

Mathematics A

General Certificate of Secondary Education

Unit **A502/02**: Mathematics B (Higher Tier)

Mark Scheme for January 2012

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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 awarded for a correct final 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).
 - **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. 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 of working
 - i. 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.
 - ii. but the answer space is blank, allow full marks. Place the annotation ✓ next to the correct answer.
 - iii. but a completely different answer is seen in the answer space, 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.
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)		Correct ruled line from $x = -2$ to $x = 3$	3	<p>M2 for 2 correct points plotted (implied by correct but short line) Or M1 for 2 correct points calculated or a ruled line passing through (0, 4) or a ruled line with gradient -2</p>	<p>Overlay is guide only, the points must be plotted within $\pm \frac{1}{2}$ small square of correct place</p> <table border="1"> <tr> <td>x</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr> <tr> <td>y</td><td>8</td><td>6</td><td>4</td><td>2</td><td>0</td><td>-2</td></tr> </table> <p>Ignore extra lines</p>	x	-2	-1	0	1	2	3	y	8	6	4	2	0	-2
x	-2	-1	0	1	2	3														
y	8	6	4	2	0	-2														
	(b)		<p>Correct ruled line ($y = 3$)</p> <p>$x = \frac{1}{2}$ oe</p> <p>$y = 3$</p>	<p>1</p> <p>1FT</p> <p>1</p>	<p>Apply choice if more than one horizontal line unless $y = 3$ is used or indicated</p> <p>Correct answer or FT <i>their</i> two straight lines ($\pm \frac{1}{2}$ small square)</p> <p>SC1 for correct answers reversed</p>	Any length, not a point														
2	(a)		3 points correctly plotted	2	B1 for 1 point correctly plotted	Set “fit to height” Centre of the points should lie within or just touching the circles on the overlay – if in doubt give bod														
	(b)		Straight line of best fit drawn	1		Line to cross the red and green lines, can be on ends; red anchored on (2, 20 000)														
	(c)		Positive	1	Ignore other adjectives eg weak	Not a description of higher engine size, higher price														
	(d)		Any value in range 15 500 – 21 000	1	Condone a 3dp decimal eg 18.000	Not 18.0[0]														
	(e)		Furthest point above <i>their</i> line of best fit	1FT	Correct(2, 29945) or FT <i>their</i> line of best fit															

Question			Answer	Marks	Part Marks and Guidance	
3	(a)		$10m + 2d$	2	Accept $10 \times m + 2 \times d$ and other letters if clear B1 for 1 correct term seen	Mark final answer so eg $10m + 2d = 12md$ scores B1
	(b)	(i)	$2t^2$	1	Accept equivalent statements eg $2t \times t$	Mark final answer
		(ii)	800	1		
4	(a)		Translation $\begin{pmatrix} -7 \\ 2 \end{pmatrix}$ or 7 left and 2 up	1 2	Ignore the word 'transformation' B1 for 1 correct component If no marks for vector allow SC1 for $\begin{pmatrix} 7 \\ -2 \end{pmatrix}$ or $\begin{pmatrix} 2 \\ -7 \end{pmatrix}$ or $(-7, 2)$	Condone line across vector (looks like fraction) Ignore vector if description worth credit
	(b)	(i)	180°	1		
		(ii)	Centre indicated	1	It should be nearer to the centre than grid lines	Overlay gives guide
	(c)		Enlargement $-1 < SF < 1$	1 1	Allow stretch Accept a number without sf	Double transformation scores 0
5			20	3	M2 for $360 \div \textit{their} (180 - 162)$ Or M1 for $180 - 162$ seen or 18 seen or $\frac{(n-2) \times 180}{n} = 162$	M2 for other complete methods

Question			Answer	Marks	Part Marks and Guidance	
6			90×0.8 , 88×0.8 , 88×0.75 or 90×0.75 oe	M2	This is their starting point and can be implied from clear working B1 for 90, 88, 0.2, 0.25, 0.8 or 0.75 oe seen	eg $90 - 90 \times 0.2$ scores M2 the subtraction can be implied eg $\times 20$ then $\div 100$ or 20% is equivalent to 0.2 If 22% calculated max 2 marks
			Answer in the range 66 to 72	1	Independent	
7	(a)		$\frac{1}{15}$	2	M1 for $\frac{2}{30}$ oe	Answer may be in body so allow 2 if $a = \frac{1}{15}$ clearly stated
	(b)		$1\frac{11}{13}$ or $\frac{24}{13}$	4	B3 for $\frac{12}{5} \times \frac{10}{13}$ or $\frac{13}{10} \times b = \frac{12}{5}$ oe or $\frac{120}{65}$ oe Or B2 for $\frac{12}{5}$ or $2\frac{2}{5}$ Or M1 for $\frac{2}{5} \div \frac{1}{6}$ or $\frac{1}{6} \times ? = \frac{2}{5}$ And M1dep for <i>their</i> $\frac{12}{5} \times \frac{10}{13}$	
8	(a)		Ruled line (continuous or dashed) through (50, 0) and (0, 60)	2	B1 for ruled diagonal line passing through (50, 0) or (0, 60) or correct full line not ruled or short line	Put NR only if grid bare Ignore extra lines
	(b)	(i)	$y > 2x$ oe $y < 70$ oe	1 1	If more than two inequalities mark the best two SC1 if correct but includes equals on both	Treat $y < 70 < x$ as $y < 70$ and $70 < x$

Question			Answer	Marks	Part Marks and Guidance	
		(ii)	2 correct ruled lines (continuous or dashed) and shade the 2 regions NOT required	3FT	B1 for each line, accept correct answer or FT <i>their</i> linear inequalities	The shading depends on getting B2 for the lines
	(c)	(i)	$y < 2x$ or (30, 50) is in the shaded region or for 30 adults there would be more than 60 children	1	Answer in symbols or words, accept the best part and condone use of 'twice as much'	
		(ii)	Any correct pair eg (5, 61)	1	Any point in correct region, not on lines	
9	(a)		$\frac{5}{11}$	3	B2 for $\frac{45}{99}$ oe Or M1 for $100x = 45.4\dot{5}$ (min 4 figs)	
	(b)		$\frac{1}{22}$	1FT	Correct or FT <i>their</i> $(a) \div 10$ in its lowest terms	
10	(a)		$6b - 6a$	1	Or $-6a + 6b$ or $6(b - a)$ or $-6(a - b)$	
	(b)		$3a + 3b$ or $3(a + b)$	2	M1 for $6a + \frac{1}{2}$ <i>their</i> (a) or $\overrightarrow{OA} + \frac{1}{2}\overrightarrow{AB}$ or $6a + \frac{1}{2}\overrightarrow{AB}$ or the same using $\overrightarrow{OB}$	Working must be seen to award M1
	(c)	(i)	$3b - 6a$	1	Or $-6a + 3b$ or $3(b - 2a)$ or $-3(2a - b)$	
		(ii)	$2a + 2b$ or $2(a + b)$	2	M1 for $\overrightarrow{OG} = 6a + \frac{2}{3}$ <i>their</i> $(3b - 6a)$ or $\overrightarrow{OA} + \frac{2}{3}\overrightarrow{AM}$ or $\overrightarrow{OM} + \frac{1}{3}\overrightarrow{MA}$ or $3b - \frac{1}{3}$ <i>their</i> $(3b - 6a)$	Working must be seen to award M1

Question			Answer	Marks	Part Marks and Guidance	
	(d)		Collinear or $\overline{OG} = \frac{2}{3}\overline{ON}$ oe	1	Independent mark, accept 'on the same line'	Ignore superfluous comments but penalise conflicting comments

Question		Answer	Mark	Guidance
11*		Fully correct and concise solution ($\square = -2$, $\diamond = 9$). Correct and clear (language and) algebra throughout.	5	No need for language providing the algebra is clear and logical and steps explained eg use of a key, $\times 2$ or $-$ signs
		Fully correct solution but there might be superfluous work eg finding values of other symbols first or minor errors in spelling, punctuation or grammar or lack of clear algebraic method. Alternatively it may be a fully correct method up to finding the value of one variable, with at most one error, and correct and clear (language and) algebra throughout.	4-3	For lower mark – more progress eg correct method such as elimination of one variable correctly from the 2 simplest equations ($3s + h = 3$ and $2h + 2s = 14$) allowing for one arithmetic slip at any stage or with 3/4 variables/symbols with elimination of one of these allowing for one arithmetic slip at any stage or correct method leading to only 1 value found correctly. Alternatively they will have the correct equations with some progress made by equating coefficients correctly and clear (language and) algebra throughout.
		Numerical trial and improvement approach leading to 2 correct values or correct equations and some progress made eg correct method such as coefficients of one variable equated allowing for one arithmetic slip. Alternatively they write the two equations (enable the solution to be found) with a clear explanation of how these were obtained eg letters on the diagram, use of symbols in algebra, use of 's' and 'h' or key given.	2-1	For lower mark – only 1 correct value found by trial and improvement or sufficient equations to solve the problem correctly written with no further progress Alternatively one correct equation with a clear key.
		No work of any value	0	The common approach to make judgements on simultaneous equations is: Each term of an equation must change when multiplied to be the correct method, two terms must be correct. When adding or subtracting the two equations to eliminate a variable, the operation must be applied consistently to all terms to be a correct method.

APPENDIX 1

Exemplar responses for question 8(c)(i)

Response	Mark awarded
for 30 adults there would be more than 60 children	1
50 is less than double 30	1
there should be more than twice the number of children than adults so there should be at least 60 (condone)	1
the 30 adults and the 50 children does not satisfy $y \geq 2x$	1
it is in the shaded area	1

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