AS MATHEMATICS 7356/2

Paper 2

Mark scheme

June 2025

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256A7356/2/MS

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

No student should be disadvantaged on the basis of their gender identity and/or how they refer to the gender identity of others in their exam responses.

A consistent use of 'they/them' as a singular and pronouns beyond 'she/her' or 'he/him' will be credited in exam responses in line with existing mark scheme criteria.

Further copies of this mark scheme are available from aqa.org.uk

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Mark scheme instructions to examiners

General

The mark scheme for each question shows:
- the marks available for each part of the question
- the total marks available for the question
- marking instructions that indicate when marks should be awarded or withheld including the principle on which each mark is awarded. Information is included to help the examiner make his or her judgement and to delineate what is creditworthy from that not worthy of credit
- a typical solution. This response is one we expect to see frequently. However credit must be given on the basis of the marking instructions.

If a student uses a method which is not explicitly covered by the marking instructions the same principles of marking should be applied. Credit should be given to any valid methods. Examiners should seek advice from their senior examiner if in any doubt.

Key to mark types

M	mark is for method
R	mark is for reasoning
A	mark is dependent on M marks and is for accuracy
B	mark is independent of M marks and is for method and accuracy
E	mark is for explanation
F	follow through from previous incorrect result

Key to mark scheme abbreviations

CAO	correct answer only
CSO	correct solution only
FT	follow through from previous incorrect result
'their'	indicates that credit can be given from previous incorrect result
AWFW	anything which falls within
AWRT	anything which rounds to
ACF	any correct form
AG	answer given
SC	special case
OE	or equivalent
NMS	no method shown
ISW	ignore subsequent working
PI	possibly implied
sf	significant figure(s)
dp	decimal place(s)

AS/A-level Maths/Further Maths assessment objectives

AO		Description
AO1	AO1.1a	Select routine procedures
	AO1.1b	Correctly carry out routine procedures
	AO1.2	Accurately recall facts, terminology and definitions
AO2	AO2.1	Construct rigorous mathematical arguments (including proofs)
	AO2.2a	Make deductions
	AO2.2b	Make inferences
	AO2.3	Assess the validity of mathematical arguments
	AO2.4	Explain their reasoning
	AO2.5	Use mathematical language and notation correctly
AO3	AO3.1a	Translate problems in mathematical contexts into mathematical processes
	AO3.1b	Translate problems in non-mathematical contexts into mathematical processes
	AO3.2a	Interpret solutions to problems in their original context
	AO3.2b	Where appropriate, evaluate the accuracy and limitations of solutions to problems
	AO3.3	Translate situations in context into mathematical models
	AO3.4	Use mathematical models
	AO3.5a	Evaluate the outcomes of modelling in context
	AO3.5b	Recognise the limitations of models
	AO3.5c	Where appropriate, explain how to refine models

Examiners should consistently apply the following general marking principles:

No Method Shown

Where the question specifically requires a particular method to be used, we must usually see evidence of use of this method for any marks to be awarded.

Where the answer can be reasonably obtained without showing working and it is very unlikely that the correct answer can be obtained by using an incorrect method, we must award **full marks**. However, the obvious penalty to students showing no working is that incorrect answers, however close, earn **no marks**.

Where a question asks the student to state or write down a result, no method need be shown for full marks.

Where the permitted calculator has functions which reasonably allow the solution of the question directly, the correct answer without working earns **full marks**, unless it is given to less than the degree of accuracy accepted in the mark scheme, when it gains **no marks**.

Otherwise we require evidence of a correct method for any marks to be awarded.

Diagrams

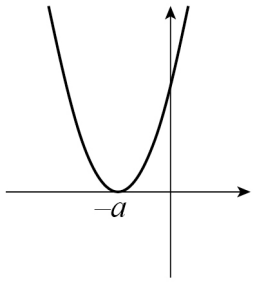
Diagrams that have working on them should be treated like normal responses. If a diagram has been written on but the correct response is within the answer space, the work within the answer space should be marked. Working on diagrams that contradicts work within the answer space is not to be considered as choice but as working, and is not, therefore, penalised.

Work erased or crossed out

Erased or crossed out work that is still legible and has not been replaced should be marked. Erased or crossed out work that has been replaced can be ignored.

Choice

When a choice of answers and/or methods is given and the student has not clearly indicated which answer they want to be marked, mark positively, awarding marks for all of the student's best attempts. Withhold marks for final accuracy and conclusions if there are conflicting complete answers or when an incorrect solution (or part thereof) is referred to in the final answer.

Q	Marking instructions	AO	Marks	Typical solution
1	Ticks fourth box	1.1b	B1	
	Question 1 Total		**1**	

Q	Marking instructions	AO	Marks	Typical solution
2	Circles second answer	1.1b	B1	$6x$
	Question 2 Total		**1**	

Q	Marking instructions	AO	Marks	Typical solution
3	Multiplies the area of their triangle by 20 and equates to 500 PI by 25 or $\sin A = \frac{5}{6}$	1.1a	M1	Area of triangle $= \frac{500}{20} = 25$ $\frac{1}{2} \times 10 \times 6 \times \sin A = 25$ $\sin A = \frac{5}{6}$ $A = 56.4°$ obtuse angle $= 180 - 56.4$ $= 124°$
	Uses $\frac{1}{2}ab\sin C$ with 6 and 10 PI by $30\sin A$	1.1b	B1	
	Solves equation of the form $\sin A = k \quad 0 < k < 1$	1.1a	M1	
	Obtains AWRT $124°$	3.2a	A1	
	Question 3 Total		**4**	

Q	Marking instructions	AO	Marks	Typical solution
4(a)	States $-\frac{2}{3}$	1.1b	B1	Gradient $= -\frac{2}{3}$
	Subtotal		**1**	

Q	Marking instructions	AO	Marks	Typical solution
4(b)(i)	Obtains perpendicular gradient of $\frac{3}{2}$ PI Or Obtains midpoint of *AB* as $\left(6\ ,\ \frac{p-2}{2}\right)$	1.1b	B1	$\therefore$ Gradient of $AB = \frac{3}{2}$ $\frac{p-(-2)}{10-2} = \frac{3}{2}$ $p = 10$
	Forms an equation in p by using coordinates of *A* and *B* and their gradient of *AB* (≠ their gradient from **(a)**) Or Substitutes their midpoint into the equation of L PI by correct value of p Or Forms an equation for *AB* and substitutes (10 , p)	3.1a	M1	
	Obtains p = 10	1.1b	A1	
	Subtotal		**3**	

Q	Marking instructions	AO	Marks	Typical solution
4(b)(ii)	Writes their correct midpoint FT their value of p	1.1b	B1F	(6,4)
	Subtotal		**1**	

	Question 4 Total		**5**	

Q	Marking instructions	AO	Marks	Typical solution
5	Expresses 4^{2x} and 4^{x} in terms of u At least one of $16u^2$ or $-33u$ correct	1.1a	M1	$16u^2-33u+2=0$ $u=2$ or $u=\frac{1}{16}$ $4^x=2$ or $4^x=\frac{1}{16}$ $x=\frac{1}{2}$ or $x=-2$
	Obtains 2 and $\frac{1}{16}$ ACF	1.1b	A1	
	Obtains $x=\frac{1}{2}$ or $x=-2$ CSO	1.1b	A1	
	Obtains $x=\frac{1}{2}$ and $x=-2$ CSO	1.1b	A1	
	Question 5 Total		**4**	

Q	Marking instructions	AO	Marks	Typical solution
6	Substitutes to obtain a quadratic equation, must have = 0, in terms of x or y only. PI by two correct values of x or two correct values of y.	1.1a	M1	$x=2(2x^2-4x+1)-11$ $0=4x^2-9x-9$
	Obtains $x=3, x=-\frac{3}{4}$ Or Obtains $y=7, y=\frac{41}{8}$ CSO	1.1b	A1	$x=3, x=-\frac{3}{4}$ When $x=3$ $y=2(3^2)-4(3)+1=7$ When $x=-\frac{3}{4}$ $y=2\left(-\frac{3}{4}\right)^2-4\left(-\frac{3}{4}\right)+1=\frac{41}{8}$
	Substitutes at least one of their x or y values into either equation to obtain y or x values	1.1a	M1	
	Obtains $x=3, x=-\frac{3}{4}$ $y=7, y=\frac{41}{8}$ ACF CSO Do not ISW	1.1b	A1	
	Question 6 Total		**4**	

Q	Marking instructions	AO	Marks	Typical solution
7(a)	Obtains $a = 3$	1.1b	B1	$3\left(x^2+x\right)-8$ $3\left(x+\frac{1}{2}\right)^2-\frac{35}{4}$
	Obtains $b = \frac{1}{2}$	1.1b	B1	
	Obtains $c = -\frac{35}{4}$	1.1b	B1	
	Subtotal		**3**	

Q	Marking instructions	AO	Marks	Typical solution
7(b)(i)	States $-\frac{35}{4}$ **Or** FT their value of c from **(a)**	2.2a	B1F	$-\frac{35}{4}$
	Subtotal		**1**	

Q	Marking instructions	AO	Marks	Typical solution
7(b)(ii)	Equates $\sin\theta$ to their $-b$, OE provided $-1 \leq b \leq 1$ PI by correct answer	3.1a	M1	$\sin\theta = -\frac{1}{2}$ $\theta = -30$ $\theta = 180-(-30)$ $\theta = 210°$
	Obtains 210 ACF	1.1b	A1	
	Subtotal		**2**	

	Question 7 Total		**6**	

Q	Marking instructions	AO	Marks	Typical solution
8	Differentiates with at least one term correct	1.1a	M1	$\frac{dy}{dx} = 3x^2 - 10x - 8$ For stationary point $\frac{dy}{dx} = 0$ $3x^2 - 10x - 8 = 0$ $x = -\frac{2}{3}$ or $x = 4$ $\frac{d^2y}{dx^2} = 6x - 10$ When $x = -\frac{2}{3}$, $\frac{d^2y}{dx^2} = -14$, maximum When $x = 4$, $\frac{d^2y}{dx^2} = 14$, minimum When $x = 4$, $y = -46$ Minimum is $(4, -46)$
	Obtains correct derivative	1.1b	A1	
	Explains that $\frac{dy}{dx} = 0$ for stationary point OE	2.4	E1	
	Sets their derivative = 0 and solves to find at least one real value for x PI by both correct values of x	1.1a	M1	
	Obtains $x = -\frac{2}{3}$ and $x = 4$	1.1b	A1	
	Substitutes at least one of their values of x to obtain a y value PI by -46 or $\frac{130}{27}$ Must have obtained M1 M1	1.1a	M1	
	Differentiates a second time using their $\frac{dy}{dx}$ and tests at least one of the x coordinates of their turning points **Or** Evaluates the gradient either side of at least one of their x value **Or** Justifies fully from shape of cubic with reference to a sketch or using the nature of a positive cubic graph	3.1a	M1	
	Completes a reasoned argument to justify the minimum point at (4, –46) Can obtain R1 without the E1 Must see derivative = 0 for R1 Must test both x values for R1 CSO	2.1	R1	
	Question 8 Total		**8**	

Q	Marking instructions	AO	Marks	Typical solution
9(a)	States 16	2.2a	B1	16
	Subtotal		**1**	

Q	Marking instructions	AO	Marks	Typical solution
9(b)	States 12	2.2a	B1	12
	Subtotal		**1**	

Q	Marking instructions	AO	Marks	Typical solution
9(c)	States 8	2.2a	B1	8
	Subtotal		**1**	

	Question 9 Total		**3**	

Q	Marking instructions	AO	Marks	Typical solution
10(a)	Uses $\left(\sqrt{k}+\sqrt{k+1}\right)\left(\sqrt{k}-\sqrt{k+1}\right)$ Or $\left(\sqrt{k}+\sqrt{k+1}\right)\left(\sqrt{k+1}-\sqrt{k}\right)$ PI by $\pm\left[k-(k+1)\right]$ on denominator	1.1a	M1	$\frac{1}{\sqrt{k}+\sqrt{k+1}}\times\frac{\sqrt{k}-\sqrt{k+1}}{\sqrt{k}-\sqrt{k+1}}$ $=\frac{\sqrt{k}-\sqrt{k+1}}{k-(k+1)}$ $=\frac{\sqrt{k}-\sqrt{k+1}}{-1}$ $=\sqrt{k+1}-\sqrt{k}$
	Completes a reasoned argument to show given result Must see correct simplification of the denominator AG	2.1	R1	
	Subtotal		**2**	

Q	Marking instructions	AO	Marks	Typical solution
10(b)	Uses part **(a)** to rewrite given expression with no fractions	3.1a	M1	$\frac{1}{\sqrt{1}+\sqrt{2}}+\frac{1}{\sqrt{2}+\sqrt{3}}+\frac{1}{\sqrt{3}+\sqrt{4}}$ $=\left(\sqrt{2}-\sqrt{1}\right)+\left(\sqrt{3}-\sqrt{2}\right)+\left(\sqrt{4}-\sqrt{3}\right)$ $=\sqrt{4}-\sqrt{1}$ $=2-1$ $=1$
	Obtains 1 Do not accept $\sqrt{4}-1$ CSO	1.1b	A1	
	Subtotal		**2**	

	Question 10 Total		**4**	

Q	Marking instructions	AO	Marks	Typical solution
11	Obtains $(2k-1)^2-4(1)(4-2k)$	3.1a	B1	$(2k-1)^2-4(1)(4-2k)>0$ $4k^2-4k+1-16+8k>0$ $4k^2+4k-15>0$ $k=-\frac{5}{2},k=\frac{3}{2}$ $k<-\frac{5}{2}$ or $k>\frac{3}{2}$
	Compares their b^2-4ac with 0 and obtains two critical values	1.1a	M1	
	Obtains $-\frac{5}{2},\frac{3}{2}$	1.1b	A1	
	Obtains $k<-\frac{5}{2}$ $k>\frac{3}{2}$ ACF	1.1b	A1	
	Question 11 Total		**4**	

Q	Marking instructions	AO	Marks	Typical solution
12(a)	Demonstrates given result starting with $\cos\theta=\frac{12}{AC}$ OE (in terms of adj/hyp)	2.1	R1	$\cos\theta=\frac{12}{AC}$ $AC=\frac{12}{\cos\theta}$
	Subtotal		**1**	

Q	Marking instructions	AO	Marks	Typical solution
12(b)	States $12\cos\theta$ CAO	1.1b	B1	$AD=12\cos\theta$
	Subtotal		**1**	

Q	Marking instructions	AO	Marks	Typical solution
12(c)	Expresses *CD* as the difference between *AC* and their *AD* Or Expresses *BD* as $12\sin\theta$ and uses $\tan\theta$ in triangle *BCD*	3.1a	M1	$CD=\frac{12}{\cos\theta}-12\cos\theta$ $=\frac{12}{\cos\theta}-\frac{12\cos^2\theta}{\cos\theta}$ $=\frac{12-12\cos^2\theta}{\cos\theta}$
	Completes reasoned argument to obtain given result Must see two separate fractions with a common denominator Or $CD=\frac{12\sin^2\theta}{\cos\theta}$ Or $CD\cos\theta=12-12\cos^2\theta$ before final answer AG	2.1	R1	
	Subtotal		**2**	

Q	Marking instructions	AO	Marks	Typical solution
12(d)	States $8\sqrt{3} = \dfrac{12-12\cos^2\theta}{\cos\theta}$	1.1b	B1	$8\sqrt{3} = \dfrac{12-12\cos^2\theta}{\cos\theta}$ $8\sqrt{3}\cos\theta = 12-12\cos^2\theta$ $12\cos^2\theta + 8\sqrt{3}\cos\theta - 12 = 0$ $\cos\theta = \dfrac{\sqrt{3}}{3}$ or $-\sqrt{3}$ $\cos\theta = -\sqrt{3}$ not valid $\therefore \cos\theta = \dfrac{\sqrt{3}}{3}$ $\theta = 55°$
	Rearranges to give a three-term quadratic equation in $\cos\theta$ (must be = 0)	3.1a	M1	
	Solves their quadratic to obtain at least one real value for $\cos\theta$	1.1a	M1	
	Obtains $\cos\theta = \dfrac{\sqrt{3}}{3}$ and explains that $-\sqrt{3}$ is not valid OE	2.4	A1	
	Obtains AWRT 55 ISW CSO	1.1b	A1	
	Subtotal		**5**	

	Question 12 Total		**9**	

Q	Marking instructions	AO	Marks	Typical solution
13	Circles the first answer	1.1b	B1	0.18
	Question 13 Total		**1**	

Q	Marking instructions	AO	Marks	Typical solution
14	Circles the second answer	1.1b	B1	0.15
	Question 14 Total		**1**	

Q	Marking instructions	AO	Marks	Typical solution
15	Uses area to obtain 14 or $5k$ PI by 28 or $2.5k$	1.1a	M1	$5k = 2 \times 20 \times 0.7$ $5k = 28$
	Obtains $\frac{28}{5}$ ACF Do not ISW	1.1b	A1	$k = \frac{28}{5}$
	Question 15 Total		**2**	

Q	Marking instructions	AO	Marks	Typical solution
16	Sums the probabilities and equates to 1. Allow one slip in the summing of the probabilities or the omission of one of the probabilities. PI by correct answer	1.1a	M1	$0.2 - p + 0.05 + 3p + 4p + 2p + 2p = 1$ $10p + 0.25 = 1$ $10p = 0.75$
	Obtains 0.075 ACF	1.1b	A1	$p = 0.075$
	Question 16 Total		**2**	

Q	Marking instructions	AO	Marks	Typical solution
17(a)	States A	2.2a	B1	A
	Subtotal		**1**	

Q	Marking instructions	AO	Marks	Typical solution
17(b)	Explains that the value would become more negative or strong negative OE Accept smaller/decrease	2.4	E1	The value would become more negative
	Subtotal		**1**	

Q	Marking instructions	AO	Marks	Typical solution
17(c)	Describes the correlation in context. Require '**sale(s)**' and '**wind speed**' Do not accept 'number' /'amount' Accept negative correlation (with '**sale(s)**' and '**wind speed**') Do not accept 'number'/'amount'	2.2b	E1	The higher the wind speed the lower the daily sales of raincoats
	Subtotal		**1**	

Q	Marking instructions	AO	Marks	Typical solution
17(d)	States claim is not valid OE, with a comment; E.g. • Scatter diagram/correlation cannot prove causality • Could be another factor for drop in sales • 15 days is a small sample from a six-month period Accept it may be valid but the scatter diagram does not prove it.	2.2b	E1	This claim is not valid. The scatter diagram cannot prove causality, there could be another factor which is causing the fall in sales, e.g. amount of rainfall
	Subtotal		**1**	

	Question 17 Total		**4**	

Q	Marking instructions	AO	Marks	Typical solution
18(a)	States one assumption in context. Accept • One battery being **faulty** is independent of any other battery OE • Two possible outcomes Battery is **faulty** or **not faulty** • The probability of a battery being **faulty** is constant at **3%** But **not** fixed number of trials	3.5b	E1	One battery being faulty is independent of any other battery being faulty.
	Subtotal		**1**	

Q	Marking instructions	AO	Marks	Typical solution
18(b)	Obtains AWFW [0.2575,0.26]	1.1b	B1	P(1 battery is faulty) = 0.2575
	Subtotal		**1**	

Q	Marking instructions	AO	Marks	Typical solution
18(c)	States B(10 , their p) from **(b)**	3.4	M1	Use a X ~ B(10 , 0.2575) model $P(X \geq 2) = 1 - P(X \leq 1)$
	Obtains AWFW [0.77 , 0.78]	1.1b	A1	$= 1 - 0.2275\ldots$ $= 0.772$
	Subtotal		**2**	

	Question 18 Total		**4**	

Q	Marking instructions	AO	Marks	Typical solution
19(a)	Deduces 1	2.2a	B1	1
	Subtotal		**1**	

Q	Marking instructions	AO	Marks	Typical solution
19(b)	Obtains 48 CAO	1.1b	B1	Mean = 48
	Subtotal		**1**	

Q	Marking instructions	AO	Marks	Typical solution
19(c)	Obtains AWRT 20.9 Accept AWRT 21.4	1.1b	B1	Standard deviation = 20.9
	Subtotal		**1**	

Q	Marking instructions	AO	Marks	Typical solution
19(d)	Explains why it is not valid to make the comparison. Must be clear that **neither propulsion type OE** is in the 2002 data.	2.4	E1	The 2002 data does not contain any electric or electric/petrol cars.
	Subtotal		**1**	

	Question 19 Total		**4**	

Q	Marking instructions	AO	Marks	Typical solution
20(a)	Obtains AWRT 0.18	1.1b	B1	P(all 4 are red) $= 0.54 \times 0.6 \times 0.7 \times 0.8$ $= 0.181$
	Subtotal		**1**	

Q	Marking instructions	AO	Marks	Typical solution
20(b)	Obtains at least one correct term PI by correct answer	3.1a	M1	P(exactly one set is red) $= 0.54 \times 0.4 \times 0.3 \times 0.2$
	Obtains all four correct terms PI by correct answer	1.1b	A1	$+ 0.46 \times 0.6 \times 0.3 \times 0.2$ $+ 0.46 \times 0.4 \times 0.7 \times 0.2$
	Obtains AWRT 0.099	1.1b	A1	$+ 0.46 \times 0.4 \times 0.3 \times 0.8$ $= 0.01296 + 0.01656 + 0.02576 + 0.04416$ $= 0.0994$
	Subtotal		**3**	

	Question 20 Total		**4**	

Q	Marking instructions	AO	Marks	Typical solution
21	States both hypotheses correctly for a one-tailed test. Accept population proportion for p. Accept 80%, but not $x =$ or $\overline{x} =$ or $\mu =$	2.5	B1	X is 'No of people who said they had an 'excellent' experience' H_0: $p = 0.8$ H_1: $p < 0.8$
	States model used PI by AWRT 0.043, 0.022, 0.077, 0.011, 0.021	1.1a	M1	Under H_0: $X \sim B(60, 0.8)$ $P(X \leq 42) = 0.0427$
	Obtains AWRT 0.043 condone AWRT 0.022 for A1	1.1b	A1	As $0.0427 < 0.05$ Reject H_0
	Compares 0.043 to 0.05 and states rejects H_0 Condone accept H_1 No ft here. Must see clear comparison (inequality or diagram)	3.5a	A1	There is sufficient evidence to suggest that the proportion of people who had an excellent experience at the concert is less than the organiser's claim.
	Concludes correctly in context **'sufficient evidence'** OE and **proportion** required. Can score B0 M1 A1 A1 R1	3.2a	R1	
	Question 21 Total		**5**	

	Question Paper Total		**80**	