External Assessment Report 2015

Subject(s)	Applied Mathematics
Level(s)	Advanced Higher

The statistics used in this report are prior to the outcome of any Post Results Services requests

This report provides information on the performance of candidates which it is hoped will be useful to teachers/lecturers in their preparation of candidates for future examinations. It 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 question papers and marking instructions for the examination.

Comments on candidate performance — Statistics

General comments

An unusually disappointing set of responses was recorded this year and the reason for this is not clear, particularly as the examining team has changed little for some time.

Candidates appear to have been prepared well only for the more routine operations and so answers requiring more careful thought, reasoning, interpretation and judgement were poorly done.

Generally candidates need to appreciate that one of the differences between Mathematics and Statistics is that the latter requires much more thought about assumptions, justifications and descriptions. This is an important aspect of Statistics and should be addressed.

In general candidates require a much sounder understanding of the principles and processes required at this level and a much greater ability to write concisely about them.

The average (mean) mark for the paper was 56.2.

Areas in which candidates performed well

A6 A very standard hypothesis test done very well – many scoring 6/6.

A7 Chi-Squared test – the test itself was done well.

Areas which candidates found demanding

A1 Sampling – responses tended to be somewhat vague, as we have seen over many years with this kind of question on standard bookwork material

A2 Probability – the theoretical nature of this question defeated almost all candidates, 1/5 being a typical score

As it happens it was perhaps unfortunate that these two questions came at the beginning of the paper but that is where they are normally to be found and no difficulty was anticipated with A1 in any case.

A3 Normal Distribution – candidates need to understand when to use a continuity correction and when not (as in this case)

A4 Parametric or non Parametric – mean or median – many candidates did not really appreciate what this question was about and confused the two types of test. Also very vague responses to ‘Explain how …’ as mentioned above.

A5 Confidence Intervals – most candidates could not make the bridge from confidence intervals to the binomial distribution in (b) and back again to confidence intervals thereafter.

A7 Chi-Squared test – when asked to comment or to do something unfamiliar there was a general failure to think clearly and explain what could be deduced from the test result and then to move on to a further analysis.

A8 Control Charts – a big variability in competence shown in this question

A9 Bivariate Analysis – similar to A8 but very few demonstrated the mathematical knowledge of the properties of a negative exponential function required to do well in (d)

Comments on candidate performance — Mechanics

General comments

Candidates were able to access at least part of most of the questions in Section A, and all questions in Section B

The paper consists of written response questions with a total maximum possible mark of

100.

Nearly all candidates attempted all questions, with a further year on year reduction in the number of very weak or very underprepared candidates.

Questions A2, A4 and A5 were done well by the majority. However A3, A7 and A9 were tackled poorly.

The average (mean) mark for the paper was 56.2.

Section A (Mechanics 1 and 2)

Areas in which candidates performed well

Candidates are confident working with constant acceleration (A2), with circular motion (A5), and work, power and energy (A4) but it remains concerning that formulae are not always known accurately.

Areas which candidates found demanding

Candidates must realise that when a question involves a rope etc, consideration of tension is likely to be necessary in solution. In this paper, tension was inherent in A3, A6 and A9 and many ignored it. A3 also tested elastic potential energy, a part of the course with very few recognising the solution. A10 required a proof of SHM, and most candidates tried to do this without the introduction of a variable.

Section B (Mathematics for Applied Mathematics)

Areas in which candidates performed well

Differentiation as required in B1 and B3 was well attempted and many tackled B4 successfully.

Areas which candidates found demanding

B2 Is the determinant (ad – bc) or the reciprocal of (ad – bc)? When does an inverse exist?

B3 Many could not see that $-\sin^2 x - \cos^2 x = -1$.

B4 Some found logs and summation in the same context difficult.

B5 A number of candidates could not get $\tan x \cos x = \sin x$ and therefore the last part was inaccessible.

B6 Accurate substitution skill was lacking for a significant minority and the many negative signs caught many candidates so that the connection between (a) and (b) was not available.

Advice to centres for preparation of future candidates

Presentation and explanation continue to improve, as does appropriate rounding, and it was encouraging to see more thorough use of algebra and calculus. However, it is disappointing to see simple formulae stated wrongly, with this immediately leading to significant loss of marks as solutions cannot be straightforward.

With reference to A10 where candidates required to **prove** SHM and many could not, it is prudent to point out that future papers will ask candidates to derive formulae (eg equations of motion under constant acceleration, SHM equations) or to prove algebraic equations used in context (eg parabolic motion) as well as proving motion to be simple harmonic etc, so increased attention should be focused here.

It is vital that candidates do not rely on recent papers as their final preparation for any paper, as this can result in them being unprepared for those areas of study tested less frequently.

With the introduction in 2016 of the effects of turning and the centre of mass of a body, as well as second-order homogeneous equations, centres should provide guidance to candidates as to where further examples and practice can be found.

The SQA website contains the Marking Instructions for 2015 (as well as previous years). All those teaching Advanced Higher Mathematics of Mechanics, as well as candidates undertaking the course, may benefit from looking at these detailed Marking Instructions for further advice and guidance.

Statistical information: update on Courses

Number of resulted entries in 2014	346

Number of resulted entries in 2015	403

Statistical information: Performance of candidates

Distribution of Course awards including grade boundaries

Distribution of Course awards	%	Cum. %	Number of candidates	Lowest mark
Maximum Mark - 100				
A	46.2%	46.2%	186	57
B	18.6%	64.8%	75	46
C	16.6%	81.4%	67	36
D	5.5%	86.8%	22	31
No award	13.2%	-	53	-

For this course, the intention was to set an assessment with grade boundaries as close to the notional values of 50% for a Grade C and 70% for a Grade A. The paper was more demanding than expected and the grade A and C boundaries were adjusted accordingly.

General commentary on grade boundaries

- While SQA aims to set examinations and create marking instructions which will allow a competent candidate to score a minimum of 50% of the available marks (the notional C boundary) and a well prepared, very competent candidate to score at least 70% of the available marks (the notional A boundary), it is very challenging to get the standard on target every year, in every subject at every level.

- Each year, SQA therefore holds a grade boundary meeting for each subject at each level where it brings together all the information available (statistical and judgemental). The Principal Assessor and SQA Qualifications Manager meet with the relevant SQA Business Manager and Statistician to discuss the evidence and make decisions. The meetings are chaired by members of the management team at SQA.

- The grade boundaries can be adjusted downwards if there is evidence that the exam is more challenging than usual, allowing the pass rate to be unaffected by this circumstance.

- The grade boundaries can be adjusted upwards if there is evidence that the exam is less challenging than usual, allowing the pass rate to be unaffected by this circumstance.

- Where standards are comparable to previous years, similar grade boundaries are maintained.

- An exam paper at a particular level in a subject in one year tends to have a marginally different set of grade boundaries from exam papers in that subject at that level in other years. This is because the particular questions, and the mix of questions, are different. This is also the case for exams set in centres. If SQA has already altered a boundary in a particular year in, say, Higher Chemistry, this does not mean that centres should necessarily alter boundaries in their prelim exam in Higher Chemistry. The two are not that closely related, as they do not contain identical questions.

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