

Mathematics

My report from last year is reproduced with one additional comment. A large number of supervisors in school continue to allow the essay to be submitted without any comment from them. The markers can find comments from the supervising teacher extremely helpful as they assess the essay. Additionally, a rule of thumb is that an essay should be accessible to any good among the author's fellow students. Avoid writing 'research paper' type essays.

Preamble

There has been an increase in the number of students submitting an extended essay in mathematics, which is very pleasing, as is the continued variety of topics chosen for the essays. In this respect, in almost one hundred essays that I personally read there were some topics that I had hardly seen in previous years, with sport and stock markets making several appearances. There were some essays with very imaginative titles, demonstrating the limitless ways in which mathematics can be successfully made applicable or merely appreciated for its beauty. Graph theory, number theory, analysis and statistics were popular areas for essay topics. Generally, it has again been an enjoyable experience to read and assess extended essays in mathematics

The range of marks awarded extended from low single figures to close to, and possibly at, the maximum thirty-six. I have mentioned one worrying aspect in my previous reports, and I do so again because there has not been any major change in the situation. It is the number of essays that are submitted without any comment whatsoever from the supervisor, and it is not just at one end of the quality range that this happens. In my own initial allocation, the best essay had no comment from the supervisor. It may not follow that the absence of comments indicates a lack of involvement with the student in the essay writing process, and that if there is such a lack it is necessarily the teacher's fault. Some teachers do report that they were not consulted or given drafts to read before submission. I also realise that these duties are perhaps not evenly distributed among members of staff and hence there are pressures on those that do supervise essays. However I do stress the value of teacher comment to those assessing the essays. This year again there were essays wrongly submitted as mathematics essays. I marked one such which scored highly on the general criteria but zero on the subject specific criteria. It contained no mathematics at all, but it was a good essay. If an essay is submitted as a mathematics essay it has to be marked as such, and the onus is on the supervisor to ensure that an essay is assessed under the correct subject specific criteria. The assessment criteria are freely available and I think that teachers would find it beneficial to judge the essay against them before it is submitted.

Although the general assessment criteria *A research question*, carries only two of the twenty four general marks available, it is crucial to the success of the essay. The maximum mark is awarded when the research question is clearly and precisely stated in the early part of the essay and it is sharply focused, making it susceptible to effective treatment within the word limit. Get this right and an acceptable essay will almost always result, get it wrong and marks will be regularly dropped throughout the assessment. I read one essay this year which attempted, in four pages, a similar task to that which Bertrand Russell wrote several volumes to achieve. *The Development of Mathematics* is not a suitable topic for an essay. The chosen topic must be focused, and both the student and the supervisor must remember that an essay is what is required, nothing more, but nothing less.

Before continuing with a few comments from the examiners, a remark on word count appearing in criterion A. Word count is rarely an important factor in a good extended essay on a mathematical topic. Concise, elegant mathematics supported by graphs, diagrams and important proofs that do not interrupt the development of the essay are encouraged. Clearly an essay that is excessive in its length will be penalized, especially if it is because of unnecessary content. There is no mandatory minimum length for an essay in mathematics, and credit will be given for organizing the content in an efficient readable style, rather than for a page or word count. Mastery of appropriate concepts, and an ability to present these in an effective way using mathematical means, should be the aim. Essays in mathematics have their own specific requirements in their formation, with necessary divisions, headings *etc* that are

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not so important in other subject essays. It is in structuring the essay that supervisors have an important responsibility, as they do in the elimination of simple errors that survive into the final essay.

Comments on the General Assessment Criteria

On the whole these first seven criteria were satisfied, provided of course that the essay had a focus. However, some students do not give sufficient attention to the *abstract* and the *conclusion*, both very important sections of the essay, though for different reasons of course. Again, supervisors have a real responsibility here, to check that the formal requirements have been observed. Such is the availability and sophistication of word processing now that the expected standards in formal presentation have crept up, not least of all because many students are producing very well presented essays, setting the standards themselves. The spread of marks for criterion H, *holistic judgement* is an accurate reflection of the range of quality of the essays.

Comments Subject assessment criteria

There has to be a balance in the level of mathematics that is made use of in the essays. It has to be relevant to the topic and it must not be of an elementary nature. Equally though it must not be at a level far beyond what is necessary, or what diploma students can reasonably be expected to appreciate. A good essay is one that would make sense to the author's fellow students. Sometimes, because of content and style, the perception is that not even the author understands the mathematics. Depth and sophistication are to be applauded, but only up to a point. Once again the supervisors have a responsibility because competent work sometimes includes serious errors. Statistical essays seem prone to this occurrence, and it is not uniformly apparent throughout all schools. There are clear differences in quality of essays from school to school, perhaps because for many new schools the demands on both student and teacher are also new. Perhaps there is a need for a list of past essay titles to help new teachers.

Recommendations for the supervision of future candidates

1. First a repeat of what is stated above. Encourage and assist students to take great care in choosing a suitable topic for an extended essay in mathematics, with sufficient potential for development as an essay.
2. Prevent essays being submitted if there is very little mathematics in them.
3. Advise them on structure, and ensure that sufficient time is left to write an abstract and conclusions. Abstracts must be precise, and conclusions should also, where applicable, indicate suggestions for further work.
4. Encourage proper use of the Internet and library resources. (It is, for me, always pleasing to see books in the bibliography as well as web sites.) Discourage mere parroting of work from sources and emphasise the need to display understanding.
5. Read the assessment criteria carefully.