FURTHER MATHS

Overall grade boundaries

Standard level

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 13	14 - 26	27 - 34	35 - 45	46 - 57	58 - 68	69 - 100

Standard level paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 7	8 - 14	15 - 20	21 - 27	28 - 35	36 - 42	43 - 60

General comments

The paper was well received judging by the G2 forms and proved to be a good paper from the points of view of difficulty and syllabus coverage.

The areas of the programme and examination that appeared difficult for candidates

Students' preparation in Geometry was not what it should have been. Many were unable to obtain equivalence classes and to clearly demonstrate a sound knowledge of the different aspects of proof.

The areas of the programme and examination in which candidates appeared well prepared

Knowledge of group theory, Euclid`s algorithm and the Poisson distribution seemed to be secure.

The strengths and weaknesses of the candidates in the treatment of individual questions

Q1. Part (a) was generally well done but not always in the most direct manner. Too many missed the equivalence classes in part (b).

Q2. The approach was generally correct but the term $P(X = 2)$ was frequently missing so that an incorrect mean was obtained.

Q3. This proved difficult for many candidates and often the ratios and negative signs were `blurred`.

Q4. This was often done using Euclid`s algorithm rather than writing $m(3k+2)+n(5k+3)=1$ for the relatively prime numbers.

Q5. Some curious integration was involved in this question using doubtful limits and incorrect symbols.

Q6. A surprising number could not find the partial fractions and too many did not show clearly that the limit was 0.5 in part (a). It was simply written down without clear support. In part (b) many did not recognize the sum of a simple geometric series to infinity and got involved in some heavy Maclaurin work thus wasting time. The clear instruction `Hence' was ignored by many candidates so that the question became more difficult and time consuming than it should have been. However, part (c) proved not to be as difficult as expected.

Recommendation and guidance for the teaching of future candidates

Candidates need a strong base in algebra and in geometry. The latter particularly seems to be too often neglected. Many seemingly intractable problems yield to a geometric approach. They must be encouraged to use the many hints that are scattered throughout the papers since it is these that in one sense make the paper 'doable' in the time allowed. The various methods of proof (particularly contradiction) should have more exposure and students should realise that solutions to problems often will begin with 'suppose...', 'let...', 'assuming that...'etc.

Further comments

Candidates cannot expect all questions to be exactly like the ones they may have seen in some textbook so exposing them to unusual problems and different approaches will bear fruit.

Standard level paper two

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 16	17 - 32	33 - 41	42 - 54	55 - 68	69 - 81	82 - 120

General comments

The paper was not unusually difficult compared to previous years and most candidates were able to produce reasonable attempts at all five questions. The most striking aspect was how difficult some candidates find producing clear, complete and mathematically precise solutions.

The areas of the programme and examination that appeared difficult for the candidates

Again the geometry was not well known, cumulative frequency distributions and proof in group theory and modular arithmetic were not convincingly handled.

The areas of the programme and examination in which candidates appeared well prepared

Series, statistical testing, group tables, graph theory algorithms, convergence and the properties of cyclic quadrilaterals were all areas that seemed to be known with confidence.

The strengths and weaknesses of the candidates in the treatment of individual questions

Question 1

Part A: The derivation of a series from a given one by substitution seems not to be well known. This made finding the required series from (e^x) in part (a) to be much more difficult than it need have been. The fact that this part was worth only 3 marks was a clear hint that an easy derivation was possible. In part (b)(i) the 0.5 was usually missing which meant that this part came out incorrectly.

Part B: The conditions required in part (a) were rarely stated correctly and some candidates were unable to state the hypotheses precisely. There was some confusion with `less than` and 'less than or equal to`. Levels of accuracy in the body of the question varied wildly leading to a wide range of answers to part (c).

Question 2

Part A: Most candidates drew a table for this part and generally achieved success in both (i) and (ii). In (b) most did use Cayley tables and managed to match element order but could not clearly state the two possible bijections. Sometimes showing that the two groups were isomorphic was missed.

Part B was not well done and the properties of a three element group were often quoted without any proof. Clear arguments for part (a) were not common.

Question 3

Part A: This was usually well done although some candidates have difficulty showing clearly the procedure through the algorithm.

Part B: (a) was not well done although there were many suspect attempts at a proof. If part (a) was missed it should still have been possible to use the 'Hence' to complete part (b). Unfortunately this did not often happen.

Question 4

Part A: In (a) the general term was usually found and then part (b) was completed mostly except for testing the ends of the interval of convergence.

Part B: A surprising number of candidates started off their solution by saying 'let $x = u$ and $y = v$' as if the world suddenly changed when x and y were not being used in a differential equation. Some also after seeing u and v thought they had a homogeneous equation and got lost in a maze of algebra that lead nowhere. Find $\frac{du}{dv}$ by inverting the given expression was also something that only the best candidates were able to do.

Question 5

Part A: As in paper 1 there is a sad lack of knowledge of geometry although some good solutions were seen and at least one school is using techniques very successfully that are not mentioned in the program.

Part B (a) was well done but few clear solutions to part (b) were seen.

Recommendation and guidance for the teaching of future candidates

Attention to detail, knowledge of proof, using the hints given in the questions are all to be encouraged. Producing clear convincing arguments and widening the experience of candidates to include more problems rather than more exercises would both be beneficial to all candidates.