LaTeX Cheat Sheet

"Write clear & beautiful english with LaTeX!"

1. LaTeX Basics

You have to include the package mentioned in the headings e.g. to use `\definecolor` you have to include the `xcolor` package with `\usepackage{xcolor}` in the preamble

Available units for lengths and dimensions:

points	pt	millimeter	mm	inch	in	m width	em
pixel	px	centimeter	cm	pica	pc	x height	ex

1.1. Special Characters

\	introduces a command	(in text \textbackslash)
{ }	embraces arguments, creates logical parts	($\{ \}$)
[ ]	embraces *optional* command parameters	($\[\]$)
%	comments: code after % will be ignored.	(\%)
&	separates columns in tables	(\&)
#	parameter for own command declarations	(\#)
_ ^	indizes and exponents in mathmode. e.g. a_1^2	(_ \^)

2. Preamble before `\begin{document}`

2.1. Documentclass (necessary)

Usage: `\documentclass[opt,opt]{class}`

Common classes:
`scrartcl (article), scrreprt (report), scrbook (book)`

Common Options:

10pt/11pt/12pt	Font size.
letterpaper/a4paper	Paper size.
twocolumn	Use two columns.
twoside	Set margins for two-sided.
landscape	Landscape orientation.

2.2. Load Packages (they do all the magic)

Usage: `\usepackage[opt, opt]{package}`

`\PassOptionsToPackage{opt, opt}{package}`

2.3. Penalties

Penalties are the main values that TEXtries to minimise when line or page breakes are calculated.

\linepenalty=10	breaking a page within a paragraph
\hyphenpenalty=50	line breaking at an automatic hyphen
\binoppenalty=700	breaking a line at a binary operator
\relpenalty=500	breaking a line at a relation
\clubpenalty=150	*breaking after first line of a paragraph
\widowpenalty=150	*breaking before last line of a paragraph
\brokenpenalty=100	page breaking after a hyphenated line

2.4. Language Settings with `babel`

`\usepackage[ngerman, english]{babel}` (last language default)
`\selectlanguage{language}` `\foreignlanguage{language}{text}`

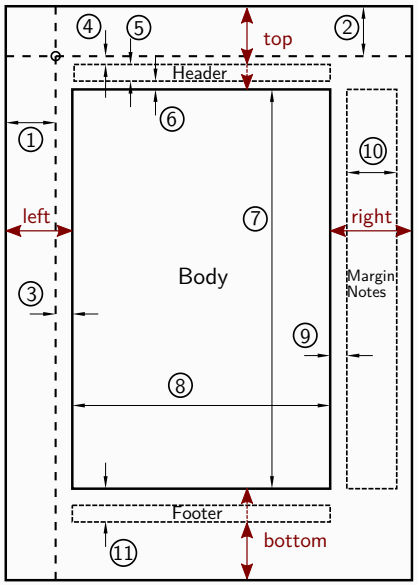
2.5. Glossar and Nomenclature with `glossaries`

Load `\usepackage[acronym]{glossaries}`
Define: `\newacronym{label}{ABB}{written-out}`
`\newglossaryentry{label}{name=..., description=...}`
Use: `\gls{label}`, `\glspl{label}`

3. Layout

3.1. Pagelayout with `geometry` package

Usage: `\geometry{ opt, opt, ... }`



①	1in + \hoffset	②	1in + \voffset
③	\oddsidemargin	④	\topmargin
⑤	\headheight	⑥	\headsep
⑦	\textheight	⑧	\textwidth
⑨	\marginparwidth	⑩	\marginparwidth
⑪	\footskip		

Additional paramter: `left,right,top,bottom, paper=a4paper, landscape|portrait, includehead,includefoot, twocolumn`

3.2. Header and Footer with `fancyhdr`

```
\usepackage{fancyhdr}
\pagestyle{fancy}    % use fancyhdr pagestyle
\fancyhf{}           % clear header and footer
\fancyhead[RE]{}     % even page right header
```

3.3. Colors with `xcolor`

```
\usepackage{xcolor}
\definecolor{tum_blue}{RGB}{0, 115, 207}
\colorlet{col_section}{tum_blue}
```

Predefined colors:
white, gray, black, red, green, blue, cyan, magenta, yellow
Fade a color with !value between 0 and 100, e.g. \color{gray!70}
Usage in Text: \textcolor{red}{text} or {\color{red}text}

4. Structure the Document

4.1. Title with `titlepage`

default: `\author{text}`, `\title{text}`, `\date{\today}`, `\maketitle`
titlepage: `\begin{titlepage} text \end{titlepage}`

4.2. Table of Content, List of ...

`\tableofcontents` `\listoftables` `\listoffigures`
`\printglossaries` (needs glossaries package)

4.3. Headings

`\part{title}` `\subsubsection{title}`
`\chapter{title}` `\paragraph{title}`
`\section{title}` `\subparagraph{title}`
`\subsection{title}`

*: no numbering, no entry in ToC
`\part` and `\chapter` only in dcumentcalss book or report

4.4. Lists

`\begin{itemize}` with bullet `\item` or `\item[symbol]`
`\begin{enumerate}` with numbered `\item`
`\begin{description}` with bold `\item[word]`

```
\begin{enumerate}\itemsep0pt
  \item First Argument
  \item Second Argument
\end{enumerate}
```

5. Text

5.1. Fonts

Command	Declaration	Effect
\textrm{text}	{\rmfamily text}	Roman family
\textsf{text}	{\sffamily text}	Sans serif family
\texttt{text}	{\ttfamily text}	Typewriter family
\textmd{text}	{\mdseries text}	Medium series
\textbf{text}	{\bfseries text}	**Bold series**
\textup{text}	{\upshape text}	Upright shape
\textit{text}	{\itshape text}	*Italic shape*
\textsl{text}	{\slshape text}	*Slanted shape*
\textsc{text}	{\scshape text}	Small Caps shape
\emph{text}	{\em text}	*Emphasized*
\textnormal{text}	{\normalfont text}	Document font
\underline{text}		Underline

5.2. Font size

\tiny	tiny	\Large	Large
\scriptsize	scriptsize	\LARGE	LARGE
\footnotesize	footnotesize	\huge	huge
\small	small	\Huge	Huge
\normalsize	normalsize		
\large	large		

5.3. Justification

Environment	Declaration	Other
\begin{center}	\centering	*text* \vfill *text*
\begin{flushleft}	\raggedright	*text* \hfill *text*
\begin{flushright}	\raggedleft	

6. Math Equations

Textstyle: `$x^2 + 4$`, $x^2 + 4$ as part of the text.
Disyplaystyle: `\begin{equation} x^2 + 4 \end{equation}`

$$\lambda := \lim_{x_1 \to \infty} \int_{x_0}^{x_1} \frac{f\left(\frac{t}{2}\right)}{\sqrt[n]{t^2 + \sin^2(t)}} \, \mathrm{d}t \overset{!}{\leq} 1 \tag{1}$$

for numbered equations. use the * variant for unnumbered equations.

6.1. Fonts and Sizes in Math Mode

`\scriptscriptstyle`, `\scriptstyle`, `\textstyle`, `\displaystyle`
`\mathrm`, `\mathit`, `\mathbb`, `\mathcal`, `\mathfrak`

6.2. Often used math expressions

x^{n+1}	x^{n+1}	E_{kin}	E_{\mathrm{kin}}
$\frac{a+b}{2}$	\frac{a+b}{2}	$\sqrt[n]{a^2+b^2}$	\sqrt[n]{a^2+b^2}
$x_1, \ldots, x_n$	x_1 , \ldots, x_n		
$x_1 + \cdots + x_n$	x_1 + \cdots + x_n		
$\left(a + \frac{1}{2}\right)^2$	\left(a + \frac12 \right)^2		
$\sum_{i=1}^{N}, \prod_{i=1}^{N}$	\sum\limits_{i=1}^{N}, \prod\limits_{i=1}^{N}		
$\boldsymbol{F}_{\perp}, \boldsymbol{F}_{\parallel}$	\vec F_{\perp}, \vec F_{\parallel}		
$\lim_{a \to \infty}$	\lim\limits_{a \rightarrow \infty}		
$\int_a^b x^2 \, \mathrm{d}x$	\int\limits_a^b x^2\; \mathrm{d}x		
$\left.\frac{\mathrm{d}f}{\mathrm{d}x}\right\|_{x_0}$	\left.\frac{\mathrm df}{\mathrm dx}\right|_{x_0}		
$\vec{a}^{\top}, A^{\dagger}, A^*$	\vec a^\top, A^\dagger, A^*		
$\overset{!}{<}, \overset{\text{def}}{=}$	\stackrel{!}{<}, \stackrel{\rm def}{=}		

6.3. Math function names (upright, correct spacing)

\sin	\sinh	\arcsin	\csc	\ln	\min
\cos	\cosh	\arccos	\sec	\lg	\max
\tan	\tanh	\arctan	\cot	\log	\lim
\exp	\det	\tr	\dim	\ker	\Pr

6.4. Important Math functions

$\sum$	\sum	$\prod$	\prod	$\int$	\int		
$\int$	\int	$\iint$	\iint	$\iiint$	\iiint	$\oint$	\oint
$\vec{a}$	\vec a	$\dot{a}$	\dot a	$\ddot{a}$	\ddot a	$\hat{a}$	\hat a

6.5. Important Symbols in Mathmode

+	+	−	-	±	\pm	∓	\mp
<	<	≤	\le	≪	\ll	·	\cdot
>	>	≥	\ge	≫	\gg	×	\times
=	=	≠	\ne	≡	\equiv	≈	\approx
|	|	⊥	\perp	∣	\mid	∥	\parallel
f'	f'	∇	\nabla	Δ	\Delta	∂	\partial
∈	\in	∀	\forall	∃	\exists	∄	\nexists
∩	\cap	∪	\cup	∉	\notin	\	\setminus
ℓ	\ell	∠	\angle	∘	\circ	∅	\emptyset
∨	\lor	∧	\land	¬	\lnot	∅	\varnothing
⊤	\top	⊥	\bot	∞	\infty	∝	\propto

6.6. Delimeters

(.)	(.)	[.]	[.]	⌊.⌋	\lfloor.\rfloor
|.|	|.|	{.}	\{.\}	⌈.⌉	\lceil.\rceil
‖.‖	|.|	|.|	\vert.\vert	⟨.⟩	\langle.\rangle

Use \left(*expr* \right) to stretch any delimeter to the height of *expr*
Or \big, \Big, \bigg for manual sizing e.g. \Big\| \Big\|

6.7. Arrows

Every combination of left,right,up,down with arrow(s)

↦	\mapsto	⇝	\leadsto
→	\rightarrow	⇒	\Rightarrow
⟶	\longrightarrow	⟹	\Longrightarrow
←	\leftarrow	⇐	\Leftarrow
⟵	\longleftarrow	⟸	\Longleftarrow
↑	\uparrow	⇑	\Uparrow
↓	\downarrow	⇓	\Downarrow
↔	\leftrightarrow	⇔	\Leftrightarrow
⇇	\leftleftarrows	⇉	\rightrightarrows
⇆	\leftrightarrows	⇄	\rightleftarrows
⇋	\leftrightharpoons	⇌	\rightleftharpoons

6.8. Physical Units with `siunitx`

Use the package `siunitx` for correct display of numbers and units. It provide the commands \num{<number>}, \si{<unit>}, and \SI{<number>}{<unit>}. Some examples:

$7.123\,456 \times 10^{12}$	\num{7.123456e12}
$[g] = \mathrm{m\,s^{-2}}$	[g] = \si{\meter \per \second \squared}
$E = 1.3\ \frac{\mathrm{kV}}{\mathrm{mm}}$	E = \SI{1.3}{\kilo\volt\per\milli\meter}

You can use all SI units (pascal, henry, ...) and not only the base units. It is also possible to change the style of display with \sisetup{per-mode=reciprocal} or \sisetup{per-mode=fraction}:
Prefixes like \kilo,\deca,\mega,\micro

7. LaTeX4EI classes & packages

`latex4ei_thesis`: layout with TUM colors
`scientific`: useful scientific macros

$\mathrm{d}x$	\diff x	$\mathbb{N}, \mathbb{R}, \mathbb{C}$	\N, \R, \C
$\underline{\boldsymbol{x}}$	\vec x	$\begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$	\vect{ x_1 \\ x_2 }
$\underline{\underline{\boldsymbol{A}}}$	\ma A	$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$	\mat{ 1 & 2 \\ 3 & 4}
$\circ\!\!-\!\!\bullet^{\mathcal{F}}$	\FT	$\overset{\mathcal{DTF}}{\circ\!\!-\!\!\bullet}$	\DTFT
$\circ\!\!-\!\!\bullet^{\mathcal{L}}$	\LT	$\overset{\mathcal{Z}}{\circ\!\!-\!\!\bullet}$	\ZT

Additional function names (upright, correct spacing):
\const, \sinc, \grad, \rot, \div, \tri, \rect, \erf

8. Floating Environments

8.1. Figures with `graphicx`

```
\begin{figure}
  \centering
  \includegraphics[width=9cm]{./img/diagram.pdf}
  \caption[title for LOF]{this is the long title}
  \label{fig:example1}
\end{figure}
```

Load image: \includegraphics[width=*x*]{*file*}
Alter numbering: \renewcommand\thefigure{\arabic{figure}}

8.1.1 Subfigures with `subfigure`

Usage \subfigure[*caption*]{*graphic, label*}

8.2. Tables

```
\begin{table}
  \centering
  \begin{tabular}{ll}
    \textsc{Name} & \textsc{Desc.}\\ \hline
    test1 & is no good idea &\\
    bla2 & even worse &\\
  \end{tabular}
  \caption{My first Table}
  \label{tab:example1}
\end{table}
```

Usage: \begin{tabular}[htbp]{@{}lrc|p{3cm}}
Column distance: \setlength{\tabcolsep}{5pt}
Adjust row distance: \renewcommand{\arraystretch}{1.5}
Partial lines: \cline{2-3} instead of \hline
Additional packages: `longtable, booktabs, colortbl`

8.3. Source Code Listings with `listings`

Options: \lstset{basicstyle=\tt, language=C}
Languages: C,C++,Java,Matlab,Python,HTML,XML,bash,...

Environment: \begin{lstlisting} *code* \end{lstlisting}
Inline: \lstinline?*code*?

```
\begin{lstlisting}
int i=0;
for(i = 0; i < 10; i++){
  printf("Line %i", i);
}
\end{ltlisting}   % missing s!
```

9. Correct Typography

9.1. Hyphen and Dashes

Rule: The hyphen is never placed between two spaces!

Name	Source	Example	Usage
hyphen	-	X-ray, in- and output	connect words
en-dash	--	1 – 5, Paris – Rom	seperate numbers.
em-dash	---	Yes—or no?	Punctuation.
minus	$-$	$5 - 3 = 2$	Equations.

9.2. Quotation Marks

Language	Symbols	LaTeX
German	„ , . . . ‘ “	\glqq \glq ... \grq \grqq
English	“ ‘ . . . ’ ”	`` \lq ... \rq ''
France	≪<... >≫	\flqq \flq ... \frq \frqq

“I think”, said Anna, “he shouted ‘This is Lars's car!’, when I saw him.”

9.3. Numbers and Dates

Numbers	Look	Usage
old-style	1234567890	as part of text, dates
lining	1234567890	as math value

British	American	German
27/06/93	06/27/93	27.06.1993
27 June, 1993	June 27, 1993	27. Juni 1993

International notation (ISO 8601): yyyy-mm-dd: 1993-06-27

9.4. Spacing

a\!b	ab	a\,b	a b	a\;b	a b	a\quad b	a b
ab	ab	a\>b	a b	a\ b	a b	a\qquad b	a b

\hspace{*length*}, \vspace{*length*} *: even at line start
, \vphantom{*text*}
Protected space ~

9.5. Boxes and Rules

Normal: \parbox[pos][height][contentpos]{width}{text} or \begin{minipage}[pos][height][contentpos]{width} text

Prevent line breaking: \mbox{text}
Lift Text: \raisebox{lift}[height][depth]{text}
Framed Box: \framebox[width][pos]{text} or \fbox{text}
Resize: \scalebox{10}{Giant}
Lengths: \setlength{\fboxsep}{10pt}, \setlength{\fboxrule}{2pt}

10. Bibliography with BibTeX

10.1. BibTeX entry types

`@article`	Journal or magazine article. fields: `author, title, journal, year, volume`
`@book`	Book with publisher. fields: `author/editor, title, publisher, year`
`@techreport`	Tech report, usually numbered in series. fields: `author, title, institution, year`
`@phdthesis`	PhD. or other thesis. fields: `author, title, school, year`

```
\bibliographystyle{alphadin}
\bibliography{<bibliographyfile.bib>}
```

10.2. References with `hyperref`

\cite{*key*}	Cite a reference
\label{*marker*}	Set a marker for cross-reference, often of the form \label{sec:item} like \label{fig:diag1}.
\ref{*marker*}	Give section/body number of marker.
\pageref{*marker*}	Give page number of marker.
\footnote{*text*}	Print footnote at bottom of page.
\url{*url*}	Creates click-able web-adress.
\href[*options*]{*url*}{*text*}	click-able link
\hyperref[*marker*]{*text*}	click-able ref

10.3. Reference management software supporting BibTeX

Mendeley: free, Win/Linux/Mac, import from several websites
Citavi: free, Win

11. Include beautiful Matlab Plots

Same font, line width, vector graphic

12. Own Commands and Writing Packages

\usepackage[options]{package}	load package
\newcommand[paranum]{\newcmd}{tex #1}	define command
\renewcommand{\cmd}{ latex #1,#2 }	alter command
\let\cmdcopy\cmd	copy a command

Read this document CTAN

Some important variables:
Counters: \thepage, \thesection, \thefigure
Lengths: \textwidth, \parindent, \parskip

12.1. Plain TeX

These plain TeX commands should be used carfully

Fonts	\rm, \sf, \sc, \sl, \it, \tt
Definitions	\def\newcmd{texcode}, \let\newcmd\cmd
If	\ifnum\counter<10 true text \else false text \fi

13. Useful Weblinks

LaTeX4EI	www.latex4ei.de
Font & Symbols	https://de.wikipedia.org/wiki/Hilfe:TeX
Color Schemes	http://colorschemedesigner.com

Tipps for Package Writers: