

Notes on Typing Mathematical Papers

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1 Introduction

These notes are to alert you to important features of any mathematical paper that you may be writing. This is not a set of instructions for any word processor. My purpose is not to give you detailed instructions, but to make you aware of the intended results. If you don't know what you are trying to achieve, you will not achieve it. It's up to you to find out how to achieve correct results with appropriate software.

Office-type word processors are often inadequate for mathematics. Most mathematicians find that they need \LaTeX or one of its derivatives. \LaTeX software is free but requires some effort to learn; I recommend buying, and working through, the handbook by Leslie Lamport.

2 Physical format of your paper

When you type a scholarly paper, do not invent a new format; follow existing standards. You may be given very detailed instructions. If not, use 12-point Times New Roman or a similar-looking roman (not sans-serif) type-

face, spaced vertically to give anywhere from three to six lines per inch, and margins of at least one inch on all sides. The pages must be numbered.

Mark all paragraphs the same way, either by line spacing or by indentation. Do not let the format fluctuate from paragraph to paragraph or page to page.

3 Typing mathematical formulas

3.1 Developing an eye for type

This is roman type.

This is italic type.

This is boldface type.

This is sans-serif type.

This is underlined roman type.

3.2 Uses of type styles in mathematics

Roman type is used for the text of your paper; for numbers and symbols in formulas; and for functions such as sin, cos, tan, log, and arg max.

Some newer books put the d for derivative in roman type (dy/dx rather than dy/dx) to make it clear that it is not a variable. That usage is preferred by some publishers but is not universal.

Italic type is used for foreign words in English context; for words that are being defined or discussed as examples of language; for titles of books and journals; and for most variables in formulas.

In \LaTeX , there is a further distinction between ordinary italics and math italics. The latter have some of the the letters spaced more widely to avoid bumping into symbols such as parentheses. Math italics should never be used to spell words.

Boldface type is often used for variables denoting vectors or matrices. It

may be used for titles and section headings in papers, but apart from that, it has little use.

Sans-serif type is used in charts, tables, and illustrations, but not in ordinary text.

Underlined type does not normally appear in printed papers. It is used in some very specialized mathematical notations. In handwritten papers, underlining is the equivalent of italics, and wavy underlining is the handwritten equivalent of boldface.

3.3 Typography in formulas

Disaster can ensue if you copy a formula from a book or web page without understanding it; you'll make mistakes without realizing it. In order to be qualified to use a formula in your paper, you need to understand the meaning and usage of every symbol in it.

Here is an example of a correctly typed formula:

$$\cos \theta = x^2 + 2xy + y^2 = \prod_{i,j \in \{0,1\}} \frac{c_{ij}}{\sqrt{a_{ij}^2 + b_{ij}^2}}$$

Note that x and y are in italics but the other symbols, including the symbol for the cosine function, are in upright roman type. Note also the horizontal spacing: $\cos \theta$, not $\cos\theta$.

Superscripts and subscripts must be smaller than ordinary type, not just shifted up and down. Write x^2 , not x^2 . Write c_{ij} or $c_{i,j}$, not c_{ij} or (worse) cij .

Do not use computer programming symbols in a purely mathematical formula. Write ab or $a \times b$, not $a*b$. Write 10^6 , not 10^6 or $10**6$.

Most importantly, *imitate the typography in well-edited mathematics books, not in conference papers typeset by their authors*. That is, imitate the work of people who know more than you do, not those who know less.

3.4 Symbols frequently confused

Do not confuse the empty set symbol \emptyset or \varnothing with the Greek letter phi ϕ .

Do not confuse the set membership symbol \in with the Greek letter epsilon ϵ (or ε) or the Euro currency symbol € .

Do not confuse the letter x with the multiplication sign \times .

3.5 Computer programs

Use a distinctive kind of type for computer programs, and use it rigorously not only for listings, but also for every fragment of a computer program that is quoted in English context. Usually, you will want to use **typewriter-style type**, such as the Courier or Consolas font. In some programming languages, **sans-serif type** may work well for this purpose even though the characters are not all the same width. In any case, be consistent.

When writing a computer program, consider whether it is going to be displayed in print, and if so, limit the length of the lines to about 55 or 60 characters, or at most, 72 characters (the old FORTRAN maximum).

Beware of “smart quotes” in Microsoft Word. That is, do not write ‘**this**’ if you mean '**this**'. (Do quoted strings in your language begin and end with the same kind of quotation mark? If so, that is how you must print them.) The *upquote* package in L^AT_EX makes the characters ' and ` print the same way they appear on the keyboard.

4 Cautions

Your bibliography lists the sources from which you got information that is not common knowledge. You do not have to cite sources for common knowledge, which is information that is widely known and not attached to any particular discoverer, such as the information in encyclopedias, dictionaries, and basic textbooks.

If a piece of information is only available from one source, and you used it,

you must cite it, even if it's a web page, class handout or a personal communication from another scientist. *However, it is your duty to find out whether that is really the best source.* Do not use web pages or course handouts as a substitute for the real sources of the information. Your duty as a scholar is to trace information to the *original* or *best* sources so that the originators so that they get proper credit for their ideas.

The purpose of a bibliography entry is to *enable people to find the source in a library without further use of a search engine* (except the library's own catalog). Every bibliography entry lists an author, date of publication, title, and place of publication. For a book, the place of publication is the publisher and city. For a journal article, the place of publication is the journal, with volume number and pages. For a web page, the place of publication is the URL. Detailed formats for bibliography entries are given in many handbooks.

Never copy a bibliography entry from someone else's bibliography without checking that all parts of it are correct and complete.

Never list a paper in your bibliography which you have not seen with your own eyes. That constitutes academic dishonesty — you are claiming to have read something that you did not actually read.

The bibliography entry cites the full paper (including all the pages of a scholarly article). You can identify individual pages in the citation, such as "Covington (1997, p. 247)."