

GCSE Mathematics (1MA1) – Higher Tier Paper 3H

November 2022 student-friendly mark scheme

Please note that this mark scheme is not the one used by examiners for making scripts. It is intended more as a guide to good practice, indicating where marks are given for correct answers. As such, it doesn't show follow-through marks (marks that are awarded despite errors being made) or special cases.

It should also be noted that for many questions, there may be alternative methods of finding correct solutions that are not shown here – they will be covered in the formal mark scheme.

NOTES ON MARKING PRINCIPLES

Guidance on the use of codes within this mark scheme

M1 – method mark. This mark is generally given for an appropriate method in the context of the question. This mark is given for showing your working and may be awarded even if working is incorrect.

P1 – process mark. This mark is generally given for setting up an appropriate process to find a solution in the context of the question.

A1 – accuracy mark. This mark is generally given for a correct answer following correct working.

B1 – working mark. This mark is usually given when working and the answer cannot easily be separated.

C1 – communication mark. This mark is given for explaining your answer or giving a conclusion in context supported by your working.

Some questions require all working to be shown; in such questions, no marks will be given for an answer with no working (even if it is a correct answer).

Question 1 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$p + 9 = 3a$	M1	This mark is given for a first step at a method to rearrange the formula
	$a = \frac{p+9}{3}$	A1	This mark is given for the correct answer only

Question 2 (Total 1 mark)

Part	Working or answer an examiner might expect to see	Mark	Notes
	For example: Rob should have divided by 8	A1	This mark is given for a valid description of the error in Rob's working

Question 3 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes																				
	<table border="1"> <thead> <tr> <th></th> <th>F</th> <th>S</th> <th>G</th> <th>Total</th> </tr> </thead> <tbody> <tr> <th>Girls</th> <td></td> <td></td> <td>18</td> <td>110</td> </tr> <tr> <th>Boys</th> <td>60</td> <td></td> <td></td> <td>90</td> </tr> <tr> <th>Total</th> <td>104</td> <td>70</td> <td></td> <td>200</td> </tr> </tbody> </table>		F	S	G	Total	Girls			18	110	Boys	60			90	Total	104	70		200	P1	This mark is given for a process to add the information given into a two-way table
	F	S	G	Total																			
Girls			18	110																			
Boys	60			90																			
Total	104	70		200																			
	<table border="1"> <thead> <tr> <th></th> <th>F</th> <th>S</th> <th>G</th> <th>Total</th> </tr> </thead> <tbody> <tr> <th>Girls</th> <td></td> <td></td> <td>18</td> <td>110</td> </tr> <tr> <th>Boys</th> <td>60</td> <td>22</td> <td>8</td> <td>90</td> </tr> <tr> <th>Total</th> <td>104</td> <td>70</td> <td>26</td> <td>200</td> </tr> </tbody> </table> <p>$200 - 104 - 70 = 26$ $26 - 18 = 8$</p>		F	S	G	Total	Girls			18	110	Boys	60	22	8	90	Total	104	70	26	200	P1	This mark is given for a process to use the information in the table to find out how many students chose German
	F	S	G	Total																			
Girls			18	110																			
Boys	60	22	8	90																			
Total	104	70	26	200																			
	$90 - 60 - 8 = 22$	A1	This mark is given for the correct answer only																				

Question 4 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\pi \times 40^2 \times 160 = 804\,247\dots \text{cm}^3$	P1	This mark is given for a process to find the volume of one tank
	$4 \times 804\,247\dots = 3\,216\,990.2\dots \text{cm}^3$	P1	This mark is given for a process to find the volume of all four tanks
	32 litres = 32 000 cm ³ Amount of mixture = 101 × 32 000 = 3 232 000 cm ³	P1	This mark is given for a process to find how much of the mixture 32 litres will make
	32 320 000 cm ³ > 3 216 990 cm ³ Yes, Karina has enough fertiliser for the four tanks	C1	This mark is given for a valid answer supported by correct working

Question 5 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$\frac{20}{5} = 4$	M1	This mark is given for a method to find a ratio of the lengths of the triangles
	$4 \times 4 = 16$	A1	This mark is given for the correct answer only
(b)	$\frac{22}{4}$	M1	This mark is given for a method to find the length of <i>AB</i>
	5.5	A1	This mark is given for the correct answer only

Question 6 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)		B1	This mark is given for 0.7 on the first branch
		B1	This mark is given for 0.65 and 0.65 on the second branches
(b)	0.3×0.35	M1	This mark is given for a method to find the probability of winning both quizzes
	0.105	A1	This mark is given for the correct answer only

Question 7 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$\frac{8000}{100 \times 100 \times 100} = 0.008$	B1	This mark is given for the correct answer only
(b)	180 km = 180 000 m 1 hour = 3600 seconds	M1	This mark is given for a method to convert km to m or hours to seconds
	$\frac{180\ 000}{3600}$	M1	This mark is given for a method to find the speed in metres per second
	50	A1	This mark is given for the correct answer only

Question 8 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$50 \times 167.6 = 8380$ $20 \times 182 = 3640$	P1	This mark is given for a process to find the total heights of all 50 people or the total height of the 20 men
	$\frac{8380 - 3640}{30}$	P1	This mark is given for a process to find the mean height of the 30 women
	158	A1	This mark is given for correct answers in the ranges 5.1 to 5.3 and 0.7 to 0.9

Question 9 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	0.000675	B1	This mark is given for the correct answer only
(b)	$\frac{(2.56 \times 4.12) \times (10^6 \times 10^{-3})}{1.6 \times 10^{-2}} = \frac{10.5472 \times 10^3}{1.6 \times 10^{-2}}$	M1	This mark is given for 10.5472×10^3 seen or 6.592×10^n where $n \neq 5$ seen
	$\frac{10.5472}{1.6} \times 10^{3-(-2)}$ 6.592×10^5	A1	This mark is given for the correct answer only

Question 10 (Total 1 mark)

Part	Working or answer an examiner might expect to see	Mark	Notes
	For example: Peter should have added the terms $2x$ and 4 rather than subtracted them The answer should be $5x + 9$	P1	This mark is given for a valid explanation

Question 11 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	x could be 4, 5, 6, 7 y could be 5, 6, 7, 8, 9	B1	This mark is given for the identification of possible values of x and y
	5, 6, 7	A1	This mark is given for the correct answers only

Question 12 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$1.2 \leq P < 1.3$	B1	This mark is given for a 1.2 in the correct position
		B1	This mark is given for a 1.3 in the correct position

Question 13 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	For example: The label on the horizontal axis is missing	C1	This mark is given for a valid criticism of the graph
	For example: The graph has not been plotted at the top end of the class intervals	C1	This mark is given for a valid criticism of the graph

Question 14 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$81x^{20}y^{24}$	B2	These marks are given for a fully correct answer (B1 is given for any two of 81, x^{20} or y^{24} seen)
(b)	$(x + 2)(x - 3) = x^2 - x - 6$ or $(x + 2)(x + 4) = x^2 + 6x + 8$ or $(x - 3)(x + 4) = x^2 + x - 12$	M1	This mark is given for a method to find the product of any two linear expressions
	$(x^2 - x - 6)(x + 4) =$ $x^3 - x^2 - 6x + 4x^2 - 4x - 24$ or $(x^2 + 6x + 8)(x - 3) =$ $x^3 + 6x^2 + 8x - 3x^2 - 18x - 24$ or $(x^2 + x - 12)(x + 2) =$ $x^3 + x^2 - 12x + 2x^2 + 2x - 24$	M1	This mark is given for a method to find the full expansion of the three terms
	$x^3 + 3x^2 - 10x - 24$	A1	This mark is given for the correct answer only

Question 15 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$7 \times 5 = 35$ $13 \times 5 = 65$ $7 \times 13 \times 5 = 455$	M1	This mark is given for a method to find at least one product
	$35 + 65 + 455 = 555$	C1	This mark is given for a full explanation

Question 16 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$EAB + BDE = 180$, $ABD + AED = 180$ $ABD = 120$ so $AED = 60$	M1	This mark is given for a method to use the properties of a cyclic quadrilateral
	Let $EAB = 2x$ and $BCD = x$	M1	This mark is given for a method to use the ratio 2 : 1
	$EAB + BCD + AED = 180$ $2x + x + 60 = 180$ $3x + 60 = 180$ $3x = 120$	M1	This mark is given for a method to find the size of angle BCD
	40	A1	This mark is given for the correct answer only

Question 17 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$A : B = 2 : 3$ $C : D = 3 : 4$ $A + B : C + D = 3 : 1$	P1	This mark is given for a first step in a process to write at least one relationship between two weights
		P1	This mark is given for process to write all three relationships between the weights
	For $A : B$, multiply by $(3 + 4)$ to get $14 : 21$ For $C : D$, multiply by $(2 + 3)$ to get $15 : 20$ But $A + B : C + D = 3 : 1$ so ratio is $(3 \times 14) : (3 \times 21) : 15 : 20$	P1	This mark is given for process to use ratios to compare $A + B$ and $C + D$ and link all four weights
	$42 : 63 : 15 : 20$	A1	This mark is given for the correct answer only

Question 18 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	translation of $\begin{pmatrix} 8 \\ 0 \end{pmatrix}$	C1	This mark is given for translation stated
		A1	This mark is given for the correct vector

Question 19 (Total 3 marks)

Part	Working or answer examiner might expect to see	Mark	Notes
	Probability of a green counter = $\frac{8}{15} \times 0.6$	P1	This mark is given for a process to use the ratio to work out the probability of choosing a green counter
	$\frac{8}{15} \times 0.6 \times 50$	P1	This mark is given for a process to work out an estimate for the number of green counters
	16	A1	This mark is given for the correct answer only

Question 20 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	angle $EAD = \text{angle } ADE$ base angles of an isosceles triangle are equal	C1	This mark is given for a finding equal angles with a valid reason
	$AB + BC = BC + CD$	C1	This mark is given for use of the ratio 1 : 2: 1
	Thus ACE is congruent to DBE (using SAS)	C1	This mark is given for a complete proof

Question 21 (Total 4 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$4(x^2 - 14x)$ or $(2x - 14)^2 + c$	P1	This mark is given for factorising the equation of the curve
	$4((x - 7)^2 - 49)$ or $(2x - 14)^2 - 196$	P1	This mark is given for a method to find the gradient of the tangent
	$(7, -196)$	A1	This mark is given for a full answer supported by correct working

Question 22 (Total 3 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$\frac{(2x + 3)(x + 5) + (x - 4)(x - 5)}{(x - 5)(x + 5)} - \frac{3(x - 5)(x + 5)}{(x - 5)(x + 5)}$ $= \frac{(2x + 3)(x + 5) + (x - 4)(x - 5) - 3(x - 5)(x + 5)}{(x - 5)(x + 5)}$	M1	This mark is given for a method to use a common denominator
	$= \frac{2x^2 + 3x + 10x + 15 + x^2 - 9x + 20 - 3x^2 + 75}{x^2 - 25}$	M1	This mark is given for a method to find the numerator
	$= \frac{4x + 110}{x^2 - 25}$ $a = 4 \text{ and } b = 110$	A1	This mark is given for the correct answers only

Question 23 (Total 2 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
(a)		B1	This mark is given for a sketch which crosses the x -axis at $(-3, 0)$, $(-1, 0)$, $(0, 0)$ and passes through $(-2, 2)$
(b)	$y = -g(x)$	B1	This mark is given for the correct answer only

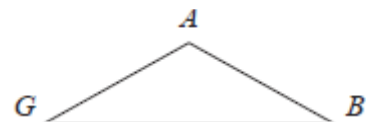
Question 24 (Total 4 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$\vec{CE} = 2\mathbf{a} - \mathbf{b}$	C1	This mark is given for a finding a vector expression of \vec{CE}
	$\vec{EP} = 2\mathbf{a} - \mathbf{b}$ $\vec{CP} = 4\mathbf{a} - 2\mathbf{b}$	C1	This mark is given for a finding a vector expression of \vec{EP} or \vec{CP}
	$\vec{CF} = \mathbf{a} - \mathbf{b}$	C1	This mark is given for a finding a vector expression of \vec{CF}
	$\vec{CF} = \mathbf{a} - \mathbf{b}$ and $\vec{DP} = 2\mathbf{a} - 2\mathbf{b}$ $\vec{DP} = 2\vec{CF}$ so are parallel	C1	This mark is given for a full proof and correct conclusion

Question 25 (Total 5 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$92.8 \div 2.9 = 32 \text{ cm}^3$	P1	This mark is given for a process to find the volume of the top
	$92.8 + 972.8 = 1065.6$	P1	This mark is given for a process to find the total mass of P
	$\frac{1065.6}{4.7} = 226.7234$	P1	This mark is given for a process to find the total volume of P
	$\frac{32}{226.7234} \times 100$	P1	This mark is given for a process to find the volume of the top as a percentage of the volume of the total volume P
	14.1	A1	This mark is given for a correct answer to one decimal place in the range 14.1 to 14.2

Question 26 (Total 5 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	Exterior angle = $360 \div 7 = 51.43\dots$ Interior angle = $180 - (360 \div 7) = 128.57\dots$	P1	This mark is given for a process to find an exterior or interior angle
	$\frac{1}{2} \times AB \times AG \times \sin GAB = 30$	P1	This mark is given for a process to find the length of one side by using the formula for the area of a triangle
	$AB \times AG = \frac{2 \times 30}{\sin 128.57\dots}$ Since $AB = AG$, $AB = AG = \sqrt{\frac{2 \times 30}{\sin 128.57\dots}} = 8.76\dots$	P1	This mark is given for a process to find the length of a side of the polygon
	 $GB = 2 \times \sin \frac{128.57\dots}{2} \times 8.76\dots$	P1	This mark is given for a complete process to use the sine rule to find the length GB
	15.8	A1	This mark is given for a correct answer to one decimal place in the range 15.7 to 15.8