Expository Papers in Mathematics

Introduction

It is very helpful to have an introduction (and, depending on how long your paper is, an abstract) to contextualize your paper. Introductions should not yet bombard the reader with heavy mathematics. Keep it light. It is often interesting to frame the paper in some interesting question that can only be answered by understanding the material in your paper. Or, if your topic is not something you can tie into a real-world problem, use your introduction to convince the reader of the relevance of the topic. Why is it interesting? What subfields of math is it pertinent to? Historical background, if you choose to use any, finds a great home in the introduction.

Audience

As with any paper, it is important to know your audience. If your professor doesn’t specify, ask. Can you assume that the reader has taken your course? Or should your paper be accessible to the general public? With math being in essence its own language, it is important to know how much hand-holding and defining your paper should do. Regardless of your audience, though, you must give concrete examples of the often abstract ideas being discussed.

Examples

When in doubt, use examples! Examples are the best way to ground your reader and ensure they understand your complex material. Particularly when your definitions or theorems are in general form, pick a basic yet illustrative example with which to couple it. It is often helpful to give an example before stating the general definition or theorem. That way, the example eases your reader into the general form, as opposed to serving as damage control after having scared them with abstraction.

Style

Let your voice come through! Just because it’s a math paper doesn’t mean it has to uphold the field’s stigma of being dry and clinical-sounding. Your reader should want to read your paper. So, don’t shy away from being punny, taking on a tone, or varying your syntax. And have fun—just as you would in any piece of writing. What is unique about a math paper, though, is that actual definitions, theorems, conjectures, proofs etc. must retain their formalities.

Form

As such, it is helpful to keep your informal prose visually separate from the more precise and technical components of the paper. Paragraphs and punctuation are still crucial in math papers (and the same rules of grammar apply), but the prose certainly can and should be spliced by definitions, examples, theorems, proofs, etc. It would be helpful for the mind and easier on the eye to use boldface and italicized language where appropriate, for distinction and consistency. Additionally, papers are often divided into sections and subsections, in order to make structural sense of the material.
LaTeX is a typesetting language that does much of this formatting for you and is particularly helpful in typing out equations. It is the most commonly used language for writing technical math papers. Some professors may even require you to use LaTeX. If so, Claremont Center for the Mathematical Sciences (CCMS) Software Lab is a helpful resource for learning. They offer tutorials at the library. For more information, go to: http://www.ccms.claremont.edu/CCMS-Software-Lab

Make sure that you understand the conventions of the subfield you’re discussing. Subfields of mathematics have specific ways of expressing things, and the same symbol may mean something totally different in two different subfields. In that vein, clarify what your symbols mean. Now, mathematical shorthand is prevalent in class lectures, but it should not make an appearance in your paper. Just as academic papers refrain from using contractions and abbreviations, your math paper’s prose should use words.

You don’t necessarily need a conclusion, but it is a nice way to wrap up. Many math papers end abruptly, so you really shouldn’t feel obligated to write a conclusion. If you choose to write one, you can bookend it with some of the information relayed in your introduction. It can include more math within it than did the introduction, but it should not leave your reader with the sensation of being overwhelmed. It can also include the limitations or extending applications of the topic/results, and it can highlight open problems and suggest areas for future research.

Lastly, make sure to cite your sources! It is convention to use endnotes to cite information throughout the paper, so it does not interrupted the flow of the sentence. If you are using LaTeX, it compiles a bibliography for you, as you write and cite. Make sure your sources are reliable and valid. Peer reviewed sources are ideal.

For more information on mathematical writing (including tips for writing proofs, posters, and research papers) reference Handbook of Writing for the Mathematical Sciences by Nicholas J. Higham (1998).