



Course report 2022

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| Subject | Mathematics |
| Level | Advanced Higher |

This report provides information on candidates' performance. Teachers, lecturers and assessors may find it useful when preparing candidates for future assessment. The report is intended to be constructive and informative and to promote better understanding. It would be helpful to read this report in conjunction with the published assessment documents and marking instructions.

The statistics used in this report have been compiled before the completion of any appeals.

Grade boundary and statistical information

Statistical information: update on courses

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|------------------------------------|------|
| Number of resulted entries in 2022 | 3915 |
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Statistical information: performance of candidates

Distribution of course awards including grade boundaries

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|-----------------|------------|------|-----------------------|------|----------------------|------|-----------------------|-----|
| A | Percentage | 38.7 | Cumulative percentage | 38.7 | Number of candidates | 1515 | Minimum mark required | 68 |
| B | Percentage | 21.7 | Cumulative percentage | 60.4 | Number of candidates | 850 | Minimum mark required | 56 |
| C | Percentage | 16.9 | Cumulative percentage | 77.3 | Number of candidates | 665 | Minimum mark required | 44 |
| D | Percentage | 11.5 | Cumulative percentage | 88.8 | Number of candidates | 445 | Minimum mark required | 32 |
| No award | Percentage | 11.2 | Cumulative percentage | N/A | Number of candidates | 440 | Minimum mark required | N/A |

You can read the general commentary on grade boundaries in appendix 1 of this report.

In this report:

- ◆ 'most' means greater than 70%
- ◆ 'many' means 50% to 69%
- ◆ 'some' means 25% to 49%
- ◆ 'a few' means less than 25%

You can find more statistical reports on the statistics page of [SQA's website](https://sqa.my/).

Section 1: comments on the assessment

Paper 1 (non-calculator)

Feedback from the marking team suggests paper 1 was more demanding than expected, particularly questions 4, 5 and 7, resulting in grade boundaries being lowered.

Paper 2 (calculator)

Feedback from the marking team suggests that paper 2 proved slightly more demanding than expected, particularly questions 4 and 12, resulting in grade boundaries being lowered.

Section 2: comments on candidate performance

Paper 1 (non-calculator)

Question 1(a) and (b): Most candidates performed well in carrying out basic differentiation procedures.

Question 2: Most candidates carried out Gaussian elimination correctly.

Question 3: Working in Cartesian form, most candidates were able to determine a complex conjugate and multiply complex numbers.

Question 4(a): Most candidates were able to carry out implicit differentiation.

Question 4(c): Many candidates found it difficult to process a zero gradient, possibly because the expression was rational and involved two variables. Where candidates managed to carry out the appropriate algebra, some failed to communicate effectively and did not complete demonstration of the required result.

Question 5(a): Most candidates were able to produce a simple Maclaurin expansion, either from first principles or by substitution into a known expansion.

Question 5(b): Many candidates attempted to produce a Maclaurin expansion of a linear expression, and some did not correctly interpret the link with part (a).

Question 6(a): When asked for a counterexample, some candidates produced a composite number as required but failed to communicate that their number was not prime.

Question 6(b): Many candidates were not able to state algebraically the general form of two consecutive integers, with appropriate reference to the source set. Some candidates did not draw an appropriate conclusion with respect to divisibility.

Question 7(a): Some candidates retained the original limits when writing an integral in terms of a new variable. This was followed either by attempting to evaluate the new integral with the old limits, or returning to the original variable, having written a number of incorrect expressions.

Question 7(b): Only a few candidates recognised that the required area was double their answer to part (a).

Question 7(c): Many candidates were unable to perform a straightforward algebraic division.

Question 7(d): Many candidates were unable to follow the link to part (c) and were therefore unable to access possible follow-through marks. When attempting to evaluate the volume of revolution, some candidates either did not specify the variable of integration or included the wrong variable.

Paper 2 (calculator)

Question 2: Some candidates did not carry out the appropriate division when integrating a logarithmic function.

Question 3: Most candidates were able to use the Euclidean algorithm to express the greatest common divisor of two positive integers as a linear combination of those integers.

Question 4: Most candidates did not deal with the Higher integration correctly.

Question 6(a): Many candidates, having identified the difference between two terms in a sequence, did not communicate the requirement to check with a different pair of terms to establish that the sequence was arithmetic. While it is not clear whether this was because of a lack of understanding or communication, it is likely that a number of candidates did not understand the need to carry out the second subtraction.

Question 7(a) and (b): Most candidates were able to investigate the complex roots of a polynomial.

Question 9: Many candidates found proof by induction difficult. Some candidates' communication showed a lack of understanding of the assumption that underlies this method of proof. Only some managed to complete a proof with a sufficiently explicit final statement.

Question 11: In an unfamiliar style of question, many candidates were able to interpret parametric differentiation. This question was particularly challenging, and some candidates produced insightful and clearly expressed solutions.

Question 12(b): Most candidates were able to state and simplify a binomial expansion involving complex numbers.

Question 12(ci): Some candidates were able to combine skills and knowledge in a challenging question to produce the required identity. Some candidates did not provide sufficient justification when moving from one identity to the next, and so did not adequately demonstrate the required result.

Question 12(cii): Most candidates were unable to process the imaginary part from part (b), despite having correctly identified the real part earlier. There was some direction in identifying the real part, and candidates were expected to be able to repeat the process without direction for the imaginary part, but many were unable to do this.

Question 13(aii): Many candidates were unable to provide the necessary communication to justify the given result. Some candidates were unable to communicate a relationship between the derivatives, although scaffolding had been provided in the previous part of the question.

Question 13(b): Candidates were asked to provide a simple, and commonly encountered, proof of a result that would be useful in the final part of the question. Many candidates were either unable to state the identity from Higher, from which the new identity derives, or unable to develop the necessary algebraic steps.

Question 13(c): Some candidates were able to meet the demands of this very challenging question. The context of the question as a whole was unfamiliar, and much reading and interpretation was required, as well as the ability to bring together earlier elements to determine the result in this final part.

Section 3: preparing candidates for future assessment

Paper 1 (non-calculator) and paper 2 (calculator)

In general, candidates were well prepared for the assessment. Good use was made of published guidance. This included taking note of amendments to the current course specification and referring to this document along with the revision support.

There was some evidence of the previous versions (pre-2019 or pre-2015) of course specifications being used. Centres should use the SQA website, including the section on Understanding Standards, to ensure that the information and guidance they are using is current.

Some candidates produced excellent and insightful answers for the more challenging questions, in particular questions 11, 12(c) and 13(c) of paper 2. There was evidence, in paper 1 questions 1, 2, 3, 4(c) and 5, and paper 2 questions 3, 7(a) and 7(b), that candidates had thoroughly revised several techniques and routines to ensure their familiarity and understanding. Teachers and lecturers should continue to encourage this.

Proof, including induction (paper 2 question 9), continues to present difficulties, and candidates would benefit from thorough preparation in this area, particularly in communication (paper 1 question 6(b)). There is still a need to emphasise the requirement to specify source sets when giving the form of, for example, consecutive integers (paper 1 question 6(b)).

In questions where candidates are asked to show that a certain result is true, teachers and lecturers should ensure candidates know that justification must be clear and detailed, and demonstrate understanding. Questions 4(c), 6(a) and 6(b) in paper 1, and questions 6(a), 9, 12(c), 13(a) and 13(b) in paper 2 provide examples of this.

Communication continues to cause difficulties. Teachers and lecturers should emphasise accurate use of notation, terminology, brackets and symbols. Many candidates omitted linking words and phrases, especially where proof or justification was required.

While a degree of flexibility can be allowed on occasion, candidates should be reminded of the need for accuracy in writing integrals. This is especially important when the relevant variable is not obvious, such as volume of revolution (paper 1 question 7(c) and integration by substitution (paper 1 question 7(a)). In the latter case, it should be stressed that it is incorrect to leave the limits unchanged when the variable changes.

Centres are reminded of the continuing need to reinforce prior knowledge, including exponentials and logs, the chain rule, and exact values. Knowledge of exact values is particularly relevant now that there is a non-calculator paper.

Appendix 1: general commentary on grade boundaries

SQA's main aim when setting grade boundaries is to be fair to candidates across all subjects and levels and maintain comparable standards across the years, even as arrangements evolve and change.

For most National Courses, SQA aims to set examinations and other external assessments and create marking instructions that allow:

- ◆ a competent candidate to score a minimum of 50% of the available marks (the notional grade C boundary)
- ◆ a well-prepared, very competent candidate to score at least 70% of the available marks (the notional grade A boundary)

It is very challenging to get the standard on target every year, in every subject at every level. Therefore, SQA holds a grade boundary meeting for each course to bring together all the information available (statistical and qualitative) and to make final decisions on grade boundaries based on this information. Members of SQA's Executive Management Team normally chair these meetings.

Principal assessors utilise their subject expertise to evaluate the performance of the assessment and propose suitable grade boundaries based on the full range of evidence. SQA can adjust the grade boundaries as a result of the discussion at these meetings. This allows the pass rate to be unaffected in circumstances where there is evidence that the question paper or other assessment has been more, or less, difficult than usual.

- ◆ The grade boundaries can be adjusted downwards if there is evidence that the question paper or other assessment has been more difficult than usual.
- ◆ The grade boundaries can be adjusted upwards if there is evidence that the question paper or other assessment has been less difficult than usual.
- ◆ Where levels of difficulty are comparable to previous years, similar grade boundaries are maintained.

Grade boundaries from question papers in the same subject at the same level tend to be marginally different year on year. This is because the specific questions, and the mix of questions, are different and this has an impact on candidate performance.

This year, a package of support measures including assessment modifications and revision support, was introduced to support candidates as they returned to formal national exams and other forms of external assessment. This was designed to address the ongoing disruption to learning and teaching that young people have experienced as a result of the COVID-19 pandemic. In addition, SQA adopted a more generous approach to grading for National 5, Higher and Advanced Higher courses than it would do in a normal exam year, to help ensure fairness for candidates while maintaining standards. This is in recognition of the fact that those preparing for and sitting exams have done so in very different circumstances from those who sat exams in 2019.

The key difference this year is that decisions about where the grade boundaries have been set have also been influenced, where necessary and where appropriate, by the unique circumstances in 2022. On a course-by-course basis, SQA has determined grade boundaries in a way that is fair to candidates, taking into account how the assessment (exams and coursework) has functioned and the impact of assessment modifications and revision support.

The grade boundaries used in 2022 relate to the specific experience of this year's cohort and should not be used by centres if these assessments are used in the future for exam preparation.

For full details of the approach please refer to the [National Qualifications 2022 Awarding — Methodology Report](#).