Course report 2024

Advanced Higher Mathematics of Mechanics

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. You should read the report with the published assessment documents and marking instructions.

We compiled the statistics in this report before we completed the 2024 appeals process.

Grade boundary and statistical information

Statistical information: update on courses

Number of resulted entries in 2023:   356

Number of resulted entries in 2024:   427

Statistical information: performance of candidates

Distribution of course awards including minimum mark to achieve each grade

A	Number of candidates	171	Percentage	40.0	Cumulative percentage	40.0	Minimum mark required	68
B	Number of candidates	60	Percentage	14.1	Cumulative percentage	54.1	Minimum mark required	57
C	Number of candidates	45	Percentage	10.5	Cumulative percentage	64.6	Minimum mark required	46
D	Number of candidates	46	Percentage	10.8	Cumulative percentage	75.4	Minimum mark required	35
No award	Number of candidates	105	Percentage	24.6	Cumulative percentage	100	Minimum mark required	N/A

We have not applied rounding to these statistics.

You can read the general commentary on grade boundaries in the appendix.

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 statistical reports on the statistics and information page of our website.

Section 1: comments on the assessment

Most of the questions in the paper performed broadly as expected, although some proved more challenging than expected. This was taken into account when setting the grade boundaries.

Section 2: comments on candidate performance

Overall, many candidates performed well in the question paper.

Areas that candidates performed well in

Question 2

Many candidates gained full marks for this question. Partial fractions, particularly distinct linear factors, continues to be a topic that many candidates perform well in.

Question 4

Many candidates gained full marks for this question on the quotient rule. Candidates who studied the Advanced Higher Mathematics course alongside this course would have found this topic very familiar.

Question 8(a)

Many candidates attempted this standard proof of the trajectory equation very well. Candidates took different approaches, such as calculus and equations of motion.

Question 18

Resolving forces on a slope appears most years in the question paper. Responses to these questions have improved greatly in recent years. Many candidates answered this question well.

Areas that candidates found demanding

Question 1

Although this type of question should be familiar to candidates, and many candidates answered this question well, some candidates failed to provide a response.

Question 2(b)

Some candidates did not integrate the term with $2x$ in the denominator. Some candidates had the same issue in question 13.

Question 5

Some candidates did not seem to realise that the maximum velocity and acceleration are magnitudes and, therefore, are not negative.

Question 6

Some candidates performed the differentiation perfectly but did not evaluate the answer, despite having a calculator. Some candidates' responses did not demonstrate an understanding of the relationships between sine, cosine, and tangent, and secant, cosecant, and cotangent.

Question 10

Some candidates did not factor the slope being part of a circle into their calculations at all. In these cases, answers were very short.

Question 12

Many candidates did not draw an exponential graph correctly. (Many candidates drew a straight line instead of an exponential curve.) Many candidates did not integrate the exponential to find the area under the curve and, hence, the distance travelled.

Question 15

Many candidates did not apply the equations of motion to more than one body correctly. Many candidates made errors involving the different start times.

Question 17

Many candidates missed out on marks in this circular motion question, which had a gravitation context. Although the question required an algebraic answer, the set-up at the start was a very common one, namely the application of Newton's inverse square law at both the satellite and the surface.

Question 19

This was a nearest approach question, which candidates could use a vector or geometric approach to solve. Candidates who applied a geometric approach performed better than those who applied a vector approach.

Section 3: preparing candidates for future assessment

The Advanced Higher Mathematics of Mechanics course is challenging and, by its nature, attracts candidates who excel in mathematics or physics or both. It is not enough, however, for candidates to simply be strong in mathematics and physics because this course is distinct from these areas.

The skills from the Advanced Higher Mathematics course can help build good foundations in algebra and calculus, which can benefit candidates when tackling longer, more-involved calculations and problems. However, centres should ensure that candidates cover the entire course content for Advanced Higher Mathematics of Mechanics to be best prepared for the question paper.

The following advice may help prepare future candidates:

♦ Rounding can be an issue, specifically rounding within a question, then using the rounded answer rather than the exact value from the calculator.

♦ Clear notation is so important in this course and carelessness in this area can lead to mistakes. For example:

— in relative motion, using P and Q rather than displacement vectors $\mathbf{r}_P$, $\mathbf{r}_Q$ and $_P\mathbf{r}_Q$ and their velocity equivalents

— in algebraic expressions, using $\frac{1}{2} - g$ instead of $\frac{1}{2}\left(-g\right)$

— in gravitation questions, not using m_1 and m_2 for different masses or confusing two different radii by not labelling them as r and R

♦ Candidates can forget skills from National 5 and Higher Mathematics. It can be helpful to revise algebraic fractions, quadratic equations, and rules of logs and exponentials.

♦ Teachers and lecturers should encourage candidates to use the same calculator all year, so they are used to its functions when they use it in the exam. Many candidates show the correct figures and calculations in their working but end up with an incorrect final numeric answer because they make an inputting error when using their calculator.

♦ Candidates should practise answering a combination of short, sharp questions that take less thought and time and longer, more in-depth problems. Candidates should use the number of marks available for each question to help them determine how detailed they should make their responses.

Appendix: 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.

Every year, we evaluate the performance of our assessments in a fair way, while ensuring standards are maintained so that our qualifications remain credible. To do this, we measure evidence of candidates' knowledge and skills against the national standard.

During the pandemic, we modified National Qualifications course assessments, for example we removed elements of coursework. We kept these modifications in place until the 2022–23 session. The education community agreed that retaining the modifications for longer than this could have a detrimental impact on learning and progression to the next stage of education, employment or training. After discussions with candidates, teachers, lecturers, parents, carers and others, we returned to full course assessment for the 2023–24 session.

SQA's approach to awarding was announced in March 2024 and explained that any impact on candidates completing coursework for the first time, as part of their SQA assessments, would be considered in our grading decisions and incorporated into our well-established

grading processes. This provides fairness and safeguards for candidates and helps to provide assurances across the wider education community as we return to established awarding.

Our approach to awarding is broadly aligned to other nations of the UK that have returned to normal grading arrangements.

For full details of the approach, please refer to the National Qualifications 2024 Awarding — Methodology Report.