GCSE Mathematics (1MA1) – Higher Tier Paper 1H (Set 2)

Aiming for Grade 9 – Spring 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 6 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$\sqrt[4]{81 \times 10^8} = \sqrt[4]{81} \times \sqrt[4]{10^8}$ $= 3 \times 10^2$	M1	This mark is given for a method to find the fourth root of 81 or 10^8
	$= 300$	A1	This mark is given for the correct answer only
(b)	$\dfrac{1}{\sqrt{64}} =$	M1	This mark is given for recognising the expression as the reciprocal of $\sqrt{64}$
	$\dfrac{1}{8}$	A1	This mark is given for the correct answer only
(c)	$3^n \times 9^{-(n-1)} =$ $3^n \times 3^{-2(n-1)} =$	M1	This mark is given for a method to find the expression as a single power of 3
	3^{2-n}	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
	Ted cannot calculate $4.3\dot{4} - 0.\dot{4}\dot{3}$. He needs to find $100x = 43.\dot{4}\dot{3}$ so that he can use $100x - x = 43.\dot{4}\dot{3} - \dot{4}\dot{3}$	C1	This mark is given for a correct evaluation

Question 3 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$x^2 - 5x - 24 = 0$	M1	This mark is given for a method to rearrange to find a quadratic equation equal to zero
	$(x + 3)(x - 8) = 0$	M1	This mark is given for a method to factorise the equation
	$x = -3, x = 8$	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
	Surface area of cube $= 6x^2$	M1	This mark is given for a method to find an expression for the surface area of the cube
	Surface area of sphere $= 4\pi \times 3^2 = 36\pi$	M1	This mark is given for a method to find an expression for the surface area of the sphere
	$6x^2 = 36\pi$ $x^2 = 6\pi$	M1	This mark is given for a method to equate expressions for the surface areas
	$x = \sqrt{k\pi}$ where $k = 6$	A1	This mark is given for showing that $x = \sqrt{k\pi}$

Question 5 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$d(f - 4) = 3(1 - f)$ $df - 4d = 3 - 3f$	M1	This mark is given for a method to find an equation with no fraction
	$df + 3f = 4d + 3$	M1	This mark is given for a method to isolate the terms in f
	$f(d + 3) = 4d + 3$	M1	This mark is given for a method to factorise
	$f = \dfrac{4d + 3}{d + 3}$	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)	$\dfrac{20}{120} = \dfrac{90}{N}$	P1	This mark is given for the expressions $\dfrac{20}{120}$ or $\dfrac{90}{N}$ seen
		P1	This mark is given for a process to work out an equation in terms of N
	$N = \dfrac{90 \times 120}{20} = 540$	A1	This mark is given for the correct answer only
(b)	For example: If the marks fall off Shirley will have over-estimated the number of bees	A1	This mark is given for a correct effect stated

Question 7 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	Gradient of L$_2$ = $-\dfrac{1}{m} = -\dfrac{1}{3}$	M1	This mark is given for a method to find the gradient of the line L$_2$
	When $x = 9$, $5 = (-\dfrac{1}{3} \times 9) + c$	M1	This mark is given for a method using $y = mx + c$ to substitute using the common point (9, 5) to find the value of c
	$y = -\dfrac{1}{3}x + 8$	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
	$1 - 0.3 = 0.7$	P1	This mark is given for a process to find the probability that Sally will **not** win
	$(0.3 \times 0.7) + (0.7 \times 0.3)$	P1	This mark is given for a process to find the probability that Sally will win exactly one of the two games
	0.42	B1	This mark is given for the correct answer only

Question 9 (Total 6 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$6(2w + y) = 7w(3y + 6)$	P1	This mark is given for a process to find an expression equating the area of **A** with the area of **B**
	$12w + 6y = 21wy + 42w$ $6y - 21wy = 30w$	P1	This mark is given for rearranging to find an equation in three terms
	$y(6 - 21w) = 30w$	P1	This mark is given for a process to factorise $6y - 21wy$
	$y = \dfrac{30w}{6 - 21w}$	A1	This mark is given for the correct answer only (or equivalent expression)

Solutions to this question may be seen where all expressions are divided through by 3

Question 10 (Total 5 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$\dfrac{8 + \sqrt{12}}{5 + \sqrt{3}} = \dfrac{8 + 2\sqrt{3}}{5 + \sqrt{3}}$	M1	This mark is given for a process to write $\sqrt{12}$ as $2\sqrt{3}$ in the fraction
	$\dfrac{8 + 2\sqrt{3}}{5 + \sqrt{3}} \times \dfrac{5 - \sqrt{3}}{5 - \sqrt{3}}$ $= \dfrac{40 + 10\sqrt{3} - 8\sqrt{3} - 6}{25 - 3}$	M1	This mark is given for a process to multiply numerator and denominator by $5 - \sqrt{3}$
	$= \dfrac{34 + 2\sqrt{3}}{22}$	M1	This mark is given for a process to collect terms
	$= \dfrac{17 + \sqrt{3}}{11}$	A1	This mark is given for the correct answer in the form $\dfrac{a + \sqrt{3}}{b}$

Question 11 (Total 3 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$\dfrac{3}{8}$ and $\dfrac{7}{9}$	P1	This mark is given for finding the fraction of cards with a black shape and the fraction of cards with a triangle
	$\dfrac{3}{8} \div \dfrac{7}{9}$	P1	This mark is given for a process to find the total number of cards with a black shape as a fraction of the total number of cards with a triangle
	$\dfrac{27}{56}$	A1	This mark is given for the correct answer only

Question 12 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\sqrt{180} = \sqrt{(36 \times 5)} = 6\sqrt{5}$	P1	This mark is given for writing $\sqrt{180}$ as $6\sqrt{5}$
	$\dfrac{6\sqrt{5} - 2\sqrt{5}}{5\sqrt{5} - 5} \times \dfrac{5\sqrt{5} + 5}{5\sqrt{5} + 5}$	P1	This mark is given for a process to rationalise the denominator
	$= \dfrac{100 + 20\sqrt{5}}{125 - 25}$	P1	This mark is given for expanding terms
	$= 1 + \dfrac{\sqrt{5}}{5}$	A1	This mark is given for a fully simplified correct answer only

Question 13 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$x = k\sqrt{y}$	P1	This mark is given for correct statement of proportionality
	$x' = k\sqrt{(1.44)y}$ $x' = 1.2x$	P1	This mark is given for a process to find the increased value of x
	20	A1	This mark is given for the correct percentage increase only

Question 14 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	Probability of red, yellow, yellow $= \dfrac{3}{8} \times \dfrac{5}{7} \times \dfrac{4}{6} = \dfrac{60}{336}$	P1	This mark is given for a process to find the probability of taking one red counter then two yellow counters
	Probability of yellow, red, yellow $= \dfrac{5}{8} \times \dfrac{3}{7} \times \dfrac{4}{6} = \dfrac{60}{336}$	P1	This mark is given for a process to find the probability of taking one red counter one yellow counter then one red counter
	Probability of yellow, yellow, red $= \dfrac{5}{8} \times \dfrac{4}{7} \times \dfrac{3}{6} = \dfrac{60}{336}$	P1	This mark is given for a process to find the probability of taking two yellow counters then one red counter
	$3 \times \dfrac{60}{336} = \dfrac{180}{336}$	A1	This mark is given for a correct answer only

Question 15 (Total 4 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$\overrightarrow{DQ} = \frac{1}{2}(\mathbf{b} - \mathbf{a})$	B1	This mark is given for a vector equation for $\overrightarrow{DQ}$
	$\overrightarrow{PQ} = \frac{1}{2}\mathbf{a} + \overrightarrow{DQ}$	M1	This mark is given for a vector equation for $\overrightarrow{PQ}$
	$\overrightarrow{PQ} = \frac{1}{2}\mathbf{a} + \frac{1}{2}(\mathbf{b} - \mathbf{a}) = \frac{1}{2}\mathbf{b}$	B1	This mark is given for a vector equation for $\overrightarrow{PQ}$ in terms of $\mathbf{b}$
	$\overrightarrow{PQ} = \frac{1}{2}\mathbf{b}$ and $\overrightarrow{FE} = \mathbf{b}$ Therefore PQ is parallel to FE	C1	This mark is given for a correct conclusion supported by correct working

Question 16 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
		M1	This mark is given for two of the three lines $2y + 4 = x$, $x = 3$ and $y = 6 - 3x$ correctly drawn
		M1	This mark is given for all three lines $2y + 4 = x$, $x = 3$ and $y = 6 - 3x$ correctly drawn
		A1	This mark is given for a fully correct region with all lines correct

Question 17 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\frac{1}{2}h(a + b) = 66$ where a = length AB and b = length DC	P1	This mark is given for a process to find an equation for the area of the trapezium
	$h = 6 \sin 30° = 6 \times 0.5 = 3$	P1	This mark is given for a process to find the height of the trapezium
	$\frac{3}{2}(a + b) = 66$ $a + b = 44$	P1	This mark is given for a process to find a value for $a + b$
	$a = \frac{2}{5} \times 44$	P1	This mark is given for a process to find the length of AB
	17.6	A1	This mark is given for a correct answer only

Question 18 (Total 6 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
(a)	$f(1) = 4$	M1	This mark is given for a method to find the value of $f(1)$
	$gf(1) = g(4) = \dfrac{4}{16} = \dfrac{1}{4}$	A1	This mark is given for a correct answer only
(b)	$fg(x) = 3\left(\dfrac{4}{x^2}\right)^2 + 1$	M1	This mark is given for a method to find $fg(x)$
	$fg(x) = \dfrac{48}{x^4} + 1$	M1	This mark is given for a method to find the composite function fg
	$h(x) = \sqrt[4]{\dfrac{48}{x-1}}$	M1	This mark is given for a method to find $h(x)$
		A1	This mark is given for the correct answer only

Question 19 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
		M1	This mark is given for drawing the line $y - 2x = 1$ on the diagram
		A1	This mark is given for reading the points $x = 2.1$, $y = 5.1$ from the diagram (Accept answers in the range 2.0 to 2.2 and 5.0 to 5.2)
		A1	This mark is given for reading the points $x = -2.9$, $y = -4.7$ from the diagram (Accept answers in the range –2.8 to –3.0 and –4.6 to –4.8)

Question 20 (Total 4 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$9 + 18x - 3x^2 = -3(x^2 - 6x - 3)$	P1	This mark is given for process to factorise the equation
	$(x - 3)^2 - 9$	P1	This mark is given for the start of a process to complete the square
	$-3(x - 3)^2 + 36$	P1	This mark is given for a full process to complete the square
	$(3, 36)$	A1	This mark is given for the correct answer only

Question 21 (Total 5 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$\frac{\pi}{8}[(5x - 1)^2 - (3x - 1)^2] = \frac{\pi}{8}(16x^2 - 4x)$	P1	This mark is given for process to find the area of shape **A**
	$\pi(1 - x)^2 = \pi(x^2 - 2x + 1)$	P1	This mark is given for process to find the area of circle **B**
	$(2x^2 - \frac{1}{2}x) = x^2 - 2x + 1$ $4x^2 - x = 2x^2 - 4x + 2$ $2x^2 + 3x - 2 = 0$	P1	This mark is given for equating and rearranging to form a quadratic equation to be solved
	$(2x - 1)(x + 2) = 0$	P1	This mark is given for a process to find the value of x
	$x = \frac{1}{2}$	A1	This mark is given for the correct answer only

Qn	Skill tested	Max score	Mean score %	Edexcel averages: scores of candidates who achieved grade:						
				ALL	9	8	7	6	5	4
1	Index notation	6	36	2.17	4.94	3.99	3.19	2.49	1.83	0.97
2	Recurring decimals and their corresponding fractions	1	35	0.35	0.83	0.78	0.70	0.52	0.32	0.11
3	Solve quadratic equations	3	35	1.04	2.93	2.80	2.23	1.46	0.89	0.23
4	Surface area and volume of spheres, pyramids, cones and composite solids	4	34	1.37	3.90	3.52	2.54	1.80	1.16	0.58
5	Rearrange formulae to change the subject	4	31	1.22	3.70	3.19	2.31	1.41	0.56	0.16
6	Sampling	4	29	1.14	3.27	2.39	1.64	1.22	0.83	0.44
7	Graphs and equations of lines	3	27	0.80	2.88	2.60	1.72	0.77	0.17	0.04
8	Independent and dependent combined events	3	26	0.77	2.53	1.93	1.41	0.84	0.40	0.12
9	Simplify and manipulate algebraic expressions and fractions	4	25	1.00	3.49	2.83	2.00	1.25	0.84	0.25
10	Calculate exactly with surds	4	21	0.82	3.55	2.74	1.94	0.94	0.52	0.07
11	Relate ratios to fractions and to linear functions	3	19	0.57	2.01	1.40	0.83	0.57	0.41	0.14
12	Calculate exactly with surds	4	18	0.73	3.26	2.34	1.29	0.66	0.27	0.05
13	Solve problems involving direct and inverse proportion	3	18	0.54	2.37	1.42	0.89	0.55	0.26	0.06
14	Independent and dependent combined events	4	17	0.67	3.37	2.03	1.39	0.81	0.39	0.12
15	Vectors	4	13	0.53	3.25	2.22	0.98	0.26	0.04	0.01
16	Represent the solution set of inequality on a number line	3	12	0.37	2.25	1.69	0.83	0.28	0.12	0.02
17	Pythagoras's Theorem and Trigonometry	5	12	0.61	3.99	2.70	1.29	0.50	0.20	0.03
18	Inverse and composite functions; formal function notation	6	12	0.72	3.93	2.51	1.62	0.82	0.35	0.06
19	Solve two simultaneous equations	3	9	0.28	2.37	1.61	0.47	0.10	0.06	0.02
20	Roots, intercepts, turning points of quadratic functions	4	8	0.30	2.66	1.38	0.57	0.14	0.07	0.00
	Arc lengths, angles and areas of sectors of circles	5	6	0.31	2.91	1.16	0.42	0.10	0.02	0.00
		80	**20**	**16.31**	**64.39**	**47.23**	**30.26**	**17.49**	**9.71**	**3.48**

Students who were awarded a Grade 9 averaged 64 marks on this set of questions in the November 2020 and 2021 examinations. That said, there weren't very many of them in these cohorts.

Aiming for 9 – Set 2 (Spring 2022)

Suggested grade boundaries

	Max	9	8	7	6	5	4
1H	80	56	39	24	14	7	3
2H	80	54	37	23	12	6	2
3H	80	49	33	20	11	5	2
Total	240	159	109	67	37	18	7

Grade boundaries are based on the average performance data for students answering these questions who gained grades 4-9 in the November 2020 & 2021 GCSE Mathematics examinations at Higher tier.

Students did not answer these questions as 90-minute tests, of course; so there is some scope for adjustment. These boundaries are for guidance only.