

GCSE Mathematics (1MA1)

Themed papers – Coordinate geometry: Circles

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.

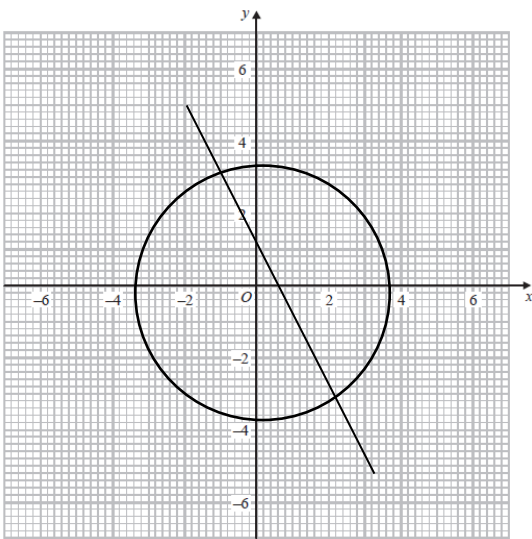
A1 – accuracy mark. This mark is generally given for a correct answer following correct working.

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 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)		B1	This mark is given for a circle with centre (0, 0)
		B1	This mark is given for a circle with a radius of 3.5
		M1	This mark is given for the line $2x + y = 1$ drawn
(b)	$x = 2.0, y = -2.9$ $x = -1.2, y = 3.3$	A1	This mark is given for one correct pair of solutions for x and y
		A1	This mark is given for both correct pairs of solutions for x and y , unambiguously matched

Question 2 (Total 1mark)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\sqrt{42.25} = 6.5$	B1	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)	The curve cuts the y axis at $x = 0$ $y = a^x = a^0 = 1$ $(0, 1)$	B1	This mark is given for the correct answer only
(b)		M1	This mark is given for any one of a circle with radius 4, centre $(3, 0)$ or points $(-1, 0)$ and $(7, 0)$ labelled
		M1	This mark is given for any further element of a circle with radius 4, centre $(3, 0)$ or points $(-1, 0)$ and $(7, 0)$ labelled
	A hand-drawn sketch of a circle on a Cartesian coordinate system. The circle is centered at $(3, 0)$ on the x-axis. The x-axis is labeled with points $(-1, 0)$, $(3, 0)$, and $(7, 0)$. The y-axis is also shown, intersecting the circle at $(3, 4)$ and $(3, -4)$.	A1	This mark is given for a fully correct sketch only: a circle with radius 4 and centre $(3, 0)$ and with the points $(-1, 0)$ and $(7, 0)$ labelled

Question 4 (Total 4 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
(a)	$OA = 16 \sin 30^\circ = 8$	P1	This mark is given for a process to find the length OA
	$x^2 + y^2 = 64$	P1	This mark is for a process to use the equation of the circle $x^2 + y^2 = r^2$
	$9p^2 + p^2 = 64$ $10p^2 = 64$ $p = \sqrt{6.4}$	P1	This mark is given for a process to substitute $3p$ and p into the equation for a circle to solve for p
	2.53	A1	This mark is given for a correct answer in the range 2.52 to 2.53

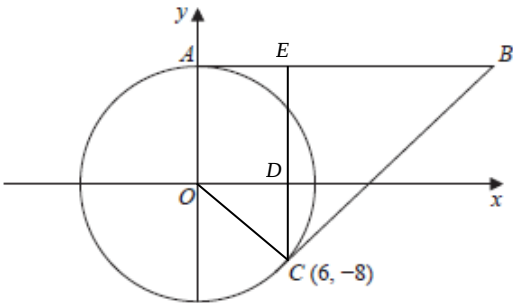
Question 5 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$-1 \div \frac{3}{4} = -\frac{4}{3}$	M1	This mark is given for a method to find gradient of tangent
	using $y = -\frac{4}{3}x + c$	M1	This mark is given for a method to find the y -intercept
	$y = -\frac{4}{3}x + \frac{25}{3}$	A1	This mark is given for a correct answer or a correct equivalent

Question 6 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$x = 10 + 2y$ $(10 + 2y)^2 + y^2 = 20$	1	This mark is given for a method to start the process by finding a value for x in terms of y and substituting
	$(100 + 20y + 20y + 4y^2) + y^2 = 20$ $4y^2 + 20y + 20y = 100$	1	This mark is given for expanding brackets on the expression obtained
	$5y^2 + 40y + 80 = 0$	1	This mark is given for forming a quadratic equation to be solved
	$(5y + 20)(y + 4) = 0$ $y = -4, x = 2$	1	This mark is given for solving the quadratic equation for y and so find the value of x
	The line intersects the circle at only one point $(2, -4)$, so must be a tangent	1	This mark is given for a fully correct statement to conclude the proof

Question 7 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$AB = BC$	P1	This mark is given for recognising that the lines AB and BC are equal in length
	 $x^2 + y^2 = 100$ so $OC = 10$ Using Pythagoras' theorem, $CD = 8, DE = 10, OD = 6$	P1	This mark is given for a start to the process to find the length of the tangent AB or BC
	Let length $AB = \text{length } CB = x$ $AE = OD = 6, EB = x - 6, CE = 18$ Using Pythagoras, $CB^2 = EC^2 + EB^2$ $x^2 = 18^2 + (x - 6)^2$ $x^2 = 324 + x^2 - 12x + 36$ $-12x + 360 = 0$ $x = 30$	P1	This mark is given for a complete process to find the length of the tangent AB or BC
	Area of $ABCO = \text{area of triangle } OCB + \text{area of triangle } OAB$ $= 2 \times \frac{1}{2} \times 30 \times 10 = 300$	A1	This mark is given for the correct answer only

Question 8 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	draw diagram and find gradient of $OA (= 3)$	P1	This mark is given for a process to start the problem
		P1	This mark is given for a process to find equation of tangent with $m = -1/3$
		P1	This mark is given for a process to find x-axis intercept of tangent
		P1	This mark is given for a process to find area of triangle
	60	A1	This mark is given for a correct answer only

Question 9 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	Gradient $\frac{y}{x} = \frac{\sqrt{7}}{2} \div \frac{3}{2} = \frac{\sqrt{7}}{3}$	M1	This mark is given for a method to find gradient of OP
	$\frac{\sqrt{7}}{3} \times m = -1$, so $m = \frac{-3}{\sqrt{7}}$	M1	This mark is given for a method to find gradient m of the tangent to OP
	Gradient of tangent to OP, $y = \frac{-3}{\sqrt{7}}x + c$ $\frac{\sqrt{7}}{2} = \frac{-3}{\sqrt{7}} \times \frac{3}{2} + c$ so $c = \frac{\sqrt{7}}{2} + \frac{9}{2\sqrt{7}} = \frac{16}{2\sqrt{7}} = \frac{8}{\sqrt{7}}$ Thus equation of the tangent to L is $y = \frac{-3}{\sqrt{7}}x + \frac{8}{\sqrt{7}}$	A1	This mark is given for the correct answer only

Mark scheme for 1MA1 Higher themed papers: Coordinate geometry: Circles

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	16a	June 2018	2H	2	Algebra	A16	2	41	0.81	1.92	1.74	1.30	0.74	0.29	0.11	0.05	-	-	0.03
1b	16b	June 2018	2H	3	Algebra	A19	2	19	0.58	2.48	1.67	0.79	0.27	0.07	0.02	0.01	-	-	0.00
2	15	Nov 2018	2H	1	Algebra	A16	1	30	0.3	1	0.94	0.81	0.65	0.42	0.2	0.08	-	-	0.01
3a	20a	June 2017	3H	1	Algebra	A14	1	20	0.2	0.81	0.49	0.22	0.1	0.05	0.03	0.03	-	-	0.03
3b	20b	June 2017	3H	3	Algebra	A13	2	25	0.76	2.66	2.01	1.1	0.44	0.14	0.04	0.02	-	-	0.01
4	22	June 2019	3H	4	Algebra	A16, G10, G20	3	11	0.42	2.12	0.9	0.45	0.21	0.08	0.03	0.01	-	-	0
5	23	June 2017	2H	3	Algebra	A16	2	9	0.26	1.89	0.73	0.18	0.04	0.01	0	0	-	-	0
6	19	Nov 2017	3H	5	Algebra	A19 A16	1	2	0.12	4.62	1.88	1.08	0.34	0.19	0.03	0.01			0
7	21	Mock Set 4	1H	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	22	Spec Set 2	1H	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	23	Spec Set 1	2H	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				34					3.45	17.5	10.36	5.93	2.79	1.25	0.46	0.21	-	-	0.08