

How to Check Proofs

The objective of a proof is to show an informed reader (e.g. a fellow mathematician), why the statement under consideration is correct. Because of its communicative nature, a proof has to satisfy the same standards as other technical writing: It has to be correct (your main concern!), express its thoughts clearly, explain its ideas in the easiest way possible, be coherent, legible and aesthetically pleasing.

Alternating between “proofreading” your proof line-by-line and considering your “product” as a whole is one way to achieve these goals.

Line-by-line Analysis. While you are carefully checking each line and each little step of your proof, you should watch out for the following:

- Is this step correct?
- Are there counterexamples?
- Are all symbols defined or explained, the first time they show up in the proof?
- Do I need all the symbols and steps I use?
- Is the spelling correct?
- Can the wording be improved upon?
- Is there a more elegant way of explaining the argument?

Even making minor changes during a line-by-line analysis usually requires to start the analysis all over again. If you make more than minor changes, you have to rewrite your proof completely. Proofs you have seen in books have probably been rewritten by the author more than a dozen times.

Global Analysis. During a global analysis you consider your proof as a whole:

- Does my proof “really” show what I am supposed to show?
- Did I forget to prove any of the statements?
- Are all parts of my proof really necessary?
- Do I use all the hypotheses?
- Do I give all necessary references and acknowledgements?
- Does one need all the hypotheses? Does my proof suggest generalizations?
- Does my “final product” look good?

Acknowledgements and References. If you work together with classmates obtaining a solution to a problem, proper credit must be given, e.g., ... *jointly obtained by J. Doe and myself, we thank J. Doe for her helpful advice.*

There is a fine line between academic cooperation and collusion. To avoid the latter, it is recommended when working in a group, that the participants independently compose their own final version of the proof. Copying a solution from a classmate or using other sources without references constitutes an act of academic dishonesty.