

Mathematics B (Linear)

General Certificate of Secondary Education

Component **J567/04**: Mathematics Paper 4 (Higher)

Mark Scheme for November 2013

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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 $180 \times (\text{their '37'} + 16)$, or FT $300 - \sqrt{(\text{their '5}^2 + 7^2)}$. Answers to part questions which are being followed through are indicated by eg FT $3 \times \text{their (a)}$.

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.

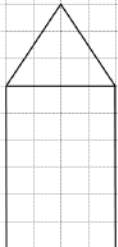
4. Where dependent (**dep**) marks are indicated in the mark scheme, you must check that the candidate has met all the criteria specified for the mark to be awarded.
5. The following abbreviations are commonly found in GCSE Mathematics mark schemes.
 - **figs 237**, for example, means any answer with 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.
 - **nfw** 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)		6.21	2	B1 for 6.20[5...] or 35.99 seen	
	(b)		5.9	2	B1 for 5.8[71...] or 34.47... or an answer of 34	
2	(a)		0.05 , 5% or $\frac{1}{20}$ oe	2	M1 for 1 - (0.07 + 0.23 + 0.18 + 0.28 + 0.19) oe	isw attempt to simplify accept $\frac{0.05}{1}$
	(b)		0.48, 48% or $\frac{12}{25}$ oe	2	M1 for 0.07 + 0.23 + 0.18	isw attempt to simplify accept $\frac{0.48}{1}$
3			<p>attempt to extend the straight line from (9.10, 14) with a straight line or sequence of dots of similar gradient</p> <p>correct ruled line or a sequence of correct points plotted e.g. every 10 minutes, within tolerance</p> <p>fully correct response using all their evidence and a clear decision given</p>	<p>M1</p> <p>A1</p> <p>A1</p>	<p>Within blue lines on overlay</p> <p>must be up to either the time=10.00 or the distance=70 lines and tolerance is between the red lines on the overlay</p> <p>for first 2 marks mark to the candidates advantage</p> <p>tolerance $\pm \frac{1}{2}$ small square</p> <p>if 0 scored SC1 for yes it arrives at either 9.45 to 9.55 or 5 to 15 minutes early</p>	<p>allow alternative methods by applying e.g.</p> <p>M1 for a correct and appropriate reading from the graph, A1 for a correct figure which they can use to answer the question, usually time or speed and A1 for a fully correct response from all their work or</p> <p>M1 for 6 km in 5 minutes or $\frac{6}{5}$, A1 for 72 kmph oe and A1 for arrives just before 1 hour [as 72 > 70] or</p> <p>M1 for 14 km in 10 mins or $\frac{14}{10}$ oe</p> <p>A1 for 50 A1 for e.g. arrives just before 1 hour or at 9 50</p>

Question			Answer	Marks	Part marks and guidance	
4	(a)		$5n + 2$ as final answer	2	B1 for $5n$ seen	
	(b)		92, 84, 76	2	B1 for 92 in correct place or 100, 92, 84 or -92, -84, -76 or two correct	
5			3.5 or $3\frac{1}{2}$ or $\frac{7}{2}$ oe	3	B1 for $12x - 18$ or $2x - 3 = 4$ M1 for <i>their</i> $12x = 24 + \text{their } 18$ or better M1 for $ax = b$ leading to $x = b/a$ ($a \neq 1$) to a maximum of 2 marks	
6	(a)	(i)	33 [000]	2	B1 for 9 [000] or 24 [000] seen	Note 10.5 scores 0
		(ii)	$0 < \text{length} \leq 10$	1	accept 0 to 10, $0 < m > 10$, $0-10$, $0 < 10$	
	(b)		38.6 or 39	4	B1 for at least 4 mid-points seen (from 5, 15, 25, 35, 45, 55) or implied by products M1 for Σmf where m is a value within each group allow one error M1dep for <i>their</i> $'965' \div \Sigma f (25)$	isw rounding 39 must not come from wrong working ie $[0] + 45 + 75 + 210 + 360 + 275 = 965$
	(c)	(i)	December and it has a higher mean	1	accept any correct statement	condone numbers for mean and implied statement
		(ii)	November and it has a higher range	1	accept any correct statement	condone numbers for range and implied statement

Question			Answer	Marks	Part marks and guidance																				
7			<p>Plan</p>  <p>Front Elevation</p> 	2	B1 for correct plan with one error such as wrong scale or one dimension incorrect or no diagonals	allow centre point not at centre																			
				2	B1 for correct elevation with one error such as wrong scale, one dimension incorrect, one point incorrect, missing base to triangle or all correct with extras	allow centre point not at centre																			
					If reversed then SC2 for both correct or SC1 for one correct and the other with one error	in both condone freehand attempt at straight line, otherwise deduct 1 mark in (b) if lines are excessively wavy																			
8	(a)	(i)	<table border="1"><tr><td></td><td>Senior</td><td>Junior</td></tr><tr><td>Male</td><td>8</td><td>7</td></tr><tr><td>Female</td><td>5</td><td>4</td></tr></table> <p>or any other correct diagram</p>		Senior	Junior	Male	8	7	Female	5	4	3	allow the other orientation and any other table or chart that shows the information in the four classes such as <table border="1"><tr><td></td><td></td></tr><tr><td>Senior Male</td><td>8</td></tr><tr><td>Junior Male</td><td>7</td></tr><tr><td>Senior Female</td><td>5</td></tr><tr><td>Junior Female</td><td>4</td></tr></table> B2 for any table with no class missing or with no extra cells, classes can be implied by tallies or letters or B1 for a table which has a class missing or extra cells and B1 for correctly completed table			Senior Male	8	Junior Male	7	Senior Female	5	Junior Female	4	ignore any totals columns such as 11 juniors and 15 males allow a bar chart, tally chart or a pictogram classes mean the headings senior/junior and male/female
	Senior	Junior																							
Male	8	7																							
Female	5	4																							
Senior Male	8																								
Junior Male	7																								
Senior Female	5																								
Junior Female	4																								
		(ii)	$\frac{11}{24}$ or [0].45[8...] or [0].46 or 46% oe	1	correct or FT <i>their</i> table	isw when they attempt to simplify																			

Question			Answer	Marks	Part marks and guidance	
	(b)		24	3	M2 for $(\frac{31}{25} - 1) \times 100$ oe or M1 for $\frac{31-25}{25}$ or $\frac{6}{25}$ oe or $\frac{31}{25}$ or 1.24 oe and M1 for $\frac{\text{their } 6}{25} \times 100$ or SC2 for answer of 124 or SC1 for answer 19.3... or 19.4	e.g. $(\frac{31}{25}) \times 100 - 100$ not $\frac{6}{31}$
9			ruled perpendicular bisector of AB with at least one pair of correct arcs and then an intended route due West, which is always between 1 cm and 2 cm from the coast, it must be a joined up line	4	B1 for correct ruled line between A and B going through and beyond the midpoint of AB, condone extension of bisector towards coastline B1 for at least one intersection of one pair of correct arcs B1 for an intended route due west B1 for a route always within 1 cm and 2 cm of coast	on or between the two V lines route parallel to coastline (due West) by eye, could be anywhere on diagram must remain between the two parallel lines for its length which has to be at least 5 mm by eye.
10			$600 \div 30 = 20$ or $600 \div 25 = 24$	2	accept $560 \div 28 = 20$ or 570 or $580 \div 30 = 19$ (or 19.3 for 580) or $575 \div 25 = 23$ or $580 \div 25 = 23$ or 23.2 or $580 \div 29 = 20$ M1 for 560, 570, 580, 600, 25 or 30 seen	

Question			Answer	Marks	Part marks and guidance	
11			E	1		accept equations in the place of letters
			A F	1	in either order	
			A E	1	in either order	
12	(a)		190 800	3	M2 for $180\,000 \times 1.06$ oe or M1 for $180\,000 \times (0).06$ or 10 800	
	(b)		350 000	3	M2 for $371\,000 \div 1.06$ oe or M1 for 1.06 or 106% oe seen	
13	(a)		$x^2 + 4x - 21$	2	M1 for three correct terms from x^2 [+] $7x - 3x - 21$	accept in a grid
	(b)		$6x(y - 2x)$	2	M1 for a correct partial factorisation eg $6(xy - 2x^2)$, $x(6y - 12x)$ or $3x(2y - 4x)$ or $2x(3y - 6x)$ or $3(2xy - 4x^2)$ or $2(3xy - 6x^2)$	condone missing final bracket
	(c)		$[x =] \sqrt{A + 4y}$	2	M1 for first step correct $A + 4y = x^2$ or for square root seen	
	(d)		$xy = 120$ oe	3	M1 for $xy = k$ oe B1 for $[k =] 120$	accept $30 \propto \frac{k}{4}$ for M1
14	(a)		54 alternate segment [theorem]	1 1		may be on diagram
	(b)		102 angles [in a] triangle [add to 180°] or triangle [adds to] 180° or angle[s on a] straight line opposite and/or angles [in a] cyclic quadrilateral [add up to 180°]	1 1 1		may be on diagram

Question			Answer	Marks	Part marks and guidance	
15	(a)		125 000	1		condone 124 999[.9...]
	(b)		2336[.448...] or 2340 or 2336.45 or 2337	3	B1 for 53.5 M1 for <i>their</i> '125 000' ÷ <i>their</i> '53.5'	isw after correct answer seen <i>their</i> '53.5' can be in range 52 to 55
16	(a)	(i)	full correct argument e.g. $14.7^2 + 11.5^2 [=] 19.4^2$ 348.34 ≠ 376.36 use of appropriate symbol (≠) or a statement that these two numbers are not the same	3	M1 for an appropriate method e.g. $\sqrt{19.4^2 - 11.5^2}$, $\sqrt{19.4^2 - 14.7^2}$, $\sqrt{11.5^2 + 14.7^2}$ oe or cosine rule for angle B A1 for correct result to compare e.g. 15.6..., 12.6..., 18.6... or 18.7 or B = 94.7 A1 for a statement that the result does not equal the actual figure	accept any correct method including a drawing tolerance ±2 mm, M1 for a triangle with one side correct A1 for all three sides correct A1 for measuring <i>their</i> angle accurately (±2°) or stating clearly it is not 90° e.g. another equivalent method would be $11.5^2 + 14.7^2 = 18.6...^2$ for M1 A1 allow these results rounded
		(ii)	36.2 to 36.22 or 36	3	M2 for $(\cos a) = \frac{19.4^2 + 14.7^2 - 11.5^2}{2 \times 19.4 \times 14.7}$ or 0.8068(...) or M1 for $11.5^2 = 19.4^2 + 14.7^2 - 2 \times 19.4 \times 14.7 \times \cos(\text{their } a)$	Make sure that 36 does not come from a wrong method
	(b)		10.89 to 10.9[0]	2	M1 for $\frac{1}{2} [\times] 8 [\times] 6 [\times] \sin 27$ oe	must be fully correct method
17			fully correct histogram	3	M1 for correct bar widths e.g. 40–50, 50–60, 60–80, 80–120 M1 for two correct heights or three correct figures seen from 0.8, 1.5, 0.3, 0.1	tolerance on graph is $\pm \frac{1}{2}$ small square condone freehand 'bars'

Question			Answer	Marks	Part marks and guidance	
18	(a)		$(x =) 4$ $(y =) -1$ with an algebraic solution	4	M1 for multiplying first equation correctly e.g. $15x - 6y = 66$, allow one error M1 for multiplying second equation correctly e.g. $4x + 6y = 10$, allow one error M1 for adding or subtracting the equations appropriately, allow one error mark best attempt if 0 scored SC1 for correct answers with little or no supporting algebraic work	substitution: M1 for rearranging one equation to make x or y the subject, allow one error M1 for substituting correctly into the other equation M1 for rearranging to get the value of x or y , allow one error
	(b)	(i)	$(x - 3)^2 - 5$ as final answer	3	B1 for $(x - 3)^2$ B2FT for -5 or a correct FT from <i>their</i> ' $(x - 3)^2$ '	condone $+^{-}5$ and $+^{-}3$ FT $(x - p)^2$ only If this is blank (NR) then you can award SC2 if $(x - 3)^2 - 5 [= 0]$ is seen in (b)(ii)
		(ii)	0.8, 5.2	2	B1, B1 correct or FT <i>their</i> (i) accept $3 + \sqrt{5}$, $3 - \sqrt{5}$ for 2 marks if 0 scored SC1 for 5.236... and 0.763... rot to at least 2 dp	

Question			Answer	Marks	Part marks and guidance																							
19			2018 with correct calculations of two further years for both species	4	B3 for correctly calculating both species for two additional years e.g. 2014 and 2016 or B2 for correctly calculating both species for one additional year e.g. 2014 or one species correct for two additional years or B1 for correctly calculating one species for 2014 or another year the figures need only be rot to at least 2 sf e.g. 6499 could be 6400 or 6500 but do not FT their incorrect rounding	<table><tr><td>2013</td><td>6700</td><td>4800</td></tr><tr><td>2014</td><td>6499</td><td>4992</td></tr><tr><td>2015</td><td>6304.03</td><td>5191.68</td></tr><tr><td>2016</td><td>6114.909</td><td>5399.347</td></tr><tr><td>2017</td><td>5931.462</td><td>5615.321</td></tr><tr><td>2018</td><td>5753.518</td><td>5839.934</td></tr><tr><td>2019</td><td>5580.912</td><td>6073.531</td></tr></table> ignore extras like 'Spring' in their answer condone the wrong labels for the years	2013	6700	4800	2014	6499	4992	2015	6304.03	5191.68	2016	6114.909	5399.347	2017	5931.462	5615.321	2018	5753.518	5839.934	2019	5580.912	6073.531	
2013	6700	4800																										
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2018	5753.518	5839.934																										
2019	5580.912	6073.531																										

Question	Answer	Marks	Answer
20*	The correct answers for the surface area of the Earth ($4\pi 6371^2 = 510\,064\,471.9$) [and the water area ($361\,124\,471.9$)]. They show that land area is $148\,940\,000 \div 510\,064\,471.9 = 29.2\% = \text{roughly } 30\%$ so $30:70 = 3:7$. They may use an equivalent method to achieve the same result. Clear annotation and explanation of reasoning. Correct spelling, punctuation and grammar.	5	
	The correct answers are obtained, but the working is difficult to follow or parts are missing, or there is just one error in all the working and their answer is consistent with their working. They may obtain the correct answers, but fail to connect with the information given in the question. Clear annotation and explanation of reasoning. Correct spelling, punctuation and grammar.	4–3	The correct answers for the surface area of the Earth ($4\pi 6371^2 = 510\,064\,471.9$) and the water area ($361\,124\,471.9$) found, or they make an attempt to find the proportion of land but they do not reach 30%. Reasoning is coherent and clear but they are unable to show the ratio is correct.
	The correct answers for the surface area of the Earth ($4\pi 6371^2 = 510\,064\,471.9$) and no further progress is made or they find the sea area or surface area from the land area. Reasoning is evident and there is correct spelling, punctuation and grammar.	2–1	An attempt is made to find the surface area of the Earth and $4\pi r^2$ is seen or used, but the correct answer is not found, or for finding one third of the area of land.
	No progress is made although an attempt is seen.	0	

APPENDIXExemplar responses for Q6ci.

Response	Mark
December was 39.7 and it was 34.2 in November	1
December as $39.7 > 34.2$	1
December because it has a higher mean	1
December it has the greatest mean	1
December as the mean is greater by 6.5 (BOD greater is enough)	1
December because the mean is big	0
December if you sum the mean and range it is larger	0
December as it has a lower range	0
December as it has a higher mean and a higher range	0
December as it has a higher mean and a lower range (both comments are true but range is not relevant for average)	0

Exemplar responses for Q6cii.

Response	Mark
November has a higher range	1
$67.4 > 43.8$ so November	1
November the range is wider	1
November the range is bigger and the mean is bigger	0
November the range is bigger and the mean is smaller	0
November the range is big (no comparison)	0
November the range is more spread out	0

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