Writing a Formal Mathematical Report[1]

General Information

Your analytical work in solving problems is of no value if you cannot communicate it to others. A written report is just one method of doing this. The ability to write clear, concise, accurate and professional looking reports is as important as the analysis that goes into problem-solving.

Any individual familiar with the general area of investigation should be able to read and understand your report without difficulty. He or she should also be able to quickly scan it and find a statement of the problem, the results obtained, and the significance of the work. These requirements can only be met if the report is effectively organized and clearly written.

The following guidelines should help you meet the requirements for written reports in mathematics.

1. The report must be typed. This includes all mathematical calculations. You may typeset this using LaTeX or Microsoft Word. (Word has an excellent equation editor that is easy to use. It can be found under "insert---object" in the menu. If you don't know how to use it, this is a good time to learn. If you have difficulties, please feel free to drop by Prof. Schumacher's office, and she will help you get started.)
2. Graphs, figures, and tables should be professional in appearance and should be labeled in a clear and consistent manner throughout the document. When first referencing a graph, figure, or table, place it on the same page or the page after its explanation.[2] Furthermore, when you include a graph, figure or table, you should discuss the graph explicitly in your narrative, referring to features of interest, and explaining their significance. If you are including an important diagram and never refer to it explicitly in your narrative, you are almost certainly leaving out an important part of the discussion.
3. Units should be clearly specified and consistently used, where appropriate.
4. Your explanations should balance informal language (for intuition) and appropriate mathematical language that is direct, precise, and clear. Be certain that mathematical elements and procedures are referred to by their correct, conventional names.
5. Enhance the flow of your report by ensuring a sense of continuity. The reader should be able to easily follow the train of ideas presented.
6. Proofread your report! Sloppy prose that is filled with typographical errors, misspellings, awkward phrasings, etc., reflects poorly on your work and on you.

Organizing the Report

The formal report is written to summarize an analysis or investigation of problems of interest. The elements that should be included in your report are:

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[1] This set of instructions is closely based on a similar set distributed to his students by Prof. Keith Howard. Some of the wording is blatantly stolen from his handout. My thanks go to Professor Howard for allowing me to use it.

[2] If the figure or table is central to your argument, it should not be attached at the end of the paper as the reader needs it to follow what you are saying. If the figure is not central to your argument, but only of peripheral interest, you may include it in an appendix.

Title Page
Abstract
Body: Introduction
Theory
Analysis
Results & Discussion
Conclusions
References
Appendices (if applicable)

Title Page: The title of the report should be as brief as possible, but should make it clear what the report is about. In addition to the title, the name(s) of the author(s), the name or number of the course, and the date submitted should be clearly displayed.

Abstract: Although the abstract is placed first, it should not be written until all other parts of the report have been completed. The abstract provides a basic summary, highlighting the main points of the report. Consisting of only one or two paragraphs, it should state in simple declarative sentences what was attempted, how it was accomplished (but only if special techniques were used), and what were the significant results. The abstract must stand alone, presenting all relevant ideas and results to readers who will not go into the report for explanation. It is understood that the reader should look to the full report to get more information about what is in the abstract. Likewise, the report should be fully comprehensible even to those who have not read the abstract; moreover, the report should never refer the reader to the abstract.

Note: the abstract should be clearly labeled, and separate from the body of the report.

Body: **Important**: Though the following describes sections that should go into the report, these sections should not be labeled or given separate headings. Rather they should flow, one to the next, to form a seamless narrative.

Introduction: The introduction should state the problem and describe the motivation behind it. It should provide any germane background information, and it should describe the goals of the project. The introduction should be interesting enough to provide the reader with the motivation to read on.

Analysis: The mathematical solution of the problem should be presented in this section. The analysis should proceed from the general underlying theory to specific relationships and formulas developed in the course of the investigation. The analysis should not contain a simple reproduction of the theory found in references; rather, it should represent your understanding of how the general theory relates to the specific problem at hand.

Analytical results that have been derived previously in the text can be referenced. Their derivation need not be repeated unless it is central to the understanding of the work. Of course, you will be referring to that background in your references, and these should be properly cited so that the reader can follow up, if he or she wants more information.

All relevant mathematical analysis should be presented. The question arises: "what is *relevant*?" You may assume that your reader can verify routine calculations if he/she desires, (e.g. "We solved this equation and found its roots to be . . .," or "we computed the partial derivative of this function with respect to x and found it to be . . .") but you should include any calculations that are, in themselves, relevant to *understanding the mathematical reasoning that underlies your argument*. What is crucial to a good analysis is the supporting explanation and commentary on the mathematics. Your report should not require the reader to do extra work to follow the *flow* of your argument.

Results and Discussion: Here the major results of your analysis are presented in summary form. The summary is then bolstered by your interpretation of the results, by noting what is "as expected," what is unexpected, what is of primary interest, and what is particularly intriguing. Be sure to *explicitly* answer any questions that were asked of you in the project.

Conclusions: Here you are to explain how your work meets the objectives set out in the introduction. Usually, no new material will be presented here.

References: A list of references should be provided, indicating all sources of information contained in the report. For a class project, this may be no more than the relevant sections of your text. If you sought other sources in the course of the project, however, you should include the proper citations.

Appendices: Some reports will include appendices, and some will not. They are optional sections designed for information that may support and deepen understanding of information provided in the main body of the paper. This can include sample calculations (including computer work), data, lists of nomenclature or units, copy of the original problem, etc. (Careful: Appendices should not just be a "data dump." This material should be just as carefully prepared and properly presented as the information in the body of the paper. For instance, if you include a printout of maple work that you did during the course of the project, it should be well organized, and annotated to make it easy to follow. False starts and irrelevant information should be removed before printing.)

BEWARE OF PLAGIARISM: This is a good time to remind you that plagiarism is a serious offence; avoid it at all costs. Here is a definition from Kenyon's Course of Study. The process of "learning from other scholars, artists, or fellow students . . . becomes plagiarism whenever the words, projects, performances, reports, or ideas of another person or source are presented as if they were the original contributions of the student presented them. Such work is also plagiarism whether or not the misrepresentation was an intentional attempt to deceive." If you have any questions about proper attribution, please consult with your instructor. In your report, you may be reproducing much of the content of a project handout, but it should be written in your own words, or you should quote it appropriately.