GCSE Mathematics (1MA1) – Higher Tier Paper 2H (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 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\dfrac{AB}{\sin 34°} = \dfrac{23.8}{\sin 120°}$	M1	This mark is given for a method to use the sine rule to find the length AB
	$AB = \dfrac{23.8}{\sin 120°} \times \sin 34°$ $AB = \dfrac{23.8}{0.866...} \times 0.559...$	M1	This mark is given for a method to rearrange to find the length AB
	15.4 (to 1 decimal place)	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
	$1.025^3 = 1.07689…$	P1	This mark is given for a process to find Louise's initial investment
	$\dfrac{344\,065}{1.025^3} = 320\,000$	P1	This mark is given for a complete process to find Louise's initial investment
	$320\,000 \times 1.02^2 \times 1.035$	P1	This mark is given for a process to find the value of Sadiq's investment
	$344\,580.48$	A1	This mark is given for the correct answer in the range 344 580 to 344 581

Question 3 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$\dfrac{27}{300}$	M1	This mark is given for a method to find the gradient
	$= -0.09$	A1	This mark is given for the correct answer only
(b)	For example: the volume of petrol used each km litres / km	C1	This mark is given for a correct interpretation of the gradient

Question 4 (Total 1 mark)

Part	Working or answer an examiner might expect to see	Mark	Notes
	−12, −7	B1	This mark is given for the correct answer only

Question 5 (Total 2 marks)

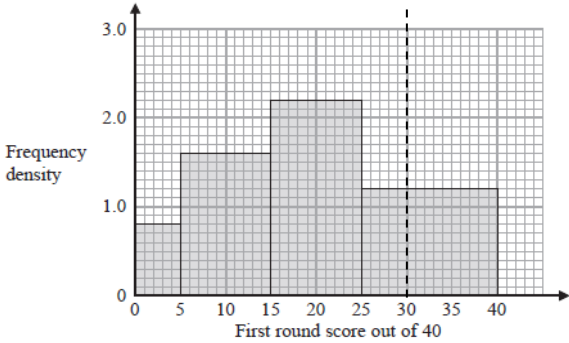| Part	Working or answer an examiner might expect to see	Mark	Notes
	$\pi \times 10 \times 25 = 250\pi$	P1	This mark is given for a process to find the surface area of the whole cone
	$\dfrac{15}{25} \times 10 = 6$	P1	This mark is given for a process to find the radius of the smaller cone
	$\pi \times 6 \times 15 = 90\pi$	P1	This mark is given for a process to find the surface area of the smaller cone
	$250\pi - 90\pi = 160\pi$	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
	$(x + 4)^2 - x^2 = 70$	P1	This mark is given for a process to set up an equation relating **A** and **B**
	$8x + 16 = 70$ $8x = 54$	P1	This mark is given for a process to multiply out terms to produce a linear equation
	$x = \dfrac{54}{8} = 6.75$	A1	This mark is given for finding the length of the side of square **A**
	Area of **B** $= (6.75 + 4)^2$ $= 116$ (to 3 significant figures)	B1	This mark is given for a correct answer only

Question 7 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$\sqrt[3]{10 - 2 \times 2} = \sqrt[3]{6} = 1.817$	M1	This mark is given for a method to substitute $x = 2$ in the original equation
	$\sqrt[3]{10 - 2 \times 1.817} = 1.853$ $\sqrt[3]{10 - 2 \times 1.853} = 1.846$	M1	This mark is given for a method to substitute to find x_2 and x_3
	$x_1 = 1.817$ $x_2 = 1.853$ $x_3 = 1.846$	A1	This mark is given for three correct answers
(b)	$x^3 = 10 - 2x$ $x^3 + 2x - 10$ $a = 2, b = -10$	C1	This mark is given for a correct answer only

Question 8 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$0.8 \times 5 = 4$ $1.6 \times 10 = 16$ $2.2 \times 10 = 22$ $1.2 \times 15 = 18$	P1	This mark is given for a process to find the frequencies
	$4 + 16 + 22 + 18 = 60$	P1	This mark is given for a process to find the number of people in the competition
	$60 \times 0.2 = 12$	P1	This mark is given for a process to find the number of people who qualified for the next round
	  30	A1	This mark is given for a correct answer only

Question 9 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$BC^2 = 8^2 + 11^2 - (2 \times 8 \times 11 \times \cos 72°)$	M1	This mark is given for a method to use the cosine rule to find the length BC
	$BC = \sqrt{(64 + 121 - 54.38…)}$	M1	This mark is given for a method to use the correct order of operations
	11.4	A1	This mark is given for an answer in the range 11.4 to 11.5
(b)	$0.5 \times \sin 72° \times 8 \times 11$	M1	This mark is given for a method to use area = $\frac{1}{2}ab \sin C$ to find the area
	41.8	A1	This mark is given for an answer in the range 41.5 to 41.9

Question 10 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	x-coordinate = $6 \times \dfrac{3}{2} = 9$ y-coordinate = $3 \times \dfrac{5}{2} = 7.5$	M1	This mark is given for a method to find the x-coordinate **or** the y-coordinate of R
	(9, 7.5)	A1	This mark is given for the correct answer only
(b)	$3 \div 6 = 0.5$	P1	This mark is given for a process to find the gradient of the line **L**
	$-\dfrac{1}{0.5} = -2$	P1	This mark is given for a process to find the gradient of the perpendicular to **L**
	$y = -2x + 3$	A1	This mark is given for the correct answer only

Question 11 (Total 2 marks)

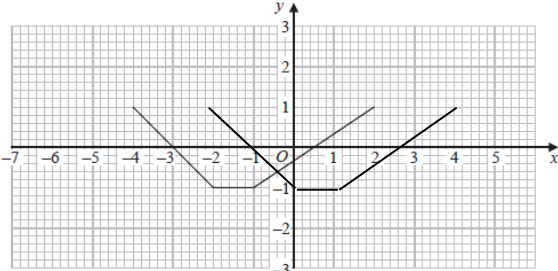| Part	Working or answer an examiner might expect to see	Mark	Notes
	Enlargement, scale factor –1.5	B1	This mark is given for a correct transformation and scale factor stated
	Centre of enlargement (1, 1)	B1	This mark is given for a correct centre of enlargement stated

Question 12 (Total 1 mark)

Part	Working or answer an examiner might expect to see	Mark	Notes
	All inequalities should start with zero	C1	This mark is given for an error correctly identified
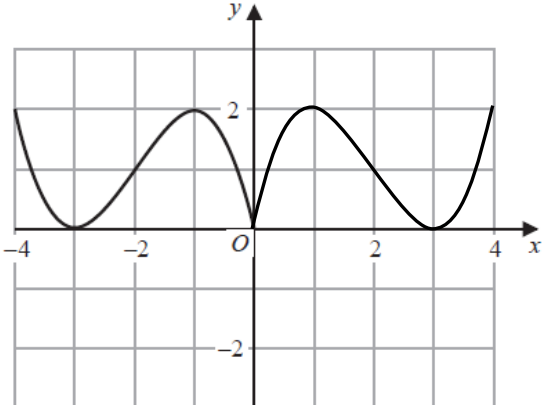
Question 13 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	RR = 0.7 × 0.8 = 0.56 R–NR= 0.7 × 0.2 = 0.14 NR–R= 0.3 × 0.6 = 0.18 NR–NR= 0.3 × 0.4 = 0.12	P1	This mark is given for a process to find the correct probability for two consecutive days (R = rain, NR = not rain)
	0.56 × 0.8 = 0.448 0.14 × 0.6 = 0.084 0.18 × 0.8 = 0.144 0.12 × 0.6 = 0.072	P1	This mark is given for a process to find the correct probability for rain on Wednesday
	0.448 + 0.084 + 0.144 + 0.072	P1	This mark is given for a complete process to find the probability of rain on Wednesday
	0.748	A1	This mark is given for the correct answer only

Question 14 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	37, 143, (360 + 37) = 397, (360 + 143) = 503	M1	This mark is given for any two angles found in the ranges 35 to 40, 140 to 145, 395 to 400 and 500 to 505
		A1	This mark is given for all four angles found in the ranges 35 to 40, 140 to 145, 395 to 400 and 500 to 505
(b)	$y = -\sin x°$	B1	This mark is given for the correct equation (or any equivalent)
(c)		A1	This mark is given for a graph translated by 2 in the positive x-direction

Question 15 (Total 4 marks)

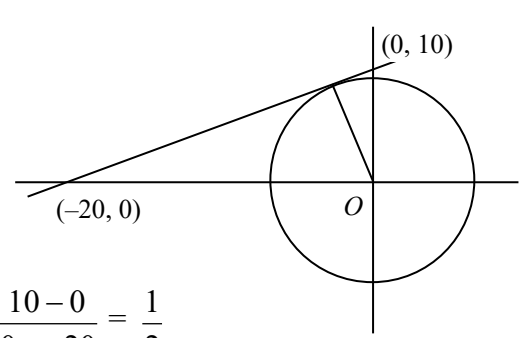| Part	Working or answer an examiner might expect to see	Mark	Notes
(a)		C2	These marks are given for a fully correct graph (a curve reflected in the y-axis passing through points (0, 0), (1, 2), (2,1), (3, 0) and (4, 2)) (C1 is given for a curve reflected in the y-axis or a curve passing through four of the five points)
(b)	$y = 5 + 2(x - 3) - (x - 3)^2$	C2	These marks are given for a fully correct equation (C1 is given for an equation of the form $y = 5 + 2(x - a) - (x - a)^2$, $a \neq 3$

Question 16 (Total 8 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	If P(red) = $\frac{7}{10}$ then $\frac{n}{n+8} = \frac{7}{10}$	M1	This mark is given for a method to set up an equation in terms of n
	$10n = 7(n + 8)$ $10n = 7n + 56$ $n = \frac{56}{3}$	M1	This mark is given for a process to find a value for n
	n is not a whole number, therefore P(red) cannot be $\frac{7}{10}$	C1	This mark is given for a valid conclusion supported by correct working
(b)	P(1st red sweet) = $\frac{n}{n+8}$ P(2nd red sweet) = $\frac{n-1}{n+7}$	P1	This mark is given for a process to work out the probabilities of the first sweet being red and the second sweet being red
	$\frac{n}{n+8} \times \frac{n-1}{n+7} = \frac{3}{5}$	P1	This mark is given for a process to form an appropriate equation
	$5(n^2 - n) = 3(n^2 + 15n + 56)$ $2n^2 - 50n - 168 = 0$ $n^2 - 25n - 84 = 0$	P1	This mark is given for a process to find a quadratic equation to be solved
	$(n - 28)(n + 3) = 0$	P1	This mark is given for factorising a quadratic equation (or quadratic formula may be used)
	$n = 28$	A1	This mark is given for the correct answer only

Question 17 (Total 3 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$\sqrt[3]{125} : \sqrt[3]{27}$ $= 5 : 3$	P1	This mark is given for a process to find the ratio of the radius of sphere **A** to the radius of sphere **B**
	$(5 \times 1) : (3 \times 2)$ $= 5 : 6$	P1	This mark is given for a process to find the ratio of the radius of sphere **B** to the radius of sphere **C**
	$5^2 : 6^2$ $= 25 : 36$	A1	This mark is given for the correct answer in the form $\dfrac{a + \sqrt{3}}{b}$

Question 18 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	   $\dfrac{10 - 0}{0 - -20} = \dfrac{1}{2}$	P1	This mark is given for a process to find the gradient of the tangent to **C**
	gradient of normal to tangent $= -2$	P1	This mark is given for a process to use $-\dfrac{1}{m}$ to find the gradient of the normal to the tangent to **C**
	equation of tangent is $y = \dfrac{1}{2}x + 10$ equation of radius of **C** is $y = -2x$	P1	This mark is given for a process to find equations for the tangent to **C** and the radius of **C**
	When $\dfrac{1}{2}x + 10 = -2x$, $x = -4$ and $y = 8$	P1	This mark is given for a process to find the x and y-coordinates of the point where the tangent meets **C**
	$x^2 + y^2 = 80$	A1	This mark is given for a correct equation of **C** only

Question 19 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$h_1 = K \times 1200 + 20 = 1040$	P1	This mark is given for a process to find an equation for h_1
	$K = \dfrac{1040 - 20}{1200} = 0.85$	P1	This mark is given for a process to find the value of K
	At 09 17, $h_2 = 0.85 \times 1040 + 20 = 904$	P1	This mark is given for a process to find the value of h_2 at 09 17
	At 09 18, $h_3 = 0.85 \times 904 + 20 = 788.4$	A1	This mark is given for a process to find the value of h_3 at 09 18

Question 20 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	Angle $BCD = \dfrac{180}{(3+1)} = 45$ Opposite angles of a cyclic quadrilateral add up to 180	M1	This mark is given for a method to find the size of angle BCD with a reason
	Angle $BDA = 180 - 20 - (180 - 45) = 25$ Angles in a triangle add up to 180	M1	This mark is given for a method to find the size of angle BDA
	Angle $SBA = BDA = 25$	A1	This mark is given for the correct answer only
	Alternate segment theorem	C1	This mark is given for a correct reason

Question 21 (Total 4 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$51.95 \leq l \leq 52.05$ $1.445 \leq T \leq 1.455$	B1	This mark is given for stating an upper or lower bound for l or T
	$g = \dfrac{4\pi^2 l}{T^2}$	P1	This mark is given for a process to rearrange the formula to give g as the subject
	upper bound = $\dfrac{4\pi^2 \times 52.05}{1.445^2}$ lower bound = $\dfrac{4\pi^2 \times 51.95}{1.455^2}$	P1	This mark is given for a process to find an upper or lower bound for g
	upper bound = 984.11… lower bound = 968.76…	A1	This mark is given for two correct answers (rounded or truncated to 2 decimal places)

Qn	Skill tested	Max score	Mean score %	Edexcel averages: scores of candidates who achieved grade:						
				ALL	9	8	7	6	5	4
1	Pythagoras's Theorem and Trigonometry	3	36	1.08	2.88	2.62	2.11	1.35	0.51	0.09
2	Growth and decay, compound interest	4	35	1.41	3.74	3.38	2.64	1.97	1.29	0.51
3	Gradient at a point on a curve as the instantaneous rate of change	3	25	0.76	2.43	1.90	1.35	0.82	0.39	0.18
4	Roots, intercepts, turning points of quadratic functions	1	25	0.25	0.95	0.81	0.49	0.23	0.09	0.01
5	Surface area and volume of spheres, pyramids, cones and composite solids	4	25	1.00	3.15	1.94	1.54	1.10	0.72	0.35
6	Translate situations or procedures into algebraic expressions, formulae or equations	4	24	0.94	3.61	2.69	1.74	0.92	0.38	0.13
7	Approximate solutions to equations using iteration	4	24	0.94	3.29	2.45	1.82	1.31	0.71	0.28
8	Histograms with equal and unequal class intervals	4	23	0.93	3.36	2.76	2.00	1.21	0.65	0.18
9	Area of a triangle using the angle formula	5	22	1.11	4.56	3.56	2.49	1.43	0.71	0.12
10	Gradients and intercepts of linear functions	5	21	1.06	4.44	3.41	2.18	1.31	0.57	0.26
11	Transformations	2	20	0.40	1.58	1.07	0.76	0.37	0.17	0.06
12	Cumulative frequency graphs	1	19	0.19	0.59	0.53	0.36	0.24	0.16	0.09
13	Conditional probability	4	18	0.73	3.30	2.13	1.45	0.91	0.40	0.19
14	Translations and reflections of a function	4	13	0.53	3.25	2.16	1.28	0.47	0.15	0.03
15	Translations and reflections of a function	4	13	0.52	2.55	1.60	0.88	0.41	0.19	0.08
16	Conditional probability	8	13	1.03	6.33	3.80	1.55	0.69	0.28	0.07
17	Relationships between lengths, areas and volumes in similar figures	3	13	0.38	2.49	1.19	0.83	0.32	0.20	0.04
18	Equation of a circle	5	12	0.60	3.35	1.64	1.03	0.53	0.20	0.06
19	Growth and decay, compound interest	4	12	0.46	3.28	1.90	0.60	0.23	0.09	0.01
20	Circle theorems	4	11	0.43	2.63	1.64	0.92	0.52	0.12	0.02
	Limits of accuracy; bounds	4	10	0.38	2.43	1.43	0.78	0.35	0.15	0.03
		80	19	15.13	64.19	44.61	28.80	16.69	8.13	2.79

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.