

Part B Extended Essays Guidance Notes

Version 2022/23

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1 Introduction

The Projects Committee for the Final Honour School of Mathematics offers the following notes as guidance to tutors and undergraduates. It should be observed in particular that these notes relate to Mathematics extended essays only. In the case of those doing one of the joint schools options the notes may provide helpful advice, but they are not intended to be definitive.

A project may take the form of:

- an H-level 7500-word double unit **Extended Essay** in Mathematics or its applications (option **BEE**) in Part B;
- an H-level 7500-word double unit **Extended Essay** in a topic closely related to Mathematics ('other mathematical' option **BOE**);

While 'other mathematical' options might, for example, treat relationships between mathematics and music, or topics in the history of mathematics, mathematical extended essays must have substantial mathematical content. You may offer one but not both of the mathematical and other mathematical options. You may offer both an extended essay option in your third year and a dissertation in your fourth year, if you so wish.

Note these Key Points:

- an extended essay will not be accepted for examination unless the project has been approved in advance by the Projects Committee of the Department of Mathematics.
- students wishing to offer a Part B extended essay should submit an application for prior approval of a project no later than noon on Friday of Week 0 of Michaelmas Full Term (but may be submitted at any time from the beginning of the preceding Trinity Term);
 - applications must contain the **title** and a brief but clear description of the project;
 - the description of the project should be such as to convince the Projects Committee that it is appropriate to be offered as an H-level extended essay.

1.1 Timeline for extended essays

Trinity Term

Week 4, Options Fair Lecture on Part B/C project options

Long Vacation

15th September Deadline for making initial contact with your proposed supervisor.

Michaelmas Term

Friday Week 0, 12noon Deadline for submitting an application to offer an extended essay

Week 1 Projects Committee meet to consider applications

Week 2 Students informed of the outcome of their application

Friday (Week 3), 12noon Deadline for students asked to revise their proposal to re-submit their extended essay abstract

Week 4 onwards Meeting(s) with supervisor. You'll receive 6 hours in total over the course of MT and HT

Hilary Term

Weeks 1–8 Further supervision meetings.

Weeks 6–8 Oral presentations take place

Trinity Term

Monday Week 1, 12noon Submission deadline

2 Why choose to offer a project?

There are two main reasons why project options are offered by the Department. The first is educational. Most mathematics graduates have to write reports of one kind or another. The necessary skills—of collecting material, organising it, expounding it clearly and persuasively—are better learned sooner than later. The second is also educational. The department recognises that some students might prefer to show their mathematical understanding and progress via a sustained piece of exposition rather than in a timed examination.

3 The amount of work involved

A project is of double unit weight, and should therefore be equivalent to two sixteen-hour lecture courses. Accordingly you might think of the project as being the equivalent of half a term's work. If some preparation has been done in the Summer Vacation, it should occupy approximately a quarter of your working time during Michaelmas Term, the Christmas Vacation and Hilary Term.

You will receive 6 hours of tutorials from your supervisor as you work on your project. You and your supervisor can agree how best to arrange those six hours.

There is always a risk that a project might not succeed, especially if the original plan had involved some original research. Although this is a rare occurrence, examiners are aware of the possibility. They accept that a well-written account of the work done, with an explanation of why the original aims were not met, can nevertheless be worthy of high credit.

4 How to choose an extended essay topic

Any mathematical subject (or—in the case of the BOE option—any subject related to mathematics) is appropriate as long as it gives you an opportunity to present your own work. It is understood that only in exceptional cases will this include original mathematical research. Often it will be a matter of organising, presenting, or completing material culled (and understood) from advanced textbooks, monographs or journals. There have in the past been projects on philosophy of mathematics, on history of mathematics, on algebra, on number theory, on geometry, on topology, on analysis, on numerical analysis, on mechanics, on mathematical biology, on finance, on theoretical physics, on mathematics and music, and on other subjects in, or closely related to, mathematics.

Examples of past extended essays can be found in the projects archive: <https://www.maths.ox.ac.uk/members/students/undergraduate-courses/teaching-and-learning/projects/project-archive> (please note you will need to be logged in to access this page). The Projects Committee can give advice as to whether a proposed topic is suitable to be considered as a BEE or BOE essay.

If you have ideas about a project you would like to do, you should first seek guidance on content and possible supervisors from your college tutors or from members of the Projects Committee who will also be happy to help focus a project and find a supervisor (see further below).

5 Finding a Supervisor

Any member of the Mathematical Institute may act as supervisor. Members of Projects Committee are willing to try to help you find a supervisor. The present committee is:

- Prof. Dmitry Belyaev, Academic Lead for Parts B and C (Chair)
- Dr Cath Wilkins, BSP Course Organiser
- Prof. Andrea Mondino
- Dr David Allwright
- Prof. Ian Hewitt
- Prof. Vidit Nanda
- Prof. Luc Nguyen
- Prof. Panos Papazoglou
- Dr Kathryn Gillow
- Dr Neil Laws

If it is proposed that any other person from outside the Mathematical Institute should supervise, then prior approval should be obtained from the chair of the Projects Committee.

You should make initial contact with your proposed supervisor by **15th September**; do not wait until the beginning of Michaelmas Term. You should be aware that your tutors and potential supervisors may be hard to contact during the long vacation, and so you are advised to sort out a supervisor at the end of the preceding Trinity Term.

6 Applying to offer an extended essay

Once you have found a supervisor, you should prepare an abstract for your project (your supervisor will assist you with this). The abstract together with the project application form need to be submitted to the Projects Committee via Undergraduate Studies Administrator, Mathematical Institute. Your application must be received before 12 noon on Friday of Week 0 of Michaelmas Full Term. The application form is available at <https://www.maths.ox.ac.uk/members/students/undergraduate-courses/teaching-and-learning/projects/essays>.

The Committee gives its approval if it estimates that the project is appropriate and viable and that suitable assessors are available. If the committee judges that the project is not on an appropriate subject it will request that you revise your proposal. Similarly, if the proposal does not provide enough

information for an assessment to be made, you will be asked to submit a revised abstract.

The committee will decide during the first week of Michaelmas term which proposals are acceptable. Where a proposal is deemed unacceptable, the student will be allowed to submit a version revised along the lines suggested by the committee. If the revised version is unsuccessful, no further resubmission will be allowed. The decisions of the committee will be communicated by email.

If, after your project has been approved, you wish to make minor changes to the title or description of your project, then you may apply to the Chairman of the Projects Committee for the appropriate permission.

6.1 The project proposal

The proposal should be at least 150 words, excluding references, and at most one A4 side. It must be typed, and should be sufficiently detailed for the members of the committee to judge whether the project is of appropriate depth and content and whether it will be possible to find a suitable assessor in the University. You should include details of the *main* references—books, papers, etc.—with full bibliographic details.

A common turn of phrase at the annual meeting where Projects Committee considers the proposals is “original contribution to the literature”. Few projects will produce original research, but there should be a flavour, topics, mindset or aim to the project that makes it distinct from anything in the literature. It should not be possible for a committee member to reference one or two chapters of a text or an article that essentially cover the same material as a proposal and in much the same style. However it would be reasonable to take material that only exists in sources, written in a technical and abstract style for professional mathematicians, and explain this material at a more undergraduate level, possibly illuminating the discussion by focusing on one or two examples. It would precisely be this exposition, and collation of the material from several sources, that made the piece original.

In deciding when to approve project proposals the committee will consider how closely the work will relate to existing courses available to the student in the Oxford Mathematics syllabus. Following the principle that a student may not gain credit twice for the same material, projects which relate too closely to courses the student has already taken, or is eligible to take in the future, will not be allowed. For this reason you must declare, on your project application, which courses you have previously taken.

To ensure that you have included all the information required by the examiners and the committee the appropriate sections of the

form should be checked and signed. Here is an example proposal, with some comments:-

Approximation of Irrational numbers by Rationals
BEE Extended Essay
C.F. Gauss (Worcester)

If α is a real irrational number then one can prove that there are infinitely many rational numbers a/q such that

$$\left| \alpha - \frac{a}{q} \right| \leq \frac{3}{q^2}.$$

A number of questions naturally arise. Can one replace the constant 3 by anything smaller? Can one replace q^2 by q^3 ? What happens for specific irrationals like $\sqrt{2}$ or π ?

The essay will discuss such issues. It will give an exposition of the theorems of Liouville, Thue, and Apéry, and describe applications to transcendence problems and Diophantine equations. If time permits a complete proof of the finiteness of integer solutions of the Mordell equation $y^3 = x^2 + k$ will be given. The latter will use results from the section B ‘Algebraic Number Theory course’.

References

G.H. Hardy and E.M. Wright, An introduction to the theory of numbers, Sixth edition. (Oxford University Press, Oxford, 2008). [Chapter XI in particular]

L.J. Mordell, Diophantine equations, Pure and Applied Mathematics, Vol. 30 (Academic Press, London-New York 1969).

A. van der Poorten, A proof that Euler missed ... Apéry’s proof of the irrationality of $\zeta(3)$, Math. Intelligencer 1 (1978/79), no. 4, 195–203.

Comments: This is neatly typed, in Latex in fact. However the proposal is rather short, at around 100 words rather than the expected 150. The first paragraph introduces the problem to be discussed, and the second paragraph says more of what the essay would include. There isn’t much sense of why the problem is historically interesting or what the answers are to these further questions. The final sentence tries to set out the relationship to courses on the syllabus and this is useful. It would also have been useful to cite the references during the proposal.

Further details of the specific results of Liouville, Thue and Apéry would be helpful (again with references). Reference to specific theorems of Liouville

etc. would allow the committee to pinpoint the level of difficulty for the project.

The three references are not presented in quite the correct style – the essay itself will have to do better! However they do contain the key information. Two of the sources cited are text books, but one is a (rather easy) research article.

The proposal however is weak in making clear its individuality. What is being discussed that isn't found in standard text books? It would be helpful to make clear the purpose of the cited research article. Some specific investigation relating to a specific irrational (as mentioned in the second paragraph) or some bringing up to date of where current knowledge stands, a review of recent papers or similar, would help extend the scope of the essay outside the canonical material of a standard text.

So the proposal is most of the way there to being adequate and agreeable, but most likely Projects Committee would in the first instance refer the proposal back asking for some of the above points to be addressed, seeking more detail, and seeking a clear sense of the individual aims of the project. This would not involve much delay (a few days) and would be intended as constructive criticism, on the basis of which the student can start the project with clearer aims in mind.

7 Supervision

You will have six hours of supervision across Michaelmas and Hilary terms, and you will be able to decide with your supervisor how best to arrange the supervision meetings. At the meetings, you should expect to update your supervisor on the work you have done since the last meeting, and can highlight any difficulties you have encountered. Your supervisor will provide you with suggestions on how to overcome difficulties and may direct you to relevant literature. Your supervisor will read and comment on a draft of your extended essay but you should ensure that you give it to them in good time and not just prior to the submission deadline.

Supervisors are asked to keep a log of the amount and nature of project supervision that they give and this will be made available to the second assessor marking the essay. Your supervisor will be one of two assessors for the extended essay. Further information about the marking of essays can be found in section 14.

8 Format of the essay

The examiners give credit for qualities such as content, accuracy, organisation, clarity and style. The final essay should be no longer than 7,500 words, and this usually equates to 25–30 pages. The word count may exclude any table of contents, all mathematical equations and symbols, diagrams, tables, bibliography and the texts of computer programs. However any preface, footnotes, and appendices must be included. Students will need to self-certify the word length of their essay, and must specify how the word-count was produced. Guidance on how to count words in a \LaTeX document can be found on the Maths Institute website: <https://www.maths.ox.ac.uk/members/it/faqs/latex/word-count>.

Essays must be word-processed. For BEE essays they must be prepared using \LaTeX , or some other dialect of \TeX . For BOE essays other appropriate packages may be used. **A short course on the use of \LaTeX will be offered in Michaelmas Term** (see the lecture list on Mathematical Institute website for the time). The references section gives details of a standard text book for \LaTeX (Lamport [6]), and an excellent online guide is The Not So Short Introduction to $\text{\LaTeX}2\text{e}$ [8].

You may apply for an IT account to enable you to use the computers in the study room to work on your essay. The computer account application form is available online at: <http://www.maths.ox.ac.uk/members/it/it-facilities-access>.

The submitted essay should conform to the following points.

- The essay must be word-processed and have a font size of 12pt.
- The text may be single spaced.
- The essay should have a title page which includes the following:
 - the title of the essay,
 - the candidate’s examination number, NOT the candidate’s name or college
 - the title of the candidate’s degree course,
 - the term and year of submission.

9 Writing mathematics

Students should put effort into presenting their work as clearly as possible. The paper by Ehrenberg [1] is only 4 pages long and contains good advice on technical writing. Strunk and White [11] is a guide to writing more generally. Katzoff [3] is an older report on technical writing.

Excellent brief advice on mathematical writing is to be found on the London Mathematical Society website [7]. The book by Higham [2] gives very good tips on writing mathematics. The book of Krantz [5] is also recommended, as is the older book by Steenrod, Halmos, Schiffer and Dieudonne [10]. Section 1 of Knuth, Larrabee and Roberts [4] is a mini-course on technical writing and there is plenty of good advice in the rest of the book too.

Students should remember to back up all the files relating to their work regularly. This includes not only the codes used to generate results but also the drafts of the essay. This will be done automatically for students who are working on the Mathematical Institute computer network.

The finished essay should be a clear and well-reasoned account of the project. It is not necessary to include everything that has been learnt, only what is relevant. There is no point in writing out in great detail things that are well known (references should be used) but the essay should be able to be read and understood as it stands.

10 Referencing and plagiarism

It is most important that an essay is your own work and thus all sources should be carefully referenced in order to avoid plagiarism. The University's policy on plagiarism is available online at <http://www.ox.ac.uk/students/academic/guidance/skills/plagiarism>.

The London Mathematical Society's advice to its authors [9] gives advice on how to reference the work of others and explains a common referencing system. The conventions for citing internet resources include stating the URL and date accessed.

11 Tips for writing a successful extended essay

Responsibility for the essay lies with the student and you should take a proactive approach to completing your essay. Below are some tips on writing a successful essay.

- Manage your time wisely. You should have a clear plan for when and how you will work on your project across Michaelmas term, the Christmas vacation, and Hilary term. Avoid leaving writing up your essay to the last minute.
- Structure your essay write-up with the reader in mind. Ensure that it has a clear beginning, middle and end.
- Proof-read your essay before you submit it. Make sure you have defined all the notation and terms that you use.

12 Oral presentations

Each student offering an essay is required to give an oral presentation to their supervisor and at least one other person with some knowledge of the field of the project. This presentation forms no part of the final assessment of the project. It is intended to give you an opportunity to practise your presentation skills and for your supervisor to test, through questioning, your understanding of the material included in the essay. It is recommended that this presentation be delivered near the end of Hilary Term and after a first draft has been completed.

13 Submitting your extended essay

You should submit your essay digitally via Inspira for your chosen essay. You will be required to fill out a digital declaration of authorship as part of the process. You do not need to add a separate document to your project for this.

No essay will be accepted if it has already been submitted, wholly or substantially, for a degree at the University of Oxford, or for a degree of any other institution. This will then (with the student's consent on the declaration form) be submitted to the turnitin plagiarism system.

13.1 Late submission

It is vital that you submit your work by the given deadline as any late submission will be reported to the Proctors and a late submission penalty may be applied. The late submission penalty tariff is set out in the examination conventions available at <https://www.maths.ox.ac.uk/members/students/undergraduate-courses/examinations-assessments/examination-conventions>. Please contact your college, see the examination conventions and the Oxford Student website (<http://www.ox.ac.uk/students/academic/exams/submission>) for advice on what to do if you are unable to submit your work on time due to medical emergency or other urgent cause.

14 Marking of extended essays

The essay will be read and double blind marked by your supervisor and another assessor. When writing your essay, you should be aware of how it will be assessed and marked. The most important point is that for mathematical topics the project should be in **mathematics**. Do not forfeit marks by making your project inadequately mathematical. In fact, marks are awarded in the following proportions:

Mathematical Content 50%; Content 25%; Presentation 25%.

For other mathematical options marks are awarded in the following proportions:

Content 75%; Presentation 25%.

Here is a brief explanation of these terms, a detailed mark scheme is given below:

Mathematical Content: proofs and assertions should be correct, and the mathematics should be appropriate for the level of study. In applied topics, the derivation of the model should be properly justified.

Content: the examiners are looking for some of your own thoughts and contributions: you must do more than rehash text books and lecture notes; you should use original sources; you must not plagiarise.

Presentation: the mathematics must be clear and well laid out; the English should be clear and grammatically correct; sources should be properly acknowledged, references should be properly cited. Give some thought to

notation, choice of typeface, and numbering of equations and sections. Do not fail to number the pages. Be sure to supply complete and accurate references for all the sources used in completing the project, and be sure to cite them properly in the text.

14.1 Marking criteria

BEE Essays

50% Mathematical Content

20% Difficulty

16-20 The conceptual demands of the material go well beyond that expected and the scope of the project's aims are ambitious.

12-15 The conceptual demands of the material are largely as expected of a project and the scope of the project's aims range appropriately.

9-11 The conceptual demands of the material are below that expected or the scope of the project's aims are limited and less than expected.

0-8 The conceptual level of the material is significantly below that expected and the scope of the project is narrow and unambitious.

20% Correctness

16-20 The mathematical content of the project is invariably correct – as relevant this means that theorems are rigorously stated and proved and/or mathematical/statistical modelling is reasonable and justified.

12-15 There are minor errors with the mathematical content – this may involve some slips or omissions with rigour when stating or proving theorems, imperfect or somewhat simplistic modelling.

9-11 There is a significant error of omission or misunderstanding with the mathematical/statistical content of the project or a significant weakness in an important model.

0-8 There are repeated errors of some substance with the mathematical/statistical content or modelling involved in the project.

10% Comprehensiveness

8-10 The coverage of the project's themes is comprehensive and in depth, beyond what would normally be expected.

- 6-7 The coverage of the project's themes is largely comprehensive with the main theorems, methods and examples included.
- 4-5 The coverage of the project's themes is somewhat lacking, with the occasional omission of standard results or examples.
- 0-3 Significant results or themes within the scope of the project are omitted.

25% Content

10% Coherence

- 8-10 Overall the project's content has a superb coherence, certainty of direction, with the aims of the project being clear, main results well addressed and the conclusions well presented.
- 6-7 Overall the project's content coheres well, with the scope and aims of the project being clearly addressed.
- 4-5 The direction of the project is occasionally unclear, with the presence of some results or examples sometimes at odds with other material.
- 0-3 The project lacks coherence overall, with a sketchiness to its larger conception.

15% Individuality

- 12-15 The project is highly novel in its conception, and something completely original to the literature. It would make good recommended reading for an undergraduate interested in the project's topics.
- 9-11 The project is individual in its conception, with a good range of references.
- 6-8 The project overall is somewhat unimaginative and derivative in its aims. The range of references is a little narrow.
- 0-5 The project overall is rather derivative in nature, showing little imagination.

25% Presentation

10% Narrative

- 8-10 The project is superbly readable with an inviting style and well motivated in its direction, populated with well chosen examples and/or historical context.

- 6-7 The project is easy to read with the different themes linking naturally.
- 4-5 Poorly motivated and somewhat jarring turns in the narrative occasionally appear.
- 0-3 The project makes for difficult reading, with an unclear direction and poorly motivated material.

15% Clarity

- 12-15 The clarity of explanation is superb with ideas carefully, roundly introduced; the effort made for the benefit of the reader is obvious. Language is well chosen and never verbose. References are particularly well chosen and carefully cited. Notation is transparently introduced and important equations are clearly displayed.
- 9-11 The explanation is clear with any new definitions carefully introduced. The language is unambiguous. Referencing is carefully done. Notation is transparently introduced and important equations clearly displayed.
- 6-8 The explanation is occasionally opaque/ambiguous or crucial/necessary definitions are either omitted or difficult to find. References and/or referencing is somewhat minimal. Care is occasionally not taken displaying mathematics.
- 0-5 The explanation is commonly vague and poorly referenced. Commonly notation is poorly chosen and/or equations hidden amongst text. References and/or referencing is poor.

BOE Essays

75% Content

20% Difficulty

- 16-20 The conceptual demands of the material go well beyond that expected and the scope of the project's aims are ambitious. The project requires nuanced understanding in various contexts.
- 12-15 The conceptual demands of the material are largely as expected of a project and the scope of the project's aims range appropriately, requiring subtle appreciation of some topics.
- 9-11 The conceptual demands of the material are below that expected or the scope of the project's aims are limited and less than expected. The project requires relatively straightforward understanding of topics.

0-8 The conceptual level of the material is significantly below that expected and the scope of the project is narrow and unambitious.

20% Correctness

16-20 The factual content of the project is invariably correct – as relevant this entails accurate statements of theorems and veracity of mathematics, logical conclusions and argument drawn from references, awareness of historical detail and context, correct appreciation of current educational theory, handling of data, etc..

12-15 There are minor errors with the mathematical content – this may involve some minor slips with theorems and proofs, logical conclusions and argument drawn from references, historical detail or context, current educational theory, handling of data, etc..

9-11 There is a significant error involving omission, misunderstanding, invalid logical argument, misappreciation of historical context or educational theory, analysis of data etc..

0-8 There are repeated errors of some substance within the project.

10% Comprehensiveness

8-10 The coverage of the project's themes is comprehensive and in depth, beyond what would normally be expected.

6-7 The coverage of the project's themes is largely comprehensive with the main theorems, methods, examples, ideas, developments, historical figures, educational theory, etc. included as appropriate.

4-5 The coverage of the project's themes is somewhat lacking, with some standard/canonical ideas, points of view, themes, historical figures or examples omitted or tangentially addressed.

0-3 Significant themes or topics of interest within the scope of the project are omitted.

10% Coherence

8-10 Overall the project's content has a superb coherence, certainty of direction, with the aims of the project being clear, main results well addressed and the conclusions well presented.

6-7 Overall the project's content coheres well, with the scope and aims of the project being clearly addressed.

4-5 The direction of the project is occasionally unclear, with the presence of some results or examples sometimes at odds with other material.

0-3 The project lacks coherence overall, with a sketchiness to its larger conception.

15% Individuality

12-15 The project is highly novel in its conception, and something completely original to the literature. It would make good recommended reading for an undergraduate interested in the project's topics.

9-11 The project is individual in its conception, with a good range of references.

6-8 The project overall is somewhat unimaginative and derivative in its aims. The range of references is a little narrow.

0-5 The project overall is rather derivative in nature, showing little imagination.

25% Presentation

10% Narrative

8-10 The project is superbly readable with an inviting style and well motivated in its direction, populated with well chosen examples and/or historical context.

6-7 The project is easy to read with the different themes linking naturally.

4-5 Poorly motivated and somewhat jarring turns in the narrative occasionally appear.

0-3 The project makes for difficult reading, with an unclear direction and poorly motivated material.

15% Clarity

12-15 The clarity of explanation/argumentation is superb with ideas carefully, roundly introduced. The effort made for the benefit of the reader is obvious. Language is well chosen and never verbose. References are particularly well chosen and carefully cited. Any mathematics/figures are clearly displayed.

9-11 The explanation is clear with any new ideas/themes/points of view carefully introduced. The language is unambiguous and transparent. Referencing is carefully done. Any mathematics/figures are clearly displayed.

- 6-8 The explanation/argumentation is occasionally opaque/ambiguous or involves omissions. References and/or referencing is somewhat minimal. Care is occasionally not taken displaying mathematics/figures.
- 0-5 The explanation is commonly vague and poorly referenced. References and/or referencing is poor.

14.2 Class descriptors

BEE Essays

- 90–100 Work of potentially publishable standard, as evidenced by its clear individual narrative and insight. The work should show depth and accuracy, and should have a clear focus. It is likely to go beyond the normal level for part B. The standard one sees in winners of one of the examination prizes.
- 80–89 Work in this range will be at the level of a strong candidate for a DPhil applicant. The project will be an easy choice as a winner of a college essay prize. It will have depth, accuracy and a clear focus. It will show a strong command of material at least at the level of part B. It is likely to contain original material, which may take the form of new mathematical propositions, new examples, or new calculations, for example.
- 70–79 The work submitted is of a generally high order, with depth, clarity and accuracy, but may have minor errors in content and/or deficiencies in presentation. It may contain original material, at least in the sense of new examples or calculations.
- 60–69 The candidate shows a good grasp of their subject, but without the command and clarity required for first class marks. Presentation, referencing and bibliography should be good, and the mathematics should have no more than minor errors.
- 50–59 The work shows an adequate grasp of the subject, but is likely to be marred by having material at too low a level, by serious or frequent errors, a high proportion of indiscriminate information, or poor presentation and references.
- 40–49 The candidate shows reasonable understanding of parts of the basic material, but reveals an inadequate competence with others. The material may be at too low a level. There are likely to be high levels of error or irrelevance, muddled or superficial ideas, or very poor writing style.

- 30–39 The candidate shows some limited grasp of at least part of the material.
- 0–29 Little evidence of understanding of the topic. The work is likely to show major misunderstanding and confusion.

BOE Essays

- 70–100 The candidate shows clear focus on the question, with precise and accurate details (mathematical and other), imaginative selection of examples and appropriate selection and quality (rather than quantity) of sources, and cogent argument, supported by evidence.

Within this band the following finer gradations may be helpful:

- 90–100 A polished work of high individuality, well researched and of potentially publishable quality (in a gazette of a professional society say).
- 80–89 Demonstrates strong individuality of content or insight. Would be an appropriate entry for a national or university prize.
- 70–79 Work of high or very high quality, but perhaps lacking the originality that would be expected of publishable work. Might be a good candidate, for example, for a college prize.
- 60–69 Work that addresses the given topic, with solid command of factual content, reasonable range of examples and sources, coherent argument and analysis, and correct referencing and bibliography.
(Essays at the lower end of this range may lack some of these qualities or show them only intermittently.)
- 50–59 Work with some use of facts, sources, and arguments, but marred by one or more of a failure to address the topic, serious or frequent errors of fact, a high proportion of indiscriminate information, speculation or unsupported argument, and incomplete or inaccurate referencing.
- 40–49 The candidate shows some knowledge of the topic but the work is marred by several of the following:- high levels of error or irrelevance, muddled or superficial ideas, incoherent or non-existent argument, incompetent use of sources, or very poor writing style.
- 30–39 The work demonstrates a little knowledge of the topic but no coherent argument.
- 0–29 The work demonstrates almost no knowledge of the topic.

15 Problems and complaints

Students who experience any problems with their project at any point should ensure they discuss this with somebody as soon as possible. If they feel unable to approach their supervisor, they should contact their college tutor or one of the Academic Administration team in the first instance.

If a student wishes to make a formal communication to the examiners relating to their essay, then it must be stressed that in order to preserve the independence of the examiners, they are not allowed to make contact directly. Any communication must be via the Senior Tutor of their college, who will, if they deem the matter of importance, contact the Proctors. The Proctors in turn communicate with the Chair of Examiners. Students who have any queries about the examinations or anything related to the examinations, for example, illness, personal issues, should not hesitate to seek further advice from their college tutor or from one of the Academic Administration team.

References

- [1] A. S. C. Ehrenberg, *Writing Technical Papers or Reports*, The American Statistician **36** (1982), no. 4, 326–329. <http://www.jstor.org/stable/2683079?origin=JSTOR-pdf>.
- [2] N.J. Higham, *Handbook of Writing for the Mathematical Sciences*, SIAM, 1998.
- [3] S. Katzoff, *Clarity in Technical Writing*, Second Edition, NASA, 1964. https://archive.org/details/nasa_techdoc_19640016507.
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