

G.2. Tables width aligned material

```
\begin{table}[htbp] \centering
\caption{Table caption}\label{tab:exp}
\begin{tabular}{@{}l@{}}
\emph{Name} & \emph{Desc.}\ \hline
entry & entry
\end{tabular}
\end{table}
```

- suppress leading space `{@{}l@{}}`
- fixed width cells `{ | m{5em} | m{1cm} | m{1cm} | }`
- fixed width table
- `\begin{tabularx}{0.8\textwidth}{c|c}\end{tabularx}`
- alignment of cols

```
\begin{tabularx}{
|>\raggedright\arraybackslashX
|>\centering\arraybackslashX
|>\raggedleft\arraybackslashX | }
```

- `\multirow` `\usepackage{multirow}`
- `\multipage` `\usepackage{longtable}`
- Column separation: `@{\hspace{unit}}` or `\setlength{\tabcolsep}{unit}`
- Row separation: `\[unit]` or `\renewcommand{\arraystretch}{unit}`
- Partial lines: `\cline{2-3}` instead of `\hline`
- row coloring `\rowcolors{3}{green!80!yellow!50}{green!70!yellow!40}` (set outside table) Additional packages: `array`, `booktabs`, `tabu`, `xcolor` with option `table`, `tabularx`, `tabulary`

G.3. Code Listings with `verbatim`

Build-In Option (no highlighting)
Use: Environment: `\begin{verb} ... \end{verb}`
In line: `\verb|...|` (same start- and end char)

G.4. Fancy Code Listings with `listings`

Load: `\usepackage{listings}`
Options: Various Styling of Code possible. Keywords, Comments etc are recognized and can be set as a style
Use: `\lstdefinestyle{mystyle}{language=Python, Options}`
`\lstset{style=mystyle}`
Environment: `\begin{lstlisting} ... \end{lstlisting}`
In line: `\lstinline+ ... \lstinline+` (same start- and end char)
File: `\lstinputlisting{filename}`

```
1 % Python collection
2 secret=42
3 guess=Int(input("Enter number: "))
4 if guess==secret:
5     print ("You won!")
6 elif guess==secret:
7     print ("Secret number is bigger.")
8 else:
9     print ("No, secret number is smaller.")
```

G.5. Boxes and Rules

Normal: `\parbox[pos]{height}[contentpos]{width}{text}` or `\begin{minipage}[pos]{height}[contentpos]{width}\text\end{minipage}`
Lift Text: `\raisebox{lift}[height][depth]{text}`
Framed Box: `\fbox{text}` or `\framebox[width][pos]{text}`
Colored Box (`xcolor`): `\colorbox{backgroundcolor}{text}`
Framed colored Box: `\colorbox{bordercolor}(backgroundcolor){text}`
Resize (`graphicx`): `\scalebox{10}{Giant}`
Lengths: `\setlength{\fboxsep}{unit}`, `\setlength{\fboxrule}{unit}`

H. Math

H.1. Math mode (Standard \LaTeX)

Textstyle: $\backslash(x^2 + 4) \backslash x^2 + 4 \backslash \rightsquigarrow x^2 + 4$ as part of the text.
Displaystyle: $\backslash[x^2 + 4 \backslash] \rightsquigarrow$ separat line, centered
Equation: `\begin{equation} ... \end{equation}\label{name}`

$$\lambda := \lim_{x_1 \rightarrow \infty} \int_{x_0}^{x_1} \frac{f\left(\frac{t}{2}\right)}{\sqrt{t^2 + \sin^2(t)}} dt \leq 1 \quad (1)$$

- Use `*` variant for unnumbered equation (without label).
- Options for positions of equation number: `leqno` or `reqno`.

H.2. Important Symbols in Math

+	+	-	-	±	$\backslash pm$	∓	$\backslash mp$
<	<	≤	$\backslash le$	≪	$\backslash ll$	×	$\backslash cdot$
>	>	≥	$\backslash ge$	≫	$\backslash gg$	·	$\backslash times$
=	=	≠	$\backslash ne$	≡	$\backslash equiv$	≈	$\backslash approx$
		⊥	$\backslash perp$	∩	$\backslash mid$	∥	$\backslash parallel$
f'	f'	∇	$\backslash nabla$	Δ	$\backslash Delta$	∂	$\backslash partial$
∈	$\backslash in$	∀	$\backslash forall$	∃	$\backslash exists$	∄	$\backslash nexists$
∩	$\backslash cap$	∪	$\backslash cup$	∉	\backslashnotin	∓	$\backslash setminus$
ℓ	$\backslash ell$	∠	$\backslash angle$	∅	$\backslash circ$	∅	$\backslash emptyset$
∨	$\backslash lor$	∧	$\backslash land$	¬	$\backslash not$	∅	$\backslash varnothing$
T	$\backslash top$	⊥	$\backslash bot$	∞	$\backslash infty$	∞	$\backslash propto$

H.3. Math Functions (upright typeface)

$\backslash arccos$ $\backslash arcsin$ $\backslash arctan$ $\backslash arg$ $\backslash cos$ $\backslash cosh$ $\backslash cot$ $\backslash coth$ $\backslash csc$ $\backslash deg$ $\backslash det$
 $\backslash dim$ $\backslash exp$ $\backslash gcd$ $\backslash hom$ $\backslash inf$ $\backslash ker$ $\backslash lg$ $\backslash lim$ $\backslash liminf$ $\backslash limsup$
 $\backslash ln$ $\backslash log$ $\backslash max$ $\backslash min$ $\backslash Pr$ $\backslash sec$ $\backslash sin$ $\backslash sinh$ $\backslash sup$ $\backslash tan$ $\backslash tanh$

H.4. More Math Functions

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

H.5. Fonts and Sizes in Math Mode (some from `amsmath`)

$\backslash mathrm{}$	aA	$\backslash mathit{}$	aA
$\backslash mathbf{}$	aA	$\backslash mathsf{}$	aA
$\backslash mathtt{}$	aA	$\backslash boldmath{}$	1 + aA
$\backslash mathbb{}$	\mathbb{Z}	$\backslash mathcal{}$	\mathcal{Z}
$\backslash mathfrak{}$	\mathfrak{Z}	$\backslash boldsymbol{}$	α
$\backslash displaystyle$	$\backslash scriptstyle$	$\backslash scriptscriptstyle$	$\backslash textstyle$

H.6. Often used Math Expressions

x^{n+1} x^{n+1} E_{kin} E_{\cdot} ($\backslash mathrm{kin}$)
 $\frac{a+b}{2}$ $\backslash frac{a+b}{2}$ $\sqrt[n]{a^2+b^2}$ $\backslash sqrt[n]{a^2+b^2}$
 x_1, \dots, x_n x_1, \dots, x_n $x_1 + \dots + x_n$ $x_1 + \dots + x_n$

$$\left(a + \frac{1}{2}\right)^2 \quad \backslash left(a + \backslash frac{1}{2} \backslash right)^2$$

$$\sum_{i=1}^N \prod_{i=1}^N \quad \backslash sum_{i=1}^N \backslash prod_{i=1}^N$$

$$\lim_{a \rightarrow \infty} \quad \backslash lim_{a \rightarrow \infty}$$

$$\int_a^b x^2 dx \quad \backslash int_a^b x^2 \backslash ; \backslash mathrm{d}x$$

$$\frac{df}{dx} \bigg|_{x_0} \quad \backslash left. \backslash frac{\backslash mathrm{d}f}{\backslash mathrm{d}x} \backslash right|_{x_0}$$

$$A^\dagger A^* \quad A^\dagger \backslash dagger \quad \backslash boldmath{A}^* \backslash *$$

$$\underbrace{2x - 6y} \quad \backslash underbrace{2x - 6y} \backslash . \backslash text{\$=\$, since \$x = 3y\$}$$

$$= 0, \text{ since } x = 3y \quad \backslash stackrel{!}{<} \quad \backslash stackrel{\backslash mathrm{def}}{\{=\}}$$

$$\overset{above}{mid} \quad \backslash overset{above}{mid} \quad \underset{below}{mid} \quad \backslash underset{below}{mid}$$

H.7. Math with `amsmath` (replacing standard Environments)

`equation` `equation*` One line, one equation
`multline` `multline*` One unaligned multiple-line equation, one number
`gather` `gather*` Several equations without alignment
`align` `align*` Several equations with multiple alignments
`alignat` `alignat*` Multiple alignments, choose spacing between cols
`flalign` `flalign*` Several equations: horizontally spread form of align cases
`cases` Alignment for cases
`split` A simple alignment within a multiple-line equation
`aligned` A "mini-page" with multiple alignments
`gathered` A "mini-page" with unaligned equations

- The content is automatically placed in math mode.
- Use `\intertext{text}` to set text within an `amsmath` environment
- Length parameter to influence vertical spacing within any `amsmath` environment: `\jot` (e.g. `\addtolength{\jot}{1ex}`)
- Add singular vertical space for a line via `\[<amount>]` (see A.1)

H.7.1. `amsmath align`

Aligns at $\&$.

```
\begin{align}
y \&= d \backslash \quad \quad \quad y = d \quad (1)
y \&= cx+d \backslash nonumber \backslash \quad \quad \quad y = cx + d
y \&= bx^2+cx+d \backslash label{eq:key} \quad \quad \quad y = bx^2 + cx + d \quad (2)
\end{align}
```

H.7.2. `amsmath matrix`

`\begin{pmatrix} a & b \backslash c & d \backslash \end{pmatrix}`

<code>matrix</code>	<code>pmatrix</code>	<code>bmatrix</code>	<code>Bmatrix</code>	<code>vmatrix</code>	<code>Vmatrix</code>
$a \quad b$	$\begin{pmatrix} a & b \\ c & d \end{pmatrix}$	$\begin{bmatrix} a & b \\ c & d \end{bmatrix}$	$\begin{Bmatrix} a & b \\ c & d \end{Bmatrix}$	$\begin{vmatrix} a & b \\ c & d \end{vmatrix}$	$\begin{Vmatrix} a & b \\ c & d \end{Vmatrix}$

H.7.3. Dots

$\backslash dots$ or $\backslash ddots$... $\backslash dots$...
 $\backslash vdots$ $\backslash ddots$...
 $\backslash dotsfor{cols}{dotspace}$ multicolumn dots.

H.8. `amsmath cases`

`f(n) = \begin{cases} n/2 & \backslash quad \backslash text{if \$n\$ is even} \backslash \\ -(n+1)/2 & \backslash quad \backslash text{if \$n\$ is odd} \backslash \end{cases}`

$$f(n) = \begin{cases} n/2 & \text{if } n \text{ is even} \\ -(n+1)/2 & \text{if } n \text{ is odd} \end{cases}$$

H.9. Arrows

\rightarrow	$\backslash mapsto$	\rightsquigarrow	$\backslash leadsto$
\rightarrow	$\backslash rightharpoonup$	\Rightarrow	$\backslash Rightarrow$
\rightarrow	$\backslash longrightarrow$	\Longrightarrow	$\backslash Longrightarrow$
\leftarrow	$\backslash leftharpoonup$	\Leftarrow	$\backslash Leftarrow$
\leftarrow	$\backslash longleftarrow$	\Longleftarrow	$\backslash Longleftarrow$
\uparrow	$\backslash uparrow$	\Uparrow	$\backslash Uparrow$
\downarrow	$\backslash downarrow$	\Downarrow	$\backslash Downarrow$
\leftrightarrow	$\backslash leftrightarrow$	\Leftrightarrow	$\backslash Leftrightarrow$
\Leftrightarrow	$\backslash leftleftarrows$	\Rrightarrow	$\backslash rightrightarrows$
\Leftrightarrow	$\backslash leftrightarrows$	\Rrightarrow	$\backslash rightrightarrows$
\Leftrightarrow	$\backslash leftrightharpoons$	\Rrightarrow	$\backslash rightrightharpoons$

H.10. Delimiters

$(.)$	$(.)$	$[.]$	$[.]$	$\backslash floor$	$\backslash rfloor$
\lfloor	\lfloor	$\{.$	$\{.$	$\backslash ceil$	$\backslash rceil$
$\ $	$\ $	$\ $	$\backslash vert$	$\backslash vert$	$\backslash angle$
$\ $	$\ $	$\ $	$\backslash vert$	$\backslash angle$	$\backslash angle$

- Use `\left expr \right` to stretch delimiters to the height of `expr`
- A missing delimiter can be added with `.`, e.g. `\left.`
- For manual sizing use `\big`, `\Big`, `\bigg`, e.g. `\Big| \Big| \lceil`

I. TikZ Nodes

```
\begin{tikzpicture}[node distance={25mm},
thick, main/style = {draw, circle}]
\node[main] (0) {0};
\node[main] (1) [above left of=0] {1};
\draw (0) -- node[midway, below, sloped] {abc} (1);
\draw (4) to [out=260,in=340, looseness=5]
node[midway, below, sloped] {0} (4);
\draw[->] (0) -- (1)
\draw[->] (1,-1) -- (f);];
\end{tikzpicture}
```

J. Own Commands and Environments

J.1. Own Commands in General

- `\newcommand` doesn't work if the command is already defined: so it's a completely new definition.
- `\renewcommand` works only if the command is already defined: it's a redefinition.
- `\providecommand` works like `\newcommand`, but if the command is already defined, the (re)definition is ignored.

J.2. Own Commands

Params: `#1 ... #n`
Define: `\newcommand{paramsquantity}{cmdname}{cmds #1 ...}`
Exmp: `\newcommand{\setlisted}[1]{\Omega = \{#1\}}`
`\setlisted{1,2,3,4}` will produce $\Omega = \{1, 2, 3, 4\}$
Exmp: `\newcommand{\mytext}{Some text which I need very often.}`

K. Bibliography with `bibtex` & External Processor `biber`

K.1. Entry types

<code>@article</code>	<code>@book</code>	<code>@inbook</code>	<code>@collection</code>
<code>@incollection</code>	<code>@manual</code>	<code>@misc</code>	<code>@online</code>
<code>@patent</code>	<code>@phdthesis</code>	<code>@proceedings</code>	<code>@periodical</code>
<code>@techreport</code>	<code>@thesis</code>		

K.2. Entry Fields

author	title	journal	year	volume
editor	publisher	institution	school	series
pages	organization	number	note	key

K.3. Styles

alphabetic authoryear authortitle numeric mla verbose
chem-acs phys nature science ieee apa
See https://de.sharelatex.com/learn/Bibtex_bibliography_styles

K.4. Example

```
% in preamble
\usepackage{autostyle=true}[csquotes] % Load
\usepackage[backend=biber, style=nature, language=british]
{bibtex} % Load
\addbibresource{mybibliographyfile.bib} % Define
% anywhere within the document
\autocite{citekey} % Use
\printbibliography % Print
```

```
# example.bib
@misc{WC:2017, % cite reference name (\autocite{WC:2017})
author = {Wikipedia},
title = {\TeX}---Wikipedia,{ The Free Encyclopedia},
note = {\url{https://en.wikipedia.org/wiki/TeX}},
last referenced 24-June-2017}
}
```