Principal Assessor Report 2005

Assessment Panel:	**Mathematics**

Qualification area

Subject(s) and Level(s) Included in this report	**Mathematics Advanced Higher**

Statistical information: update

Number of resulted entries in 2004	2,416

Number of resulted entries in 2005	2,318

General comments re resulted entry numbers

It is disappointing to see any fall in numbers. Hopefully, numbers will pick up in 2006.

Statistical Information: Performance of candidates

Distribution of awards including grade boundaries

Distribution of awards	%	Cum %	Number of candidates	Lowest mark
Maximum Mark- **100**	-	-	-	-
A	23.4	23.4	543	73
B	16.8	40.2	389	60
C	22.7	62.9	527	47
D	11.6	74.5	269	40
No award	25.5	100.0	590	-

General commentary on passmarks and grade boundaries

- While SQA aims to set examinations and create mark schemes which will allow a competent candidate to score a minimum 50% of the available marks (notional passmark) and a very well-prepared, very competent candidate to score at least 70%, it is almost impossible to get the standard absolutely on target every year, in every subject and level
- Each year we therefore hold a passmark meeting for each subject at each level where we bring together all the information available (statistical and judgmental). 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 senior management team at SQA
- We adjust the passmark downwards if there is evidence that we have set a slightly more demanding exam than usual, allowing the pass rate to be unaffected by this circumstance
- We adjust the passmark upwards if there is evidence that we have set a slightly less demanding exam than usual, allowing the pass rate to be unaffected by this circumstance
- Where the standard appears to be very similar to previous years, we maintain similar grade boundaries
- 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 are different. This is also the case for exams set in centres. And just because SQA has altered a boundary in a particular year in say Higher Chemistry 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
- Our main aim is to be fair to candidates across all subjects and all levels and maintain standards across the years, even as arrangements evolve and change.

Comments on any significant changes in distribution of awards/grade boundaries

The proportion obtaining an A was unchanged, the proportion getting a C or better was down slightly from 65.2%. These are hardly significant.

Comments on candidate performance

General comments

Overall, candidates performed pretty well as expected. The mean mark was down by 2 in comparison with 2004 but this small change is probably due to the paper being ever-so slightly more of a challenge.
There seemed to be fewer candidates performing very badly.

Areas of external assessment in which candidates performed well

The early questions were generally tackled well. Basic calculus techniques were pretty sound. The questions had been put in an estimated order of difficulty so as candidates went on, more difficulty was encountered. It was pleasing to see how well candidates did on the long question to solve a second-order differential equation.

Areas of external assessment in which candidates had difficulty

As indicated above, the later questions proved more difficulty than the early ones. It was very disappointing to see how badly some candidates were at basic algebra. In some cases, work was very untidy which made the task of marking even more difficult.
Question 10 was a standard proof by induction but the majority were unable to provide a valid solution.

Recommendations

Feedback to centres

Comments on Advanced Higher Mathematics 2005

General comments
Overall, responses were satisfactory and there were some excellent scripts. However, there were very many scripts which were extremely difficult to read. It is very surprising that candidates who present their work badly do not realise that they run a very real risk of failing to gain all they might because examiners cannot read their work! There was a great deal of very poor algebraic manipulation which proved costly in many cases.

The need for the Correction Notice for question 13 is greatly regretted but, given the late stage in the question and in the paper that the error occurred, it is likely to have had only minimal effect.
The following comments are best considered alongside the question paper and the marking instructions.

Question 1.
In part (a), the need for the product rule was universally recognised. However, relatively few *knew* the derivative for $\tan x$ and so had to attempt to work it out.
In part (b), most successfully applied the quotient rule. Attempts to simplify sometimes foundered on poor algebra. Some tackled it by dividing and then differentiating whilst other used the product rule.

Question 2.
The majority recognised the need for implicit differentiation and were mostly successful in obtaining a formula for the derivative. Many stopped there, some realised that, for zero derivative, $y = x$ but the final step of using this to find the values of x eluded many.

Question 3.
Many candidates were able to give the formula for e^x but a significant number showed working. (The phrase 'write down' is used to imply that there is no *need* to show working.)
Few candidates seemed to realise that the series for e^{x^2} can be obtained easily from the series for e^x. Many resorted to applying Maclaurin's series - much work for potentially little reward.
The final part was intended to be done by multiplying the answers to the earlier parts. Some tackle it that way but a significant number applied Maclaurin's series with variable degrees of success. A small number decided that they should add the answers to the first two parts.

Question 4.
Most candidates were successful in obtaining the first three terms of the series and identifying it (subject to a variety of spelling).
Many used the appropriate formula to get an expression for the general term but some lost a mark through failing to simplify their expression.

Question 5.
Many candidates successfully completed this question. Marks were lost by failing to change limits. The expected way of integrating does not seem to be difficult but some use of integration by parts was observed.

Question 6.
The first 4 marks of this question were frequently obtained (although some who reached $(\lambda - 2)y = 0$ failed to deduce that $y = 0$).
But, as anticipated, the final 2 marks were rarely obtained (being discriminating marks).

Question 7.
The correct expression for A^2 was usually obtained, as was the value for k.
The final 2 marks proved much harder to get. Attempts to obtain A^{-1} explicitly were seen (but often failed). Attempts which involved division by a matrix lost both marks.

Question 8.
The answers to this question were very mixed! Some did achieve the anticipated solution but by no means all. Quite a number worked out the vector product of the direction vectors of the given lines, found a point on the line of intersection and the symmetric equation leading to the parametric equations. When these steps were carried out successfully, the result was very impressive.
The final mark was often lost, even when correct parametric equations were used.

Question 9.
This was a poorly done question. It makes use of fundamental properties of complex numbers, albeit in a slightly unusual fashion. Very many candidates seemed not to recognise the notation for the complex conjugate which meant that no progress was possible.

Question 10.
It is not fanciful to describe this as a fairly standard question on mathematical induction. Many candidates obtained 3 marks of the first 5. They knew how to set about the inductive proof but in a huge number of cases they were let down by elementary algebraic errors as well as by a lemming-like tendency to multiply out brackets.
It was unusual to see work for the final mark even attempted.

Question 11.
Overall, this question proved profitable to many candidates.
The first mark was usually obtained (since it did not require the correct copying of either vertical or asymptote).
In part (b), most candidates used the quotient rule but a significant number tried to express y in quotient/remainder form before differentiating which was a very poor choice of strategy in this case. In true Pavlovian fashion, many justified the nature of the stationary values, failing to realise that (a) this was not asked for, and (b) the graph rather gave the game away!
The easy marks in (c) were usually obtained.

Question 12.
Attempts at this question were very varied and all 10 marks seldom obtained.
Part (a) was usually well tackled but errors with coefficients and failing to include i with raising $\sin\theta$ to a power were common. The mark for expressing in terms of real and imaginary parts was often lost.
Part (b) was very often well done.
Part (c) defeated all but the most persistent and perceptive although there were many worthwhile attempts. The main stumbling block would seem to have been a lack of awareness that the required answer was, essentially, in terms of just $\cos\theta$.

Question 13.
The response to even the early part of this question was very disappointing.
A significant number failed to use a linear term for the quadratic denominator. (This was not a problem for those who produced a factorisation of $x^2 + 1$.) Even when the correct 'framework' was used and the correct coefficients obtained, many candidates got confused and ended up with $\frac{1}{x} - \frac{1}{x^2 + 1}$ with inevitable consequences.
It was a minority of those who obtained $\frac{1}{x} - \frac{x}{x^2 + 1}$ who were able to integrate it successfully and thus get towards the difficulty of the correction notice. (All scripts from schools which realised that they had failed to read out the correction notice and had informed SQA of this were reviewed. There was very strong evidence that candidates in such cases were not upset, many didn't get that far and many simply cruised through it.)
The final 2 marks proved to be the challenge that was expected.

Question 14.
An overwhelming majority made very good attempts at this question with a lot obtaining full marks.

It was rare for the Complementary Function not to be found.
There were instances where the form of the Particular Integral was taken as $y = a \sin x + a \cos x$ which cost marks.
Some confusion in the final part was apparent, especially when the PI was wrong.

Question 15.
It was good to see the majority of candidates persevered right to the end and made attempts at this question even though it proved too great a challenge for most.
There were a number of successful attempts and candidates who managed to get all 10 marks deserve to be congratulated.