

GCSE Mathematics (1MA1)

Themed papers – Linear equations and inequalities

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 6 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$1^3 + 1 = 2$ $2^3 + 2 = 10$	C1	This mark is given for substituting both 1 and 2 into $x^3 + x$
	2 is < 7 and $10 > 7$ which implies there is a solution between 1 and 2	C1	This mark is given for a correct statement
(b)	$x^3 + x = 7$ $x^3 = 7 - x$ (subtracting x from both sides) $x = \sqrt[3]{7 - x}$ (cube root of both sides)	C1	This mark is given for a correct algebraic rearrangement
(c)	$x_1 = \sqrt[3]{7 - 2} = \sqrt[3]{5} = 1.70997$	M1	This mark is given for a substitution of 2 into the equation to find x_1
	$x_2 = \sqrt[3]{7 - 1.70997} = \sqrt[3]{5.29003} = 1.74241$	M1	This mark is given for a substitution of x_1 into the equation to find x_2
	$x_3 = \sqrt[3]{7 - 1.74241} = \sqrt[3]{5.25759} = 1.73885$	A1	This mark is given for a substitution of x_2 into the equation to find x_3

Question 2 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$x_1 = -2.64$	M1	This mark is given for the substitution of -2.5 into the equation to find a value for x_1
	$x_2 = -2.57392$	M1	This mark is given for the substitution of x_1 to give x_2
	$x_3 = -2.603767255$	A1	This mark is given for the substitution of x_3 to give x_3
(b)	The iterative form is a rearrangement of the equation	C1	This mark is given for a correct statement
	Each iteration gives an estimation of a solution to the equation	C1	This mark is given for a correct statement

Question 3 (Total 9 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$f(0) = -5$ and $f(1) = 3$,	1	This mark is given for showing the sign changes between $f(0)$ and $f(1)$
	Thus since there is a sign change, the solution is between $x = 0$ and $x = 1$	1	This mark is given for a correct comment
(b)	$x^2 + 7 = \frac{5}{x}$ (dividing both sides by x)	1	This mark is given for the first step in a rearrangement
	Thus $x = \frac{5}{x^2 + 7}$	1	This mark is given for clear steps showing the complete rearrangement
(c)	$x_1 = 0.625$	1	This mark is given for the first correct iteration
	$x_2 = 0.6765327696$	1	This mark is given for the second correct iteration
	$x_3 = 0.6704483001$	1	This mark is given for the third correct iteration
(d)	$(0.670)^2 + (7 \times 0.670) - 5 = 0.134$	1	This mark is given for substituting 0.670 into $x^2 + 7x - 5$
	This is an accurate estimate of the root since the calculation is very close to zero	1	This mark is given for a correct comment

Question 4 (Total 7 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
(a)	$x^2 + 5x - 4 = -4$ when $x = 0$, $x^2 + 5x - 4 = 2$ when $x = 1$	M1	This mark is given for a method to establish at least one root in the interval $0 < x < 1$
	Since there is a sign change, there must be at least one root in $0 < x < 1$	C1	This mark is given for a correct statement
(b)	$x^3 + 5x = 4$ $x^2 + 5 = \frac{4}{x}$	C1	This mark is given for at least one correct step in rearrangement
	$x = \frac{4}{x^2 + 5}$	C1	This mark is given for a fully correct chain of reasoning
(c)	$x_1 = 0.8$ or $x_1 = \frac{4}{5}$	B1	This mark is given for a correct answer only
	$x_2 = \frac{4}{(0.8)^2 + 5}$	M1	This mark is given for a method to substitute x_1 into the iteration formula to find x_2
	$0.709\dots$ or $\frac{100}{141}$	A1	This mark is given for a correct answer only

Question 5 (Total 6 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$f(2) = -1, f(3) = 3$	M1	This mark is given for a method to establish that there is at least one root in the interval (2, 3)
	Since there is a sign change, there must be at least one root in $2 < x < 3$	A1	This mark is given for a supporting explanation
(b)	$x^3 = 3x^2 - 3$ $x = \sqrt[3]{3x^2 - 3}$	C1	This mark is given for a correct rearrangement
(c)	$x_1 = \sqrt[3]{3 \times 2^2 - 3}$	M1	This mark is given for finding an expression for x_1
	$x_1 = 2.080\dots$	A1	This mark is given for correctly evaluating x_1
	$x_2 = 2.153\dots$	A1	This mark is given for correctly evaluating x_2

Question 6 (Total 6 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)		M1	This mark is given for rearranging to $x^3 =$
		C1	This mark is given for a clear step to show rearrangement
(b)	$x_1 = 3.29296875$ $x_2 = 3.276659786$ $x_3 = 3.279420685$	M1	This mark is given for one correct iteration
		M1	This mark is given for 2 further iterations seen
		A1	This mark is given for a fully correct answer only
(c)	“iteration is an estimation of the solution”	C1	This mark is given for a correct statement

Mark scheme for 1MA1 Higher themed papers: Linear equations and inequalities

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	18a	June 2018	3H	2	Algebra	A4	2	38	0.76	1.77	1.44	1.05	0.70	0.43	0.23	0.11	-	-	0.04
1b	18b	June 2018	3H	1	Algebra	A20	2	70	0.70	0.98	0.95	0.90	0.80	0.59	0.33	0.14	-	-	0.05
1c	18c	June 2018	3H	3	Algebra	A20	1	58	1.75	2.95	2.86	2.57	1.95	1.13	0.51	0.21	-	-	0.06
2a	16a	June 2017	3H	3	Ratio	R16	1	41	1.23	2.70	2.29	1.78	1.18	0.65	0.27	0.09	-	-	0.03
2b	16b	June 2017	3H	2	Ratio	R16	3	7	0.14	0.81	0.35	0.14	0.05	0.02	0.01	0.00	-	-	0.00
3a	15a	Nov 2017	3H	2	Algebra	A20	2	9	0.17	1.50	1.15	0.65	0.37	0.22	0.16	0.11	-	-	0.02
3b	15b	Nov 2017	3H	2	Algebra	A4	2	17	0.34	2.00	1.82	1.40	1.13	0.66	0.28	0.10	-	-	0.03
3c	15c	Nov 2017	3H	3	Algebra	A20	1	8	0.25	2.62	2.06	1.22	0.81	0.50	0.18	0.05	-	-	0.01
3d	15d	Nov 2017	3H	2	Algebra	A20	1	3	0.05	0.88	0.94	0.19	0.20	0.08	0.02	0.00	-	-	0.00
4a	13a	Mock Set 1	3H	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4b	13b	Mock Set 1	3H	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4c	13c	Mock Set 1	3H	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5a	16a	Mock Set 3	2H	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5b	16b	Mock Set 3	2H	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5c	16c	Mock Set 3	2H	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6a	21a	Spec Set 1	3H	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6b	21b	Spec Set 1	3H	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6c	21c	Spec Set 1	3H	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				39					5.39	16.21	13.86	9.9	7.19	4.28	1.99	0.81	-	-	0.24