



National
Qualifications
2022

2022 Statistics

Advanced Higher - Paper 1

Finalised Marking Instructions

© Scottish Qualifications Authority 2022

These marking instructions have been prepared by examination teams for use by SQA appointed markers when marking external course assessments.

The information in this document may be reproduced in support of SQA qualifications only on a non-commercial basis. If it is reproduced, SQA must be clearly acknowledged as the source. If it is to be reproduced for any other purpose, written permission must be obtained from permissions@sqa.org.uk.

General marking principles for Advanced Higher Statistics

Always apply these general principles. Use them in conjunction with the detailed marking instructions, which identify the key features required in candidates' responses.

The marking instructions for each question are generally in two sections:

- *generic scheme* – this indicates why each mark is awarded
- *illustrative scheme* – this covers methods which are commonly seen throughout the marking

In general, you should use the illustrative scheme. Only use the generic scheme where a candidate has used a method not covered in the illustrative scheme.

- Always use positive marking. This means candidates accumulate marks for the demonstration of relevant skills, knowledge and understanding; marks are not deducted for errors or omissions.
- If you are uncertain how to assess a specific candidate response because it is not covered by the general marking principles or the detailed marking instructions, you must seek guidance from your team leader.
- One mark is available for each •. There are no half marks.
- If a candidate's response contains an error, all working subsequent to this error must still be marked. Only award marks if the level of difficulty in their working is similar to the level of difficulty in the illustrative scheme.
- Only award full marks where the solution contains appropriate working. A correct answer with no working receives no mark, unless specifically mentioned in the marking instructions.
- Candidates may use any mathematically correct method to answer questions, except in cases where a particular method is specified or excluded.
- If an error is trivial, casual or insignificant, for example $6 \times 6 = 12$, candidates lose the opportunity to gain a mark, except for instances such as the second example in point (h) below.
- If a candidate makes a transcription error (question paper to script or within script), they lose the opportunity to gain the next process mark, for example

This is a transcription error and so the mark is not awarded.

This is no longer a solution of a quadratic equation, so the mark is not awarded.

$$x^2 + 5x + 7 = 9x + 4$$

$$x - 4x + 3 = 0$$

$$x = 1$$

The following example is an exception to the above

This error is not treated as a transcription error, as the candidate deals with the intended quadratic equation. The candidate has been given the benefit of the doubt and all marks awarded.

$$x^2 + 5x + 7 = 9x + 4$$

$$x - 4x + 3 = 0$$

$$(x - 3)(x - 1) = 0$$

$$x = 1 \text{ or } 3$$

(i) **Horizontal/vertical marking**

If a question results in two pairs of solutions, apply the following technique, but only if indicated in the detailed marking instructions for the question.

Example:

$$\begin{array}{cc} \bullet^5 & \bullet^6 \\ \bullet^5 & x = 2 \quad x = -4 \\ \bullet^6 & y = 5 \quad y = -7 \end{array}$$

Horizontal: $\bullet^5 x = 2$ and $x = -4$ Vertical: $\bullet^5 x = 2$ and $y = 5$
 $\bullet^6 y = 5$ and $y = -7$ $\bullet^6 x = -4$ and $y = -7$

You must choose whichever method benefits the candidate, **not** a combination of both.

(j) In final answers, candidates should simplify numerical values as far as possible unless specifically mentioned in the detailed marking instruction. For example

$$\begin{array}{ll} \frac{15}{12} \text{ must be simplified to } \frac{5}{4} \text{ or } 1\frac{1}{4} & \frac{43}{1} \text{ must be simplified to } 43 \\ \frac{15}{0.3} \text{ must be simplified to } 50 & \frac{4/5}{3} \text{ must be simplified to } \frac{4}{15} \\ \sqrt{64} \text{ must be simplified to } 8^* & \end{array}$$

*The square root of perfect squares up to and including 100 must be known.

(k) Do not penalise candidates for any of the following, unless specifically mentioned in the detailed marking instructions:

- working subsequent to a correct answer
- correct working in the wrong part of a question
- legitimate variations in numerical answers/algebraic expressions, for example angles in degrees rounded to nearest degree
- omission of units
- bad form (bad form only becomes bad form if subsequent working is correct), for example

$$\begin{aligned} & (x^3 + 2x^2 + 3x + 2)(2x + 1) \text{ written as} \\ & (x^3 + 2x^2 + 3x + 2) \times 2x + 1 \\ & = 2x^4 + 5x^3 + 8x^2 + 7x + 2 \\ & \text{gains full credit} \end{aligned}$$

- repeated error within a question, but not between questions or papers

(l) In any 'Show that...' question, where candidates have to arrive at a required result, the last mark is not awarded as a follow-through from a previous error, unless specified in the detailed marking instructions.

(m) You must check all working carefully, even where a fundamental misunderstanding is apparent early in a candidate's response. You may still be able to award marks later in the question so you must refer continually to the marking instructions. The appearance of the correct answer does not necessarily indicate that you can award all the available marks to a candidate.

(n) You should mark legible scored-out working that has not been replaced. However, if the scored-out working has been replaced, you must only mark the replacement working.

- (o) If candidates make multiple attempts using the same strategy and do not identify their final answer, mark all attempts and award the lowest mark. If candidates try different valid strategies, apply the above rule to attempts within each strategy and then award the highest mark.

For example:

Strategy 1 attempt 1 is worth 3 marks.	Strategy 2 attempt 1 is worth 1 mark.
Strategy 1 attempt 2 is worth 4 marks.	Strategy 2 attempt 2 is worth 5 marks.
From the attempts using strategy 1, the resultant mark would be 3.	From the attempts using strategy 2, the resultant mark would be 1.

In this case, award 3 marks.

Marking instructions for each question

Question			Generic scheme	Illustrative scheme	Max mark
1.	(a)		<ul style="list-style-type: none"> •¹ calculate upper fence •² write conclusion 	<ul style="list-style-type: none"> •¹ upper fence = $13 + (13 - 5) \times 1.5 = 25$ •² ... > 21 (the maximum), so no, there were no outliers 	2
<p>Notes:</p> <p>1. For •², the conclusion must provide a reason for why there are no outliers.</p>					
<p>Commonly Observed Responses:</p>					

Question		Generic scheme	Illustrative scheme	Max mark
	(b)	<ul style="list-style-type: none"> •³ give an explanation •⁴ continue explanation 	<ul style="list-style-type: none"> •³ simple random sample of 2% of all songs from each year •⁴ combine these 10 samples together 	2
Notes:				
1. For • ³ , explanation must mention both random sample, and 2% from each year or each strata.				
Commonly Observed Responses:				
	(c)	<ul style="list-style-type: none"> •⁵ appropriate description •⁶ appropriate explanation •⁷ appropriate description •⁸ appropriate explanation •⁹ appropriate description •¹⁰ appropriate explanation 	<ul style="list-style-type: none"> •⁵ means and/or medians of number of weeks are both increasing •⁶ meaning songs are staying in the charts for longer as each decade goes by •⁷ standard deviations and/or IQRs are all increasing •⁸ meaning that there is a growing spread of charting duration as each decade goes by •⁹ sample sizes are decreasing •¹⁰ meaning that there were fewer new songs charting in the Top 40 as each decade goes by 	6
Notes:				
1. For each description and explanation, comparisons must be across all three decades, and not just comparing any two decades.				
2. For • ⁵ , accept 'averages' instead of either 'mean' or 'median'.				
3. For • ⁵ , do not accept 'measures of location'.				
4. For • ⁷ , accept 'spread' instead of either 'standard deviation' or 'IQR'.				
Commonly Observed Responses:				

Question			Generic scheme	Illustrative scheme	Max mark
1.	(d)	(i)	<ul style="list-style-type: none"> •¹¹ correct critical value •¹² show calculation •¹³ correct assumption 	<ul style="list-style-type: none"> •¹¹ $t_{32,0.975} = 2.037$ •¹² $12.700 \pm 2.037 \frac{7.038}{\sqrt{33}}$ •¹³ the distribution of the population of the number of weeks in the top 40 charts in the 1990s is normally distributed 	3
Notes: 1. For • ¹³ , candidates must mention 'number of weeks' to gain the mark.					
Commonly Observed Responses:					
		(ii)	<ul style="list-style-type: none"> •¹⁴ appropriate explanation 	<ul style="list-style-type: none"> •¹⁴ In repeated samples, 95 out of 100 intervals calculated using 95% confidence would contain the population mean 	1
Notes: 1. For • ¹⁴ , candidates must mention 'true mean' or 'population mean'. 2. For • ¹⁴ , also accept '95% of the time, the interval would contain the population mean'. 3. For • ¹⁴ , do not accept any of the following phrases: '95% confident...' '95% chance...' '95% certain...' '95% accurate...' 'with a 95% likelihood'					
Commonly Observed Responses:					

Question		Generic scheme	Illustrative scheme	Max mark
1.	(e)	<ul style="list-style-type: none"> •¹⁵ correct decision •¹⁶ appropriate interpretation 	<ul style="list-style-type: none"> •¹⁵ $0.4042 > 0.05$ so do not reject H_0 •¹⁶ there is no evidence to conclude that the mean number of weeks of individual songs in the charts are different (between the 2000s and 2010s) 	2
<p>Notes:</p> <ol style="list-style-type: none"> 1. For •¹⁵, also accept '0.4042 is high, so do not reject H_0'. 2. For •¹⁵, do not accept either 'accept H_0' or 'reject H_1'. 3. For •¹⁶, must reference '...mean number of weeks...' 4. For •¹⁶, do not accept conclusions that are too definite. Phrasing must include 'evidence to conclude...', or 'evidence to suggest...', or similar. 				
<p>Commonly Observed Responses:</p>				
	(f)	<ul style="list-style-type: none"> •¹⁷ correct comment 	<ul style="list-style-type: none"> •¹⁷ assumption appears not to be valid as the sample standard deviations are not similar in value 	1
<p>Notes:</p> <ol style="list-style-type: none"> 1. For •¹⁷, response must comment on the validity of the assumption as well as giving a reason. 2. For •¹⁷, also accept 'sample standard deviations are not equal', 'sample standard deviations are very different'. 				
<p>Commonly Observed Responses:</p>				

Question		Generic scheme	Illustrative scheme	Max mark
2.	(a)	<ul style="list-style-type: none"> •¹ state sampling method •² appropriate disadvantage 	<ul style="list-style-type: none"> •¹ convenience sampling •² eg the gathered data would potentially be unrepresentative of young people, response rates vary across groups 	2
Notes: <ol style="list-style-type: none"> 1. For •², also accept 'biased' in place of 'unrepresentative'. 2. For •², do not accept 'unrepresentative of population'. 3. For •², response must reference the specific population that is being sampled. 4. For •², accept appropriate disadvantage for (any incorrect) sampling method stated in •¹. 5. For •², do not accept 'only 1 school used' or 'only those who want to respond will'. 				
Commonly Observed Responses:				
	(b)	<ul style="list-style-type: none"> •³ appropriate suggestion 	<ul style="list-style-type: none"> •³ eg incentives, teacher led gathering (such as S6 lessons, or year group meetings), reminders 	1
Notes: <ol style="list-style-type: none"> 1. For •³, do not accept suggestions that alter the sampling method to a different method. 				
Commonly Observed Responses:				
	(c)	<ul style="list-style-type: none"> •⁴ state group •⁵ give a reason 	<ul style="list-style-type: none"> •⁴ teachers •⁵ as they are a much smaller group, they are scaled up proportionately more than the larger groups of pupils 	2
Notes: <ol style="list-style-type: none"> 1. For •⁵, do not accept 'one group is larger than the other'. 2. For •⁵, do not accept 'percentages are higher as most teachers wear watches'. 				
Commonly Observed Responses:				

Question			Generic scheme	Illustrative scheme	Max mark
2.	(d)	(i)	<ul style="list-style-type: none"> •⁶ show calculation 	<ul style="list-style-type: none"> •⁶ $\left\{ \begin{array}{l} \frac{79 + 66 + 64 + 55 + 54 + 39 + 44}{7} \\ = 57.3 \end{array} \right.$ 	1
Notes:					
Commonly Observed Responses:					
		(ii)	<ul style="list-style-type: none"> •⁷ appropriate explanation 	<ul style="list-style-type: none"> •⁷ teachers are not part of the population of interest 	1
Notes:					
Commonly Observed Responses:					

Question		Generic scheme	Illustrative scheme	Max mark
2.	(e)	<ul style="list-style-type: none"> •⁸ state hypotheses •⁹ correct proportion •¹⁰ calculate pooled proportion •¹¹ show calculation for z •¹² show calculation for p value 	<ul style="list-style-type: none"> •⁸ $H_0 : p_1 = p_5 \quad H_1 : p_1 \neq p_5$ •⁹ $\hat{p}_5 = \frac{54}{206}$ •¹⁰ $\hat{p} = \frac{79 + 54}{224 + 206} = \frac{133}{430}$ •¹¹ $z = \frac{\frac{79}{224} - \frac{54}{206}}{\sqrt{\frac{133}{430} \cdot \frac{297}{430} \left(\frac{1}{224} + \frac{1}{206} \right)}}$ = 2.02928 •¹² $\begin{aligned} p \text{ value} &= 2 \times P(Z > 2.03) \\ &= 2 \times (1 - 0.9788) \\ &= 2 \times 0.0212 \\ &= 0.0424 \end{aligned}$ 	5
Notes: 1. For • ⁹ and • ¹⁰ , also accept decimal equivalents to at least 2 decimal places. 2. For • ¹¹ , if rounded values are used, mark can still be gained only if full calculations shown. 3. Mark • ¹² is only available for clear communication of the doubling of a probability value.				
Commonly Observed Responses:				
	(f)	• ¹³ appropriate suggestion	• ¹³ one school is not representative of young people	1
Notes: 1. For • ¹³ , accept responses that communicate the awareness of existence of other schools.				
Commonly Observed Responses:				

[END OF MARKING INSTRUCTIONS]