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 \emph{input file} (\verb|\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|\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 \textit{not} set in math-italics, so \LaTeX has the basic ones pre-defined; you should use the commands \verb|\cos|, \verb|\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 \( \epsilon \). 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 \( \Sigma \), 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, \( \backslash \) gives a small space before the differentials \( dx \) and \( dy \), while two \( \backslash! \) 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 $A \in \mathbb{R}^{m \times n}$ could be defined by

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

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

$$a_1, a_2, \ldots, a_n \quad \text{(but not } a_1, a_2, \cdots, a_n),$$

$$a_1 + a_2 + \cdots + a_n \quad \text{(but not } a_1 + a_2 + \ldots + a_n).$$

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


