cm from C
			Arc centre C radius 5 cm ± 2 mm	1		Arc must meet BC and DC within tolerance and be correct by eye or meet *their* bisector within tolerance if short arc
			Correct area shaded	1	**FT** *their* bisector and arc	Must be intersection of *their* line from A and any arc centre C
3	(a)		750 250	2	**M1** for figs 75 and 25 seen or 1000 ÷ 4 seen	Implied by 250 seen

Question			Answer	Marks	Answer
3	(b)*		Correct final answer of £32.60 with clearly expressed and annotated supporting method showing calculation of quantity and cost of each type of juice, cost of cups and takings	5	
			Correct final answer of £32.60 without clear supporting method but not from wrong working Or Answer of 32.6(0) with no units or £33.60 (with cost of cups omitted) with clearly expressed and annotated supporting method Or Complete method with annotation with one or two arithmetic slips	4-3	For lower mark: Calculation of takings (E), costs of their quantities of each type of juice (C and D, totalling 20 litres) and calculation of takings – costs (F) with one or two arithmetic slips Some annotation **or** units must be seen
			At least two correct values from A – F calculated Or One correct value from A – F clearly annotated	2-1	For lower mark: One correct value from A – F calculated
			No relevant calculations seen	0	
			A: 0.25 × 80 = 20 litres drink B: 15 litres apple, 5 litres mango required C: Cost Apple: 15 × 0.56 = £8.40 FT *their* 15 D: Cost Mango: 5 × 1.20 = £6 FT *their* 5 E: Takings: 0.60 × 80 = £48 F: Donation: £48 – £8.40 – £6.00 – £1 = £32.60 **FT** *their* takings – *their* costs (condone omitting cups)		For 2 or 1 marks units are not required and working may be in pounds, pence, ml or litres B correct implies A for 2 marks For 2 or 1 marks allow any quantity of juice ≤ 20 for C and D Only allow F if takings > costs, and takings and costs each result from a calculation seen

Question			Answer	Marks	Part Marks and Guidance	
4	(a)	(i)	80	1		
		(ii)	$\frac{30}{120}$ isw oe or 0.25 or 25%	2	**B1** for fraction with numerator 30 or denominator 120 Or **SC1** for ratio 30 : 120 oe	
		(iii)	57	2	**M1** for 114 seen or $\frac{68+46}{\textit{their}\ '80'+\textit{their}\ '120'}$ Or **SC1** for answer 79% or 78%	
	(b)	(i)	3 | 7 9 4 | 0 2 5 5 6 8 5 | 1 1 2 4 5 7 8 6 | 0 2 3 5 7 | 2	3	**M2** if correct except for one or two errors or omissions Or **M1** for unordered diagram with at most one error or omission	
		(ii)	35	1		

Question			Answer	Marks	Part Marks and Guidance	
		(iii)	No, 10 km at 12 km/h takes 50 minutes so only 8 ran faster than this which is less than half of the runners	4	**M2** for 50 [minutes] or 5 min/km or 200 m/min or 11.6 km/h or 11.7 km/h or for 5.1 min/km or 5.15 min/km Or **M1** for attempt at $\frac{10}{12}(\times 60)$ or for 10 ÷ *their* time in hours or correct non-unitary distance/time or time/distance AND **M1** for 8 people < 50 [mins] or for 12 people > 50 [mins] or for 51.5 or for 51 identified or for correct calculation of min/km for other time AND **M1** for correct comparison showing less than half at >12km/h	See exemplars Times for 12 km/h Speeds for median/10th Times for median/10th eg 2km per 10 mins Or **FT** *their* stem and leaf diagram eg 8 out of 20 is less than half or half at 51.5 so less than half at 50
5	(a)			2	**B1** for 	Allow any orientation of correct answer for **2 marks** Condone unruled and omission of internal lines for either 2 or 1 marks

Question			Answer	Marks	Part Marks and Guidance	
	(b)	(i)	Correct isometric drawing of 1 × 2 × 3 cuboid, any orientation	2	**B1** for any correct isometric drawing of solid with volume 6 cm^3	If L-shaped solid drawn assume presence of hidden cube for **B1** Mark intention, condone unruled
		(ii)	22	2	Or **FT** *their* solid **M1** for clear attempt to count number of surface squares	
	(c)	(i)	(3, 0, 1)	1		
		(ii)	(1, 1, 3)	1	**SC1** for (1, 3 ,1) after (3, 1, 0) in (a) or (1*x*, 1*y*, 3*z*) after (3*x*, 0*y*, 1*z*)	
6	(a)		$3n + 5$ **oe**	2	Mark final answer **M1** for $3n$ **soi** not $^{-}3n$	Condone any letter in place of *n* $8 + 3(n - 1)$ scores **2 marks** as final answer $n = 3n + 5$ scores **1 mark** but eg $t = 3n + 5$ scores **2 marks**
	(b)		7, 2, $^{-}3$	2	**M1** for 2 correct in correct position Or **SC1** for 12, 7, 2 or $^{-}7$, $^{-}2$, 3	
7	(a)		$3a + 12$	1		
	(b)		$2b(b + 3)$	2	**M1** for $2(b^2 + 3b)$ or $b(2b + 6)$	Condone $(2b + 0)(b + 3)$ Condone missing final bracket

Question			Answer	Marks	Part Marks and Guidance	
	(c)		4.5 oe	3	**M2** for $2x = 9$ Or **M1** for $5x - 3x - 2 = 7$ or better collecting x or $5x = 3x + 7 + 2$ or better collecting constants AND **M1** for $x = \frac{b}{a}$ after $ax = b$ seen If **M0**, **SC2** for $5 \times 4.5 - 2 = 3 \times 4.5 + 7$ as final answer	Implied by $2x = b$ Implied by $ax = 9$ $a \neq 1$
	(d)	(i)	$y \geq 2$	2	**M1** for $4y \geq 5 + 3$ or better Or **B1** for answer of 2 with no or incorrect inequality symbol or $y = 2$ Or **SC1** for $4 \times 2 - 3 \geq 5$	
		(ii)	Solid circle at 2 and line to right of 2	1	Or **FT** *their* inequality	
8	(a)		Triangle B correctly positioned Vertices (4, ⁻2), (5, ⁻2), (4, ⁻4)	3	**M2** for correct translation of *their* reflected triangle Or **M1** for correct reflection of A in *x*-axis Or **M1** for any translation of correct B Or **SC2** for triangle B (⁻1, 0), (0, 0), (0, 2) or triangle B (⁻4, 1), (⁻2, 1), (⁻2, 5)	Use overlay Green triangle scores **3 marks** Red triangle scores **SC2** Translation of green triangle scores **M1** Accept intention if triangles not labelled Condone unruled

Question			Answer	Marks	Part Marks and Guidance	
	(b)		Enlargement [Centre] (0, 0) oe [Scale factor] $^{-}2$	1 1 1		Marks are independent but if more than one transformation soi award **0** for first mark Allow origin, O for centre
9	(a)	(i)	6.14×10^7	1		Condone 6.1×10^7
		(ii)	$9 \times 10^9 \div 6 \times 10^7 = 150$ Or $60 \times 1500 = 90\,000$ Or $6.14 \times 10^7 \times 1500 = 9.21 \times 10^{10}$ Or Clearly showing Chloe's answer is ten times too big	2	**B1** for 9×10^9 o.e. seen or 6×10^7 o.e. seen or 9000 and 60 seen or 1500 × figs 61.4 seen or figs 9325 ÷ figs 61.4 seen or figs 9325 ÷ 1500 seen or scaling method to show Chloe not correct without final comment	Numbers need not be in standard form for either **2 or 1 marks**
	(b)		1.35×10^6	2	**M1** for figs 135 or $1.34(7\ldots) \times 10^6$	1347292 scores **0 marks**
10	(a)		Tree diagram complete	2	**B1** for correct placement of $\frac{9}{10}$ or $\frac{4}{5}$	Allow any equivalent fractions or decimals
	(b)		$\frac{36}{50}$ oe isw	2	**FT** *their* tree diagram **M1** for *their* $\frac{9}{10} \times \frac{4}{5}$ oe	
11	(a)		90	1		
	(b)		90 85 70	2	**B1** for 85 or 70 correct	

Question			Answer	Marks	Part Marks and Guidance	
	(c)		Smooth curve through six correct points	2	**B1** for 5 points correctly plotted **FT** table	Use overlay Tolerance ±1mm vertically from correct position for points Intention of correct smooth curve
	(d)	(i)	58 – 60	1	Or **FT** curve	Tolerance ±1 for **FT**
		(ii)	4.1 – 4.3	1	Or **FT** curve for first crossing	Tolerance ±0.1 for **FT**
12			8	3	**M1** for $3w + d = 28$ $w + d = 12$ AND **M1** for $2w = 16$ **FT** *their* equations Or **M1** for correct trial calculating number of points when 'wins + draws' = 12 or number of wins and draws when points = 28 AND **M1** for improved trial	**M2** for 3w + (12 – w) = 28 o.e. Alternative Method **M1** for 36 – 28 = 8 (points dropped) **M1** for 8 ÷ 2 = 4 (draws) **A1** 12 – 4 = 8 (wins) Be aware of answer from wrong working, 36 – 28 = 8 scores **M1** only
13	(a)		36	1		

Question			Answer	Marks	Part Marks and Guidance	
	(b)		70% of the workers in this survey worked between 30 and 45 hours, which is more than in the national survey	4	**M1** for at least 3 of 21, 36, 60, 75, 40, 18 **M1** dep for sum of *their* 6 frequencies [= 250] **M1** for 0.54 × *their* '250' or ('*their* 60 + 75 + 40') ÷ *their* '250' **M1** for comparison of two correct percentages/fractions/numbers of workers seen	**M1** implied by 175 Frequencies may be seen on graph 250 seen implies first **M2** NB this may be in two or more steps Must compare like with like and comparisons must be of 65% to 75% with 54% or 130 to 140 workers with 175 for final **M1**
14	(a)		Fd = 18 000 oe	2	**M1** for 300 × 60 soi or for $F \propto \frac{1}{d}$ or $F = \frac{k}{d}$ o.e. seen	k can be any letter or number
	(b)		450	1	Or **FT** from *their* equation in F and d in (a)	eg 200 after $F = 5d$ in (a)
15	(a)		$(x + 4)^2 - 6$	3	**M2** for $(x + 4)^2 - 16$ [+ 10] or $x^2 + 4x + 4x + 16 - 16$ [+ 10] Or **M1** for $(x + 4)$ or $(x + 4)^2$ or – 6 seen Or **SC2** for $(x - 4)^2 - 6$	
	(b)		$^{-}6$	1	Or **FT** *their* constant term from completed square expression	

Question			Answer	Marks	Part Marks and Guidance	
16	(a)	(i)	$\begin{pmatrix} 9 \\ -3 \end{pmatrix}$	1		Condone line in vector if numbers correctly placed
		(ii)	$\begin{pmatrix} 1 \\ 1 \end{pmatrix}$	1		
	(b)		$j = 3$, $k = 2$	2	**B1** for one correct or **p** or **q** or 3**p** or **p**+**q** drawn on grid or for one of $3j - 2k = 5$ or $-j + 2k = 1$ Or **SC1** for $\begin{pmatrix} 9 \\ -3 \end{pmatrix} + \begin{pmatrix} -4 \\ 4 \end{pmatrix} \left[= \begin{pmatrix} 5 \\ 1 \end{pmatrix} \right]$	
17	(a)		$\frac{1}{27}$	2	Mark final answer **M1** for $\frac{1}{3}$ or $\frac{1}{729}$ or $\frac{1}{27}$ or 27 seen	**0 marks** for $\frac{3}{81}$ if no correct working seen
	(b)		$17 + 8\sqrt{2}$	2	**M1** for $15 + 5\sqrt{2} + 3\sqrt{2} + 2$ at least 2 terms correct	For **M1** $\left(\sqrt{2}\right)^2$ or $\sqrt{4}$ is acceptable in place of the 2 Allow **M1** for $8\sqrt{2}$ or 15 + 2 but not just 17
18			$\frac{7x-1}{(x+2)(x-3)}$ or $\frac{7x-1}{x^2-x-6}$	3	**M1** for $3(x - 3) + 4(x + 2)$ or $3x - 9 + 4x + 8$ or better seen **M1** for correct common denominator seen as a denominator	Mark final answer but isw for incorrect expansion of denominator after correct answer seen Condone missing brackets in denominator for **M1** if intention clear, but for **3 marks** all brackets must be present or correct expansion

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