AS
MATHEMATICS
7356/1

Paper 1

Mark scheme

June 2024

Version: 1.0 Final

246A7356/1/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

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
PI	possibly implied
sf	significant figure(s)
dp	decimal place(s)
ISW	Ignore Subsequent Workings

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	Circles 4th answer	1.2	B1	k
	Question 1 Total		**1**	

Q	Marking instructions	AO	Marks	Typical solution
2	Ticks 3rd box	1.1b	B1	$x = 1$ and $y = 0$
	Question 2 Total		**1**	

Q	Marking instructions	AO	Marks	Typical solution
3	Multiplies numerator and denominator by conjugate of the denominator Condone missing brackets	1.1b	B1	$\frac{\sqrt{3}+3\sqrt{5}}{\sqrt{5}-\sqrt{3}} \times \frac{\sqrt{5}+\sqrt{3}}{\sqrt{5}+\sqrt{3}}$ $= \frac{3\times 5+3+\sqrt{15}+3\sqrt{15}}{5-3}$ $= \frac{18+4\sqrt{15}}{2}$ $= 9+2\sqrt{15}$ $= 9+\sqrt{60}$
	Obtains $18+4\sqrt{15}$	1.1b	B1	
	Obtains denominator of 2	1.1b	B1	
	Obtains $9+\sqrt{60}$ Accept $a = 9$, $b = 60$	1.1b	B1	
	Question 3 Total		**4**	

Q	Marking instructions	AO	Marks	Typical solution
4(a)(i)	Completes reasoned argument to obtain $\tan^2\theta = 4$ using $\tan\theta = \frac{\sin\theta}{\cos\theta}$	2.1	R1	$\frac{\sin\theta}{\cos\theta}\tan\theta = 4$ $\tan\theta \times \tan\theta = 4$ $\tan^2\theta = 4$
	Subtotal		**1**	

Q	Marking instructions	AO	Marks	Typical solution
4(a)(ii)	Obtains $\tan\theta = 2$ or $\tan\theta = -2$ PI by one correct value for θ	1.1a	M1	$\tan\theta = \pm 2$ $\theta = 63°, 117°, 243°, 297°$
	Obtains **any** two solutions for θ AWRT 63°, 117°, 243°, 297°	1.1b	A1	
	Obtains **all** four solutions for θ and no extras within $0° < \theta < 360°$ AWRT 63°, 117°, 243°, 297°	1.1b	A1	
	Subtotal		**3**	

Q	Marking instructions	AO	Marks	Typical solution
4(b)	Deduces that it is necessary to divide solutions from **(a)** by 3 PI by one correct value for α	2.2a	M1	$\alpha = 21°, 39°, 81°, 99°, 141°, 159°$
	Obtains at least three correct values for α	1.1b	A1	
	Obtains all six solutions for α and no extras within $0° < \theta < 180°$ AWRT 21°, 39°, 81°, 99°, 141°, 159°	1.1b	A1	
	Subtotal		**3**	

	Question 4 Total		**7**	

Q	Marking instructions	AO	Marks	Typical solution
5(a)	States the student should have calculated f(2) or States the student should not have calculated f(–2)	2.3	E1	The student should have calculated f(2)
	Subtotal		**1**	

Q	Marking instructions	AO	Marks	Typical solution
5(b)	Infers that $(x-2)$ may or may not be a factor Do not accept definitive conclusion that $(x-2)$ is not a factor	2.2b	E1	They do not know whether $(x-2)$ is a factor or not. They could conclude that $(x+2)$ is a factor.
	Deduces that $(x+2)$ is a factor	2.2a	E1	
	Subtotal		**2**	

	Question 5 Total		**3**	

Q	Marking instructions	AO	Marks	Typical solution
6	Simplifies to a three term quadratic > 0 or < 0 (Condone = 0)	1.1a	M1	$3x^2+2x-6>0$
	Obtains the correct two critical values ACF Accept $\frac{-1\pm\sqrt{19}}{3}$ OE	1.1b	A1	$x>\frac{-1+\sqrt{19}}{3}$ $x<\frac{-1-\sqrt{19}}{3}$
	Chooses the outer regions for their two critical values	1.1a	M1	$\{x: x<\frac{-1-\sqrt{19}}{3}\}\cup\{x: x>\frac{-1+\sqrt{19}}{3}\}$
	Expresses the correct inequalities in set notation Accept $\left(-\infty,\frac{-1-\sqrt{19}}{3}\right)\cup\left(\frac{-1+\sqrt{19}}{3},\infty\right)$	2.5	R1	
	Question 6 Total		**4**	

Q	Marking instructions	AO	Marks	Typical solution
7(a)	Substitutes values correctly into cosine rule to find any angle	1.1a	M1	$225^2 = 234^2 + 310^2 - 2 \times 234 \times 310 \times \cos A$
	Obtains correct angle AWRT 46.3°	1.1b	A1	$\cos A = 0.690867$ $A = 46.3°$
	Subtotal		**2**	

Q	Marking instructions	AO	Marks	Typical solution
7(b)	Uses $0.5 \times b \times c \times \sin A$ OE to find area	3.1a	M1	Area $= 0.5 \times 234 \times 310 \times \sin A$ $= 26223$
	Divides their area by 1200	1.1a	M1	Number of sheep $= 26223 \div 1200$ $= 21.85$
	Obtains 21	3.2a	A1	Maximum number $= 21$
	Subtotal		**3**	

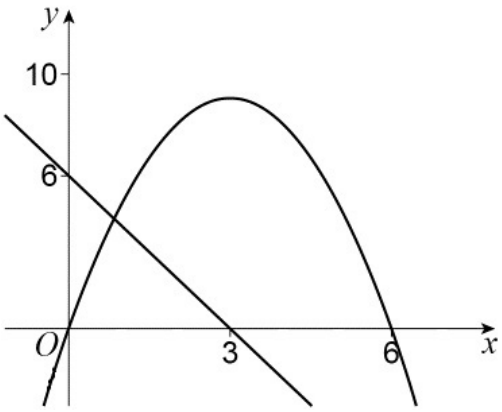
	Question 7 Total		**5**	

Q	Marking instructions	AO	Marks	Typical solution
8(a)	Obtains e^3 May be seen anywhere Accept AWRT 20.1	1.1b	B1	$\ln x - \ln y = 3$ $\ln \frac{x}{y} = 3$ $\frac{x}{y} = e^3$ $x = e^3 y$
	Uses a law of logarithms appropriately or Uses a rules of indices appropriately	1.1a	M1	
	Obtains $x = e^3 y$	1.1b	A1	
	Subtotal		**3**	

Q	Marking instructions	AO	Marks	Typical solution
8(b)	Obtains a correct equation in x or y only FT their answer to **(a)** provided it does not involve logarithms	1.1a	M1	$e^3 y + y = 10$ $y = \frac{10}{1+e^3}$ $x = \frac{10e^3}{1+e^3}$
	Obtains $x = \frac{10e^3}{1+e^3}$ or $y = \frac{10}{1+e^3}$	1.1b	A1	
	Obtains $x = \frac{10e^3}{1+e^3}$ and $y = \frac{10}{1+e^3}$	1.1b	A1	
	Subtotal		**3**	

	Question 8 Total		**6**	

Q	Marking instructions	AO	Marks	Typical solution
9(a)	Expands bracket and differentiates with at least one term correct	3.1a	M1	$f(x) = 6x - x^2$ $f'(x) = 6 - 2x$
	Obtains $6 - 2x$	1.1b	A1	
	Subtotal		**2**	

Q	Marking instructions	AO	Marks	Typical solution
9(b)	Obtains y intercept at 6	1.1b	B1	Cuts x-axis at (3, 0) Cuts y-axis at (0, 6) 
	Draws a straight line graph from a point between 0 and 10 on the y-axis to a point between 0 and 6 on the x-axis	1.1a	M1	
	Obtains x intercept at 3 with straight line graph cutting x-axis at approximately (3, 0)	1.1b	A1	
	Subtotal		**3**	

	Question 9 Total		**5**	

Q	Marking instructions	AO	Marks	Typical solution
10	Expands $\frac{dy}{dx}$ with at least one term correct	1.1a	M1	$\frac{dy}{dx} = (x+2)(4x^2 - 4x + 1)$
	Obtains $4x^3 + 4x^2 - 7x + 2$	1.1b	A1	$\frac{dy}{dx} = 4x^3 + 4x^2 - 7x + 2$
	Integrates their cubic expansion with at least one term correct	3.1a	M1	$y = x^4 + \frac{4}{3}x^3 - \frac{7}{2}x^2 + 2x + c$
	Integrates their expansion correctly to obtain an expression for y FT their cubic expansion of $\frac{dy}{dx}$ Condone missing $+ c$	1.1b	A1F	$900 = 1296 + 288 - 126 + 12 + c$ $c = -570$
	Substitutes $x = 6$ and $y = 900$ into their quartic equation and finds a value for c	1.1a	M1	$y = x^4 + \frac{4}{3}x^3 - \frac{7}{2}x^2 + 2x - 570$
	Obtains $y = x^4 + \frac{4}{3}x^3 - \frac{7}{2}x^2 + 2x - 570$	2.2a	A1	
	Question 10 Total		**6**	

Q	Marking instructions	AO	Marks	Typical solution
11(a)	Evaluates $g''(1)$ or $g''(4)$	3.1a	M1	$g''(1) = -3$
	Deduces nature of the turning point at $x = 1$ or the turning point at $x = 4$	2.2a	A1	$-3 < 0$ therefore maximum at $x = 1$
	Obtains $g''(1) = -3$ and $g''(4) = 3$ and compares each value with 0 to correctly deduce the nature of both turning points Must link to explicitly stated x values or coordinates Condone incorrect y values for any coordinates given	2.2a	R1	$g''(4) = 3$ $3 > 0$ therefore minimum at $x = 4$
	Subtotal		**3**	

Q	Marking instructions	AO	Marks	Typical solution
11(b)	Identifies one correct increasing region	2.4	M1	$x < 1, x > 4$
	Obtains $x < 1, x > 4$ Accept $x \leq 1, x \geq 4$	2.1	R1	
	Subtotal		**2**	

	Question 11 Total		**5**	

Q	Marking instructions	AO	Marks	Typical solution
12(a)	Uses the value 5 for m in the formula	3.3	M1	$T = 15 + 8 \sin (30(5) - 120)°$ $= 15 + 8 \sin 30°$
	Obtains 19°C Condone missing units	3.4	A1	$= 19°C$
	Subtotal		**2**	

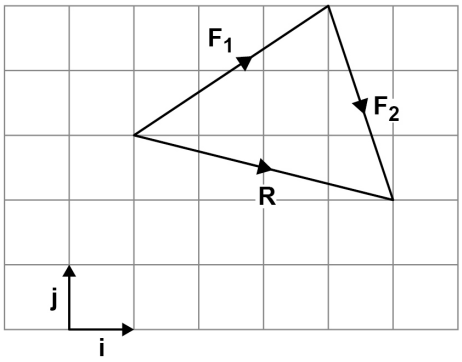
Q	Marking instructions	AO	Marks	Typical solution
12(b)	Identifies the angle for sin to be a maximum or Evaluates T for $m = 6$, 7 and 8 (ignore other values)	3.4	B1	Maximum value of sin is for 90° This requires $m = 7$ July
	Obtains $m = 7$ or July (ignore incorrect month name if $m = 7$ is clearly indicated)	2.2a	B1	
	Subtotal		**2**	

Q	Marking instructions	AO	Marks	Typical solution
12(c)(i)	Identifies 15 with a suitable explanation that explicitly refers to temperatures Accept references in context to: • Translation • Base temperature	3.5c	E1	15 because this will add more to the temperatures for every month
	Subtotal		**1**	

Q	Marking instructions	AO	Marks	Typical solution
12(c)(ii)	Identifies 8 with a suitable explanation that explicitly refers to temperatures Accept references in context to: • Amplitude • Vertical stretch • Spread	3.5c	E1	8 because this will make high temperatures higher and low temperatures lower.
	Subtotal		**1**	

	Question 12 Total		**6**	

Q	Marking instructions	AO	Marks	Typical solution
13	Circles first answer	2.2a	B1	-4
	Question 13 Total		**1**	

Q	Marking instructions	AO	Marks	Typical solution
14	Ticks bottom left box	1.1b	B1	
	Question 14 Total		**1**	

Q	Marking instructions	AO	Marks	Typical solution
15(a)	Finds any area from the graph	3.1a	M1	Area above axis = 10.5
	Obtains a fully correct expression for total area above or below axis PI by 4.5	1.1b	A1	Area below axis = 6
	Obtains 16.5 m Condone missing units	1.1b	A1	Total distance travelled = 16.5 m
	Subtotal		**3**	

Q	Marking instructions	AO	Marks	Typical solution
15(b)	Obtains $t > 5$ Ignore any upper bound of inequality provided it is 8 or more Do not accept $t \geq 5$	2.2a	R1	$t > 5$
	Subtotal		**1**	

	Question 15 Total		**4**	

Q	Marking instructions	AO	Marks	Typical solution
16	Uses $v^2 = u^2 + 2as$ Condone sign errors	3.4	M1	$a = -9.8, v = 0, s = 15$ $0 = u^2 + 2(-9.8)(15)$
	Substitutes consistent values to find u eg $a = -9.8, v = 0, s = 15$ $a = 9.8, v = 0, s = -15$	3.3	A1	$u = 17$
	Obtains $u = 17$ CSO AWRT 17 ACF	1.1b	A1	
	Question 16 Total		**3**	

Q	Marking instructions	AO	Marks	Typical solution
17	Integrates to find v with at least one non-constant term correct	3.4	M1	$v = \int 10 - 6t \ \mathrm{d}t$ $v = 10t - 3t^2 + c$
	Obtains fully correct expression for v Must include $+c$ or state that $c = 0$	1.1b	A1	When $t = 0$, $v = 0$ therefore $c = 0$
	Integrates their v with at least one term correct	1.1a	M1	$r = \int 10t - 3t^2 \ \mathrm{d}t$ $r = 5t^2 - t^3 + c$
	Completes reasoned argument to show $r = t^2(5 - t)$ Explanation for both constants of integration = 0 must be given	2.1	R1	When $t = 0$, $r = 0$ therefore $c = 0$ So $r = t^2(5 - t)$
	Question 17 Total		**4**	

Q	Marking instructions	AO	Marks	Typical solution
18(a)	Subtracts given vectors with at least one component correct for $\overrightarrow{AB}$ or $\overrightarrow{BA}$ or Finds difference between **i** and **j** components with at least one correct, may be seen on a diagram	1.1a	M1	$\begin{bmatrix}13\\5\end{bmatrix}-\begin{bmatrix}5\\-1\end{bmatrix}=\begin{bmatrix}8\\6\end{bmatrix}$ $\overrightarrow{AB}=\begin{bmatrix}8\\6\end{bmatrix}$ Distance $=\sqrt{8^2+6^2}$ Distance $=10$ m
	Uses Pythagoras for their **i** and **j** component differences	1.1a	M1	
	Shows distance between A and B is 10 metres AG Condone missing units	1.1b	A1	
	Subtotal		**3**	

Q	Marking instructions	AO	Marks	Typical solution
18(b)	Selects $s=ut+\frac{1}{2}at^2$ and substitutes given values for u, t and s	3.3	M1	$s=ut+\frac{1}{2}at^2$ $10=6+2a$ $a=2$ $R=0.15\times 2=0.3$
	Obtains $a=2$	1.1b	A1	
	Obtains value for R using $0.15\times$ their value for a Final value for R must be >0	3.4	B1F	
	Subtotal		**3**	

	Question 18 Total		**6**	

Q	Marking instructions	AO	Marks	Typical solution
19(a)	Uses $F = ma$ to form a three-term equation modelling object M or N with one side correct	3.3	M1	Model for M $0.6g - T = 0.6a$
	Finds fully correct equation for modelling M or N	1.1b	A1	
	Uses $F = ma$ to form a three-term equation for modelling the other object with one side correct	3.3	M1	Model for N $T - 0.5g = 0.5a$
	Eliminates T to find an equation in terms of a using their three-term equations for M and N	1.1a	M1	So $0.1g = 1.1a$
	Completes reasoned argument to show $a = \frac{1}{11}g$	2.1	R1	$a = \frac{1}{11}g$
	Subtotal		**5**	

Q	Marking instructions	AO	Marks	Typical solution
19(b)	Uses $v = u + at$ with $a = \frac{1}{11}g$ or AWRT 0.89	3.4	M1	Using $v = u + at$ $v = 0 + \left(\frac{1}{11}g\right)(0.5) = \frac{g}{22}$ $k = 22$
	Obtains $k = 22$ AWRT 22 Accept $v = \frac{g}{22}$ if no value of k stated	1.1b	A1	
	Subtotal		**2**	

Q	Marking instructions	AO	Marks	Typical solution
19(c)	States reasonable assumption Accept M does not reach the floor, the string breaks OE	3.5b	E1	N does not reach the peg.
	Subtotal		**1**	

	Question 19 Total		**8**	

	Question Paper Total		**80**	