

GCSE

Mathematics B (Linear)

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

General Certificate of Secondary Education

Mark Scheme for June 2014

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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
	Blank Page – this annotation must be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
	Correct
	Incorrect
	Benefit of doubt
	Follow through
	Ignore subsequent working (after correct answer obtained), provided method has been completed
	Method mark awarded 0
	Method mark awarded 1
	Method mark awarded 2
	Accuracy mark awarded 1
	Independent mark awarded 1
	Independent mark awarded 2
	Misread
	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 $180 \times (\textit{their} '37' + 16)$, or FT $300 - \sqrt{(\textit{their} '5^2 + 7^2')}$. Answers to part questions which are being followed through are indicated by eg FT $3 \times \textit{their} (a)$.

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 and applies as a default.
 - **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. In questions with no final answer line, make no deductions for wrong work after an acceptable answer (ie **isw**) unless the mark scheme says otherwise, indicated by the instruction 'mark final answer'.
7. In questions with a final answer line following working space,
- (i) if the correct answer is seen in the body of working and the answer given on the answer line is a clear transcription error allow full marks unless the mark scheme says 'mark final answer'. Place the annotation ✓ next to the correct answer.
 - (ii) if the correct answer is seen in the body of working but the answer line is blank, allow full marks. Place the annotation ✓ next to the correct answer.
 - (iii) if the correct answer is seen in the body of working but a completely different answer is seen on the answer line, then accuracy marks for the answer are lost. Method marks could still be awarded. Use the M0, M1, M2 annotations as appropriate and place the annotation ✗ next to the wrong answer.
8. In questions with a final answer line:
- (i) If one answer is provided on the answer line, mark the method that leads to that answer.
 - (ii) If more than one answer is provided on the answer line and there is a single method provided, award method marks only.
 - (iii) If more than one answer is provided on the answer line and there is more than one method provided, award zero marks for the question unless the candidate has clearly indicated which method is to be marked.
9. In questions with no final answer line:
- (i) If a single response is provided, mark as usual.
 - (ii) If more than one response is provided, award zero marks for the question unless the candidate has clearly indicated which response is to be marked.

10. 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.
11. 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.
12. Ranges of answers given in the mark scheme are always inclusive.
13. 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.
14. 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)	48	2	M1 for $60 \div (1 + 4)$ or 12	answer of 12:48 or 48:12 implies M1 note: 48 out of 60 scores 2 48/60 scores M1
	(b)	70	2	M1 for $42 \times 5 \div 3$ oe	answer of 42:70 or 70:42 implies M1
2	(a)	4 points correctly plotted (± 1 mm)	2	B1 for any two points correctly plotted	
	(b)	negative	1		ignore any extra statements such as 'strong'
	(c)	ruled line of best fit between 1.60 and 2.10	1	tolerance on 1.60: 45 – 55 and on 2.10: 20 – 30	use overlay and ignore any lines joining up the points
	(d)	(1.81, 15) indicated on graph	1		
	(e)	<u>strict</u> follow through from <i>their</i> line of best fit tolerance ± 2 for answer nfww	2 FT	M1FT for a correct reading from their single ruled line	allow tolerance ± 1 on number sold no FT from a zig-zag line
3	(a)	51	2	M1 for 9 or 45 or $5 \times 3^2 + 2 \times 3$ or better	
	(b)	28	2	M1 for 18 or – (-10) or better	

Question		Answer	Marks	Part marks and guidance
4		$3\frac{13}{30}$ or $\frac{103}{30}$ or any equivalent fraction isw	3	<p>M2 for $\frac{13}{30}$ oe from a subtraction or $\frac{18}{30}$ and $\frac{5}{30}$ oe or $\frac{168}{30}$ and $\frac{65}{30}$ oe allow an error in one of the two numerators with a correct common denominator or M1 for any correct attempt to get a common denominator or $\frac{28}{5}$ and $\frac{13}{6}$ oe</p> <p>See additional sheet eg $\frac{36}{60}$ and $\frac{11}{60}$ scores M2 eg two fractions with common denominators of a multiple of 6×5</p>
5	(a)	22 000	4	<p>M3 for $40 \times 25 \times 40 - 2 \times 15 \times 20 \times 30$ or better or B3 for an answer of 31 000 or B2 for 40 000 or 18 000 or 9 000 or M1 for $40 \times 25 \times 40$ or $15 \times 20 \times 30$</p> <p>eg $40\,000 - 18\,000$ from using one speaker</p>
	(b)	1300	3	<p>M2 for $2 \times (20 \times 15 + 10 \times 15 + 10 \times 20)$ or better or M1 for the areas of two <u>different</u> faces (from 20×15, 10×15 and 10×20 or better)</p> <p>Ignore any $\times 2$ or $\times 4$ as these are going to be the number of faces</p>

Question		Answer	Marks	Part marks and guidance	
6		bisector of angle A ($\pm 2^\circ$)	1	must be ruled, condone dotted	on or within the two lines on the overlay
		two pairs of correct supporting arcs	1	intersection arcs on AB and AD could be short lines or a single arc	
		arc of circle, centre C, radius 4 cm (± 2 mm)	1	not freehand, condone dotted and arc must meet their bisector and the line BC, if no bisector where it should have been	meets bisector 'near A' and use the ruler to check tolerance
		<i>their region</i> indicated	1FT	FT dep on any ruled line through A and an arc, centre C, intersecting with their line and BC	whole region must be within park for 4 marks the bisector through A has to intersect BC
7	(a)	$\sqrt{3}$ 1 3	1		
	(b)	correct ruled line from $x = -2$ to $x = 4$	2	B1 for 4 points correctly plotted FT their table for points only	For points and line tolerance is $\frac{1}{2}$ small square horizontally
	(c)	2 cao	1		Not 2/1
8		7.5 or $7\frac{1}{2}$ oe	4	M1 for $3 + x + 5$ or $2x + x + 5$ soi nfww M1 for $4x + 13 [= 43]$ or better or <i>their</i> linear expression = 43 M1 for correct first step from <i>their</i> linear equation, eg $4x = 43 - 13$ or better M1 for $x = b/a$ after $ax = b$ ($a \neq 1$, $b \neq 0$) from <i>their equation</i> to a maximum of 3 marks	$4x + 13 [= 43]$ implies the first M1 Their linear expression may not be simplified if you see trial-and-improvement then award M1 for each correct attempt, with input and output clearly linked, up to a maximum of 3 marks on the function $4x + 13$ eg trial of 6 result 37 scores M1

Question		Answer	Marks	Part marks and guidance	
9		62	4	<p>M1 for $60 \div 40$ or 1.5 oe seen</p> <p>M1 for $184 - 60$ or 124 or $3.5 - 1.5$ or 2 seen</p> <p>M1 for <i>their</i> '124' \div <i>their</i> '2'</p>	<p>equivalents include 1[h] 30 [m] oe allow h or hr or hour[s] and 1.30 etc not 1.3</p> <p>for distance \div time, <i>their</i> 2 has to be a time eg 2, 2.45, 120 <i>their</i> '2' cannot be 3.5 or 210 and <i>their</i> '124' cannot be 184</p>
10	(a)	$15x - 5y$	1		
	(b)	$\frac{-14}{4}$ or $\frac{14}{-4}$ or -3.5 oe isw	3	<p>M1 for $5x - x + 17 = 3$ or better</p> <p>M1 for $5x = x + 3 - 17$ or better</p> <p>M1 for $x = b/a$ after $ax = b$ ($a \neq 1$) to a maximum of 2 marks</p>	<p>ie collecting x's on one side ie collecting numbers on another side</p>
	(c)	$(x =) \frac{y+3}{2}$	2	<p>M1 for answer of $\frac{y-3}{2}$ or $y + 3 \div 2$ or a correct first step eg $y + 3 = 2x$ or $\frac{y}{2} = x - \frac{3}{2}$ if 0 scored then SC1 for $\frac{y}{2} + 3$</p>	
	(d)	$[t =] [\pm] \sqrt{\frac{u}{5}}$	2	<p>M1 for square root seen or $t^2 = \frac{u}{5}$</p>	

Question			Answer	Marks	Part marks and guidance	
11			Q and R P	1 1	SC1 for P S Q	in either order
12	(a)	(i)	5.4×10^6	1		
		(ii)	[0].000463	1		
	(b)		2.1×10^{12}	2	M1 for figs 21 or 0.7×10^{12} or 28×10^{11} or one of the numbers correctly seen in normal form	
13			171	3	M2 for 180×0.95 oe or M1 for $(180 \div 10) \div 2$ or 1.8×5 or 9 seen and M1 for 180 – <i>their</i> 9	Their 9 is an attempt at finding 5% of 180
14	(a)		10 15 30 46 50	2	B1 for 3 correct	
	(b)		correct curve	2	condone straight lines joining the points B1 for 3 correct points clearly plotted ($\frac{1}{2}$ small square tolerance), FT their table if 0 scored SC1 for an horizontal translation of the correct curve	Ignore 'curve' below $x = 0.5$ and be generous with judgement, allow curve if 4 points are within $\frac{1}{2}$ small square Condone a little feathering.

Question		Answer	Marks	Part marks and guidance		
	(c)	[median =] 1.3 – 1.4 and a correct response, eg higher or more or a reading from $x = 1.2$ [c.f. =] 18 - 21 and a correct response, eg higher or more or if no numbers given accept a clear indication on graph of method and a correct response, eg higher or more	1	or FT their c.f.' curve' reading from 25 (or 1.2), and accept any correct conclusion	Must be a 'curve' not decreasing tolerance for reading ± 0.05 ie one line their response could be lower or less with names	
	(d)	16 – 22 or FT <i>their c.f. 'curve'</i>	3	B1 for a correct reading (± 0.5) from their c.f. 'curve' at 1.8 M1 for 50 – <i>their reading</i> or 100 – <i>their percentage</i>	Must be a 'curve' not decreasing eg 50 – 42 or 100 – 42 \times 2	
	(e)	two correct comments from different categories	2	B1 for each, ignore any figures and the categories are 'average', spread, max or min and skewness	see acceptable list	
15	(a)	$(y =) (x + 6)^2 - 12$	3	B1 for $(x + 6)^2$ B2FT for <i>their</i> '-12' following from <i>their</i> ' $(x + 6)^2$ ' or M1 for 24 – (<i>their</i> 6) ²	Condone + -12 eg $(x + 4)^2 + 8$ scores B2 FT because $4^2 + 8 = 24$ eg 24 – 4 ² following $(x + 4)^2$	
	(b)	(i)	-12	1	or FT <i>their</i> '-12'	if they have $(x + p)^2 + q$ then accept q
		(ii)	-6	1	or FT <i>their</i> $(x + 6)$	if they have $(x + p)^2 + q$ then accept $-p$

Question		Answer	Marks	Part marks and guidance	
16	(a)	$10 + 6\sqrt{3}$	2	M1 for three correct terms from 4 [+] $2\sqrt{3}$ [+] $4\sqrt{3}$ [+] $2\sqrt{3}$ $\sqrt{3}$ oe or better	eg $2\sqrt{9}$ is acceptable for $2\sqrt{3}\sqrt{3}$
	(b)	$\frac{2+3\sqrt{2}}{2}$ oe	2	M1 for $\frac{(3+\sqrt{2})\times\sqrt{2}}{\sqrt{2}\times\sqrt{2}}$ oe	ie for intention to multiply top and bottom by $\sqrt{2}$
	(c)	2π or π^2	3	M2 for $\pi \times 3^2 \times \frac{80}{360}$ oe or M1 for [k \times] $\pi \times 3^2$ or better or SC1 for 7π	clearly not π^2 accept 3.14[2] or 22/7 for π for M1
17	(a)	$\frac{9}{10}$, $\frac{1}{3}$ and $\frac{2}{3}$ on the correct branches	2	M1 for either $\frac{9}{10}$ or $\frac{1}{3}$ and $\frac{2}{3}$ on the correct branches	ignore any extra
	(b)	$\frac{2}{5}$ or $\frac{12}{30}$ oe isw	3	equivalents include decimals, fractions and percentages M2 for $\frac{1}{10} + \frac{9}{10} \times \frac{1}{3}$ or FT their tree diagram or M1 for use of one correct branch ie $\frac{1}{10}$ or <i>their</i> $\frac{9}{10} \times \frac{1}{3} = \frac{9}{30}$ oe	Percentages must have % May be seen on diagram to count it has to be part of their answer eg $\frac{1}{10}$ [+...] for M1

Question		Answer	Marks	Part marks and guidance	
18	(a)	$\begin{pmatrix} 9 \\ -6 \end{pmatrix}$	1		there should be no fraction line
	(b)	4^{-3}	1		watch out for -4,3 which scores 0
19		$\frac{8}{11}$	3	M2 for $\frac{72}{99}$ or M1 for $100 [n] = 72.72$ or better	
20	(a)	(i) $4a$	1		
		(ii) $4b - 4a$	1	allow any equivalent <u>simplified</u> expression	
		(iii) $3a$	2	M1 for $-b + 4a + \frac{1}{4}(4b - 4a)$ or EA + AB + BF or $3b - \frac{3}{4}(4b - 4a)$ oe	Note: EA (etc) does not need arrows
	(b)	parallel	1	accept AB is $1\frac{1}{3}$ times longer	see accepted list and choose the best if more than one comment

Question	Answer	Marks	Answer
21*	<p>Complete method leading to the correct answer, $a = 12.5$[0] and $c = 7.5$[0]. The initial equations $5a + 3c = 85$ and $4a + 2c = 65$ seen and the middle one, may be written, but will be ignored. Correct algebraic method, either elimination or substitution, will be used. (Allow correct trial and improvement with at least two valid trials.) Clear annotation and explanation of reasoning. Correct spelling, punctuation and grammar.</p> <p>The two correct equations seen and the coefficients of one variable equated and it has been eliminated either by addition or subtraction. or fully correct answer with one valid trial.</p> <p>The two correct equations seen with an attempt to equate coefficients but they are unable to eliminate either a or c from their two equations or $a + c = 20$. or one correct answer with either none or one valid trial or two valid trials seen (with no correct answers).</p> <p>No worthwhile work attempted.</p>	<p>5</p> <p>4 – 3</p> <p>2 – 1</p> <p>0</p>	<p>The two correct equations seen and the coefficients of one variable equated. There may be some clear annotation or the equations are written so that the method can be clearly implied or the correct answers may be seen from a wholly or partial numerical method with no valid trials or supportive algebra or one correct answer seen with two valid trials.</p> <p>One correct equation seen eg $5a + 3c = 85$, $2a + c + 3s = 58$ or $4a + 2c = 65$. or one valid trial seen.</p>

APPENDIX

Exemplar responses for Q.14(e)

Response	Mark
A has a higher average(median)	1
B has a higher upper quartile	1
B has a larger spread/range/IQR of results	1
They both have a (slight) negative skew	1
The heaviest/biggest fish was at A	1
Place B box plot is longer meaning weights of fish varied	1
Place B had lightest fish	1
A had greater weights	0
On average B had a wider range	0
A has a higher mean	0
Half of A's are above 1.75 and half of B's are above 1.6	0
Mean for place A is higher. Therefore the average weight is higher in A	0
The lowest value is lower than A, place B is lower than A	0
More fish caught at place B	0
Place B had lighter fish than Place A	0

These must come from two different categories

Exemplar responses for Q20 (b)

Response	Mark
parallel	1
AB is $1\frac{1}{3}$ times longer	1
They are parallel and multiples of each other	1
EF is $\frac{3}{4}$ of AB	1
They are multiples of each other	0

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