Some LaTeX Introduction

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1 Section Title Here

This is the beginning of a section.

The overriding principle of LaTeX is that the *input file* (`\emph{...}` emphasizes the text in the argument) should be easy to read; the system takes care of all formatting decisions!

In the following, I keep using the `\verb` command; it quotes the text between the plus signs verbatim.

1.1 Subsection Title Here

Here, you see how a mathematical equation can be generated inline, for instance $f(x) = \frac{1}{1+25x^2}$. The `$`-symbols enclose the formula. As a so-called displayed formula, it would look like

$$f(x) = \frac{1}{1+25x^2}.$$

It is customary that mathematical functions are *not* set in math-italics, so LaTeX has the basic ones pre-defined; you should use the commands `\cos`, `\exp`, etc. to get $f_1(x) = \cos x$, $f_2(x) = -e^x \sin^2 x$, etc.

Here, I use some of my commands defined above: I like $\varepsilon = \varepsilon$ better than the default ϵ. A partial derivative (with 2 arguments) would be obtained as follows. If $f(x,y) = x^2y^3$, then

$$\frac{\partial f}{\partial x} = 2xy^3, \quad \frac{\partial f}{\partial y} = 3x^2y^2.$$

1.2 Sums and Integrals

When you say "capital sigma," you probably did not really mean Σ, but rather a summation symbol. You would get that as in

$$\sum_{i=0}^{\infty} r^i = \frac{1}{1-r} \quad \text{for all } |r| < 1.$$

Finally, we have

$$\int_0^1 \sin(2\pi x)\,dx = 0$$

and

$$\iint f(x)g(y)\,dx\,dy = \int f(x)\,dx \int g(y)dy.$$

Here, `\,` gives a small space before the differentials dx and dy, while two `\!` force the two integral symbols in the double integrals closer together; you have to work on the proper spacing for integrals, as LaTeX does not understand, what is going on.

1.3 Matrices in LaTeX

A matrix $A \in \mathrm{R}^{m \times n}$ could be defined by

$$A = \begin{pmatrix} 11 & 12 & 13 & \cdots & 1n \\ 21 & 22 & 23 & \cdots & 2n \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ m1 & m2 & m3 & \cdots & mn \end{pmatrix} \quad \text{or} \quad A = \begin{bmatrix} 11 & 12 & 13 & \cdots & 1n \\ 21 & 22 & 23 & \cdots & 2n \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ m1 & m2 & m3 & \cdots & mn \end{bmatrix},$$

to give examples with parentheses as well as brackets. Here, the word `dots` in the commands stands for an ellipsis (i.e., three dots) placed horizontally in the center (`\cdots`), vertically (`\vdots`), or diagonally (`\ddots`); what is not mentioned is `\ldots` for horizontal dots at the lower baseline. Use the baseline or central version as appropriate, for instance

$$\begin{aligned} a_1, a_2, \ldots, a_n \qquad & \text{(but not } a_1, a_2, \cdots, a_n\text{)}, \\ a_1 + a_2 + \cdots + a_n \qquad & \text{(but not } a_1 + a_2 + \ldots + a_n\text{)}. \end{aligned}$$

Some more comments on the matrix are needed, I suppose: The `\left(` and `\right)` or `[` and `]` create the variable-sized parentheses or brackets, respectively, around the actual array of terms. You can also use `\left[` and `\left\{` and `\right\}` or `\langle` and `\rangle` in other situations. The actual array arrangement is organized by the `array` environment; you need the arguments `ccccc` to indicate that there are five columns and you want the entries centered ("c"), other options are left ("l") and right ("r"). Notice how `&` separate columns and `\\` the rows.

2 Further Reading

2.1 This document

This document is written with the intention that you also read the source code; indeed, many statements will only then make sense. The source of this file can be downloaded from the Introduction to LaTeX on my homepage `http://www.umbc.edu/~gobbert/`. Furthermore, I strongly recommend the following books in the reference list, all of which are well-written and recognized standards.

References

[1] Leslie Lamport. *LaTeX: A Document Preparation System.* Addison-Wesley, second edition, 1994. *The* basic introduction to LaTeX by the author of the package.

[2] Frank Mittelbach, Michel Goossens, Johannes Braams, David Carlisle, and Chris Rowley. *The LaTeX Companion.* Addison-Wesley, second edition, 2004. If you want to change LaTeX's internal settings, this book is unavoidable; not needed for a novice.

[3] George Grätzer. *Math into LaTeX.* Birkhäuser, third edition, 2000. Deeper introduction with solutions to many math typesetting problems.

[4] Nicholas J. Higham. *Handbook of Writing for the Mathematical Sciences.* SIAM, third edition, 2020. A general treatise of all things pertaining to writing mathematics.