

Mark Scheme (Results)

Summer 2025

Pearson Edexcel GCE
AS Mathematics (8MA0)
Paper 21 Statistics

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

EDEXCEL GCE MATHEMATICS
General Instructions for Marking

1. The total number of marks for the paper is 30.

2. The Edexcel Mathematics mark schemes use the following types of marks:

- **M** marks: method marks are awarded for 'knowing a method and attempting to apply it', unless otherwise indicated.
- **A** marks: Accuracy marks can only be awarded if the relevant method (M) marks have been earned.
- **B** marks are unconditional accuracy marks (independent of M marks)
- Marks should not be subdivided.

3. Abbreviations

These are some of the traditional marking abbreviations that will appear in the mark schemes.

- bod – benefit of doubt
- ft – follow through
- the symbol $\surd$ will be used for correct ft
- cao – correct answer only
- cso - correct solution only. There must be no errors in this part of the question to obtain this mark
- isw – ignore subsequent working
- awrt – answers which round to
- SC: special case
- oe – or equivalent (and appropriate)
- dep – dependent
- indep – independent
- dp decimal places
- sf significant figures
- $*$ The answer is printed on the paper
- ⌐ The second mark is dependent on gaining the first mark

4. For misreading which does not alter the character of a question or materially simplify it, deduct two from any A or B marks gained, in that part of the question affected.

5. Where a candidate has made multiple responses and indicates which response they wish to submit, examiners should mark this response.
   If there are several attempts at a question which have not been crossed out, examiners should mark the final answer which is the answer that is the most complete.

6. Ignore wrong working or incorrect statements following a correct answer.

7. Mark schemes will firstly show the solution judged to be the most common response expected from candidates. Where appropriate, alternatives answers are provided in the notes. If examiners are not sure if an answer is acceptable, they will check the mark scheme to see if an alternative answer is given for the method used.

Question	Scheme	Marks	AOs
1(a)	awrt 0.173	B1	1.1b
		(1)	
(b)	awrt 0.191	B1	1.1b
		(1)	
(c)	awrt 0.191	B1ft	2.2a
		(1)	
			(3 marks)

Notes

(a)

B1: calc gives 0.172968…

(b)

B1: calc gives 0.191004… do not isw if e.g. 1 – 0.191 = 0.809 is then found

(c)

B1ft: ft their answer to (b) to 3sf or better only ft 0 < "their (b)" < 1

SC: For all correct answers given to 2sf i.e. (a) 0.17 (b) 0.19 (c) 0.19 score B0B0B1ft

Question	Scheme	Marks	AOs
2(a)	Census	B1	1.2
		(1)	
(b)(i)	$1018 - (1025 - 1018) \times 1.5$ (= 1007.5)	M1	2.1
	(1007 < 1007.5) There is one outlier/1007 is an outlier	A1	1.1b
		(2)	
(b)(ii)	Lower whisker drawn to 1009 **and** a single outlier at 1007	B1ft	2.2a
	Allow lower whisker to end at 1007.5 or 1009		
		(1)	
(c)	184 – 161 = 23 days with "Moderate" Windspeed 23 × 0.25 = 5.75, so 6 days.	M1 A1	2.4 2.2b LDS
		(2)	
			(6 marks)

Notes

(a)

B1: cao

(b)(i)

M1: finding the correct IQR for "light days" **and** using it to calculate the lower outlier limit (implied by a correct lower limit 1007.5)

A1: correct outlier limit with correct conclusion
Note: 1007 on its own with no supporting working is M0A0.

(b)(ii)

B1ft: correct lower whisker drawn to 1009 **and** single outlier marked at 1007
or correct ft their **conclusion** to part (b)(i) i.e. if they state there are no outliers, then the lower whisker must be drawn to 1007

(c)

M1: using knowledge of LDS to find the number of days with "Moderate" Windspeed.
Allow use of 180 to 185.
Implied by an answer of 5.75 or 19 to 24 from correct knowledge of LDS

A1: allow 5 or 6 days Correct answer only M1A1.

Question	Scheme	Marks	AOs
3(a)	$p + 0.2 + 4p = 1$	M1	1.1b
	B(inomial)	M1	3.3
	$n = 40$ $p = 0.16$	A1	1.1b
		(3)	
(b)(i)	$H_0 : p = 0.2$ $H_1 : p > 0.2$	B1	2.5
	[X ~] B(40, 0.2)	M1	3.3
	[P($X \geqslant 11$) = 1 – 0.8392…] = 0.1607... awrt 0.16	A1	3.4
	[Do not reject H_0/not significant…] There is insufficient evidence to support Jayda's belief.	A1	2.2b
		(4)	
(ii)	Require P($X \leqslant k$) > 0.95 so [P($X \leqslant 11$) =] 0.9125 or [P($X \leqslant 12$) =] 0.9568	M1	3.4
	[0 $\leqslant$] $X \leqslant 12$	A1	1.1b
		(2)	
			(9 marks)

Notes

(a)

M1: use of sum of probabilities = 1 (may be implied by $p = 0.16$)

M1: identifying the B(inomial) distribution to model this situation (must be seen in part (a))

A1: both correct parameters $n = 40$ and $p = 0.16$
Answer only B(40, 0.16) scores M1M1A1.

Mark (b)(i) and (b)(ii) together

(b)(i)

B1: both hypotheses correct in terms of p or π

M1: writing or using Binomial (40, 0.2) (implied by awrt 0.16 or awrt 0.073)

A1: awrt 0.16
If P($X \geqslant 11$) = awrt 0.16 is seen, isw if a different p–value is stated.
Watch out [P($X = 8$) =] 0.156 and is A0

A1: dep on M1A1 (but independent of hypotheses)
for suitable conclusion in context that suggests **Jayda's belief** is **not supported <u>or</u>** states that there is **not** enough evidence that the **proportion/probability** of **green counters** in the bag is **greater than 0.2**
with bold words oe Do not allow **number** for proportion/probability
Allow not increased/not changed/is 0.2 for not greater than 0.2
A0 for contradictory statements e.g. Reject H_0 ∴ Jayda's belief is not supported.

SC: Use of critical region without stating p-value can score max B1M1A0A1
The final A1 is for the correct contextual conclusion **<u>and</u>** a correct CR $X \geqslant 13$ seen (allow any letter) or equivalent.

(b)(ii)

M1: Use of B(40, 0,2) to find a relevant acceptance region probability
i.e. awrt 0.91 or awrt 0.96 or awrt 0.088 or awrt 0.043
Allow if these are seen in part (b)(i) as part of a critical region approach

A1: correct acceptance region or equivalent, e.g. $X < 13$. Allow any letter. May be stated in words. Correct acceptance region on its own scores M1A1.
Do **not** allow probability statements for acceptance region e.g. P($X < 13$)

SC: Use of a two-tailed test in (b)(i) leading to an acceptance region of $3 \leqslant X \leqslant 13$ scores M1A0

Question	Scheme	Marks	AOs
4(a)	$\sigma = \left[\sqrt{\frac{S_{cc}}{n}} = \sqrt{\frac{394}{25}}\right] = 3.9698...$ awrt **3.97**	B1	1.1b
		(1)	
(b)(i)	$b = \frac{-3.5}{500}$ or $16.5 = a + 2200b$	M1	2.2a
	$= -0.007$	A1	1.1b
		(2)	
(b)(ii)	$20 = a +$ "-0.007"(1700) or $20 = a + 1700b$	M1	2.2a
	$= 31.9$	A1	1.1b
		(2)	
			(5 marks)

Notes

(a)

B1: awrt 3.97 (allow s = awrt 4.05)

Mark (b)(i) and (b)(ii) together

(b)(i)(ii)

M1: deducing that the first bullet point can be used to :
Either set up a correct numerical expression for b (allow ±)

implied by ± 0.007 or $\pm\frac{3.5}{500}$

or write a correct equation from the first bullet point e.g. $16.5 = a + 2200b$
Allow equivalent use of the first bullet point e.g. $(20 - 3.5k) = a + (1700 + 500k)b$
NB: $(\pm)3.5 = a + 500b$ is M0

A1: -0.007 oe (allow standard form) correct answer scores M1A1.

M1: using the second bullet point with their value of b to find a
Either substituting "their b" into $20 = a + 1700b$ oe e.g. $20 -$ "their b" $\times 1700$
or writing the correct equation $20 = a + 1700b$ oe

A1: 31.9 oe correct answer scores M1A1.

Questi	Scheme	Marks	AOs
5(a)	$[u =]$ 0.23	B1	1.1b
		(1)	
(b)	$p + q + s + t = 0.55$ **and** $r + 0.55 + u = 1$ $[r =]$ 0.22	M1 A1	3.1a 1.1b
		(2)	
(c)	$q + s = 0.18$ P(B) = "0.22" + 0.18 P(A) = "0.22" + 0.18 – 0.1 **and** P(A and B) = 0.3 × 0.4 = 0.12 $q = 0.12$ and $s = 0.06$ $p = 0.18$ and $t = 0.19$	M1 M1 A1 A1	2.2a 2.1 1.1b 1.1b
		(4)	
			(7 marks)

Notes

Mark parts (a), (b) and (c) together

(a)

B1: 0.23 oe

(b)

M1: For realising P(A) + P(C) = $p + q + s + t = 0.55$ **and** $r + 0.55$ + "their u" = 1

A1: 0.22 oe

(c)

M1: Writing or using $q + s = 0.18$ (implied by "their q" + "their s" = 0.18)
implied by P(B) = 0.4

M1: Use of 4th **and** 5th bullet points:

For 4th bullet point accept:

- P(A) × P(B) = P(A and B)
- P(A) × P(B) = q (may see substitution of their values)
- $(p + q) \times (q + r + s) = q$ (may see substitution of their values)

For 5th bullet point accept:

- P(A) = 0.3 and P(B) = 0.4
- $(q + r + s) = (p + q) + 0.1$ (may see substitution of their values)
- P(B) = "their r" + 0.18 and P(A) = "their r" + 0.08

Correct values for q and s imply M1M1

A1: $q = 0.12$ oe and $s = 0.06$ oe

A1: $p = 0.18$ oe and $t = 0.19$ oe

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