

Mark scheme for 1MA1 Higher themed papers: Circle Theorems

GCSE Mathematics (1MA1)

Themed papers – Circle Theorems

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
	$BDA = \frac{180 - 40}{2} = 70^\circ$ $BCD = 180 - 70 = 110$	M1	This mark is given for a method to find the angles BDA and BCD
	Base angles at the base of an isosceles triangle are equal Opposite angles of a cyclic quadrilateral add up to 180	C1	This mark is given for two appropriate reasons stated
	$BDC = 55$	M1	This mark is given for a finding the angle BDC
	Base angles at the base of an isosceles triangle are equal	C1	This mark is given for a an appropriate reason stated
	$ADE = 180 - 55 - 70 = 75^\circ$ Angles on a straight line add up to 180°	A1	This mark is given for correctly finding the angle ADE with an appropriate reason stated

Question 2 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$OAD = 90$	B1	This mark is given for a finding the size of the angle OAD
	$AOB = 90 + 32 = 122$ $OAB = \frac{180 - 122}{2} = 29$	M1	This mark is given for a method to find the size of the angle OAB
	$CAB = 180 - 90 - 29 = 61$	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
	$BAO = x$ Base angles in an isosceles triangle are equal $AOB = 180 - 2x$ Angles in a triangle add up to 180° $OBC = 90$ A tangent to a circle is perpendicular to the radius	M1	This mark is given for identifying at least one missing angle
	$180 - x - x - 90$ Angles in a triangle add up to 180°	M1	This mark is given for a full method to find the required angle
	$90 - 2x$	A1	This mark is given for the correct answer in its simplest form
	Base angles in an isosceles triangle are equal, angles in a triangle add up to 180° , a tangent to a circle is perpendicular to the radius	C2	These marks are given for a full set of reasons (One mark is given for one correct reason included)

Question 4 (Total 4 marks) – Version 1

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$ODE = 90$	M1	This mark is given for a method to find one missing angle
	The tangent FDE to the circle is perpendicular (90°) to the radius OD	C1	This mark is given for a correct supporting reason
	$BDE = y$ Alternate segment theorem Thus $y - x = 90$	A1	This mark is given for a complete correct method leading to $y - x = 90$ with all correct reasons given
(b)	No; y must be less than 180 because it is an angle in a triangle.	C1	This mark is given for a correct explanation

Question 4 (Total 4 marks) – Version 2

Part	Working an or answer examiner might expect to see	Mark	Notes
(a)	$DBO = x$	M1	This mark is given for a method to find one missing angle
	Base angles of an isosceles triangle are equal	C1	This mark is given for a correct supporting reason
	$BCD = \frac{1}{2} BOD = 90 - x$ Angle at the centre is double the angle at the circumference $y + 90 - x = 180$ Opposite angles in a cyclic quadrilateral are equal Thus $y - x = 90$	A1	This mark is given for a complete correct method leading to $y - x = 90$ with all correct reasons given
(b)	No; y must be less than 180 because it is an angle in a triangle.	C1	This mark is given for a correct explanation

Question 5 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$OAB = 90 - 56$ $= 34$	C1	This mark is given for a method to find angle OAB
	$BOA = 112$ $BCA = 56$	C1	This mark is given for a method to find angle CAD (angle at the centre is twice that at the circumference)
	$CAO = 180 - 34 - 34 - 35 - 56$ $= 21$	C1	This mark is given for the correct answer only

Question 6 (Total 4 marks) – Version 1

Part	Working or answer an examiner might expect to see	Mark	Notes
	$OAB = 57^\circ$ <u>Alternate segment theorem</u>	M1	This method mark is given for method to find OAB
	$OBA = 57^\circ$ Base <u>angles</u> of an <u>isosceles</u> triangle are <u>equal</u> $AOB = 66^\circ$ <u>Angles</u> in a <u>triangle</u> add up to <u>180°</u>	M1	This method mark is given for complete method to find AOB
	66°	C2	These two communication marks are given for an answer of 66° with all reasons appropriate for their method (C1 (dep on M1) for one appropriate circle theorem reason for their method)

Question 6 (Total 4 marks) – Version 2

Part	Working or answer an examiner might expect to see	Mark	Notes
	$ODB = 90^\circ - 57^\circ = 33^\circ$ The <u>tangent</u> to a circle is <u>perpendicular</u> (90°) to the <u>radius</u> (<u>diameter</u>)	M1	This method mark is given for method to find ODB
	$OBD = 33^\circ$ Base <u>angles</u> of an <u>isosceles</u> triangle are <u>equal</u> $DOB = 114^\circ$ <u>Angles</u> in a <u>triangle</u> add up to <u>180°</u> $AOB = 66^\circ$ <u>Angles</u> on a <u>straight line</u> add up to <u>180°</u>	M1	This method mark is given for complete method to find AOB
	66°	C2	These two communication marks are given for an answer of 66° with all reasons appropriate for their method (C1 (dep on M1) for one appropriate circle theorem reason for their method)

Question 6 (Total 4 marks) – Version 3

Part	Working or answer an examiner might expect to see	Mark	Notes
	$ODB = 90^\circ - 57^\circ = 33^\circ$ The <u>tangent</u> to a circle is <u>perpendicular</u> (90°) to the <u>radius</u> (<u>diameter</u>)	M1	This method mark is given for method to find ODB
	$OBD = 33^\circ$ Base <u>angles</u> of an <u>isosceles</u> triangle are <u>equal</u> $AOB = 66^\circ$ The <u>exterior angle</u> of a triangle is <u>equal</u> to the sum of the <u>interior opposite angles</u>	M1	This method mark is given for complete method to find AOB
	66°	C2	These two communication marks are given for an answer of 66° with all reasons appropriate for their method (C1 (dep on M1) for one appropriate circle theorem reason for their method)

Question 7 (Total 4 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$ACD = 54^\circ$ or $ADC = 66^\circ$	M1	This mark is given for finding the size of angle ACD or ADC
	Alternate segment theorem or Opposite angles of a cyclic quadrilateral add up to 180	C1	This mark is given for a correct reason given for the angle found
	$CAD = 60^\circ$	A1	This mark is given for finding the size of angle $CAD = 60^\circ$
	Angles in a triangle add up to 180	C1	This mark is given for a correct reason given for the angle found

Mark scheme for 1MA1 Higher themed papers: Circle Theorems

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	18	June 2019	2H	5	Geometry	G3, G4, G10	2	52	2.61	4.63	4.20	3.49	2.52	1.61	1.01	0.58	-	-	0.33
2	17	Nov 2019	2H	3	Geometry	G3, G10	2	43	1.30	2.89	2.70	2.68	2.27	1.78	0.89	0.39	-	-	0.16
3	11	June 2018	1H	5	Geometry	G10	2	29	1.45	4.11	3.10	2.04	1.20	0.63	0.29	0.12	-	-	0.07
4a	13a	June 2018	2H	3	Geometry	A21/G10	2	26	0.77	2.33	1.49	0.95	0.66	0.41	0.21	0.08	-	-	0.03
4b	13b	June 2018	2H	1	Geometry	G3	2	55	0.55	0.88	0.76	0.65	0.56	0.45	0.35	0.24	-	-	0.11
5	12	Nov 2018	1H	3	Geometry	G3, G10	2	18	0.54	2.60	2.52	1.91	1.20	0.76	0.25	0.07	-	-	0.07
6	17	Mock Set 1	1H	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	20	Mock Set 2	2H	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				28			12	223	7.22	17.44	14.77	11.72	8.41	5.64	3	1.48			