AS
FURTHER MATHEMATICS
7366/2S

Paper 2 Statistics

Mark scheme

June 2025

Version: 1.0 Final

256A7366/2S/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
PI	possibly implied
sf	significant figure(s)
dp	decimal place(s)
ISW	Ignore Subsequent Workings

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 candidates showing no working is that incorrect answers, however close, earn **no marks**.

Where a question asks the candidate 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.

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

Q	Marking instructions	AO	Marks	Typical solution
1	Circles the 2nd answer.	1.1b	B1	6
	Question total		**1**	

Q	Marking instructions	AO	Marks	Typical solution
2	Circles the 2nd answer.	1.1b	B1	5.20
	Question total		**1**	

Q	Marking instructions	AO	Marks	Typical solution
3	Circles the 2nd answer.	1.1b	B1	$2\sqrt{6}$
	Question total		**1**	

Q	Marking instructions	AO	Marks	Typical solution
4(a)	Obtains P($X \geq 2$) = 0.8 **OE**	1.1b	B1	P($X \geq 2$) = 0.7 + 0.1 = 0.8
	Subtotal		**1**	

Q	Marking instructions	AO	Marks	Typical solution
4(b)	Obtains E(Y) = 3 **PI**	1.1b	B1	E(Y) = $\int_0^6 \frac{1}{36} y^2 (6 - y)\,\mathrm{d}y$
	Obtains E(X) = 1 × 0.2 + 2 × 0.7 + 0.1a **OE PI**	1.1a	M1	E(Y) = 3 E(X) = 1 × 0.2 + 2 × 0.7 + 0.1a
	Forms a linear equation in terms of a using their E(X) + their E(Y) = 5	1.1a	M1	E(X) = 1.6 + 0.1a E(X + Y) = 5
	Obtains a = 4	1.1b	A1	1.6 + 0.1a + 3 = 5 a = 4
	Subtotal		**4**	

	Question total		**5**	

Q	Marking instructions	AO	Marks	Typical solution
5(a)	Obtains correct z value. **AWRT** 1.48 **PI**	1.1b	B1	$z = 1.4758$ $54.7 \pm 1.4758 \times \frac{8.1}{\sqrt{50}}$ (53.01, 56.39)
	States or evaluates $54.7 + \text{their } z \times \frac{8.1}{\sqrt{50}}$ or $54.7 - \text{their } z \times \frac{8.1}{\sqrt{50}}$ **PI**	1.1a	M1	
	Obtains correct confidence interval. **AWRT** 53.01 and 56.39	1.1b	A1	
	Subtotal		**3**	

Q	Marking instructions	AO	Marks	Typical solution
5(b)	Obtains 55.1 + their $z \times \frac{8.1}{\sqrt{n}}$ **OE** or 55.1 + their $z \times \frac{8.1}{\sqrt{n-1}}$ **OE** where their z is non-zero and has a magnitude less than 4	1.1a	M1	For Dana's random sample: $55.1 + 1.4758 \times \frac{8.1}{\sqrt{n}} < 57.7$ $n > 21.1$ For Fox's random sample: $55.1 + 1.4758 \times \frac{8.1}{\sqrt{n-1}} > 57.7$ $n < 22.1$ So $n = 22$
	Obtains inequality 55.1 + their $z \times \frac{8.1}{\sqrt{n}} < 57.7$ **OE** or inequality 55.1 + their $z \times \frac{8.1}{\sqrt{n-1}} > 57.7$ **OE** where their z is non-zero and has a magnitude less than 4 Allow equations instead of inequalities Allow non-strict inequalities Condone inequalities in either direction	3.1a	M1	
	Solves one of the inequalities or equations to obtain **AWRT** 21.1 or **AWRT** 22.1 **PI** by sight of 22	1.1b	A1	
	Obtains $n = 22$	2.2a	A1	
	Subtotal		**4**	

	Question total		**7**	

Q	Marking instructions	AO	Marks	Typical solution
6(a)	Obtains $k = \frac{1}{30}$ **OE**	1.1b	B1	$k = \frac{1}{0.5\times 60} = \frac{1}{30}$
	Subtotal		**1**	

Q	Marking instructions	AO	Marks	Typical solution
6(b)	Obtains correct gradient for $\mathrm{f}(a)$ $-\frac{1}{1800}$ **OE** **PI**	1.1a	M1	$\mathrm{f}(a) = -\frac{1}{1800}a + \frac{1}{30}$ $\frac{1}{2}m\left(\frac{1}{30}+\frac{1}{30}-\frac{1}{1800}m\right) = 0.5$ $\frac{1}{1800}m^2 - \frac{1}{15}m + 1 = 0$ m = 102.4, 17.57 m = 17.57
	Obtains $\mathrm{f}(a) = -\frac{1}{1800}a + \frac{1}{30}$ **OE** **PI**	1.1b	A1	
	Forms an equation in terms of the median using their linear function $\mathrm{f}(a)$ eg $-\frac{1}{3600}m^2 + \frac{1}{30}m = \frac{1}{2}$ $\frac{1}{2}m\left(\frac{1}{30}+\frac{1}{30}-\frac{1}{1800}m\right) = 0.5$ or $\frac{1}{2}(m-60)\left(\frac{1}{30}-\frac{1}{1800}m\right) = 0.5$ **OE** **PI**	1.1a	M1	
	Obtains a real solution to their equation **PI** by sight of **AWRT** 102 or **AWRT** 17.6	1.1a	M1	
	Obtains median = **AWRT** 17.57 If **AWRT** 102 is seen it must be rejected	1.1b	A1	
	Subtotal		**5**	

	Question total		**6**	

Q	Marking instructions	AO	Marks	Typical solution
7(a)	Uses $X \sim$ Po(3) to calculate one of P($X \geq 2$) = **AWRT** 0.80 P($X \leq 2$) = **AWRT** 0.42 P($X > 2$) = **AWRT** 0.58 P($X \leq 1$) = **AWRT** 0.20 P($X = 2$) = **AWRT** 0.22 Ignore labels	3.3	M1	P($X \geq 2$) = 1 – P($X \leq 1$) P($X \geq 2$) = 1 – 0.1991 P($X \geq 2$) = 0.801
	Obtains P($X \geq 2$) = **AWRT** 0.801	1.1b	A1	
	Subtotal		**2**	

Q	Marking instructions	AO	Marks	Typical solution
7(b)(i)	Interprets Type I error in context. Must mention mean number/rate of visitors.	3.2a	E1	To conclude that the mean number of visitors per hour has changed when it hasn't.
	Subtotal		**1**	

Q	Marking instructions	AO	Marks	Typical solution
7(b)(ii)	Uses $X \sim$ Po(3) to calculate one of P($X \leq 0$) = **AWRT** 0.05 P($X \leq 1$) = **AWRT** 0.20 P($X \leq 5$) = **AWRT** 0.92 P($X \leq 6$) = **AWRT** 0.97 P($X \geq 6$) = **AWRT** 0.08 P($X \geq 7$) = **AWRT** 0.03 Condone incorrect labels, eg P($X \geq 6$) = **AWRT** 0.03	3.4	M1	P($X \leq 0$) = 0.04979 < 0.05 P($X \leq 1$) = 0.1991 > 0.05 P($X \leq 5$) = 0.91608 P($X \geq 6$) = 1 – P($X \leq 5$) P($X \geq 6$) = 1 – 0.91608 P($X \geq 6$) = 0.08392 > 0.05 P($X \leq 6$) = 0.96649 P($X \geq 7$) = 1 – P($X \leq 6$) P($X \geq 7$) = 1 – 0.96649 P($X \geq 7$) = 0.03351 < 0.05 Probability of Type I error = 0.04979 + 0.03351 = 0.0833
	Obtains P($X \leq 0$) = **AWRT** 0.05, and P($X \geq 7$) = **AWRT** 0.034 or 1 – **AWRT** 0.9665 Condone incorrect labels	1.1b	A1	
	Adds the Poisson probability of their lower tail to the Poisson probability of their upper tail to give a total less than 1	1.1a	M1	
	Completes a reasoned argument to obtain the correct value of the probability of Type I error given to four decimal places 0.0833 The correct values of P($X \leq 0$) = **AWRT** 0.0498 P($X \leq 1$) = **AWRT** 0.20 P($X \geq 6$) = **AWRT** 0.08 and P($X \geq 7$) = **AWRT** 0.0335 or P($X \leq 0$) = **AWRT** 0.0498 P($X \leq 1$) = **AWRT** 0.20 P($X \leq 5$) = **AWRT** 0.92 and P($X \leq 6$) = **AWRT** 0.9665 all need to be seen with correct labels.	2.1	R1	
	Subtotal		**4**	

Q	Marking instructions	AO	Marks	Typical solution
7(c)	Recognises a limitation of the Poisson model, in context, relating to constant/fixed mean/average number of visitors per hour/rate of visitors Condone the number of visitors per hour is not independent of the time of day	3.5b	E1	The mean number of visitors per hour to the website over time during the 24-hour period may not be constant.
	Subtotal		**1**	

	Question total		**8**	

Q	Marking instructions	AO	Marks	Typical solution
8(a)	States both hypotheses using correct language. Variables need to be stated in at least the null hypothesis. **OE**	2.5	B1	H_0: There is no association between years of experience and average time taken to repair a computer. H_1: There is an association between years of experience and average time taken to repair a computer. χ^2 cv for 2 dof = 7.378 8.645 > 7.378 Reject H_0 Sufficient evidence to suggest that there is an association between years of experience and average time taken to repair a computer.
	Obtains correct critical value **AWRT** 7.4 or obtains p = **AWRT** 0.013	2.2a	B1	
	Evaluates the χ^2-test statistic by correctly comparing the test statistic with **AWRT** 7.4 or 6.0 or their p with 0.025 and makes a correct corresponding conclusion whether to reject H_0 Condone Accept H_1	3.5a	M1	
	Concludes, from a fully correct comparison, in context by referring to association between experience and time taken to repair **OE** (The conclusion must not be definite. eg use of suggest/support)	3.2a	R1	
	Subtotal		**4**	

<table>
<tr><th>Q</th><th>Marking instructions</th><th>AO</th><th>Marks</th><th>Typical solution</th></tr>
<tr><td rowspan="2">8(b)(i)</td><td>Obtains correct expected or observed contingency table.</td><td>3.3</td><td>M1</td><td rowspan="2"><table><tr><td>E</td><td><1</td><td>1–3</td><td>>3</td></tr><tr><td><1</td><td>28</td><td>21</td><td>21</td></tr><tr><td>>1</td><td>52</td><td>39</td><td>39</td></tr></table>
<table><tr><td>O</td><td><1</td><td>1–3</td><td>>3</td></tr><tr><td><1</td><td>x</td><td>$40 - x$</td><td>30</td></tr><tr><td>>1</td><td>$80 - x$</td><td>$x + 20$</td><td>30</td></tr></table></td></tr>
<tr><td>Obtains correct expected and observed contingency tables.</td><td>1.1b</td><td>A1</td></tr>
<tr><td></td><td>Subtotal</td><td></td><td>2</td><td></td></tr>
</table>

<table>
<tr><th>Q</th><th>Marking instructions</th><th>AO</th><th>Marks</th><th>Typical solution</th></tr>
<tr><td rowspan="4">8(b)(ii)</td><td>Obtains one correct term of $\sum \frac{(O-E)^2}{E}$ for their expected and observed frequencies OE</td><td>1.1a</td><td>M1</td><td rowspan="4">$8.645 = \frac{(x-28)^2}{28} + \frac{(28-x)^2}{52}$
$+\frac{(19-x)^2}{21} + \frac{(x-19)^2}{39}$
$+\frac{(30-21)^2}{21} + \frac{(30-39)^2}{39}$

$0.1282\ldots x^2 - 5.8608\ldots x + 66.8128\ldots = 0$

$x = 24.0, 21.7$

As x must be a positive integer, then $x = 24$</td></tr>
<tr><td>Obtains correct equation for their expected and observed frequencies in terms of x
$8.645 = \frac{(x-28)^2}{28} + \frac{(28-x)^2}{52}$
$+\frac{(19-x)^2}{21} + \frac{(x-19)^2}{39}$
$+\frac{(30-21)^2}{21} + \frac{(30-39)^2}{39}$
OE</td><td>3.4</td><td>M1</td></tr>
<tr><td>Obtains solution to the correct equation
AWRT 24 or 22</td><td>1.1b</td><td>A1</td></tr>
<tr><td>Obtains $x = 24$</td><td>2.2b</td><td>A1</td></tr>
<tr><td></td><td>Subtotal</td><td></td><td>4</td><td></td></tr>
</table>

Q	Marking instructions	AO	Marks	Typical solution
8(c)	Interprets main source of association in context. Must mention less than 1 years' experience and repairs greater than 3 days and compare observed and expected frequencies correctly **OE**	3.2a	E1	Employees with less than 1 years' experience have an average time taken to repair a computer greater than 3 days more often than expected.
	Subtotal		**1**	

	Question total		**11**	

	Paper total		**40**	