

GCSE Mathematics (1MA1)

Themed papers – Complete the Square

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).

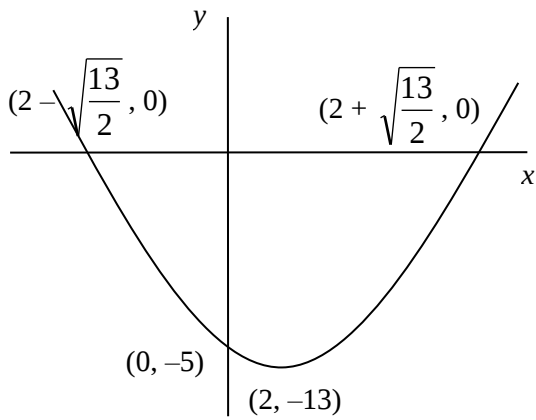
Question 1 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(i)	$x^2 - 6x + 9 = (x - 3)^2$ $a = 3$	M1	This mark is given for method to find a value for a
	$x^2 - 6x + 1 = (x - 3)^2 - 8$ $b = 8$	A1	This mark is given for method to find a value for b
(ii)	(3, -8)	B1	This mark is given for the correct answer only

Question 2 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$(x + 1)^2$	M1	
	$(x + 1)^2 - 9$	A1	This mark is given for the correct answer only

Question 3 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$x = \frac{-(-8) \pm \sqrt{(-8)^2 - 4 \times 2 \times -5}}{2 \times 2}$	M1	This mark is given for a method to find the roots of $y = 0$
	$x = 2 + \sqrt{\frac{13}{2}}, \quad 2 - \sqrt{\frac{13}{2}}$	M1	This mark is given for finding the roots of $y = 0$
	$x\text{-coordinate for turning point} =$ $\frac{1}{2} \left(2 + \sqrt{\frac{13}{2}} + 2 - \sqrt{\frac{13}{2}} \right) = 2$ When $x = 2, y = -13$	M1	This mark is given for the turning point of $y = 2x^2 - 8x - 5$
		C2	These marks are given for a fully correct parabola drawn with axes labelled, a turning point at $(2, -13)$ and intercepts at $(0, -5)$, $(2 + \sqrt{\frac{13}{2}}, 0)$ and $(2 - \sqrt{\frac{13}{2}}, 0)$ clearly shown

Question 4 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$(x + 5)^2 = x^2 + 10x + 25$	M1	This mark is given for a method to start to complete the square
	$x^2 + 10x + 18 = (x + 5)^2 - 7$	M1	This mark is given for a method to complete the square
	$(-5, -7)$	A1	This mark is given for the correct answer only

Question 5 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$(x - 8)(x + 4) = x^2 - 4x - 32$ $(x - a)^2 + b = x^2 - 2ax + a^2 + b$	P1	This mark is given for a process to expand one set of brackets
	$-4x = -2ax, \quad a = 2$	A1	This mark is given for finding the correct value of a
	$32 = a^2 + b$ $32 = 4 + b$ $b = -36$	A1	This mark is given for finding the correct value of b

Question 6 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$2x^2 + 16x + 35 = 2(x^2 + \dots)$	P1	This mark is given for a process to find a
	$2((x + 4)^2 + \dots)$ or $b = 4$	P1	This mark is given for a process to find b
	$2(x + 4)^2 + 3$	A1	This mark is given for a correct equation or for $a = 2, b = 4, c = 3$
(b)	$(-4, 3)$	B1	This mark is given for the correct answer only, or follow through from answer in part (a) of form $a(x + b)^2 + c$

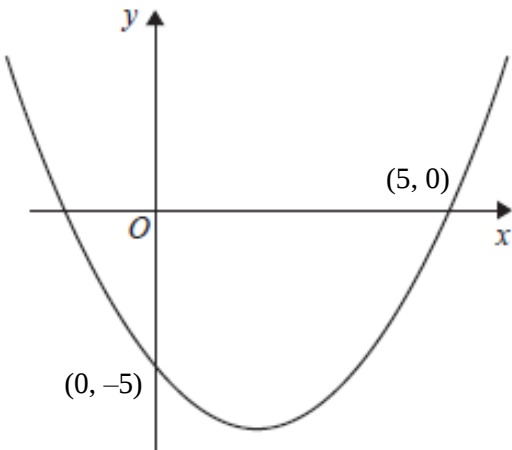
Question 7 (Total 4 marks) – Version 1

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\frac{1}{10}x^2 - 3x = 0$	P1	This process mark is given for a process to find the points where the curve meets the x-axis
	$x = 0$ and $x = 30$	P1	This process mark is given for finding the points where the curve meets the x-axis
	$\frac{1}{10}x^2 - 3x$ when $x = 15$	P1	This process mark is given for finding the x-coordinate for the deepest point on the curve ($x = 15$) and substituting
	22.5 (cm)	A1	This accuracy mark is given for the correct answer only

Question 7 (Total 4 marks) – Version 2

Part	Working or answer an examiner might expect to see	Mark	Notes
	$y = \frac{1}{10}(x^2 - 30x)$	P1	This process mark is given for rearranging $y = \frac{x^2}{10} - 3x$
	$y = \frac{1}{10}((x - 15)^2 - 225)$	P1	This process mark is given for process to rearrange the equation and complete the square
	$\frac{1}{10}((x - 15)^2 - 225)$ when $x = 15$	P1	This process mark is given for finding the x-coordinate for the deepest point on the curve ($x = 15$) and substituting
	22.5 (cm)	A1	This accuracy mark is given for the correct answer only

Question 8 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	 When $x = 0$ and $y = -5$, $-5 = 0^2 + (a \times 0) + b$ $b = -5$	P1	This mark is given for a process to substitute to find the value of b
	When $x = 5$ and $y = 0$, $0 = 5^2 + 5a - 5$ $a = -4$	P1	This mark is given for a process to substitute to find the value of a
	$y = x^2 - 4x - 5 = (x + 1)(x - 5)$ Thus the other intercept is at $(-1, 0)$	P1	This mark is given for a complete process to find the turning point
	Midpoint x-coordinate is 2 When $x = 2$, y-coordinate is -9 Turning point is $(2, -9)$	A1	This mark is given for the correct answer only

Question 9 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$5(16t - t^2)$ or $5t(16 - t)$	P1	This mark is given for factorising
	$-5[(t - 8)^2 - 64]$	P1	This mark is given for completing the square
	$(80 \times 8) - (5 \times 64)$	P1	This mark is given for a substitution of $t = 8$ into $s = 80t - 5t^2$
	320	A1	This mark is given for the correct answer only

Mark scheme for 1MA1 Higher themed papers: Complete the Square

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
1i	19i	June 2019	1H	2	Algebra	A11	2	33	0.66	1.80	1.40	0.90	0.49	0.24	0.13	0.08	-	-	0.06
1ii	19ii	June 2019	1H	1	Algebra	A11	1	27	0.27	0.90	0.66	0.37	0.15	0.05	0.02	0.01	-	-	0.01
2	11	Spec Set 1	3H	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	21	Nov 2019	1H	5	Algebra	A18	1	5	0.23	4.11	2.05	1.03	0.37	0.18	0.03	0.01	-	-	0
4	19	Mock Set 2	2H	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	18	Mock Set 3	2H	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6a	23a	Spec Set 2	3H	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6b	23b	Spec Set 2	3H	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	15	Mock Set 1	1H	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	17	Nov 2018	1H	4	Algebra	A11, A12	3	5	0.20	4.00	3.18	0.99	0.39	0.14	0.03	0.01	-	-	0.00
9	14	Mock Set 3	1H	4															
				32					1.36	10.81	7.29	3.29	1.4	0.61	0.21	0.11	-	-	0.07