

GCSE Mathematics (1MA1)

Themed papers – Indices

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 4 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
(a)	$3^5 \times 3^4 = 3^{5+4} (= 3^9)$ or $3^5 \div 3^2 = 3^{5-2} (= 3^3)$ or $3^4 \div 3^2 = 3^{4-2} (= 3^2)$	M1	This mark is given for a first step using a rule of indices
	3^7	A1	This mark is given for the correct answer only
(b)	1	B1	This mark is given for the correct answer only
(c)	$\frac{1}{9}$	B1	This mark is given for the answer shown (or for 0.111...)

Question 2 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$p^{(2 \times 5)} = p^{10}$	B1	This mark is given for the correct answer only
(b)	$\frac{12x^7y^3}{6x^3y} = \frac{12}{6} \times x^{(7-3)} \times y^{(3-1)}$	M1	This mark is given for a method to simplify the fraction
	$2x^4y^2$	A1	This mark is given for a correct answer only

Question 3 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$\sqrt{36} = 6$		This mark is given for the correct answer only
(b)	1		This mark is given for the correct answer only
(c)	$27^{\frac{1}{3}} = \sqrt[3]{27} = 3$		This mark is given for a correct first step in calculating the value
	$3^{-2} = \frac{1}{9}$		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
(a)	$81^{\frac{1}{2}} = \sqrt{81} = 9$ or $81^{-\frac{1}{2}} = \frac{1}{81^{\frac{1}{2}}}$	M1	This mark is given for a method using either a square root or a reciprocal
	$\frac{1}{9}$	A1	This mark is given for the correct answer only
(b)	$\left(\frac{64}{125}\right)^{\frac{2}{3}} = \left(\frac{64^{\frac{2}{3}}}{125^{\frac{2}{3}}}\right)$ $64^{\frac{2}{3}} = \left(64^{\frac{1}{3}}\right)^2 = (\sqrt[3]{64})^2 = 4^2 = 16$ $125^{\frac{2}{3}} = \left(125^{\frac{1}{3}}\right)^2 = (\sqrt[3]{125})^2 = 5^2 = 25$	M1	This mark is given for a method to find the cube root of 64 and 125 or 16 or 25 seen
	$\frac{16}{25}$	A1	This mark is given for the correct answer only

Question 5 (Total 3 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
(a)	$m^{3+4} = m^7$	B1	This mark is given for the correct answer only
(b)	$53 \times n^3 \times p^{3 \times 3} = 125n^3p^9$	B2	These marks are given for the correct answer only (B1 is given for 2 out of 3 terms correct in a single product)
(c)	$\frac{32}{4} \times q^{9-6} \times r^{4-1} = 8q6r^3$	B2	(B1 is given for 2 out of 3 terms correct in a single product)

Question 6 (Total 2 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$\frac{3^{7-2}}{3^3} = \frac{3^5}{3^3} = 3^{5-3} = 3^2$	M1	This mark is given for using the laws of indices to simplify the expression
	9	A1	This mark is given for the correct answer only

Question 7 (Total 1 mark)

Part	Working or answer an examiner might expect to see	Mark	Notes
	Patrick needs to find the fourth root of 64 rather than a quarter of 64	C1	This mark is given for a correct explanation

Question 8 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	10	1	This mark is given for the correct answer only
(b)	$125^{\frac{2}{3}} = (\sqrt[3]{125})^2$ or $\sqrt[3]{125} = 5$	1	This mark is given for a start to finding the answer
	25	1	This mark is given for the correct answer only

Question 9 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	1	B1	This mark is given for the correct answer only
(b)	$\frac{1}{\sqrt{49}}$ or 7	M1	This mark is given for a first step towards the solution
	$\frac{1}{7}$	A1	This mark is given for the correct answer only
(c)	$\sqrt[3]{64} = 4$ or $64^2 = 4096$	M1	This mark is given for a first step towards the solution
	16	A1	This mark is given for the correct answer only

Question 10 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$\sqrt[4]{27 \times 3} = 3$ and $\sqrt[4]{10^8} = 10^2 = 100$	B1	This mark is given for the correct use of index rules
	$3 \times 100 = 300$	B1	This mark is given for the correct answer only (as 300 or 3×10^2)
(b)	$\left(\frac{216}{1000}\right)^{-\frac{2}{3}} = \left(\frac{1000}{216}\right)^{\frac{2}{3}} = \left(\frac{10}{6}\right)^2 =$	M1	This mark is given for working out at least one step (reciprocal or cube root to both numbers)
	$\frac{100}{36} = \frac{25}{9}$	A1	This mark is given for the correct answer only

Question 11 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$16 = 2^4$ or $8 = 2^3$	P1	This mark is given for converting to a common base with at least one correct conversion
	$(2^4)^{\frac{1}{5}} \times 2^x = (2^3)^{\frac{3}{4}}$ $2^{\frac{4}{5}+x} = 2^{\frac{9}{4}}$	P1	This mark is given for a process to use of index laws to derive an equation
	$\frac{4}{5} + x = \frac{9}{4}$ $x = \frac{29}{20} = 1.45$	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
	$(3^2)^{-\frac{1}{2}} = (3^3)^{\frac{1}{4}} \times 3^{-(x+1)}$ $3^{-1} = 3^{\frac{3}{4}} \times 3^{-(x+1)}$	P1	This mark is given for a process to convert to a common base
	$-1 = \frac{3}{4} - (x+1)$	P1	This mark is given for a process to use the index laws to derive an equation in x
	$x = \frac{3}{4}$	A1	This mark is given for the correct answer only

Question 13 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$16^{\frac{1}{4}} = 2, 81^{\frac{1}{4}} = 3$	M1	This mark is given for a method to find the fourth root of both 16 and 81
	$2^3 = 8, 3^3 = 27$ $\frac{8}{27}$	A1	This mark is given for the correct answer only
(b)	$3^{-1} = \frac{1}{9}, \quad 3^{1.5} = 9\sqrt{3}, \quad 3^{-0.5} =$ $\frac{1}{\sqrt{3}}$	M1	This mark is given for finding the values of a, b and c
	$-1 + 1.5 + -0.5 = 0$	A1	This mark is given for the correct answer only

Question 14 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	3^{4n} or 5^4 or $(3^{-n})^{-4}$ or 0.2^{-4}	M1	This mark is given for one of these terms seen in an attempt to set up an equation to solve
	$3^{4n} = 5^4$ or $(3^{-n})^{-4} = 0.2^{-4} = 625$	A1	This mark is given for the correct answer 625 only

Mark scheme for 1MA1 Higher themed papers: Indices

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	1a	Mock Set 3	1H	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1b	1b	Mock Set 3	1H	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1c	1c	Mock Set 3	1H	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2a	7a	Nov 2019	1H	1	Algebra	A4	1	70	0.70	1.00	1.00	0.90	0.82	0.77	0.68	0.56	-	-	0.41
2b	7b	Nov 2019	1H	2	Algebra	A4	1	73	1.46	2.00	2.00	1.91	1.86	1.70	1.48	0.99	-	-	0.52
3a	9a	June 2018	1H	1	Number	N7	1	82	0.82	1.00	0.99	0.96	0.90	0.76	0.57	0.40	-	-	0.23
3b	9b	June 2018	1H	1	Number	N7	1	87	0.87	1.00	0.98	0.96	0.92	0.83	0.72	0.58	-	-	0.40
3c	9c	June 2018	1H	2	Number	N7	1	62	1.24	1.97	1.86	1.65	1.33	0.94	0.57	0.31	-	-	0.12
4a	12a	June 2017	1H	2	Number	N7	1	69	1.38	1.97	1.89	1.73	1.48	1.14	0.75	0.42	-	-	0.22
4b	12b	June 2017	1H	2	Number	N78	1	55	1.09	1.95	1.81	1.55	1.15	0.69	0.31	0.10	-	-	0.03
5a	1a	June 2018	2H	1	Algebra	A4	1	97	0.97	1.00	0.99	0.99	0.99	0.97	0.94	0.88	-	-	0.74
5b	1b	June 2018	2H	2	Algebra	A4	1	43	0.86	1.85	1.52	1.13	0.81	0.55	0.34	0.16	-	-	0.08
5c	1c	June 2018	2H	2	Algebra	A4	1	79	1.57	1.97	1.92	1.81	1.66	1.45	1.17	0.83	-	-	0.50
6	1	Nov 2018	1H	2	Number	N6, N7	1	36	0.71	1.10	1.67	1.29	1.08	0.91	0.67	0.37	-	-	0.23
7	12	June 2019	3H	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8a	10a	Nov 2017	1H	1	Number	N7	1	33	0.33	1.00	0.97	0.92	0.86	0.61	0.35	0.14			0.04
8b	10b	Nov 2017	1H	2	Number	N7	1	29	0.58	2.00	2.00	1.71	1.54	1.08	0.57	0.27			0.09
9a	12a	Mock Set 4	1H	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9b	12b	Mock Set 4	1H	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9c	12c	Mock Set 4	1H	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10a	15a	Mock Set 2	1H	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10b	15b	Mock Set 2	1H	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

11	18	June 2017	2H	3	Number	N7, A4, A17	3	24	0.71	2.08	1.32	0.88	0.58	0.38	0.22	0.09	-	-	0.02
12	19	Nov 2019	1H	3	Algebra	N7, A4	3	9	0.26	2.33	1.62	0.93	0.50	0.26	0.08	0.01	-	-	0.01
13a	14a	Nov 2018	1H	2	Number	N7	1	27	0.53	2.00	1.94	1.64	1.06	0.84	0.29	0.09	-	-	0.05
13b	14b	Nov 2018	1H	2	Number	N7	1	5	0.10	1.70	1.15	0.63	0.16	0.07	0.01	0.00	-	-	0.00
14	14	Mock Set 1	2H	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				43					14.18	27.92	25.63	21.59	17.7	13.95	9.72	6.2	-	-	3.69