

GCSE

Mathematics B (Linear)

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

General Certificate of Secondary Education

Mark Scheme for November 2015

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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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1. 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

2. **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.
3. 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.

4. 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.

5. 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.
6. The following abbreviations are commonly found in GCSE Mathematics mark schemes.
- **cao** means **correct answer only**.
 - **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).
 - **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**.
7. 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'.
8. 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).
9. 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.

10. 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.
11. 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' or 'cao'. 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.
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.

MARK SCHEME

Question		Answer	Marks	Part marks and guidance	
1	(a)	correct triangle at (3, -2), (5, 1) and (5, -2)	2	B1 for either the horizontal or vertical movement correct in correct orientation	Ignore labels, condone freehand, mark intent
	(b)	correct triangle at (-3, -2), (-5, -5) and (-5, -2)	2	B1 for correct rotation about the wrong centre	
	(c)	rotation [about] (0, 0) [through] 90° [anticlockwise] oe	3	B1 for rotation or rotate[s] B1 for (0, 0) or O or origin B1 for 90° [anticlockwise] oe	Not 'turn' 0 scored if more than one transformation condone missing degree sign
2		$8n + 3$	2	B1 for $8n + j$ or $kn + 3$ ($k \neq 0$)	
3	(a)	200	2	M1 for $600 \div (1 + 2)$	
	(b)	160	2	M1 for $200 \div 5$ or 40	
4	(a)	(i)	97	1	
		(ii)	397	1	
	(b)		$20x + 50$	1	
	(c)		$5(a + 4)$	1	

Question		Answer	Marks	Part marks and guidance	
	(d)	11.5 oe	3	M1 for $5x - 3x + a = b$ oe ie correctly combining x 's M1 for $cx = 16 + 7 + dx$ oe ie correctly combining numbers M1 for $x = f/e$ after $ex = f$ to a maximum of 2 marks	must be equations
	(e)	$x = \sqrt{\frac{y+3}{5}}$ oe	3	M1 for a correct first step e.g. $y+3 = 5x^2$ M1 for a correct second step e.g. (their $y+3$) $\div 5 = x^2$ M1 for a square root in their answer to a max of 2 marks	
5	(a)	[0]9 35	1		Any format for time 0935, 09.35, 09:35, 9 35am not pm
	(b)	110	2	M1 for 55 or $85 \div$ a time interval e.g. 30 or 0.5 or 55×2	
	(c)	Ruled line from (09 25, 85) to (10 10, 0)	2	B1 for correct line not ruled or for a ruled line with one end correct or for a 45 min journey from P to L	Tolerance ± 2 mm Condone horizontal line at P
	(d)	[0]9 46 to [0]9 49	1	Correct answer or FT their line from P to L	
6		$\frac{15-a}{2}$	3	M1 for $(a + b + c) \div 3$ or $a + b + c = 15$ oe M1 for making $b + c$ the subject of their first step eg $b + c = 15 - a$	

Question			Answer	Marks	Part marks and guidance	
7			$t > 1$ or $t < 0$ $0 \leq f \leq 1$ e.g. 5, 7 e.g. 5, 15 any non-square any square number number $t > 1$ $0 < f \leq 1$	4	B1 for each correct pair and accept any correct answer	
8	(a)		perpendicular bisector	2	B1 for perpendicular B1 for bisector or bisection	
	(b)		correct region	2	B1 for region satisfying two conditions	More than one region choose the worst one and split the <u>correct</u> region into 2 parts could be 1 mark
9			60 or 60 000 cm ³	2 1	M1 for $2 \times 5 \times 6$ or $20 \times 50 \times 60$ must use mm ³ if their answer >1000 or their method clearly in mm	
10	(a)	(i)	it is 'rude' or people prefer not to give their actual age	1	accept any correct explanation	see the exemplars select best response or part
		(ii)	overlapping groups	1	accept any correct explanation	see the exemplars
	(b)		Suitable question such as "How many pints of milk do you have in a <u>week</u> ?" and at least three option boxes with no overlap and no errors and covering from 0 to at least 20 pints.	2	B1 for a suitable question and at least three option boxes with one error or no suitable question with at least three correct option boxes	

Question		Answer	Marks	Part marks and guidance	
11	(a)	B C E	1	in any order	
	(b)	$y \leq 2x - 1$ oe and $x + y \geq 1$ oe	3	M1 for either $y \odot 2x - 1$ oe or $x + y \odot 1$ oe where \odot stands for any inequality sign or an equal sign A1 for $x + y \geq 1$ oe A1 for $y \leq 2x - 1$ oe	Accept the inequality sign without the equals sign

Question	Answer	Marks	Part marks and guidance
12*	<p>Two correct conclusions, with correct supporting quantitative evidence for both aspects, such as group B has a higher average height and group A has a greater spread of heights. The communication is clear and the conclusions and evidence is linked.</p> <p>Two correct conclusions, with correct supporting quantitative evidence for one aspect, such as group B has a higher average height and group A has a greater spread of heights. The communication may not be clear or the conclusions and evidence may not be linked. There also may be slight errors in reading the figures.</p> <p>One correct conclusion with partial or descriptive evidence such as group B has a higher average height or group A has a greater range of heights. They may alternatively have correct quantitative evidence for one aspect or correct descriptive evidence for two aspects.</p> <p>No worthwhile work attempted.</p>	<p>5</p> <p>4 – 3</p> <p>2 – 1</p> <p>0</p>	<p>Two correct conclusions, with partial evidence for one aspect, such as group B has a higher average height and group A has a greater range of heights. The evidence is for one aspect only and it can be qualitative such as comments on the shape of the curve, or the correct conclusion for one aspect with correct supporting quantitative evidence.</p> <p>Some evidence found or descriptive evidence, but no conclusions made.</p>

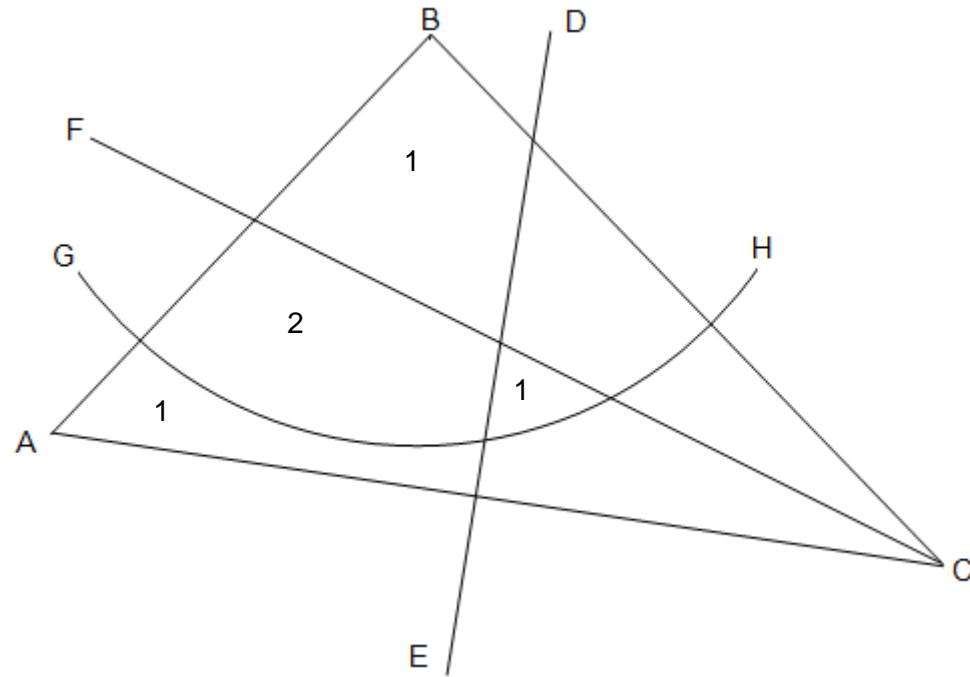
Question		Answer	Marks	Part marks and guidance	
13		8	3	M1 for $15 \div 6$ or 2.5 M1 for $20 \div$ 'their 2.5' accept any correct method	alt.1 : M1 for $20 \div 15$ or 1.33 vv or M1 for 6×1.33 alt 2 : M1 for $6 \div 15$ or 0.4 M1 for $20 \times$ 'their 0.4'
14	(a)	$(x - 10)(x + 10)$ final answer	1		Condone missing final bracket
	(b)	$(x - 4)(x + 25)$ [x=] 4 -25	2 1	B2 for $(x - 4)(x + 25)$ or B1 for two factors giving two correct terms eg $(x - 2)(x + 50)$ or $(x + 4)(x + 25)$ and B1FT for two correct answers from <i>their</i> two linear factors	Condone missing final bracket
	(c)	$\frac{10x + 34}{(x + 5)(x - 3)}$ oe final answer	3	M1 for $\frac{8(x + 5) + 2(x - 3)}{(x + 5)(x - 3)}$ condone one error M1 for $\frac{8x + 40 + 2x - 6}{(x + 5)(x - 3)}$ condone one error if 0 scored SC1 for $10x + 34$ as final answer	accept as two separate fractions for both Ms Condone denominator of $x^2 + 2x - 15$ throughout
15	(a)	$\frac{5}{8}$ on first branch, $\frac{5}{7}$ and $\frac{3}{7}$ $\frac{4}{7}$ on second branches	2	B1 for 2 probabilities correct	

Question	Answer	Marks	Part marks and guidance
(b)	$\frac{36}{56}$ or $\frac{9}{14}$ oe	3	<p>FT their tree diagram</p> <p>M2 for $1 - \frac{5}{8} \times \frac{4}{7}$ or</p> <p>$\frac{3}{8} \times \frac{2}{7} + \frac{3}{8} \times \frac{5}{7} + \frac{5}{8} \times \frac{3}{7}$ or better</p> <p>or</p> <p>M1 for $\frac{5}{8} \times \frac{4}{7}$ or two of</p> <p>$\frac{3}{8} \times \frac{2}{7}$, $\frac{3}{8} \times \frac{5}{7}$ and $\frac{5}{8} \times \frac{3}{7}$ or better</p>
16	[h =] 40 [k =] 10	5	<p>B2 for $\binom{160}{70}$ or B1 for 160 and 70 seen</p> <p>B1 for $3h + 4k = 160$ or $2h - k = 70$</p> <p>M1 for equating their coefficients eg $8h - 4k = 280$ allowing one error in each step of working</p> <p>M1 for correctly writing an equation with one variable e.g. adding to give $11h = 440$</p> <p>To a maximum of 4 marks accept any correct method</p> <p>if 0, 1 or 2 scored then SC1 for trial and improvement method seen with at least one value substituted for h or k in both components</p>

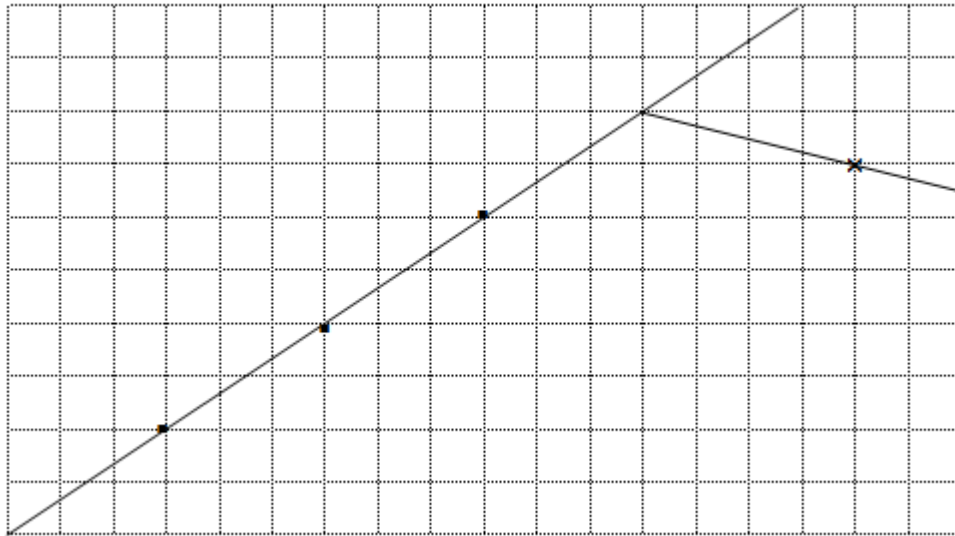
Question		Answer	Marks	Part marks and guidance	
17	(a)	bar correct width and 'height' 0.2	1		
	(b)	35	4	B1 for 4+9+5+2 implied by 20 B1 for 5+2 implied by 7 M1 for 'their 7' ÷ 'their 20' if 0 scored B1 for any two from 9, 5 and 2 seen	
18	(a)	3.4×10^7	2	B1 for 3.4×10^n oe or 34 000 000 or SC1 for $k \times 10^7$	
	(b)	1.2×10^{10}	2	B1 for 1.2×10^n oe or 12 000 000 000 oe	e.g. 12×10^9
19	(a)	$\frac{1}{64}$	3	M1 for $\frac{1}{n}$ M1 for \sqrt{m} e.g. $\sqrt{16}$ or 4 soi M1 for k^3 to a maximum of 2	If done first should be $\frac{1}{16^{\frac{3}{2}}}$
	(b)	$\frac{56}{111}$	3	B2 for $\frac{504}{999}$ oe or M1 for 504.504[...]	
20		$y = \frac{250}{x^2}$ oe	3	M1 for $y = \frac{k}{x^2}$ oe condone any letter for k B1 for $[k =] 250$ If 0 scored B1 for $y \propto \frac{1 \text{ or } k}{x^2}$	k can be anywhere e.g. $ky = \frac{1}{x^2}$ hence $k = \frac{1}{250}$

Question		Answer	Marks	Part marks and guidance	
21	(a)	<p>[angle A(or C)] = 45 [AC=] $\sqrt{6^2 + 6^2}$ or better side of square = $\frac{1}{3}$ AC $\sqrt{72} = 6\sqrt{2}$ $\frac{1}{3} \times 6\sqrt{2}$</p>	5	<p>B1 for [angle A(or C)] = 45 M1 for [AC=] $\sqrt{6^2 + 6^2}$ or better A1 for $\sqrt{72}$ oe B1 for side of square = $\frac{1}{3}$ AC implied by '<i>their</i> $\sqrt{72}$' $\div 3$ M1 for $\sqrt{72} = 6\sqrt{2}$ or '<i>their</i> $\sqrt{72}$' expressed in its simplest surd form M1 for $\frac{1}{3} \times 6\sqrt{2}$ to a max of 4 marks</p>	more than one step may be done at one time and some may be implied eg may be marked on diagram
	(b)	8	1		

Q8(c)



Q21



APPENDIXExemplar responses for Q10(a)(i)

Response	Mark
it is 'rude'	1
people prefer not to give their actual age	1
Too upfront – people would prefer to be in a margin not give their exact age	1
There is no option for people who don't want to give their age	1
The question is not detailed enough	0
There is nothing wrong with this question	0
They won't get an average score with this question	0
Some might not feel comfortable answering	1
It is too direct	1
Misleading people could put different ans such as 16.5	0
No units	0
Does not give time e.g. when?	0
Too personal	1
Should give options	1
He will count/difficult to analyse	1
They might lie	1

Exemplar responses for Q10(a)(ii)

Response	Mark
overlapping groups	1
The brackets overlap	1
0 year old can't write until 5-6 years	0
The age gaps are too wide	0
There is no box that states over 70	0
The numbers are repetitive	1
Too much gap between the ages, should be 20-25, 25-30	0
Broad question and answers	0

Not enough question boxes	0
Over 60 group is too large	0
What if they do not want to / too personal	0
20 and 40 don't know where to put it	1

Exemplar responses for Q17(a)

Response	Mark
division by a number less than 1 means the number increases	1
power of ten should be 7	1
a minus and a minus makes a plus	1

Exemplar responses for Q17(b)

Response	Mark
it is 12×10^9	1
the power of 10 should be 10	1

Exemplar responses for Q17(c)

Response	Mark
to add them the powers of 10 must be the same	1
it should be 5.2×10^4	1

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