

Mark scheme for 1MA1 Higher themed papers: Direct and Inverse Proportion

GCSE Mathematics (1MA1)

Themed papers – Direct and inverse Proportion

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.

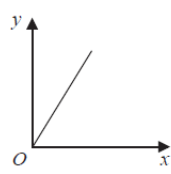
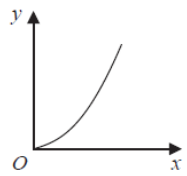
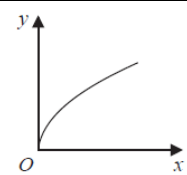
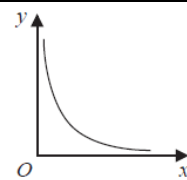
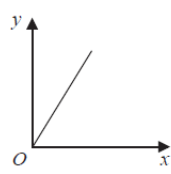
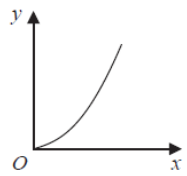
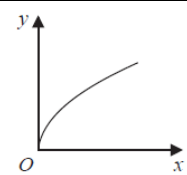
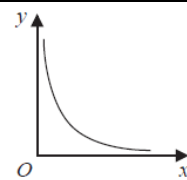
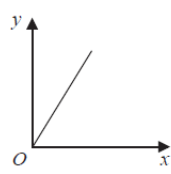
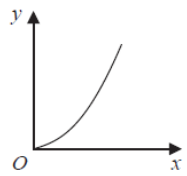
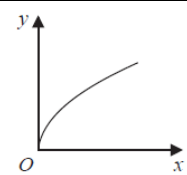
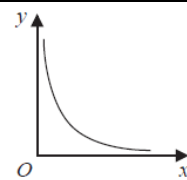
A1 – accuracy mark. This mark is generally given for a correct answer following correct working.

B1 – working mark. This mark is usually given when working and the answer cannot easily be separated.

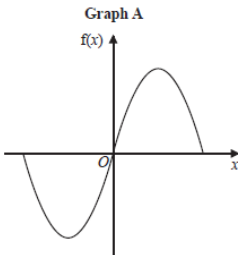
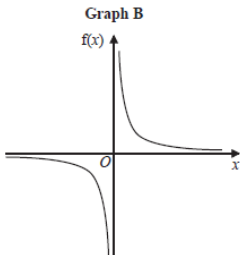
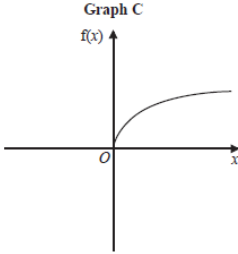
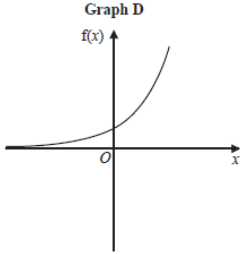
C1 – communication mark. This mark is given for explaining your answer or giving a conclusion in context supported by your working.

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 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes										
	<table><tr><th>Type of proportionality</th><th>Graph</th></tr><tr><td>$y \propto x$</td><td> Graph B </td></tr><tr><td>$y \propto x^2$</td><td> Graph D </td></tr><tr><td>$y \propto \sqrt{x}$</td><td> Graph A </td></tr><tr><td>$y \propto \frac{1}{x}$</td><td> Graph C </td></tr></table>	Type of proportionality	Graph	$y \propto x$	Graph B 	$y \propto x^2$	Graph D 	$y \propto \sqrt{x}$	Graph A 	$y \propto \frac{1}{x}$	Graph C 	B2	These marks are given for all four graphs identified correctly (B1 is given for at least 2 identified correctly)
Type of proportionality	Graph												
$y \propto x$	Graph B 												
$y \propto x^2$	Graph D 												
$y \propto \sqrt{x}$	Graph A 												
$y \propto \frac{1}{x}$	Graph C 												

Question 2 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes										
	Graph A  Graph B  Graph C  Graph D  <table><tr><th>Description of function</th><th>Graph</th></tr><tr><td>$f(x)$ is inversely proportional to x</td><td>B</td></tr><tr><td>$f(x)$ is a trigonometrical function</td><td>A</td></tr><tr><td>$f(x)$ is an exponential function</td><td>D</td></tr><tr><td>$f(x)$ is directly proportional to $\sqrt{x}$</td><td>C</td></tr></table>	Description of function	Graph	$f(x)$ is inversely proportional to x	B	$f(x)$ is a trigonometrical function	A	$f(x)$ is an exponential function	D	$f(x)$ is directly proportional to $\sqrt{x}$	C	B2	These marks are given for all four graphs labelled correctly (B1 is given for two graphs labelled correctly)
Description of function	Graph												
$f(x)$ is inversely proportional to x	B												
$f(x)$ is a trigonometrical function	A												
$f(x)$ is an exponential function	D												
$f(x)$ is directly proportional to $\sqrt{x}$	C												

Question 3 (Total 4 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$h = \frac{k}{p}$ and $p = K\sqrt{t}$	P1	This mark is given for a method to set up proportional relationships between h and p and between p and $\sqrt{t}$
	$10 = \frac{k}{6}$ so $k = 60$ $6 = K \times 12$ so $K = 0.5$	P1	This mark is given for a process to find values for both k and K
	$h = \frac{60}{p}$ $p = 0.5\sqrt{t}$	P1	This mark is given for a process to find expressions for both h and p
	$h = \frac{60}{0.5\sqrt{t}} = \frac{120}{\sqrt{t}}$	A1	This mark is given for the correct answer only

Question 4 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$y \propto \frac{1}{d^2}$ or $y = \frac{k}{d^2}$	M1	This mark is given for a process to set up a correct proportional relationship
	$4 = \frac{k}{10^2} = \frac{k}{100}$, $k = 400$	P1	This mark is given for a process to find a value of k
	$d \propto x^2$ or $d = kx^2$ $24 = k \times 4$, $k = 6$	P1	This mark is given for a process to set up a second correct proportional relationship
	$y = \frac{400}{d^2} = \frac{400}{(6x^2)^2} = \frac{400}{36x^4}$	P1	This mark is given for a process to find y in terms of x
	$y = \frac{100}{9x^4}$	A1	This mark is given for a correct and fully simplified answer only

Question 5 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$y = \frac{k}{x^2}$ Substituting, $9 = \frac{k}{1^2} \quad \text{or} \quad 2\frac{1}{4} = \frac{k}{2^2}$ or $1 = \frac{k}{3^2} \quad \text{or} \quad 2\frac{9}{16} = \frac{k}{4^2}$ so $k = 9$	M1	This mark is given for a method to find an equation for y in the form $y = \frac{k}{x^2}$ and thus the constant k
	$y = \frac{9}{x^2}$	A1	This mark is given for the correct answer only
(b)	$16 = \frac{9}{x^2} \quad \text{so} \quad x^2 = \frac{9}{16}, \quad x = \sqrt{\frac{9}{16}}$	M1	This mark is given for a method to substitute $y = 16$ into the proportional formula and rearrange
	$x = \frac{3}{4}$	A1	This mark is given for the correct answer only

Question 6 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$y = \frac{k}{x^2} \quad \text{so} \quad 8 = \frac{k}{2.5^2}$	P1	This mark is given for stating a correct relationship between x and y
	$k = 8 \times 6.25 = 50$	P1	This mark is given for a method to find the value of k
	$\frac{8}{9} = \frac{50}{x^2}$ $x^2 = \frac{50 \times 9}{8} = 56.25$ $x = 7.5 \text{ or } -7.5$ Negative value of $x = -7.5$	P1	This mark is given for the correct answer only

Question 7 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$y \propto \frac{1}{x^3}$ or $y = \frac{k}{x^3}$	M1	This mark is given for constructing a proportional equation
	$44 = \frac{k}{a^3}$ so $k = 44a^3$	M1	This mark is given for a method to find a value for k
	When $x = 2a$, $y = \frac{44a^3}{(2a)^3} = \frac{44a^3}{8a^3} = 5.5$	C1	This mark is given for a complete method to show $y = 5.5$.

Question 8 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$y = k\sqrt[3]{x}$ $\frac{7}{6} = 2k$ $k = \frac{7}{12}$	1	This mark is given for substituting to find a value for k
	$y = \frac{7}{12} \times 4$	1	This mark is given for finding an expression for y when $x = 64$
	$y = 2\frac{1}{3}$	1	This mark is given for the correct answer only

Question 9 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$T = \frac{k}{u^3}$ so $0.0096 = \frac{k}{5^3}$, $T = \frac{1.2}{u^3}$	M1	This mark is given for a method to use the constant k and substitute values for u and T .
	$u = \sqrt[3]{\frac{1.2}{0.15}}$	M1	This mark is given for a method to find a value for u
	2	A1	This mark is given for the correct answer only

Question 10 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$P \propto \frac{1}{\sqrt{m}}$ or $P = \frac{k}{\sqrt{m}}$	M1	This mark is given for an interpretation of the first line
	$10 = \frac{k}{\sqrt{0.25}}$ so $k = 5$	M1	This mark is given for a method to find the constant of proportionality
	$\frac{5}{\sqrt{m}} = 2$ so $\sqrt{m} = 2.5$ $m = 6\frac{1}{4}$	A1	This mark is given for the correct answer only

Question 11 (Total 3 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	E, C, D, A, B	B3	These marks are given for all five graphs labelled correctly (B2 for 3 or 4 graphs correct, B1 for 1 or 2 graphs correct)

Question 12 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$y = \frac{k}{x^2}$	M1	This mark is given for a forming an equation of proportionality
	$1 = \frac{k}{10^2}$ so $k = 100$	M1	This mark is given for substituting value of y to find k
	$y = \frac{100}{x^2}$, so when $x = 5$ $y = \frac{100}{5^2} = \frac{100}{25} = 4$	A1	This mark is given for the correct answer only

Mark scheme for 1MA1 Higher themed papers: Direct and Inverse Proportion

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
1	12	June 2018	2H	2	Ratio	R10	2	71	1.41	1.92	1.80	1.64	1.45	1.23	1.02	0.82	-	-	0.61
2	17	June 2019	3H	2	Algebra	A12, R10, R14	2	51	1.02	1.85	1.59	1.28	0.95	0.67	0.49	0.40	-	-	0.37
3	20	June 2019	1H	4	Ratio	R10	3	49	1.95	3.79	3.30	2.57	1.81	1.16	0.63	0.32	-	-	0.14
4	14	June 2018	1H	5	Ratio	R13, A4	3	43	2.16	4.32	3.57	2.92	2.24	1.43	0.76	0.35	-	-	0.12
5a	13a	June 2017	1H	2	Ratio	R13	1	43	0.85	1.91	1.71	1.32	0.81	0.36	0.11	0.02	-	-	0.01
5b	13b	June 2017	1H	2	Ratio	R13	1	31	0.61	1.84	1.44	0.91	0.45	0.16	0.04	0.01	-	-	0.00
6	16	Nov 2019	3H	3	Ratio	R13	1	20	0.61	3.00	2.30	2.05	1.36	0.69	0.22	0.02	-	-	0.00
7	14	Nov 2018	3H	3	Ratio	R13	2	20	0.59	3.00	2.41	1.72	1.35	0.88	0.29	0.09	-	-	0.02
8	16	Nov 2017	1H	3	Ratio	R13	1	7	0.22	3.00	2.29	1.58	0.94	0.37	0.10	0.03	-	-	0.00
9	18	Mock Set 2	2H	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	11	Mock Set 3	1H	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	13	Mock Set 3	2H	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	16	Mock Set 4	1H	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				34					6.99	20.86	17.02	13.07	8.96	5.05	2.15	0.84	-	-	0.29