

Communicating Applied Maths

(Some pointers to good mathematical writing)

SIAM Review is one of the most important journals in applied mathematics published by the **Society of Industrial and Applied Mathematics (SIAM)** (the most important in applied mathematics).

Each issue (quarterly) contains a **survey article** that provides readers with a comprehensive and up-to-date perspective **on a major topic of broad interest** to SIAM members.

The guidelines to SIAM Review authors state (among other things):

“... Papers must be well written, in an expository style that facilitates understanding by as broad an audience as is feasible for the topic. ...”

Exercise 1.

Read the two summaries of a paper published in the **Survey and Review Section** of **SIAM Review**. In each example, the first one is the abstract of the paper, and the second one an introduction by the section editor.

Does one of the summaries do a better job of enticing you to read the paper, and why? If so, why does the other summary leave you indifferent?

Exercise 2.

Question 1. What is the primary purpose of writing? (*Answer in one word.*)

Question 2. As a writer, to whom are you *primarily* obligated? (*Answer in one or two words.*)

Question 3. What does Question 2 imply, as far as the process of writing is concerned? (*Answer in fewer than ten words.*)

Respect the WWW of writing.

- What is it that I want to say?
- Why do I want to say it?
- Who is my audience?

Keep your main message and your audience always in mind when you are writing!

Use correct grammar and logic.

In mathematics this can make all the difference between a correct statement and a false one!

Be thorough and concise.

These two adjectives are not exclusive. Do not use any term/jargon unless you have explained/defined it, but do not bore the reader with endless definitions or excursions!

Do use dictionary and thesaurus.

Writing mathematics is still writing. Don't start every sentence with: "There is" or "It follows that"! Make the text flow and keep the reader entertained!

Exercise 3.

- Do you like writing? If not, why?
- Which types of writing do you enjoy the most, or the least?
- Do you see any importance in good writing (besides getting a degree or expanding your CV)?
- Have you found a strategy that makes writing easier for you?

Exercise 4.

Read the article

Bryan K, Leise T, “The \$25,000,000,000 eigenvector: The linear algebra behind Google”, *SIAM Review* **48**, pp. 569–581.

Determine the who, what and why. *Who* is my audience? *What* do I the author want to say? *Why* do I want to say it? Then write a short, informative and captivating summary of the article, of no more than 5 sentences. Make sure you understand the mathematical details.

Hand in your summary at my office by next **Friday, February 6th**, to get my feedback.

I hope that this has helped to make you understand why good writing is important and that it has motivated you to put effort into your writing!

If you want some further pointers on good mathematical writing, I recommend looking at

A Primer of Mathematical Writing,

by Steve Krantz, AMS, 1997,

or the more detailed

Handbook of Writing for Mathematical

Sciences, by Nick Higham, SIAM, 1998,

(both available from Carole in Dept. Office).

Krantz' book is very readable. The part of interest to you is only 77 pages of very large print. Have a go!
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You can also find pointers to web resources on **Ilse Ipsen's** webpage (North Carolina State) on *Communicating Applied Mathematics*:

<http://www4.ncsu.edu/~ipsen/ma798I/>

A Primer of Mathematical Writing

Steven G. Krantz, AMS, 1997

Will simply go through the **Table of Content:**
(adding my flavour to it)

CHAPTER 1: The Basics

§1.1 What Is It All About?

- what do you have to say
- help the reader understand
- don't jump in at the deep end

§1.2 Who Is My Audience?

- keep in mind a specific person to whom you might be writing
- recall the guidelines to SIAM Review authors (1st lecture)

§1.3 Writing And Thought

- ability to think clearly and ability to write clearly are inextricably linked
- | |
|----------|
| Thinking |
|----------|

Writing

- i.e. writing out ideas carefully can help understand

§1.4 Say What You Mean; Mean What You Say

- formulate your sentences accurately & logically correct (especially in mathematics this can make the difference between right or wrong)
- get your grammar right
- be as concise as possible; don't ramble on when you have said what you have to say

§1.5 Proofreading, Reading for Sound & Sense

- proofread more than once; it is hard to check both correct spelling and correct maths at the same reading
- check:
 - spelling & syntax
 - accuracy
 - organisation & logic
 - sense & flow
 - sound
- Use correct mathematical terms
- Use mnemonic & intuitive notation for your variables, functions, etc

§1.6 Compound Sentences, Passive Voice

- avoid compound sentences; break them up into shorter ones; this makes the maths easier to understand
- vary “overused” words, e.g. use words like “suppose”, “define” and “consider” instead of “let”

§1.7 Technical Aspects of Writing a Paper

- write your name and date on the drafts
- think about the organisation of your paper/report
- be careful when using \LaTeX : your printed draft will always look very professional & like a finished product; this makes it hard to spot any flaws
- consider drafting your report (or parts of it) by hand first before typing it up

§1.8 More Specifics of Mathematical Writing

- for the most part mathematical writing is like any other writing
- make sure your sentences actually read well, even when they contain displayed equations (including punctuation)
- choose good notation; don't do things like this:
A function ε defined on $f = [0, 1]$ is continuous in $g \in f$ iff
$$\forall x > 0 \exists I > 0 \forall \delta \in f : |g - \delta| < I \Rightarrow |\varepsilon(g) - \varepsilon(\delta)| < x .$$
- also, use words instead of symbols, if it doesn't make the sentence much longer

§1.9 Pretension and Lack of Pretension

- choose simple words over “big” ones where possible

§1.10 We vs. I vs. One

§1.11-12 Rules of Grammar, Syntax & Usage

- Examples:
 - **All, Any, Each, Every**
 - **Obviously, Clearly, Trivially !?**
 - **Agreement of Subject and Verb !**
 - **That or Which**
 - **etc...**

CHAPTER 2: Topics Specific to the Writing of Mathematics

§2.1 How to Organize a Paper

§2.2 How to State a Theorem

- Example (next slide).

§2.3 How to Prove a Theorem

- break a long proof up into lemmas
- use “the claim” & emphasise key steps
- let the reader know where you have got to and what remains at certain points of the proof

Theorem. *Let f be a function satisfying the following hypotheses:*

1. *The function f has domain the real number line;*
2. *The function f is positive;*
3. *The function f is uniformly continuous;*
4. *The function f is monotone;*
5. *The function f is convex;*
6. *The function f is differentiable except possibly on a set of the first category;*
7. *The function f has range that is dense in the positive real numbers;*
8. *The function f has repeated values;*
9. *The function f is a weak solution of the differential equation*

$$Lf = 0$$

(where the operator L has been defined earlier in the paper);

10. *The function f^2 is a subsolution of $Lf = 0$.*

Then f operates in the sense of functional calculus, on all bounded linear operators on a separable, real Hilbert space H .

§2.4 How to State a Definition

- as much as possible, state definitions briefly and congenitly
- don't clutter your paper/report with definitions, but do help the reader by introducing important new objects clearly in separate definitions
- again, think about your notation carefully

§2.5 How to Write an Abstract

§2.6 How to Write a Bibliography

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77 pages of very large print up to here!!

Give it a go!

Much more on this and in more detail, especially on English usage in

Handbook of Writing for Mathematical Sciences, by Nick Higham, SIAM, 1998.

You can also take a look at my thesis. It's available under

<http://www.maths.bath.ac.uk/~masrs/publications.html>

Introduction

- Subject of the Thesis
- Aims of the Thesis
- Main Achievements of the Thesis
- Structure of the Thesis

Each Chapter

- Preamble with short literature review
- Core Sections using Definitions, Lemmas, Theorems, Tables, Figures
- Summary and Conclusions at the end

Exercise 5.

Prepare a preliminary, informal pre-draft of your topic review report.

Here are some hints to get you going: Compile a table of contents. Sketch a rough outline of the story you want to tell in your report. Jot down a few sentences or keywords for each section. Possibly draw a picture of an example. Collect papers you need to reference. Think about *who is your audience* (i.e. your peers), *what you are going to say*, and *why*.

You don't have to Latex this. Handwritten is fine, provided it's legible.

Hand in your pre-draft in Week 8 on **Thursday, March 19th**.