

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

Summer 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
<p>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.</p> <p>P1 – process mark. This mark is generally given for setting up an appropriate process to find a solution in the context of the question.</p> <p>A1 – accuracy mark. This mark is generally given for a correct answer following correct working.</p> <p>B1 – working mark. This mark is usually given when working and the answer cannot easily be separated.</p> <p>C1 – communication mark. This mark is given for explaining your answer or giving a conclusion in context supported by your working.</p> <p>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).</p>

Question 1 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(b)	$8.5^2 - 4^2 = 72.25 - 16 = 56.25$ $\sqrt{56.25} =$	M1	This mark is given for a method to use Pythagoras' theorem to find x
	7.5	A1	This mark is given for the correct answer only

Question 2 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$4 \times (-3)^2 - 11$ $= 36 - 11$	M1	This mark is given for a method to substitute -3 into the equation
	25	A1	This mark is given for the correct answer only
(b)	$d - 4 = 3p$ or $\frac{d}{3} - \frac{4}{3} = p$	M1	This mark is given for a first step to make p the subject of the formula
	$p = \frac{d - 4}{3}$	A1	This mark is given for the correct answer only

Question 3 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$R = n, S = 2n, T = 2n - 6$	P1	This mark is given for a process to develop three algebraic expressions (with at least two correct)
	$n + 2n + 2n - 6 = 54$	P1	This mark is given for a process to sum the three algebraic expressions to 54
	$5n - 6 = 54$ $n = 12$	P1	This mark is given for a process to solve the linear equation
	Ratio = 12: $(2 \times 12 - 6) = 12 : 18$	P1	This mark is given for a process to find the ratio of the number of counters Rick and Tony have
	$p = 1.5$	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
	$\frac{15}{3} \times 36 = \text{£}180$	P1	This mark is given for a process to find the cost of 15 rolls from Chic Decor
	$70 \times (15 \div 5) \times 0.12 = \text{£}25.20$	P1	This mark is given for a process to find the discount available at Style Papers
	$(3 \times 70) - 25.20 = \text{£}184.80$	P1	This mark is given for a process to find the cost of 15 rolls from Style Papers
	Jo should by the wallpaper from Chic Decor	C1	This mark is given for a valid statement supported by correct working

Question 5 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	For example: 40 is missing from the frequency scale	C1	This mark is given for a mistake identified on the frequency polygon
	For example: An incorrect point (50, 5) is mapped	C1	This mark is given for a mistake identified on the frequency polygon

Question 6 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$6 \times \frac{15}{60} = 1.5$ $9 \times \frac{40}{60} = 6$	P1	This mark is given for a process to find the distance of either of the two parts of Jessica's journey
	$1.5 + 6 = 7.5$	P1	This mark is given for a process to find the total distance of Jessica's journey
	45 minutes = 0.75 hours $\frac{75}{7.5} =$	P1	This mark is given for a process to find Amy's average speed
	10	A1	This mark is given for the correct answer only

Question 7 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$A = \frac{1}{2}h(a + b)$ where $h = 4x$, $a = 5$ and $b = (3x + 5) - 2x = x + 5$	M1	This mark is given for a method to find an algebraic representation of the lengths used to work out the area of the trapezium <i>QUVR</i>
	$A = \frac{1}{2} \times 4x \times (5 + x + 5)$	M1	This mark is given for a method to find an algebraic representation of the area of the trapezium <i>QUVR</i>
	$A = 2x(x + 10) = 2x^2 + 20x$	C1	This mark is given for the correct expansion of brackets seen and simplification to the given answer

Question 8 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	For example: $\frac{7}{50}$ or $\frac{14}{100}$	M1	This mark is given for a method to find the gradient
	0.14	A1	This mark is given for correct answer in the range 0.135 to 0.145
(b)	For example: the cost per unit of electricity	C1	This mark is given for a valid explanation of what the gradient represents

Question 9 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	For example: $10^{150} \times 10^{90} = 10^{240}$ or $10^{360} \div 10^{150} = 10^{210}$ or $10^{360} \div 10^{90} = 10^{270}$ or $\sqrt{10^{360}} = 10^{180}$	M1	This mark is given for a correct first step using the rules of indices
	$\frac{10^{180}}{10^{120}}$ or $\sqrt{10^{120}}$	P1	This mark is given for a method to use the rules of indices to simplify
	10^{60}	A1	This mark is given for the correct answer only
(b)	For example: Liam should multiply the powers of 12 to get 50×2 rather than 50^2	C1	This mark is given for a correct explanation

Question 10 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\frac{17010}{0.875 \times 0.9 \times 0.9}$	P1	This mark is given for a process to use either 0.875 or 0.9×0.9 (or 0.9^2)
		P1	These marks are given for a process to find out the original value of the car
	24 000	A1	This mark is given for the correct answer only

Question 11 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$16 \times 5 \times 3$	M1	This mark is given for a method to work out how many outfits Rayheem can choose
	240	A1	This mark is given for the correct answer only

Question 12 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$AC = 8$ or $AC = 8 \times \tan 45^\circ = 8$	M1	This mark is given for a method to find the distance AC
	$\sin 20^\circ = \frac{8}{AB}$	A1	This mark is given for a method to find the length AB
	$AB = \frac{8}{\sin 20^\circ} = \frac{8}{0.342...} = 23.4$	A1	This mark is given for a correct answer in the range 23.3 to 23.4

Question 13 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$3\mathbf{a} = \begin{pmatrix} 3 \times 2 \\ 3 \times -3 \end{pmatrix} = \begin{pmatrix} 6 \\ -9 \end{pmatrix}$	M1	This mark is given for a method to find a column vector for $3\mathbf{a}$
	$2\mathbf{b} = \begin{pmatrix} 6 \\ -9 \end{pmatrix} - \begin{pmatrix} 8 \\ -17 \end{pmatrix} = \begin{pmatrix} -2 \\ 8 \end{pmatrix}$	M1	This mark is given for a method to find a column vector for $2\mathbf{b}$
	$\mathbf{b} = \begin{pmatrix} -1 \\ 4 \end{pmatrix}$	A1	This mark is given for the correct answer only

Question 14 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$4(p^2 - 9)$ or $(4p - 12)(p + 3)$ or $(p - 3)(4p + 12)$ or $(2p - 6)(2p + 6)$	P1	This mark is given for a method to find a partial factorisation
	$4(p - 3)(p + 3)$	A1	This mark is given for a correct answer only (allow $2(p - 3)2(p + 3)$)
(b)	For example: $6m^2 + 2m - 15m - 5$ or $2m^2 + 8m - 5m - 20$ or $3m^2 + 12m + m + 4$	M1	This mark is given for a method to find the product of at least two linear expressions
	$6m^3 + 2m^3 - 15m^2 + 24m^2 + 8m - 60m - 5m - 20$	M1	This mark is given for a complete method to find all the terms
	$6m^3 + 11m^2 - 57m - 20$	A1	This mark is given for a correct answer only

Question 15 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	For example: angle PXQ = angle SXR since vertically opposite angles are equal	C1	This mark is given for identifying one pair of corresponding equal angles with a correct reason given
	For example: angle QPX = angle RSX since angles in the same segment are equal	C1	This mark is given for identifying two pairs of corresponding equal angles with correct reasons given
	For example: angle PQX = angle SRX since angles in the same segment are equal The triangles are similar because all three pairs of corresponding angles are equal	C1	This mark is given for a fully correct proof

Question 16 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$6.75 < e \leq 6.85$ $0.045 < f \leq 0.055$	B1	This mark is given for stating any correct upper or lower bound
	$p = \sqrt{\frac{2 \times 6.85}{0.045}} = \sqrt{\frac{13.7}{0.045}} = \sqrt{304.444...}$	M1	This mark is given for using the upper bound of e and the lower bound of f to work out the upper bound for p
	17.4 (to 3 significant figures)	A1	This mark is given for a correct answer in the range 17.4 to 17.5

Question 17 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)		B3	<p>These marks are given for a fully correct histogram drawn with relative height 90, 96, 44, 8 and 6</p> <p>(B2 are given for 4 correct blocks or all 5 frequency \div class interval and one correct block)</p> <p>(B1 is given for at least 2 correct blocks of different widths or for frequency \div class interval for at least 3 different frequencies)</p>
(b)	<p>For example:</p> <p>height of 1–2 bar = 3.0 units and height of 3–5 bar = 0.6 unit (so areas = 6 and 2.4 respectively)</p> <p>area of 1–2 bar = 150 small squares and area of 3–5 bar = 60 small squares</p>	M1	This mark is given for a method to compare the heights or areas of the bars of the two intervals 1–2 and 3–5
	0.4n	A1	This mark is given for a correct answer only (or equivalent)

Question 18 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$TC = 14 \times \frac{3}{3+4} = 6$	P1	This mark is given for a process to find the length of TC
	$TD = \sqrt{14^2 + 6^2} = \sqrt{232} = 15.23\dots$	P1	This mark is given for a process to find the length of TD
	$147 = 0.5 \times (SD + 12) \times 14$ $SD = \frac{147}{7} - 12 = 9$	P1	This mark is given for a process to use the area of a trapezium to find the length of SD
	$\tan^{-1}\left(\frac{9}{15.23\dots}\right) = \tan^{-1} 0.59$	P1	This mark is given for a process to find the size of the angle between the line ST and the base $ABCD$
	30.6 (to one decimal place)	A1	This mark is given for a correct answer in the range 30.4 to 30.7

Question 19 (Total 4 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	For example: $\frac{3x(x-2)}{x^2-4} \quad \text{or} \quad \frac{(x+2)(2x+1)}{x^2-4} \quad \text{or} \quad \frac{x^2-4}{x^2-4}$	M1	This mark is given for a method to write one of the three terms with a denominator of $(x^2 - 4)$
	$\frac{3x(x-2)}{x^2-4} - \frac{(x+2)(2x+1)}{x^2-4} - \frac{x^2-4}{x^2-4}$	M1	This mark is given for a method to find the expression with a common denominator
	$\frac{3x^2 - 6x - 2x^2 - 5x - 2 - x^2 + 4}{x^2 - 4}$	M1	This mark is given for a method to find a single numerator
	$\frac{-11x + 2}{x^2 - 4}$	A1	This mark is given for the correct answer only (or $a = -11$ and $b = 2$)

Question 20 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$29\,600 = 24\,000a + 800$ $a = \frac{29\,600 - 800}{24\,000} = 1.2$	P1	This mark is given for a process to find the value of a
	$P_{2020} = 1.2 \times 29\,600 + 800 = 36\,320$	P1	This mark is given for a process to find the profit made by the shop in 2020
	$P_{2021} = 1.2 \times 36\,320 + 800$	P1	This mark is given for a process to find the profit made by the shop in 2021
	44 384	A1	This mark is given for the correct answer only

Question 21 (Total 4 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	For example: $\frac{a}{9} \times \frac{b}{8} \times \frac{c}{7}$ where a, b and c are < 9	P1	This mark is given for a process to form any triple product of probabilities of the form
	Odd, odd, even: $\frac{5}{9} \times \frac{4}{8} \times \frac{4}{7} = \frac{80}{504}$ Odd, even, odd: $\frac{5}{9} \times \frac{4}{8} \times \frac{4}{7} = \frac{80}{504}$ Even, odd, odd: $\frac{4}{9} \times \frac{5}{8} \times \frac{4}{7} = \frac{80}{504}$ Even, even, even: $\frac{4}{9} \times \frac{3}{8} \times \frac{2}{7} = \frac{24}{504}$	P1	This mark is given for at least one of the four products of three probabilities of cards which will give an even sum
	$\frac{80}{504} + \frac{80}{504} + \frac{80}{504} + \frac{24}{504}$	P1	This mark is given for finding the sum of at least three of the four correct probabilities of cards which will give an even sum
	$\frac{264}{504} = \frac{11}{21}$	A1	This mark is given for the correct answer only (or equivalent)

Question 22 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$(2x - 5)^2 = 6x^2 - 25x - 8$	M1	This mark is given for a method to equate two expressions for y^2
	$4x^2 - 20x + 25 = 6x^2 - 25x - 8$	M1	This mark is given for a method to expand the squared term
	$2x^2 - 5x - 33 = 0$ $(2x - 11)(x + 3) = 0$	M1	This mark is given for rearranging and finding a quadratic to be solved
	$(-3, -11)$	A1	This mark is given for the correct answer only
	$(5.5, 6)$	A1	This mark is given for the correct answer only