IDEALS AND GUIDELINES FOR WRITING MATHEMATICAL ARTICLES

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The most fundamental thing to keep in mind is that there really is nothing special about writing a mathematical article compared to writing a paper in other fields, compared to writing a newspaper article, or compared to writing a story . In principle we in all cases write an essay as we did at school. All the same rules for good and correct language, fluent presentation, and grammar applies. And as matematicians we should value that there are such universal standards, although writing essays may not have been our favourite activity when we went to school.

An ideal when we write and other read a mathematical paper, or other people read whatever we write, is that it reads as fluently as a novel. This is undeniably a difficult, in practice unreachable goal in mathematics. But it is nevertheless a goal we should keep in our minds.

Writing mathematics has however its distinguished features where the universal rules have to be adapted. And in the following we shall discuss some aspects of how this is done.

Repetitions. A rule for good language says that we do not use the same word twice or more in a sentence if this is a word with a certain distinctiveness. Also we do not use the same expression several times in the same paragraph. Instead we rather use a euphemism, an alternative phrasing, if we are to refer to it, or we use a suitable pronoun like, "it", "this" or so. When it comes to mathematical expressions, it is not desirable to use alternative phrasings, mainly because we want to be very precise, but also because such expressions are mentally demanding to read. But often we need to refer to the same concept, structure, or relation several times in a paragraph or on a page, because it is central in an argument. The solution to this when writing mathematics, is that we put it in display, for instance as

$$\mathcal{N}^k \Bbbk[0, x] \tag{1}$$

or as

$$H^p\mathcal{N}^k(S/I)_{\mathbf{r}-\epsilon_i} \xrightarrow{\cdot x_i} H^p\mathcal{N}^k(S/I)_{\mathbf{r}} \tag{2}$$

and label it, usually with a number. When we later on repeatedly need to refer to the relation or structure, we simply refer to the label. If the expression is in the immediate vicinity, we can also use unequivocal references as “we see from the last expression” or “by the right side of the formula above”.

Notation. Another rule for good language is that we do not sprinkle the text with unnecessary technical terms. Good language is varied, but it should also not be more difficult than what is needed in order to convey what we want. An analogue of this in mathematics is that we show restraint in introducing mathematical notation. We should not introduce more than what is needed in order to convey our message in a proper way. When writing about specialized topics, or poetic literature it may be necessary to use technical terms or refined wording in order to convey things precisely or give it the right nuance. But again, it should'nt be overdone.

In mathematics it is particularly important to note that the more notation is introduced, the more difficult it gets to enter at any place in the article or book, and understand the text. And with experience it is more and more rare that one reads things from beginning to end. And then it is disconcerting to leaf through the article to find where this and that is defined.

Here are some sufficiently good reasons for introducing mathematical notation:

- Notation giving a better overview of standard algebraic manipulations of equations and formulas. For instance:

$$\begin{aligned} x^2+2x-3 &= 0 \\ (x+1)^2-4 &= 0 \\ (x+1)^2 &= 4 \\ x+1 &= \pm 2 \\ x &= -1\pm 2 \\ x &= 1,-3. \end{aligned}$$

  The notation introduced here is $"+,-,="$, x for the unknown, powers by having numbers as superscripts, adjacent positioning in order to denote multiplication, and paranthesis in order to give the orders of the operations. This notation has not always been there. It was introduced in the 15- and 16 hundreds. Earlier it was not customary to use symbols for these things, they were written as ordinary text. The unknown “x”, was simply called “the thing” or “the unknown”. The introduction of simple and standardized notation for routine operations owes much of the reason for mathematics having become such a ubiquitous and flexible tool.
- Composite and complex concepts which it is *necessary* to refer to *repeatedly* can be denoted by a letter, like P, Γ, f, or α, often with indices or arguments if they depend on these. If these

arguments are fixed througout most of what we are writing, we do not need carry them along. But if they vary a bit, it will be better to write them explicitly. Here we must use our best judgement.

- One can use symbols and notation which are standard in the field one is working in, which everybody in the field ought to know. Such notation should nevertheless often be accompanied by explanations for people fresh to the field, or not so aquainted with it. At least we can, when the notation is given the first time, accompany it with discrete verbal explanations, often later also. For instance the first time we use the notation "(a, b)" in the article, we may write "let x be an element of the open interval (a, b).".

There may be other good reasons for using mathematical notation, but the main rule is to show restraint in introducing it. Let us look at some examples.

- The volume of the box is lwh, where l is the length, w the width, and h is the height.

If we do not later on repeatedly use l, w, or h, this can be done as follows.

> The volume of the box is the product of the length, width, and height.

- $\forall x \exists y, x \geq 0 \Rightarrow y^2 = x$.

This is much more demanding to read than the following.

> Every real number greater or equal to zero, has a square root.

In fact one should not use the quantifiers $\forall$ og $\exists$ when writing mathematical papers.

- Let X be a compact metric subspace of the space Y. If f is a continuous, $\mathbb{R}$-valued function on that space then it assumes both a maximum and a minimum value.

Here it is superfluous to refer to the space Y. This can be written as follows.

> Let X be a compact metric space. If f is a continuous, real-valued function on X then f assumes both a maximum and a minimum value.

In fact it is unnecessary to introduce any notation at all.

> A continuous, real-valued function on a compact metric space assumes both a maximum value and a minimum value.

The following example is from a dissertation.

> If $A \in \mathrm{Mat}_R(a,b)$ and $v_i \in R^a$ is the i^{th} column vector in A, we let $I_k(A) = I_k(v_1,\dots,v_b)$ be the ideal generated by the $k \times k$ minors of $A(k \leq a,b)$. This of course only depends on $\mathrm{im}A = \langle v_1,\dots,v_b\rangle = \{\sum_{i=1}^b c_i v_i \,|\, c_1,\dots,c_b \in k\}$.

One is almost knocked down by all the notation. Here is how to write this.

> Let A be an $a \times b$ matrix over the ring R. We let $I_k(A)$ be the ideal generated by the $k \times k$-minors of A. This of course only depends on the row space of A.

Symbols. In order to denote mathematical structures we generally use symbols from the greek and latin alphabets. Each symbol comes in two versions, lower case and capital case. We also have a wide range of symbols to denote operations on, or relations between these structures, for instance $a+b$, a/b, $A \subseteq B$, $A \cong B$, $a \to b$. In addition we have various techniques to denote variations on the letters, for instance from a we can form $\mathbf{a}$, a', a'', $\hat{a}$, $\tilde{a}$, $\overline{a}$.

The following gives some rules concerning the choice of symbols.

- As far as possible we should adhere to the conventions within the area we work, concerning what symbols is used to denote various notions and relations. This makes recognition and association easier for the reader, and eases reading. One of the oldest conventions, dating from Descartes, is that x, y, and z denote variables, while a, b, and c denote constants. Functions are most often denoted by f, g, and h. Indices often with i, j, and k. One uses capital letters, say A, for matrices, while vectors are denoted by small, often boldface letters $\mathbf{a}$.
- The notation should give assocations. This skill comes more with experience. But often this is achieved through quite simple means.

  Example. If x, y and i, j are two different types of arguments of a function f, writing $f(x,y,i,j)$ will not emphasize the distinction between these two types. It is better to write $f(x,y;i,j)$ of $f_{ij}(x,y)$. If a and b are numbers representing a lower and upper value the association to this can be achieved by writing $f_a^b(x,y)$.

- The notation should have a pleasant and aesthetical appearance.
- One should try to slim the notation, by introducing for instance higher level notation if things get to loaded or full of indices. However one must here also keep in mind the rule of showing restraint in introducing mathematical notation.

Example. If one *repeatedly* uses the expression $f_{i_1,\dots,i_r}^{j_1,\dots,j_r}(a_1,\dots,a_n)$ or its like, it would often be better to let $\mathbf{i}$ denote the r-tuple $(i_1,\dots,i_r)$ and correspondingly for $\mathbf{j}$, and let $\mathbf{a}$ denote the corresponding n-tuple. Then one can write $f_{\mathbf{i}}^{\mathbf{j}}(\mathbf{a})$.

Loosen up, make space. Good language is to avoid stacked, intricate or too condensed word constructions, and also to avoid too long sentences. One should loosen up, get more air and break into several sentences. An adaptation of this to mathematics is a rule saying that the text should not have formulas or expressions longer than a fourth or a third of a line. If the expression is longer it should either be put in display or, if one does not think it important enough, be broken into several parts. And this there are, surprisingly enough, many who do not know how to do, or at least do not have a sufficiently conscious attitude to, even among quite experienced mathematicians. In fact this is usually utterly simple. In most cases this can be done by for instance replacing an equality sign "=" with the words "is equal to", or an isomorphism sign "$\cong$" with "is isomorphic to", or "$\subseteq$" with "is a subset of", or "$\in$" with "is an element of".

- Next we shall describe the Betti space $B^p(N_l^k(S/I)) = H^p(F \otimes_S N_l^k(S/I))$ for F a projective $\mathbf{Z}^n$-graded resolution of $\Bbbk$ over S.

This can be written as:

> Next we shall describe the Betti space $B^p(N_l^k(S/I))$, which may be computed as the cohomology group $H^p(F \otimes_S N_l^k(S/I))$ for F a projective $\mathbf{Z}^n$-graded resolution of $\Bbbk$ over S.

- with $C^k(w)_u = N_{l_j}^k \Bbbk\{0, l_j - y\}$ for

This should rather be:

> where $C^k(w)_y$ is equal to $N_{l_j}^k \Bbbk\{0, l_j - y\}_w$ for

- then $Z(J, x, y' + 1) \subseteq Z(J, x, y + 1)$

This should be:

> then $Z(J, x, y' + 1)$ is a subset of $Z(J, x, y + 1)$

- we define $\gamma(r) = \sum_{j=1}^n \gamma_j(r_j)$ by the formula

This is acceptable, but the following gives more fluent and clearer prose:

> we define $\gamma(r)$ to be $\sum_{j=1}^n \gamma_j(r_j)$ where the terms in this sum are defined to be

In general the symbols used before the examples, " $=$, $\subseteq$, $\in$, $\cong$ " etc. should be replaced by words when they are in the text (i.e. are not in display). This brings the text closer to fluent prose, with sufficient air. Only with simple relations like "so $x = 3$" or "where $A \subseteq \mathbb{N}^n$ is it fine to keep the mathematical symbols.

The following is from a text book in algebra:

"By assumption, there exists a polynomial $h \in P$ such that we have $g + I' = \phi(h + I) = h(f_1, \dots, f_n) + I'$. Since $g - h(f_1, \dots, f_n) \in I'Q \subseteq J$ and $h - h(f_1, \dots, f_n) \in (x_1 - f_1, \dots, x_n - f_n) \subseteq J$ by Propositions 3.6.1.b, the polynomials g, h and $h(f_1, \dots, f_n)$ have the same normal form by Proposition 2.4.10.a. "

The following is better:

"By assumption there exists a polynomial $h \in P$ such that $g + I' = \phi(h+I)$, which again is equal to $h(f_1, \dots, f_n) + I'$. So $g - h(f_1, \dots, f_n)$ is contained in $I'Q$ which is in J. Also $h - h(f_1, \dots, f_n)$ is in the ideal $(x_1 - f_1, \dots, x_n - f_n)$ by Proposition 3.6.1.b, and this ideal again is in J. Therefore the polynomials g, h and $h(f_1, \dots, f_n)$ have the same normal form by Proposition 2.4.10.a."

Another example from the same text book:

"For every element $m \in M \backslash \{0\}$ there are $f_1, \dots, f_s \in P$ such that $m = \sum_{i=1}^s f_i g_i$ and $\mathrm{LT}_\sigma(m) = \max_\sigma \{\mathrm{LT}_\sigma(f_i g_i) | i \in \{1, \dots, s\}, f_i g_i \neq 0\}$ i.e. such that $\mathrm{LT}_\sigma(m) = \deg_{\sigma, \mathcal{G}}(\sum_{i=1}^s f_i \epsilon_i)$."

This could have been written as follows:

"For every nonzero element $m \in M$ there are polynomials $f_1, \dots, f_s$ in P such that $m = \sum_{i=1}^s f_i g_i$ and the leading term of m is the maximum among the leading terms of the nonzero $f_i g_i$ where i ranges from $1, \dots, s$. So the leading term $\mathrm{LT}_\sigma(m)$ equals the degree $\deg_{\sigma, \mathcal{G}}(\sum_{i=1}^s f_i \epsilon_i)$."

In accordance with the rule of avoiding stacked language we should take care of the following when we have expressions in display. We should not list relation after relation where each transition is due to some complex reason or piece of theory one has built up. For instance:

$$\begin{aligned}
&T\mathrm{Hom}_{J^{\mathrm{op}}}(E, K(J \cap [x, x+y])^{\mathrm{op}}) \\
&\quad \cong \; T\mathrm{Hom}_{(J \cap (x+\mathbb{N}^n))^{\mathrm{op}}}(E|_{(J \cap (x+\mathbb{N}^n))^{\mathrm{op}}}, K(J \cap [x, x+y])^{\mathrm{op}}) \\
&\quad = \; T\mathrm{Hom}_P(E, KF) \simeq \widetilde{C}^{-*}(I) \\
&\quad \simeq \; \widetilde{C}^{-*}(I^{\mathrm{op}}) \\
&\quad = \; \widetilde{C}^{-*}(J \cap (x + (\mathbb{N}^n \setminus [0, y]))).
\end{aligned}$$

Instead we should break it up and let each transition be accompanied by clear, easily comprehended prose. Such lists of relations should only be used when it involves standard algebraic manipulations like under the section "Notation".

Be descriptive. Another tool to get more fluent prose is not to have too much "let ... be", "such that ...". "Then ..." and so just fill in with mathematical notation. The mathematical notation should be accompanied by desriptive nouns or adjectives. For instance:

- Then $H^p(\mathcal{N}^{\mathbf{k}}\Bbbk[\mathbf{0},\mathbf{r}]) = \mathbf{T}^{\rho}\Bbbk[\mathbf{a},\mathbf{b}]$.

We get more air, fluency and readibility by writing as follows.

> Then the cohomology module $H^p(\mathcal{N}^{\mathbf{k}}\Bbbk[\mathbf{0},\mathbf{r}])$ will be equal to the translated interval module $\mathbf{T}^{\rho}\Bbbk[\mathbf{a},\mathbf{b}]$.

If H is an inner product space one can define the following.

- For a subspace $V \subseteq H$ define the subspace $V^{\perp} \subseteq H$ as
$$V^{\perp} = \{\mathbf{w} \in H \,|\, \mathbf{v} \cdot \mathbf{w} = 0, \,\forall \mathbf{w} \in H\}.$$

The following is easier to read.

> For a subspace $V \subseteq H$, let the orthogonal subspace $V^{\perp} \subseteq H$ consist of the vectors $\mathbf{w}$ in H such that the inner product $\mathbf{v}\cdot\mathbf{w} = 0$ for any $\mathbf{v}$ in V.

Or simply:

> For a subspace $V \subseteq H$, let the orthogonal subspace $V^{\perp} \subseteq H$ consist of those vectors in H which are orthogonal to all vectors in V.

Be instrumental. Sometimes we need to formulate rather complex and composite theorems or relations. A mistake is to smash it in the face of the reader as a big formula or a series of technical formulas, maybe ended by a "supreme formula".

Concerning formulas, it is important to distinguish between two types. On the one hand we have those which are an aesthetic goal in themselves. Those which give a compact, clear, concise, elegant formulation of an interesting and fascinating relation. On the other hand there are those which are just another step along the way, but which in themselves are not particularly interesting or exciting. Such relations we should show restraint in putting forward as formulas. They are often heavy and/or exceedingly boring to read. And if there is something to be avoided in good prose, it is to bore the reader. It is mostly better to give an instrumental and conceptual explanation of such things. Explain the principles of how one arrives at/calculates the expression. One must of course not relax on precision and clarity. All the ingredients and procedures should be crystal clear. But one does not necessarily develop explicit formulas.

These guidelines are also in accordance with fundamental pedagogical principles. If you are to explain a thing you develop it instrumentally. One explains that in this or that way you find this number or invariant, this is natural because ..., and this or that way you find this number or invariant. Then the following nice relation will hold ... . This in contrast to: Let "$\alpha = \ldots$, let $\beta = \ldots$, let $\gamma = \ldots$, etc. Then a "big formula" holds. The latter is bad pedagogics whether it is in kindergarten, elementary school, high school, beginners students, master students, Ph.D. students, or scientific presentations:

Example. Given $r \in \mathbb{Z}^n$ with $0 \leq r \leq l$ we define $\gamma(r) = \sum_{j=1}^n \gamma_j(r_j)$ by the formula

$$\gamma_j(r) = \begin{cases} 0 & \text{if } r + k_j \leq l_j \\ 1 & \text{if } k_j \leq l_j + 1 \leq k_j + r \\ 2 & \text{if } k_j = l_j + 2 \end{cases}$$

Further we define $u(r) = (u_1(r_1), \ldots, u_n(r_n))$ and $v(r) = (v_1(r_1), \ldots, v_n(r_n))$ by the formulas

$$u_j(r_j) = \begin{cases} r_j - k_j & \text{if } k_j \leq r_j \\ l_j - (k_j - 1) & \text{if } r_j + 1 \leq k_j \leq l_j + 1 \\ r_j & \text{if } k_j = l_j + 2 \end{cases}$$

and

$$v_j(r_j) = \begin{cases} l_j - r_j + 1 & \text{if } k_j \leq r_j \\ r_j + 1 & \text{if } r_j + 1 \leq k_j \leq l_j + 1 \\ l_j - r_j + 1 & \text{if } k_j = l_j + 2. \end{cases}$$

This is a listing of formulas which is boring and not very informative to read. Here we should give instrumental explanations of how one is naturally led to this. Then the reader can develop it himself or herself if he or she needs it. If these particular expressions are used much it may be acceptable to list them, but only after one has given good conceptual explanations of how one arrives at them. It should nevertheless be emphasized that almost always we will be able to present the material so that we do not need to list such boring expressions as over.

Doing things instrumentally is also according to our basic instincts. The first words were probably action words like "run", "throw". It requires much more experience in life to appreciate words like "french onion soup" or "chicken tikka masala".

> "Suppose you want to teach the "cat" concept to a very young child. Do you explain that a cat is a relatively small primarily carnivorous mammal with retractile claws, a distinctive sonic output etc.? I'll bet not.
>
> You probably show the kid a lot of different cats, saying "kitty" each time, until it gets the idea. To put it more generally, generalizations is best made by abstraction from experience."
>
> -Ralph P.Boas, *Can We Make Mathematics Intelligible? (1981)*

Two bad examples. The following is from a well-known classical book in combinatorics.

Proposition 1. *Let* $\mathbf{M}(\mathbf{S})$ *be a matroid with rank function* r *and* $\mathcal{I}$ *and* $\mathcal{R}$ *the families of independent sets and circuits. Then for* $A \subseteq S, p \in S$*:*

(i) $p \in \overline{A} \Leftrightarrow (p \in A \text{ or } \exists I \subseteq A \text{ with } I \in \mathcal{I}, I \cup p \notin \mathcal{I})$
(ii) $p \in \overline{A} \Leftrightarrow (p \in A \text{ or } \exists C \subseteq \mathcal{R} \text{ with } p \in C \subseteq A \cup p)$
(iii) $p \in \overline{A} \Leftrightarrow r(A \cup p) = r(A)$.

Fortunately writing like this is not common nowadays. It must be seen as part of the excesses of the sixties and seventies, and the time of "modern mathematics". There is too much notation, too little descriptive text and it is packed much too dense. It should have been written as follows:

Proposition 1. *Given a matroid with rank function* r *on the set* S*. For every subset* $A \subseteq S$ *and* $p \in S$ *the following holds:*

(i) *p is in the closure $\overline{A}$ if and only if either p is in A or there is an independent set $I \subseteq A$ such that adjoining p makes $I \cup \{p\}$ dependent.*
(ii) *p is in the closure $\overline{A}$ if and only if p is in A or p is contained in a circuit C which is contained in $A \cup \{p\}$.*
(iii) *p is in the closure $\overline{A}$ if and only if the rank does not change when adjoining p to A, i.e. $r(A \cup \{p\}) = r(A)$.*

In particular notice how parts (i) and (iii) are made instrumental Vi perform an action "adjoining p", and describe what happens. Here is another example from the same book:

Circuit axioms 1. *Let* $\mathbf{M}(S)$ *be a matroid and* $\mathcal{R}$ *the family of circuits. Then:*

(i) $\emptyset \notin \mathcal{R}; C \neq C' \in \mathcal{R} \Rightarrow C \not\subseteq C', C' \not\subseteq C$,
(ii) $C \neq C' \in \mathcal{R}, p \in C \cap C' \Rightarrow \exists D \in \mathcal{R} \text{ with } D \subseteq (C \cup C') - p$,
(ii') $C \neq C' \in \mathcal{R}, p \in C \cap C', q \in C - C' \Rightarrow \exists D \in \mathcal{R} \text{ with } q \in D \subseteq (C \cup C') - p$.
(iii) *There is an* $n \in \mathbb{N}_0$ *such that* $|A| \leq n$ *when* $A \not\supseteq C$ *for all* $C \in \mathcal{R}$.

If conversely, $\mathcal{R} \subseteq 2^S$ *fulfills (i),(ii),(iii), or (i), (ii'), (iii) then* $\mathcal{R}$ *is the family of circuits of a uniquely determine matroid.*

This should have been written as follows:

Circuit axioms 1. *Given a matroid on the set* S*. The following holds:*

(i) *Suppose the empty set is not a circuit. If a circuit is contained in another circuit, these circuits are equal.*
(ii) *If C og C' are distinct circuits with a common element p there is a circuit D in $C \cup C'$ which does not contain p.*

(ii') *Let C and C' be circuits with a common element p and suppose q is in C but not in C'. Then there is a circuit D contained in $C \cup C'$ and containing q but not p.*

(iii) *There is a number $n \in \mathbb{N}_0$ such that for every subset $A \subseteq S$ not containing any circuits, the cardinality of A is $\leq n$.*

If conversely a family of subsets of S, called circuits, fulfill (i), (ii), (iii), or (i), (ii'), (iii), there is a unique matroid whose circuits are given by this family.

Give the ideas, motivate. Mathematical activity always takes place at two levels. Firstly we must grasp the mathematical ideas and the mathematical models. Secondly we must be able to formalise the ideas in writing so that they can be conveyed in a precise manner. Grasping the ideas of mathematics is of course necessary for everyone who wants to use mathematics creatively. And the universe of ideas in mathematics is what makes it exciting and fascinating. So when writing mathematics we should always seek to motivate, seek to paint out the ideas for the readers, and relate it to things he or she already is familiar with. In order to do this in an efficient way, it is of course important to know whom we write for. To write a scientific paper on toric varieties for professional mathematicians requires other motivational tools than writing a popularized article about prime numbers or quantum mechanics for a broader public.

Motivating and conveying the ideas when writing mathematics is also done at several levels. On an overall level we convey the idea of the article. This happens primarily in the introduction. But we must also all the time in the details seek to motivate why we develop the article as we do, why we show this lemma, this proposition, or this theorem. What ideas to they convey? This is done by small ingresses in each section, or in some lines before the formal mathematical statement or the formal definition.

Example. The First Fundamental Theorem says that the process of differentiation reverses that of integration. This statement is remarkable because the two processes appear to be so different: differentiation gives us the slope of the curve; integration, the area under the curve. Here is a precise statement of the theorem.

Theorem (First Fundamental Theorem of Calculus). Let f be a function defined and continuous on the closed interval $[a, b]$ and let c be in $[a, b]$. Then for each x in the open interval (a, b), we have

$$\frac{d}{dx}\int_c^x f(t)dt = f(x).$$

Here are some guidlines which apply to sections or paragraphs in mathematical papers.

Introductions. In the introduction we explain what we show in the article, and relate it to what others have done, and put the results obtained, in context. In addition we should sell our results, explain why they are important, exciting and interesting.

The introduction should not develop technical material. It should be as precise as we can without technical developments. We should, to as large extent as possible, formulate the main results in the introduction. However sometimes they involve technical terms which it is not appropriate to use in the introduction. In that case we must postpone the fully precise results, and rather explain the results as well as possible.

At the end of the introduction it is also common to give a presentation of the different sections and say, rather briefly, what we do in each of them.

Remarks. These should not contain technical developments. They are there to give flesh and background to what has been done, to relate it to what others have done, to indicate subtleties one should take notice of, or shed light on a related matter.

A remark should not be necessary for further reading. Proofs or arguments should not be based on anything said there. Things used later in arguments should be stated explicitly as lemmata, propositions, corollaries, theorems or the like. And conversely, if something is not needed for further reading, and is not part of the results being developed, it should be given as a remark.

About the references.

Strunk and White [7] is a classic concerned with writing in general. “A book every writer should read once a year.” It is slim and concise and still sells well in bookstores in the US. It is primarily a book about formulation and wording. Kleiman [3] is a short and nice note giving an introduction to writing mathematical papers and the ingrediences of these. Higham [1] og Krantz [4] discusses all the technical aspects of the writing process, the first more systematically, the other more informal in style. Steenrod [6] also write about the mental processes and is from the pre-computer age. Knuth et. al. [5] is based on a writing course at Stanford and contains views and contribution from many lecturers talking about this topic.

Finally a mathematics book which in a very good way follows the guidelines we give here, is [2]. This in spite of the topic being computational algebra, which often contains awkward polynomial expressions.

> "Vigorous writing is concise. A sentence should contain no unnecessary words, a paragraph no unnecessary sentences, for the same reason that a drawing should have no unnecessary lines and a machine no unnecessary parts. This requires not that the writer make all sentences short, or avoid all detail and treat subjects only in outline, but that every word tell."
>
> -Strunk and White, *The elements of style*

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