Mathematics & Applied Mathematics Advanced Higher

External Assessment Report 2008

The statistics used in this report are pre-appeal.

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.

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Comments on candidate performance

General comments

It is very pleasing both to me and to the examining team that the number of candidates has increased by around 15% on 2007. The number of presenting centres rose by 32 to 336 which is also extremely encouraging. This represents a high proportion of the possible number. We hope both of these are sustained in 2009.

It is pleasing that the vast majority of scripts were well written and it was easy to see what the candidate intended. Some scripts were very difficult to read and candidates should be reminded that untidy work is more difficult to mark. As remarked in previous years, carelessness early on in a solution is quite likely to cause a significant loss of marks. Markers do apply 'follow through' but an error may result in an easier process or a much harder process which might well prevent a candidate demonstrating the skills needed to obtain marks.

Please see remarks in the question-by-question analysis below.

Areas in which candidates performed well

See comments on individual questions in "Advice to centres for preparation of future candidates".

Areas which candidates found demanding

See comments on individual questions in "Advice to centres for preparation of future candidates".

Advice to centres for preparation of future candidates

Centres are advised to take notice of the comments below on the questions.

The following comments are best considered alongside the question paper and the marking instructions.

Question 1.
This question was accessible to the vast majority of candidates. Most errors came from errors in remembering the necessary formula.

Question 2(a)
Testing $\cos^{-1}$ - most responded well.

Question 2(b)
This part was intended to assess both parametric differentiation and the derivatives of sec and tan. Many rose to the challenge.

Question 3.
On curve sketching. Many lost track of either the translation or the rotation or even both. Few candidates gained full marks.

Question 4.
Partial fraction questions are often done well and this proved to be no exception. The irreducible quadratic proved to be demanding, with mistakes leading to significant changes in the actual integration.

Many scripts claimed that $\int \frac{8x}{x^2+5}dx$ was $\frac{1}{4}\ln\left(x^2+5\right)$.

Question 5.
This was quite a demanding question with many candidates going wrong. It was disappointing that so many forgot to differentiate the right-hand side. It was also disappointing that some candidates failed to solve the quadratic equation $y^2+3y=4$ correctly.

Question 6.
Although set as (a) and (b), the two parts were independent. This proved very useful to those who failed with (a) either by making an error or by not knowing what was needed. Part (b) was generally done well.

Question 7.
This was a more complex and challenging question. It was good to see so many decent attempts, many of which succeeded. The majority of the errors were predictable, relating to the fractions in the constituent integrals.

Question 8.
This proved to be a discriminating question. Very few achieved the correct expression, most simply ignored the first part and expanded the expression to answer the second part.

Question 9.
Most made a reasonable attempt at this and fitted together the various hints to obtain the correct answer.

Question 10.
This question attempted to use calculus in a context. Part (a) was easy, part (b) less so. Many candidates lost a mark by omitting the constant of integration.

Question 11.
This question, of a type which many would have seen before, produced a range of attempts. It provided a good challenge to the concept of proof. For B, the true (but naive) statements that odd cubed is odd and even squared is even were not enough for full marks.

Question 12.
Very few candidates produced the hoped for solution which was to use Maclaurin for the first part and then apply that answer to the other parts. In fact, Maclaurin was very often used for all three parts, leading to the introduction of various errors.

Question 13.
The responses to second order differential equation questions have improved steadily over the years. The difficulty in this case was to correctly find the particular integral with using ax^2 as the trial integral being common. However, it was good to see many complete and accurate solutions.

Question 14.
This assessed a difficult topic which requires both mathematical insight and skilful manipulation. Many candidates did not attempt this question.

Question 15.
Definitely a challenging question on calculus, with many producing worthwhile attempts. Many candidates seemed unsure of what was required to simplify the answer.

Question 16.
A discriminating question where few candidates gained full marks.

II. Applied Mathematics

Comments on candidate performance

General comments

As the table below shows, there has again been a slight increase in the number of candidates.

Year	2005	2006	2007	2008
Candidate numbers	313	280	285	305

The breakdown across the two options was:

		Also doing AH Mathematics
Statistics	144	62 (= 43.3%)
Mechanics	161	111(= 68.9%)

Taken overall, the performances in 2007 and 2008 were virtually identical. The mean mark rose by 0.1% but, interestingly, the standard deviation fell by 4.8 to 19.5.

Option	No. of candidates	Section A average	Section B average	Overall average
Mechanics	161	39.7	24.3	64.0
Statistics	144	39.9	19.7	59.6

Analysis of this data indicates that the Statistics candidates performed less well than the Mechanics candidates. (Note that the marks available for Sections A and B were 68 and 32 respectively.) Compared with 2007, the number of centres which presented candidates for AH Applied dropped from 47 to 40. It may be worth noting that there were just 30 centres that presented in both 2007 and in 2008.

Areas in which candidates performed well

Section A

Mechanics:
Candidates did particularly well in the following questions:

Q1 : displacement and velocity in vector format

Q2: motion with uniform acceleration

Q3a : forces in equilibrium

Q7a : terminal velocity

Q8a : basic SHM

Statistics:
Candidates did particularly well in the following questions

Q3a: Normal Distribution
Q6: performing a chi-squared goodness-of-fit test
Q10a: calculating the upper and lower control limits in a p-chart

Section B

For both Statistics and Mechanics:

Q1 on matrices, Q2 on differentiation, and Q3 on partial fractions were particularly well done

Most candidates scored 2 or 3 out of 3 in Q5a on summing r and r^2 although many failed to achieve any marks in part b

Mechanics:
These candidates also did well in Q4a using integration by parts although many were unable to complete part b.

Areas which candidates found demanding

Section A

Mechanics:

Q6: relative velocity

Q7b: motion with variable acceleration

Q8b : more advanced SHM

Q9b : applying energy considerations in a complicated context

Q10a: conservation of momentum proved to be demanding although candidates were still able to access marks in part b in which they performed slightly better

Statistics:

Q2a: understanding how to obtain a random sample
Q4b: the difference between prediction and confidence intervals
Q8d: the last part of the question on the Poisson distribution

Both 2a and 4b asked for an explanation which candidates traditionally
find harder than carrying out statistical calculations

Section B

Mechanics:

Q 5b: (summation) proved to be the most demanding for the mechanics candidates.

Statistics:

Q6: Variables separable differential equation using Newton's law of cooling. Many candidates failed to achieve any marks in this question although approximately one sixth achieved full marks.

Q4b: volume of a solid of revolution proved to be the most demanding question for these candidates.

Advice to centres for preparation of future candidates

Mechanics:

Candidates should be given plenty of opportunities to tackle non-routine questions

Statistics:

Candidates should be encouraged to practise explaining and interpreting the results of statistical calculations in the context of the question.

Mathematics
Statistical information: update on Courses

Number of resulted entries in 2007	2,484

Number of resulted entries in 2008	2,752

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	23.3%	23.3%	642	72
B	24.3%	47.6%	668	59
C	21.4%	69.0%	588	47
D	8.5%	77.5%	235	41
No award	22.5%	100.0%	619	-

Applied Mathematics
Statistical information: update on Courses

Number of resulted entries in 2007	285

Number of resulted entries in 2008	305

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	36.7%	36.7%	112	72
B	17.7%	54.4%	54	60
C	21.0%	75.4%	64	49
D	9.5%	84.9%	29	43
No award	15.1%	100.0%	46	-

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.