



Mark Scheme (Results)

November 2022

Pearson Edexcel GCSE (9 – 1)
In Mathematics (1MA1)
Higher (Calculator) Paper 3H

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General marking guidance

These notes offer general guidance, but the specific notes for examiners appertaining to individual questions take precedence.

- 1** All candidates must receive the same treatment. Examiners must mark the last candidate in exactly the same way as they mark the first. Where some judgement is required, mark schemes will provide the principles by which marks will be awarded; exemplification/indicative content will not be exhaustive. When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the response should be sent to review.
- 2** All the marks on the mark scheme are designed to be awarded; mark schemes should be applied positively. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme. If there is a wrong answer (or no answer) indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.

Questions where working is not required: In general, the correct answer should be given full marks.

Questions that specifically require working: In general, candidates who do not show working on this type of question will get no marks – full details will be given in the mark scheme for each individual question.

- 3** **Crossed out work**
This should be marked **unless** the candidate has replaced it with an alternative response.
- 4** **Choice of method**
If there is a choice of methods shown, mark the method that leads to the answer given on the answer line.
If no answer appears on the answer line, mark both methods **then award the lower number of marks.**
- 5** **Incorrect method**
If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks. Send the response to review for your Team Leader to check.
- 6** **Follow through marks**
Follow through marks which involve a single stage calculation can be awarded without working as you can check the answer, but if ambiguous do not award.
Follow through marks which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.

7 Ignoring subsequent work

It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question or its context. (eg an incorrectly cancelled fraction when the unsimplified fraction would gain full marks).

It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect (eg. incorrect algebraic simplification).

8 Probability

Probability answers must be given as a fraction, percentage or decimal. If a candidate gives a decimal equivalent to a probability, this should be written to at least 2 decimal places (unless tenths).

Incorrect notation should lose the accuracy marks, but be awarded any implied method marks.

If a probability fraction is given then cancelled incorrectly, ignore the incorrectly cancelled answer.

9 Linear equations

Unless indicated otherwise in the mark scheme, full marks can be gained if the solution alone is given on the answer line, or otherwise unambiguously identified in working (without contradiction elsewhere). Where the correct solution only is shown substituted, but not identified as the solution, the accuracy mark is lost but any method marks can be awarded (embedded answers).

10 Range of answers

Unless otherwise stated, when an answer is given as a range (eg 3.5 – 4.2) then this is inclusive of the end points (eg 3.5, 4.2) and all numbers within the range

11 Number in brackets after a calculation

Where there is a number in brackets after a calculation eg $2 \times 6 (=12)$ then the mark can be awarded **either** for the correct method, implied by the calculation **or** for the correct answer to the calculation.

12 Use of inverted commas

Some numbers in the mark scheme will appear inside inverted commas eg "12" $\times 50$; the number in inverted commas cannot be any number – it must come from a correct method or process but the candidate may make an arithmetic error in their working.

13 Word in square brackets

Where a word is used in square brackets eg [area] $\times 1.5$: the value used for [area] does **not** have to come from a correct method or process but is the value that the candidate believes is the area. If there are any constraints on the value that can be used, details will be given in the mark scheme.

14 Misread

If a candidate misreads a number from the question. eg uses 252 instead of 255; method or process marks may be awarded provided the question has not been simplified. Examiners should send any instance of a suspected misread to review.

Guidance on the use of abbreviations within this mark scheme

M	method mark awarded for a correct method or partial method
P	process mark awarded for a correct process as part of a problem solving question
A	accuracy mark (awarded after a correct method or process; if no method or process is seen then full marks for the question are implied but see individual mark schemes for more details)
C	communication mark awarded for a fully correct statement(s) with no contradiction or ambiguity
B	unconditional accuracy mark (no method needed)
oe	or equivalent
cao	correct answer only
ft	follow through (when appropriate as per mark scheme)
sc	special case
dep	dependent (on a previous mark)
indep	independent
awrt	answer which rounds to
isw	ignore subsequent working

Paper: 1MA1/3H																								
Question	Answer	Mark	Mark scheme	Additional guidance																				
1	$a = \frac{p+9}{3}$	M1 A1	for correct first step to rearrange, eg $p + 9 = 3a - 9 + 9$ or $\frac{p}{3} = \frac{3a-9}{3}$ oe or answer ambiguously shown eg $a = p + 9 \div 3$ or answer given as $\frac{p+9}{3}$ oe	May be seen in different equivalent forms but must be carried out, not just intention seen.																				
2	Description	C1	Identifies a mistake in the working Acceptable examples Rob should divide by 8 He should have added the 3 and 5 first He divided 120 by 3 and 5 instead of 8 He did not do it as $120 \times \frac{3}{8}$ and $120 \times \frac{5}{8}$ He did not add the two ratios first Not acceptable examples He has done it in two parts but he should do it in one The answer should be 45 : 75 They do not add up to 120 He is supposed to add his numbers 40 + 24 does not equal 120																					
3	22	P1 P1 A1	for process to find total German eg $200 - 104 - 70 (= 26)$ for complete process to find boys choosing Spanish eg $90 - (60 + ("26" - 18))$ cao	for process to find girls choosing French, eg $104 - 60 (= 44)$ or girls total, eg $200 - 90 (= 110)$ for complete process to find boys choosing Spanish eg $70 - ("110" - "44" - 18)$																				
<table border="1"> <tr> <td></td><td>F</td><td>S</td><td>G</td><td>total</td></tr> <tr> <td>girls</td><td>44</td><td>48</td><td>18</td><td>110</td></tr> <tr> <td>boys</td><td>60</td><td>22</td><td>8</td><td>90</td></tr> <tr> <td>total</td><td>104</td><td>70</td><td>26</td><td>200</td></tr> </table>						F	S	G	total	girls	44	48	18	110	boys	60	22	8	90	total	104	70	26	200
	F	S	G	total																				
girls	44	48	18	110																				
boys	60	22	8	90																				
total	104	70	26	200																				

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
4	Yes (supported)	P1	for a process to find the volume of 1 tank eg $\pi \times 40^2 \times 160$ (= 804247.7... or 804.2...or 256000π)	Values can be truncated or rounded
		P1	for complete process to find the volume of 4 tanks, [volume of tank] \times 4 eg $\pi \times 40^2 \times 160 \times 4$ (= 3216990.8... or 3216.9... or 1024000π) or for process to find volume of fertiliser available per tank eg $32 \times 1000 \div 4$ (= 8000)	For this mark, [volume of tank] must come from a calculation involving π , r^2 , h
		P1	for a process to find the volume of fertiliser needed for 1 tank eg [volume of tank] \div 101 (= 7962.8...) or 4 tanks (= 31851.3...) OR for a process to find volume of mixture that 32 litres of fertiliser will make eg 32000×101 (= 3232000) or 32×101 (= 3232)	For this mark, [volume of tank] must come from a calculation involving π , r^2 , h or be stated as their volume.
		C1	for Yes supported by correct figures shown eg a comparable figure in the range 31.8 to 31.9 (litres) or in the range 31800 to 31900 with 32000 (cm ³) or in the range 3216 to 3217 with 3232 (litres) or in the range 3216000 to 3217000 with 3232000 (cm ³) or in the range 7958 to 7963 with 8000 (cm ³)	There are other possible pairs of values which can be used in the comparison
5 (a)	16	M1	for a ratio of $\frac{20}{5}$ or $\frac{5}{20}$ or 4 or 0.25 or $\frac{5}{4}$ or $\frac{4}{5}$ or 1.25 or 0.8 oe	
		A1	cao	
	5.5	M1	for $22 \times \text{“0.25”}$ or $22 \div \text{“4”}$ oe	
		A1	oe	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
6 (a)	0.7	B1	for 0.7 on the first branch	Accept equivalent fractions or percentages for probabilities
	0.65, 0.65	B1	for 0.65, 0.65 on the second branches	
	0.105	M1	for 0.3×0.35	
		A1	oe	
7 (a)	0.008	B1	for 0.008 or 8×10^{-3}	May be awarded at any stage
	50	M1	for conversion from km to m eg 180×1000 (= 180 000) or for conversion from hours to seconds eg $180 \div (60 \times 60)$ (= 0.05) or for conversion from km per hour to metres per second, eg $1000 \div (60 \times 60)$ (= 0.277...) (Accept $(60 \times 60) \div 1000$ (= 3.6))	
		M1	for a complete process eg $180 \times 1000 \div 3600$	
		A1	cao	
8	158	P1	for a first step in the process eg 50×167.6 (= 8380) or 20×182 (= 3640)	
		P1	for a complete process eg $(50 \times 167.6 - 20 \times 182) \div 30$ or $\frac{8380 - 3640}{30}$ or $4740 \div 30$	
		A1	cao	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
9	(a) 0.000675	B1	cao	If the answer (for 2 marks) is seen in working and then rounded or truncated, award full marks.
	(b) 6.592×10^5	M1	for 10.5472×10^3 oe or 1.6×10^8 oe or 2.575×10^{-1} oe or for 6.592×10^n where $n \neq 5$ or for 6.59×10^5 or for 6.6×10^5 or for 659200 oe	
		A1	cao	
10	Explanation	C1	for full explanation indicating the problem with the negative signs Acceptable examples He should have $+2x + 4$ on the second line He should have done -4 and $-2x$ $3x - 2x = 5x$, not $1x$ Two minuses make a plus which he didn't account for Not acceptable examples He has not expanded the brackets Peter has to factorise first He did not collect the terms He didn't include the x^2	
11	5, 6, 7	M1	for identification of possible values of x (4,5,6,7) or of y (5,6,7,8,9)	Could be shown on a number line or using a Venn diagram This mark can be awarded for an answer of 4, 5, 6, 7 Answers may be given in any order.
		A1	cao	
12	1.2, 1.3	B1	for 1.2 in the correct position	Accept $1.2\dot{9}$ or 1.299... must be 9 recurring.
		B1	for 1.3 in the correct position	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
13	Statements	C1 C1	Makes reference to the fact that the label on the horizontal axis is missing Makes reference to the fact that the graph has not been plotted at the top end of the class intervals, eg has plotted at midpoints	
14	(a) $81x^{20}y^{24}$ (b) $x^3+3x^2-10x-24$	B2 (B1 M1 M1 A1	cao for two of $81, x^{20}, y^{24}$) for method to find the product of any two linear expressions (3 out of 4 terms correct or 4 correct terms ignoring signs), eg $x^2 + 2x - 3x - 6$ or $x^2 + 2x + 4x + 8$ or $x^2 + 4x - 3x - 12$ for a complete method to find all terms, at least half of which are correct (fit their first product), eg $x^3 + 4x^2 + 2x^2 - 3x^2 + 8x - 6x - 12x - 24$ cao	Note that, for example $-x - 6$ in expansion of $(x + 2)(x - 3)$ is regarded as 3 correct terms. First product must be quadratic with at least 3 terms but need not be simplified or may be simplified incorrectly
15	Shown	M1 C1	for one correct product eg $7 \times 5 (= 35)$ or $13 \times 5 (= 65)$ or $7 \times 13 \times 5 (= 455)$ for showing three correct products added eg $35 + 65 + 455$	Ignore additional products There is no need to show the three products sum to 555

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
16	40	<p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p>	<p>for $ABD = 120$ and $AED = 60$ or for using the properties of a cyclic quadrilateral eg $EAB + BDE = 180$</p> <p>for using the ratio of 2 : 1 eg showing sizes of angles such that $EAB : BCD = 2 : 1$</p> <p>(dep on M1) for linking an angle from the cyclic quadrilateral with angle(s) in the triangle (other than $EAB : BCD = 2 : 1$) eg $BDE = BCD + 60$ or $BDE = 180 - BDC$ or $EAB + BCD + AEC = 180$</p> <p>for $BCD = 40$ from correct working</p>	<p>Angles may be shown on the diagram</p> <p>May be expressed using algebra eg $EAB = 2x$ and $BCD = x$</p> <p>Could be expressed using algebra eg $x + 60 = 180 - 2x$</p>
17	42 : 63 : 15 : 20	<p>P1</p> <p>P1</p> <p>P1</p> <p>A1</p>	<p>for a first step to write a relationship between 2 weights, eg $A + B : C + D = 3 : 1$ or $A : B = 2 : 3$ or $C : D = 3 : 4$ or $A + B = 3(C + D)$ or $A = \frac{2}{3}B$ or $C = \frac{3}{4}D$</p> <p>for giving all 3 relationships in the same form eg $A + B : C + D = 3 : 1$ and $A : B = 2 : 3$ and $C : D = 3 : 4$ or $A + B = 3(C + D)$ and $A = \frac{2}{3}B$ and $C = \frac{3}{4}D$</p> <p>for complete process to link all 4 weights, eg $\frac{2}{3}B + B = 3\left(\frac{3}{4}D + D\right)$ and $A = \frac{2}{3}B$ and $C = \frac{3}{4}D$ or $A : B : C : D = A : 63 : C : 20$ and $A = \frac{2}{3}B$ and $C = \frac{3}{4}D$ or $C : D = 3 : 4$ and $A : B : D = 42 : 63 : 20$</p> <p>oe</p>	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
18	Description	C1	for translation	Award no marks if more than one transformation
		C1	for $\begin{pmatrix} 8 \\ 0 \end{pmatrix}$	May be described as, for example “by 8 units in the direction of the x axis”
19	16	P1	for $\text{Prob}(\text{R or G}) = 1 - 0.4 (= 0.6)$ or for (number of red or green counters) = $50 - 0.4 \times 50 (= 30)$ or for use of ratio, eg $[\text{probability}] \times \frac{8}{15} (= 0.32)$ or $[\text{number of counters}] \times \frac{8}{15}$	[probability] may be 0.4 or 0.6 [number of counters] may be 20 or 50
		P1	for a complete process to find number of green counters, eg $(1 - 0.4) \times \frac{8}{15} \times 50$ or for $\frac{16}{50}$	
		A1	cao	
20	Proof	C1	for angle $EAC = \text{angle } EDB$ (Base angles of an <u>isosceles triangle</u> are equal) or for explanation that $AB + BC = BC + CD$ using ratio so $AC = DB$ oe or $AE = DE$ (given)	Reasons must be linked to their method.
		C1	for at least 2 correct pairings with reasons	
		C1	for a complete proof including all reasons given and SAS	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
21	(7, -196) supported	P1 P1 A1	for process as far as $4(x^2 - 14x)$ or $(2x - 14)^2 + c$ or for $(x - 7)^2 - 49$ for full process to complete the square eg $4((x - 7)^2 - 49)$ or $(2x - 14)^2 - 196$ for conclusion from correct use of completing the square	c may be 0
22	$a = 4$ $b = 110$	M1 M1 A1	for writing at least one of the 3 terms with a denominator of $(x^2 - 25)$ or $(x - 5)(x + 5)$ eg. $\frac{(2x+3)(x+5)}{x^2-25}$ oe or $\frac{(x-4)(x-5)}{x^2-25}$ oe or $\frac{3(x^2-25)}{x^2-25}$ oe for $\frac{(2x+3)(x+5)}{x^2-25} + \frac{(x-4)(x-5)}{x^2-25} - \frac{3(x^2-25)}{x^2-25}$ oe or for $\frac{3x^2+4x+35}{x^2-25} (-3)$ or for $\frac{[3x^2+4x+35]}{x^2-25} - \frac{3(x^2-25)}{x^2-25}$ oe for $a = 4$ and $b = 110$	Students may work with a denominator of $(x - 5)(x + 5)$ for the award of the first 2 marks.
23	(a) Sketch (b) $y = -g(x)$	B1 B1	for appropriate sketch which crosses the x axis at $(-3, 0)$, $(-1, 0)$, $(0, 0)$ and passes through $(-2, 2)$ with end points in the correct square oe	Allow some tolerance on the points and in drawing the curve if the intention is clear Accept $-y = g(x)$

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
24	Proof	C1	for $\overrightarrow{CE} = 2\mathbf{a} - \mathbf{b}$ oe	<p>Vectors may be seen on diagram. Award marks provided not ambiguous.</p> <p>For the award of the first 3 marks, expressions for vectors \overrightarrow{CE}, \overrightarrow{EP}, \overrightarrow{CP}, \overrightarrow{CF} and \overrightarrow{DP} may not be simplified</p>
		C1	for $\overrightarrow{EP} = 2\mathbf{a} - \mathbf{b}$ oe or for $\overrightarrow{CP} = 4\mathbf{a} - 2\mathbf{b}$ oe	
		C1	for $\overrightarrow{CF} = \mathbf{a} - \mathbf{b}$ oe or for $\overrightarrow{DP} = 2\mathbf{a} - 2\mathbf{b}$ oe	
		C1	for $\overrightarrow{CF} = \mathbf{a} - \mathbf{b}$ and $\overrightarrow{DP} = 2\mathbf{a} - 2\mathbf{b}$ (or $2(\mathbf{a} - \mathbf{b})$) leading to conclusion	
25	14.1	P1	for a process to find the volume of the top eg $92.8 \div 2.9 (= 32)$	<p>Values can be truncated or rounded</p> <p>For this mark, [total volume] does not have to come from a correct process but is the value that the student believes is the total volume of the pyramid.</p>
		P1	for finding total mass of P eg $92.8 + 972.8 (= 1065.6)$	
		P1	for finding total volume of P eg $\frac{"1065.6"}{4.7} (= 226.7234)$	
		P1	(dep P2) for $\frac{"32"}{[\text{total volume}]} \times 100$	
		A1	for answer in the range 14.1 to 14.2	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
26	15.8	<p>P1</p> <p>P1</p> <p>P1</p>	<p>starts process by finding an angle, eg exterior angle = $360 \div 7$ (= 51.42...) or interior angle = $\frac{900}{7}$ or $180 - (360 \div 7)$ (= 128.57...) oe</p> <p>start of process to find length of side by using area, eg $\frac{1}{2} \times AB \times AG \times \sin GAB = 30$ oe or $\frac{1}{2} \times a \times b \times \sin [128.5 \dots] = 30$ oe or $\frac{1}{2} \times x \times x \times \sin [128.5 \dots] = 30$ oe or $\frac{1}{2} \times AG \times \frac{1}{2}GB \times \sin AGB = 15$ oe or for a relationship linking GB and h, $\frac{1}{2} \times GB \times h = 30$ oe</p> <p>for process to find the length of a side of the polygon eg $\sqrt{\frac{2 \times 30}{\sin "128.5..."}} \text{ oe } (= 8.76\dots)$ or for process to get a second relationship linking AG and $\frac{1}{2}GB$, eg $AG \times \cos "25.7..." = \frac{1}{2}GB$ oe or for process to get a second relationship linking GB and h, eg $\tan "25.7..." = \frac{h}{\frac{1}{2}GB}$ oe</p>	<p>Accept values to 3 figures rounded or truncated</p> <p>Any symbols used in formulae must be consistent with any labels on the diagram.</p> <p>For this mark, [128.5...] does not have to come from a correct process but is the value that the student believes is the interior angle.</p>

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
		P1	for complete process to find <i>GB</i> eg $\frac{"8.76..." \times \sin "128.5..." }{\sin "25.7..."}$ oe or $\sqrt{"8.76"^2 + "8.76"^2 - 2 \times "8.76"^2 \times \cos "128.5..."}$ oe or $2 \times "8.76..." \times \sin "64.2..."$ or $2 \times "8.76..." \times \cos "25.7..."$ oe or $\sqrt{\frac{2 \times 60}{\tan "25.7..."}}$ oe	
		A1	for answer in the range 15.7 to 15.8	

Modifications to the mark scheme for Modified Large Print (MLP) papers: 1MA1 3H

Only mark scheme amendments are shown where the enlargement or modification of the paper requires a change in the mark scheme. Notes apply to both MLP papers and Braille papers unless otherwise stated.

The following tolerances should be accepted on marking MLP papers, unless otherwise stated below:

Angles: $\pm 5^\circ$

Measurements of length: ± 5 mm

PAPER: 1MA1_3H			
Question		Modification	Mark scheme notes
1		Value changed: a to n	Standard mark scheme but note change of letter.
2		Equations stacked vertically and moved left with equals symbols aligned.	Standard mark scheme
4		Wording added 'Look at the diagram for Question 4 in the Diagram Booklet. You may be provided with a model. It is not accurate.' Diagram enlarged. Model provided. '160cm' label moved to left side.	Standard mark scheme
5		Wording added 'Look at the diagram for Question 5 in the DB.' Diagrams stack vertically and enlarged. Angle arcs made smaller. Arcs at C and F separated more. Wording added: $AC = 5 \text{ cm}$; $BC = 4 \text{ cm}$; $DE = 22 \text{ cm}$; $DF = 20 \text{ cm}$; 'Angle $ABC = \text{Angle } DEF$ ' ; 'Angle $ACB = \text{Angle } DFE$ '	Standard mark scheme
6		Wording added 'Look at the diagram for Question 6 in the DB.' Diagram enlarged.	Standard mark scheme
11		Left align information. Values changed: x to p, y to q	Standard mark scheme but note change of letters
13		Wording added 'Look at the diagram for Question 13 in the Diagram Booklet.' The word 'this' removed and replaced with 'the'. Wording added 'in the table below'. Table and diagram enlarged. Open headed arrows. Crosses changed to dots. Small squares removed. The word 'this' removed and replaced with 'the'. Wording added 'in the Diagram Booklet'.	Standard mark scheme
14	(b)	Value changed: x to y	Standard mark scheme but note change of letter
15		Wording added 'Look at the information for Q15 in the Diagram Booklet. It shows details about the fish in a pet shop.' Information moved to the Diagram Booklet and left aligned	Standard mark scheme
16		Wording added 'Look at the diagram for Question 16 in the Diagram Booklet.' Diagram enlarged. Angle moved outside the angle arc. Angle arc made smaller. Ratio left aligned.	Standard mark scheme
20		Wording added 'Look at the diagram for Question 20 in the Diagram Booklet.' The wording 'The diagram' removed and replaced with 'It'. Diagram enlarged	Standard mark scheme

PAPER: 1MA1_3H			
Question		Modification	Mark scheme notes
23	(a)	Wording added 'Look at the diagram for Question 23(a) in the Diagram Booklet. It shows'. The wording 'is shown on the grid below' removed. Diagram enlarged. Open headed arrows. Axes labels moved above the vertical axis and right on the horizontal axis. Wording added 'in the Diagram Booklet'.	Standard mark scheme
23	(b)	Wording added 'Look at the diagram for Question 23(b) in the Diagram Booklet.' The word 'this' removed and replaced with 'the'. Wording added 'in the Diagram Booklet'. Diagram enlarged. Open headed arrows. Axes labels moved above the vertical axis and right on the horizontal axis. Graph B line made dashed. Key added to show graph line A and graph B. Odd numbers removed from X axis.	Standard mark scheme
24		Wording added 'Look at the diagram for Question 24 in the Diagram Booklet. It shows'. Diagram enlarged. Open headed arrows.	Standard mark scheme
25		Wording added 'Look at Diagram 1 and Diagram 2 for Question 25 in the Diagram Booklet. You may be provided with a model. It is not accurate.' Diagram enlarged. Diagram added to show side view. Labels moved to left side. Dashed lines longer and thicker. Model provided.	Standard mark scheme
26		Wording added 'Look at the diagram for Question 26 in the Diagram Booklet.' Wording added 'Points G and B are joined to form triangle ABG.' Diagram enlarged.	Standard mark scheme

