

Mathematics extended essay

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Extended essay

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For grade boundary information, please refer to the Grade boundaries for Diploma programme coordinators document available on the PRC.

Extended essay

The range and suitability of the work submitted

Generally, candidates produced a good standard of work, only very few candidates produced work below the required standards. It appears that the particular requirements of the EE are beginning to be better understood, so that noticeably fewer candidates are scoring lower due to a failure to adhere to the criteria requirements.

It is encouraging to note a wide range of suitable topics have been chosen by the candidates, showing that they are aware of the various mathematical possibilities for an EE. The research skills demonstrated are generally of high quality.

The work of the students was almost always appropriate for a Mathematics EE.

Candidate performance against each criterion

Criterion A: focus and method

For criterion A, it helps to start the essay with an introduction which clearly sets out the motivation behind the research question, and which outlines the planned methodology.

This is perhaps the criterion which caused most difficulty for the candidates to score highly. The main reason for this is a frequent inability or unwillingness to focus the research question to enable an in-depth analysis of a concentrated area of investigation. Inappropriately broad research questions are a recurring problem.

Criterion B: knowledge and understanding

It is vital that candidates show a clear understanding of any mathematics used, particularly if it is outside the syllabus.

The understanding of mathematical procedures needs to be shown through proof or examples which are **clearly in the candidate's own words**. If the essay is highly theoretical without examples, it can be very difficult to demonstrate understanding. Good essays invariably had explanations in the candidate's own words rather than relying on parts taken directly from a source.

It is pleasing to see that problems with mathematical notation seems to be less of an issue. Candidates are reminded that they should not use computer notation, such as * or ^ for multiplication and powers, but use correct algebraic notation.

Criterion C: critical thinking

For Criterion C, candidates are recommended to maintain a focus on the research question throughout the essay and to avoid including irrelevant material. In most cases the research carried out was very good.

Discussion/evaluation is usually a result of the analysis and those who had demonstrated good mathematical work at an appropriate level, scored well in both analysis and evaluation. However, only a few students were able to evaluate findings critically.

Unfortunately, there were a few largely narrative essays with almost no mathematics explained or used. These do not usually satisfy the criteria requirements.

Criterion D: presentation

For criterion D, candidates are reminded to state the topic, research question and word count on the cover page. Further, candidates are reminded that appendices should only be used for data, or programs. An appendix should not contain extra material, neither should footnotes.

Over the years, we have found a gradual improvement in the methods used for presentation, with candidates increasingly using their IT skills to good effect, however candidates are reminded that each diagram should have a title and that graphs need to be properly labelled.

Criterion E: engagement

For criterion E, candidates should avoid simply repeating what their supervisor has advised. There were too many descriptive reflections where candidates were just telling the story step by step rather than genuinely reflecting.

Only a few candidates achieved marks in the top range for this criterion as many reflections lacked information on how challenges were overcome and/or creative initiatives that were considered.

Recommendations for the supervision of future candidates

- Although the guidelines clearly state that the topic and the research question (which must be in the form of a question) should appear on the title page, these were omitted in some essays.
- Advise students to avoid unsuitable notations such as * for multiplication or ^ for powers.
- Help students to narrow down the research question so that it is suitably focussed, as the essays where the research question falls into the 'too broad' category usually score fewer marks. Students should stay focused on answering the research question through the entire essay.
- Some students begin the essay with a hypothesis and proceed towards showing that the hypothesis is true, without giving enough consideration to the alternate hypothesis. A good extended essay would have considered both possibilities to demonstrate critical thinking ability.
- Stress the importance of good practices such as defining all parameters in a formula, proper labelling of axes in a graph with units if applicable, inclusion of a title for each diagram or table and stating the level of accuracy when approximating. The main section of the essay could be subdivided using appropriate section headings that help coherence of the argument. **'Body' is not an appropriate or helpful heading.**
- **Stress to students the need to demonstrate understanding of ideas by explaining them 'in your own words'.**
- Students are urged to be sure to do an appropriate amount of mathematics and to show their understanding with careful communication of proofs/explanations/examples as appropriate.
- There are relatively easy marks for presentation if you follow the rules: Topic and RQ stated, word count, page numbers, good formatting of equations. These were not always evident but can be done well even by those who struggle with the essay.
- Reflections: be sure to write in your own words and from your own experience. Do not simply repeat what your supervisor told you to do.