Course Report 2016

Subject	Mathematics of Mechanics
Level	Advanced Higher

The statistics used in this report have been compiled before the completion of any Post Results Services.

This report provides information on the performance of candidates which it is hoped will be useful to teachers, lecturers and assessors in their preparation of candidates for future assessment. 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 assessment documents and marking instructions.

Section 1: Comments on the Assessment

Summary of the Course assessment

With this being the first year of Advanced Higher Mathematics of Mechanics, it was very pleasing to see that most candidates found every question accessible, with many producing very good written responses.

It must be noted that there were very few candidates that were poorly prepared for this examination or whose written responses were very weak.

The paper consists of written response questions with a total maximum possible mark of 100.

Some questions tested content that was new to this course from the previous Advanced Higher Mechanics course, ie stating assumptions (Q6b(ii), Q9b, Q12b(i)) made, Centre of Mass (Q11) and Second order Differential Equations (Q15). Second order differential equations were generally well attempted. Stating assumptions needs greater rigour.

Candidates' scripts would suggest that most used the full 3 hours to work on their responses, with little time for checking. In particular, Q15(c) was not always attempted, suggesting candidates chose to attempt the remaining Q16 and Q17 which cumulatively were worth 17 marks.

Section 2: Comments on candidate performance

Areas in which candidates performed well

Q1 offered candidates an option in method of solution and it was pleasing to see both methods used well.

Q2 required accurate resolving of forces and produced very good responses.

Q4, Q7, Q8, Q10(a), Q13(a) and Q15(b) testing various algebra and calculus skills, those parts testing skills only, were well attempted.

Q5 required the application of a given formula in Simple Harmonic Motion with algebraic manipulation and further knowledge of SHM principles and was well attempted.

Q6 showed good understanding of v/t graph and was well attempted.

Q13 required integration to find volume of revolution and it was pleasing to see that when this was presented in context, candidates were confident in their solutions.

Q16(a) required candidates to establish a formula for parabolic motion, and was very well attempted.

Areas which candidates found demanding

Q3 required the use of the scalar product of two vectors and it was disappointing to see so many unable to do this correctly.

Q9 showed a poor understanding of motion in a horizontal circle. Too many candidates attempt this as motion on a slope, failing to understand that motion is towards the centre of a circle.

Q10(b) required understanding of the application of parametric differentiation and this proved quite demanding for many. Perhaps greater exposure to *in context* questions involving calculus techniques is generally required.

Q11 tested the new course content on Centre of Mass. Those who knew the required techniques coped well with the calculus required.

Q12 tested resultant velocity. Very few candidates chose the vector solution which gave the required answer very succinctly. Most chose to use velocity triangles and the required triangle was not always accurate.

Q14 allowed all candidates to show understanding of equilibrium on a slope and the first two marks were achievable by all. However the algebra required to complete the proof was disappointing.

Q16(b) used the formula established in (a) followed by algebraic manipulation and was only achieved by the better candidate.

Q17(a) tested basic understanding of motion in a vertical circle, and it is slightly disappointing that more candidates did not attempt this. However, its position as last question on the paper may explain this.

Section 3: Advice for the preparation of future candidates

It is very pleasing to see that nearly all candidates were confident enough to attempt all questions on the paper. Presentation of work was very good, allowing candidates to maximise their scoring on each question. Maths skills were tested throughout rather than in just one section which seems to have encouraged candidates as they worked through the questions.

Centres must make sure they cover content from the course that did not appear on the previous Mechanics course. And in particular they must encourage students to consider assumptions made in a question, beyond air resistance and variation in gravity. As specified in the Course Assessment Specification/Course and Unit Support Notes, candidates must be able to analyse results in context, and interpret the solution in terms of the real world and develop skills in effectively communicating conclusions reached on the basis of physical factors and calculation. It is hoped to highlight this work in future Understand Standards workshops.

When teaching Maths skills of Calculus, students should be exposed to the application of skills as well as the methods. This is particularly true of parametric differentiation as defining motion in a plane (Q10(b)); implicit differentiation; second order differential equations where the variables are of displacement and time and so have application to velocity and acceleration, and the use of new calculus techniques in contexts such as finding Centres of Mass or Volumes of Revolutions. In general, algebraic skills need to be strengthened. This can be done by encouraging numeric substitution as the final step in a question. This also gives greater accuracy in answers.

Grade Boundary and Statistical information:

Statistical information: update on Courses

Number of resulted entries in 2015	0

Number of resulted entries in 2016	222

Statistical information: Performance of candidates

Distribution of Course awards including grade boundaries

Distribution of Course awards	%	Cum. %	Number of candidates	Lowest mark
Maximum Mark -				
A	44.1%	44.1%	98	68
B	14.0%	58.1%	31	58
C	15.8%	73.9%	35	48
D	9.5%	83.3%	21	43
No award	16.7%	-	37	0

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.