

GCSE Mathematics (1MA1)

Themed papers – Trigonometry 2D and Bearings

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
	$AB = \sin 38^\circ \times 16$ $AB = 0.61566 \times 16$	M1	This mark is given for a method to find the length of AB
	9.85	A1	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
	$\frac{7.5}{3} = 2.5, \quad \frac{12.5}{5} = 2.5, \quad \frac{10}{4} = 2.5$	M1	This mark is given for a method to divide at least a pair of corresponding sides
	All sides are enlarged by the same factor, so triangles are similar	C1	This mark is given for a correct comment

Question 3 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$16^2 = 6.7^2 + a^2$ or $\sqrt{16^2 - 6.7^2}$	M1	This mark is given for substituting into Pythagoras' theorem
	$\sqrt{256 - 44.89}$	M1	This mark is for a complete method to find the unknown length
	14.5 to 14.53	A1	This mark is given for an answer in the range of 14.5 to 14.53

Question 4 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$\cos ABC = \frac{7}{11} = 0.6363\dots$	M1	This mark is given for a method to find a value for the cosine of the angle ABC
	50.5	A1	This mark is given for the correct answer only (using a calculator)
(b)	The value of $\cos ABC$ increases as the size of the angle decreases	C1	This mark is given for a correct statement with a supporting reason

Question 5 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\sin 30^\circ = \frac{x}{18}$ or $x = 18 \times \sin 30^\circ$	M1	This mark is given for a method to find out a value for x
	$\sin 30^\circ = 0.5$, so $x = 9$	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
	$\tan QPR = \frac{3}{5}$	P1	This mark is given for a process to link 60% to a trigonometric ratio
	$\angle QPR = 30.96^\circ$	P1	This mark is given for a method to find the size of angle QPR
	$\sin QPR = 0.514$	A1	This mark is given for the correct answer only

Question 7 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\frac{BD}{\sin 34^\circ} = \frac{12.5}{\sin 109^\circ}$	P1	This mark is given for using the sine rule as a start of the process to find the length BD
	$BD = \frac{12.5}{\sin 109^\circ} \times \sin 34^\circ$ $= 7.39$	P1	This mark is given for a complete process to find the length BD
	$AD^2 =$ $11.4^2 + 7.39^2 - (2 \times 11.4 \times 7.39 \times \cos 86^\circ)$	P1	This mark is given for using the cosine rule as a start of the process to find the length AD
	$AD^2 = 129.96 + 54.6 - 11.75$ $= 172.85$	P1	This mark is given for a complete process to find the length AD
	$AD = 13.1$	A1	This 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
	$\frac{90}{(2+3)} = 18$ $A = 2 \times 18 = 36^\circ$ $B = 3 \times 18 = 54^\circ$	P1	This mark is given for a process to find values for angles A and B
	$\cos 36^\circ = 0.809$	P1	This mark is given for writing a value for $\cos A$
	$AB = \frac{14}{\cos A} = \frac{14}{0.809}$	P1	This mark is given for a process to find the length AB
	17.3	A1	This mark is given for the correct answer in the range 17.3 to 17.4

Question 9 (Total 3 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)	$\cos 60^\circ = \frac{4}{x}$ $0.5 = \frac{4}{x}, x = \frac{4}{0.5}$	M1	This mark is given for a method to find the value of x
	8	A1	This mark is given for the correct answer only

Question 10 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\frac{1}{2}(x+3)(2x-1)\sin 45 = 6\sqrt{2}$	P1	This mark is given for setting up an expression for the area in the form $\frac{1}{2}ab\sin C$
	$\frac{1}{2}(2x^2 - 5x + 3)\sin 45 = 6\sqrt{2}$	P1	This mark is given for expanding the brackets in the expression to form an equation
	$\frac{1}{2}(2x^2 - 5x + 3) \frac{1}{\sqrt{2}} = 6\sqrt{2}$ $2x^2 - 5x + 3 = 24$	P1	This mark is given for a process to set up the equation and rearrange to the form $ax^2 + bx + c + d$
	$2x^2 - 5x - 27 = 0$ $x = \frac{-5 \pm \sqrt{5^2 - 4 \times 2 \times -27}}{4}$	P1	This mark is given for a substitution into the quadratic formula
	2.63	A1	This mark is given for the correct answer only

Question 11 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\sin 40^\circ = \frac{DB}{8.6}$ $DB = 8.6 \sin 40^\circ = 5.528$	P1	This mark is given for a process to find the length DB
	$ED = \frac{5.528}{2} = 2.764$	P1	This mark is given for a process to find the length ED
	$\angle EAD = \tan^{-1}\left(\frac{2.764}{4.4}\right)$	P1	This mark is given for a process to find the angle EAD
	$\angle EAD = 32.1$	A1	This mark is given for the correct answer given to 1 decimal place

Question 12 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$7.5^2 - 6^2$	1	This mark is given for a method to find the third length of the right angled triangle shown
	$7.5^2 - 6^2 = 56.25 - 36 = 20.25$ $\sqrt{20.25} = 4.5$	1	This mark is given for finding the third length of the right angled triangle shown
	$24 - 4.5 - 10 = 9.5$	1	This mark is given for finding a length for a right angled triangle to be able to calculate angle CDA
	$\tan CDA = \frac{6}{9.5}$	1	This mark is given for finding the tangent of the angle CDA
	$\text{angle } CDA = 32.3^\circ$	1	This mark is given for an answer in the range 32.2–32.3

Question 13 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$4.5^2 + 7^2$	P1	This mark is given for a process using Pythagoras to find the length KM
	$\sqrt{(4.5^2 + 7^2)} = \sqrt{69.25} = 8.32\dots$	P1	This mark is given for finding the length KM
	$\sin KLM = \frac{\sqrt{69.25}}{15} = 0.55477\dots$	P1	This mark is given for a process to find the sine of angle KLM
	$\angle KLM = 33.7$	A1	This mark is given for the correct answer only

Question 14 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\frac{x}{4x-1} = \frac{6x+5}{12x+31}$	P1	This mark is given for a process to derive an equation in x
	$(4x-1)(6x+5) = x(12x+31)$	P1	This mark is given for a process to remove fractions from the equation
	$24x^2 + 14x - 5 = 12x^2 + 31x$ $24x^2 + 14x - 5 - 12x^2 - 31x = 0$ $12x^2 - 17x - 5 = 0$	P1	This mark is given for a process to form a quadratic equation
	$(4x+1)(3x-5) = 0$ or $\frac{-(-17) \pm \sqrt{289 - (4 \times 12 \times -5)}}{24}$ $= \frac{17 \pm \sqrt{529}}{24}$	P1	This mark is given for a process to solve the quadratic equation, either by factorising or by using the quadratic formula
	$x = \frac{5}{3}$ (rejecting $x = -\frac{1}{4}$)	A1	This mark is given for the correct answer only

Question 15 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\frac{DB}{\sin 70} = \frac{39}{\sin 74}$	P1	This mark is given for a start to the process using the sine rule
	$\frac{39}{\sin 74} \times \sin 70 = 38.1$	P1	
	$BDC = 180 - 70 - 74 = 36$	P1	
	$0.5 \times 52 \times 38.1 \times \sin "36"$	P1	
	583	A1	This mark is given for an answer in the range of 582 to 583

Question 16 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$CD^2 = 4.9^2 + 3.8^2 - 2 \times 4.9 \times 3.8 \times \cos 80 = 31.98$	P1	This mark is for a start to the process by using cosine rule to find CD
	$\frac{\sin C}{3.8} = \frac{\sin 80}{'5.655'}$ or $\frac{\sin D}{4.9} = \frac{\sin 80}{'5.655'}$	P1	This mark is for using the sine rule to find angle ACD or angle ADC
	$\frac{BD}{\sin 25} = \frac{'5.655'}{\sin '33.6'}$	P1	This mark is for using the sine rule to find BC or BD
	$1/2 ab \sin C$	P1	This mark is for a process to find area
	10.4 to 10.43	A1	This mark is given for an answer in the range of 10.4 to 10.43

Question 17 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\text{Area of triangle } ADC = \frac{1}{2} ab \sin C$ $= 0.5 \times 11 \times (CD \times \sin 105^\circ) = 56$	1	This mark is given for finding an equation for the area of triangle ADC
	$CD = \frac{56}{0.5 \times 11 \times \sin 105^\circ} = \frac{56}{5.312...}$ $= 10.54$	1	This mark is given for finding the length of CD
	$AC^2 =$ $11^2 + (10.54)^2 - 2 \times 11 \times 10.54 \times \cos 105^\circ$ $= 232.0916 + 60.01496$ $= 292.10656$ $AC = 17.091125$	1	This mark is given for using the cosine rule $c^2 = a^2 + b^2 - 2ab \cos C$ to find the length of AC
	$\frac{AB}{\sin 48^\circ} = \frac{AC}{\sin 118^\circ}$ $\frac{AB}{0.743} = \frac{17.09}{0.883}$ $AB = \frac{17.09 \times 0.743}{0.883}$	1	This mark is given for a method to use the sine rule to find the length of AB
	14.38	1	This mark is given for an answer in the range 14.3 – 14.4

Question 18 (Total 5 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$0.5 \times 7 \times BC \times \sin 70^\circ = 42$	P1	This mark is given for a process to make a correct substitution into $\frac{1}{2} ab \sin C$
	$BC = \frac{84}{0.5 \times 7 \times \sin 70} (= 12.77013327)$	P1	This mark is given for a process to rearrange to find the length BC
	$AB^2 = BC^2 + 7^2 - (2 \times BC \times 7 \times \cos 70^\circ)$	P1	This mark is given for a process to use the cosine rule to find the length AB
	$AB^2 = 163.0763 + 49 - (14 \times 12.770 \times 0.342) = 150.9$	P1	This mark is given for a process to find a value for AB^2
	$AB = \sqrt{150.9} = 12.3$	A1	This mark is given for an answer in the range 12.28 – 12.3

Question 19 (Total 53 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	Shown on diagram		This mark is given for identifying the angle of 70°
	eg. for process to find angle BAC , eg. $(180 - 50) \div 2 (= 65^\circ)$		This mark is given for a process to find an angle in triangle ABC ,
	135		This mark is given for a correct answer only

Question 20 (Total 5 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$ABC = 360^\circ - 150^\circ - 143^\circ = 67^\circ$	P1	This mark is given for a process to find the angle ABC
	$AC^2 = 9^2 + 8^2 - 2 \times 9 \times 8 \times \cos 67^\circ$ $AC^2 = 88.734\dots$	P1	This mark is given for a process to use the cosine rule $AC^2 = AB^2 + BC^2 - 2 \times AB \times BC \cos ABC$ to find AC
	$AC = 9.412$	P1	This mark is given for correctly finding the distance AC
	$\frac{\sin BAC}{9} = \frac{\sin 67^\circ}{9.412}$ $\sin BAC = \frac{9 \sin 67^\circ}{9.412} = 0.8802$ $BAC = 61.6^\circ$	P1	This mark is given for a process to use the sine rule to find the angle BAC
	$37 + 62.6 = 098.6$	A1	This mark is given for a correct answer in the range 098.5 to 098.6

Question 21 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$3.4^2 = 6.1^2 + 6.2^2 - (2 \times 6.1 \times 6.2 \times \cos C)$	B1	This mark is given for the correct use of the cosine rule $c^2 = a^2 + b^2 \cos C$
	$11.56 = 37.21 + 38.44 - (75.64 \times \cos C)$ $\cos C = \frac{64.09}{75.64} = 0.8473\dots$ $\angle BCA = 32.08^\circ$	P1	This mark is given for a process to find the value of $\angle BCA$
	$\frac{DC}{\sin(32.08 \times \frac{2}{5})} = \frac{6.2}{\sin(180 - 32.08 - (32.08 \times \frac{2}{5}))}$ $\frac{DC}{0.222\dots} = \frac{6.2}{0.706\dots}$	P1	This mark is given for a correct substitution using the sine rule
	$DC = \frac{0.222\dots \times 6.2}{0.706\dots}$	P1	This mark is given for a process to find the length DC
	1.95	A1	This mark is given for a correct answer only (to 3 significant figures)

Question 22 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\cos 30^\circ = \frac{\sqrt{3}}{2}$	B1	This mark is given for a correct statement about the value of $\cos 30^\circ$ (seen anywhere)
	$PQ^2 = 10^2 + 10^2 - 2 \times 10 \times 10 \times \cos PBQ$ $= 200 - 200 \cos PBQ$	M1	This mark is given for applying the cosine rule to find an expression for PQ^2
	$AC^2 = x^2 + x^2 - 2 \times x \times x \times \cos 30^\circ$ $= 2x^2 - 2x^2 \frac{\sqrt{3}}{2}$ $= 2x^2(1 - \frac{\sqrt{3}}{2})$ $= (2 - \sqrt{3})x^2$	M1	This mark is given for applying the cosine rule to find an expression for AC^2
	$\cos PBQ = \frac{200 - PQ^2}{200} = 1 - \frac{PQ^2}{200}$	M1	This mark is given for rearranging to find an expression for $\cos PBQ$
	$\cos PBQ = 1 - \frac{PQ^2}{200} = 1 - \frac{AC^2}{200}$ $= 1 - \frac{(2 - \sqrt{3})x^2}{200}$	A1	This mark is given for a conclusion of proof with all working seen

Question 23 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	Arc length = $25 - 9 - 9 = 7$	P1	This mark is given for a process to find the arc length
	$\frac{7}{2\pi r} = \frac{7}{18\pi} = \frac{x}{360}$	P1	This mark is given for a process linking the arc length to the circumference
	$x = \frac{7 \times 360}{18\pi}$	P1	This mark is given for a complete process to find the value of x
	$= 44.6^\circ$	A1	This mark is given for the correct answer only

Mark scheme for 1MA1 Higher themed papers: Trigonometry 2D and Bearings

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	5	June 2019	2H	2	Geometry	G20	1	83	1.65	1.97	1.95	1.9	1.78	1.5	1.06	0.53	-	-	0.22
2	7	June 2017	3H	2	Geometry	G20	1	77	1.54	1.97	1.92	1.85	1.69	1.4	0.93	0.4	-	-	0.12
3	3	Mock set 4	2H	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4a	5a	June 2018	3H	2	Geometry	G20	1	76	1.52	1.98	1.93	1.85	1.65	1.37	0.98	0.58	-	-	0.23
4b	5b	June 2018	3H	1	Geometry	G20	2	9	0.09	0.29	0.15	0.1	0.07	0.05	0.04	0.02	-	-	0.01
5	6	Mock Set 2	3H	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	12	Mock Set 3	2H	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	17	June 2018	3H	5	Geometry	G20, G22,	1	42	2.1	4.82	4.35	3.39	2.03	0.82	0.23	0.06	-	-	0.01
8	6	Nov 2018	3H	4	Geometry	R5, G20	3	31	1.23	3.7	3.97	3.54	2.9	2.01	0.61	0.12	-	-	0.05
9a	8a	Nov 2018	1H	1	Geometry	G21	1	19	0.19	1	0.82	0.56	0.38	0.22	0.11	0.08	-	-	0.04
9b	8b	Nov 2018	1H	2	Geometry	G20	1	32	0.64	2	1.88	1.66	1.34	0.92	0.43	0.16	-	-	0.1
10	15	June 2017	3H	5	Algebra	A18/ G23	3	26	1.32	4.43	3.28	1.94	0.91	0.28	0.05	0	-	-	0
11	12	Nov 2019	2H	4	Geometry	G20	3	25	1.01	3.44	3.35	2.87	2.24	1.2	0.49	0.11	-	-	0.02
12	7	Nov 2017	2H	2	Geometry	G17 G20	3	21	1.04	5	4.03	3.86	2.98	2.15	0.99	0.31	-	-	0.05
13	6	Mock Set 3	3H	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	19	June 2018	3H	5	Algebra	A18, A21, G20, R12	3	18	0.92	4.27	2.64	1.15	0.4	0.11	0.03	0.01	-	-	0
15	15	Mock set 4	3H	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	21	Spec Set 2	3H	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

17	17	Nov 2017	3H	5	Geometry	G22 G23	3	3	0.15	4.5	3.09	1.32	0.59	0.21	0.02	0	-	-	0
18	24	Mock Set 2	2H	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	9	Spec Set 1	2H	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	23	June 2019	3H	5	Geometry	G15, G20, G22	3	17	0.86	3.74	2.15	0.98	0.38	0.15	0.06	0.02	-	-	0.01
21	18	Nov 2019	3H	5	Geometry	N12, G22	3	6	0.28	4.11	2.78	1.25	0.64	0.13	0.03	0	-	-	0
22	22	June 2017	1H	5	Algebra	A4/G 21/G2 2	2	4	0.18	1.12	0.39	0.18	0.08	0.03	0.01	0	-	-	0
23	19	Mock Set 3	2H	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				88					14.72	48.34	38.68	28.4	20.06	12.55	6.07	2.4	-	-	0.86