GCSE Mathematics (1MA1)

Themed papers – Functions

Compiled from student-friendly mark schemes

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
(a)	$\frac{2}{(-5)^2} = \frac{2}{25}$	B1	This mark is given for the correct answer only
(b)	g(1) = 4 $f(4) = \frac{2}{16}$	M1	This mark is given for a method to find fg(1) = f(g(1))
	$f(4) = \frac{2}{16}$, $fg(1) = \frac{1}{8}$	A1	This mark is given for the correct answer only

Question 2 (Total 7 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$\frac{x+1}{3}$	M1	This mark is given for a method to change the subject, for example $y = 3x - 1$ or $y + 1 = 3x$
		A1	This mark is given for the correct answer only
(b)	$fg(x) = 3(x^2 + 4) - 1$	M1	This mark is given for a finding the angle *BDC*
	$gf(x) = (3x - 1)^2 + 4$	M1	This mark is given for a an appropriate reason stated
	$3x^2 + 11 = 2(9x^2 - 6x + 5)$	M1	This mark is for setting up the equation of $fg(x) = 2gf(x)$
	$3x^2 + 11 = 18x^2 - 12x + 10$	M1	This mark is given for multiplying out the expression for $2gf(x)$
	$15x^2 - 12x - 1 = 0$	C1	This mark is given for a correct conclusion following from correct working

Question 3 (Total 4 mark)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$4 \sin 23° = 4 \times 0.3907311$ $= 1.5629245$ $= 1.56$	B1	This mark is given for the correct answer to three significant figures
(b)	$g(34) = (2 \times 34) - 3$ $= 65$ $f(65) = 4 \sin 65°$ $= 4 \times 0.9063077$	M1	This mark is given for a method to find g(34) and f(65)
	$= 3.6252311$ $= 3.63$	A1	This mark is given for the correct answer to three significant figures
(c)	Both the positive and negative square roots are required for a fully correct solution	C1	This mark is given for a correct statement

Question 4 (Total 6 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
(a)	$f^{-1}(x) = \sqrt[3]{\frac{x+4}{2}}$	C1	This mark is given for finding an expression for $f^{-1}(x)$
	$f^{-1}(x) = \sqrt[3]{\frac{50+4}{2}} = \sqrt[3]{27} = 3$	C1	This mark is given for correctly substituting 50 into $f^{-1}(x)$
(b)	$hg(x) = (x + 2)^2$	P1	This mark is given for a process to find an expression for $hg(x)$
	$(x + 2)^2 = 3x^2 + x - 1$ $x^2 + 4x + 4 = 3x^2 + x - 1$ $2x^2 - 3x - 5 = 0$	P1	This mark is given for a process to find a quadratic equation to be solved
	$(2x - 5)(x + 1) = 0$	P1	This mark is given for a process to factorise to solve for x
	$x = -1$ and $x = 2.5$	A1	This mark is given for the correct answers only

Question 5 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$2((x + 1)^2 – 1)$	C1	This mark is given for a first step to find gf(x)
	$= 2(x^2 + 2x + 1 – 1)$ $= 2x^2 + 4x$ $= 2x(x + 2)$	C1	This mark is given for a complete chain of reasoning
(b)	$g^{-1}(x) = \frac{x}{2} + 1$	M1	This mark is given for a process to find an expression for $g^{-1}(x)$
	$3.5 + 1 = 4.5$	A1	This mark is given for the correct answer only

Question 6 (Total 7 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
(a)	$(–4)^2 + 2 = 18$	B1	This mark is given for a correct answer only
(b)	$(2x – 3)^2 + 2$	C1	This mark is given for a correct first step
	$= 4x^2 – 6x – 6x + 9 + 2$ $= 4x^2 – 12x + 11$	C1	This mark is given for a correct fully correct chain of reasoning that the includes correct expansion of $(2x – 3)^2$
(c)	$2(x^2 + 2) – 3 = 4x^2 – 12x + 11$	P1	This mark is given for a process to process to find fg(x) and form an equation
	$2x^2 + 1 = 4x^2 – 12x + 11$ $2x^2 – 12x + 10 = 0$	P1	This mark is given for a process to reduce the equation to the form $ax^2 + bx + c = 0$
	$(2x – 2)(x – 5) = 0$	P1	This mark is given for a process to solve the quadratic equation
	$x = 1$, $x = 5$	A1	This mark is given for a correct answer only

Question 7 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$g(2) = (4 \times 2) - 1 = 7$	M1	This mark is given for finding the value of g(2)
	$f(7) = fg(2)$ $= 7^3 = 343$	A1	This mark is given for the correct answer only
(b)	$h(x) = (4x - 1)^3$	M1	This mark is given for a method to find an expression for h(x)
	$\sqrt[3]{x} = 4y - 1$ $\sqrt[3]{x} + 1 = 4y$	M1	This mark is given for a method to find $h^{-1}(x)$
	$\frac{\sqrt[3]{x}+1}{4}$	A1	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
(a)	$ff(x) = \frac{1-\frac{1-x}{1+x}}{1+\frac{1-x}{1+x}}$	M1	This mark is given for a method to show ff(x) as an unsimplified fraction
	$\frac{1+x-(1-x)}{1+x+(1-x)}$	M1	This mark is given for a full method to write either the numerator or denominator as a single fraction
		C1	This mark is given for a complete method with correct working
(b)	$f^{-1}(x) = \frac{1-x}{1+x}$	B1	This mark is given for a correct answer only

Question 9 (Total 8 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
(a)	$\frac{1}{7} + \frac{1}{2}$	M1	This mark is given for correct substitution into the function
	$\frac{9}{14}$	A1	This mark is given for the correct answer only
(b)	– 2 or 3	B1	This mark is given for the correct answer only
(c)	$f(x) = \frac{2x-1}{(x+2)(x-3)} = 4$	M1	This mark is given for representing the equation as a single fraction
	$\frac{2x-1}{x^2-x-6} = 4$ $\frac{2x-1}{4(x^2-x-6)} = 1$ $2x - 1 = 4x^2 - 4x - 24$	M1	This mark is given for simplifying and rearranging to a quadratic equal to zero
	$4x^2 - 6x - 23 = 0$	A1	This mark is given for the correct answer only
	$a = 4$, $b = 6$, $c = -23$	M1	This mark is given for a complete method to solve using the quadratic formula
	$\frac{3 \pm \sqrt{101}}{4}$	A1	This mark is given for the correct answer only

Mark scheme for 1MA1 Higher themed papers: Functions

Performance data:

Q	Taken from			Total Marks available	TOPIC	Spec Ref	AO	% Mean marks	Edexcel mean averages Marks of candidates who achieved grade:										
	Q	Series	Paper						ALL	9	8	7	6	5	4	3	2	1	U
1a	11a	June 2018	2H	1	Algebra	A7	1	66	0.66	0.99	0.96	0.88	0.75	0.52	0.29	0.14	-	-	0.08
1b	11b	June 2018	2H	2	Algebra	A7	1	61	1.21	1.95	1.84	1.65	1.32	0.88	0.51	0.29	-	-	0.14
2a	21a	June 2019	1H	2	Algebra	A7	1	41	0.81	1.90	1.65	1.22	0.68	0.29	0.09	0.03	-	-	0.03
2b	21b	June 2019	1H	5	Algebra	A7	2	39	1.95	4.90	4.45	3.19	1.46	0.39	0.07	0.02	-	-	0.02
3a	10a	Nov 2018	3H	1	Algebra	A7	1	66	0.66	0.90	1.00	0.95	0.91	0.82	0.65	0.44	-	-	0.28
3b	10b	Nov 2018	3H	2	Algebra	A7	1	22	0.44	1.80	1.88	1.52	1.18	0.67	0.13	0.03	-	-	0.00
3c	10c	Nov 2018	3H	1	Algebra	A7, A18	3	7	0.07	0.90	0.74	0.31	0.16	0.05	0.01	0.00	-	-	0.00
4a	18a	Nov 2019	1H	2	Algebra	A7	2	14	0.27	1.78	1.68	1.08	0.58	0.28	0.06	0.01	-	-	0.01
4b	18b	Nov 2019	1H	4	Algebra	A7	3	6	0.22	3.78	2.27	1.14	0.42	0.09	0.01	0.00	-	-	0.00
5a	19a	Nov 2018	1H	2	Algebra	A4, A7	2	12	0.23	1.70	1.73	1.22	0.69	0.20	0.02	0.01	-	-	0.00
5b	19b	Nov 2018	1H	2	Algebra	A7	1	6	0.11	1.40	0.94	0.61	0.33	0.06	0.01	0.01	-	-	0.00
6a	20a	Mock Set 1	3H	1	Algebra	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6b	20b	Mock Set 1	3H	2	Algebra	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6b	20c	Mock Set 1	3H	4	Algebra	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7a	21a	Mock Set 3	3H	2	Algebra	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7b	21b	Mock Set 3	3H	3	Algebra	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8a	20a	Mock Set 4	2H	3	Algebra	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8b	20b	Mock Set 4	2H	1	Algebra	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9a	21a	Mock Set 2	3H	2	Algebra	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9b	21b	Mock Set 2	3H	1	Algebra	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9c	21c	Mock Set 2	3H	5	Algebra	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				48					**6.63**	**22**	**19.14**	**13.77**	**8.48**	**4.25**	**1.85**	**0.98**	**-**	**-**	**0.56**