Grandpa TeX Manual

A collection of LaTeX tricks for forgetful minds

GTM

Accept God & Endless Wins

A Forgotten Guide to Spells of LaTeX

LaTeX

Contents

1 General Memo

1.1 The size of font

- Common units: pt, 1pc = 12pt (Chinese size 4), 1in = 72.27pt, 1cm = 2.45pt, mm, em (width of the capital M in the current font size), ex (height of the lowercase x in the current font size)
- `\textwidth`: The total width for text on the page, which is the page width minus the left and right margins.
- `\linewidth`: The allowable line width for the current line of text.
- Variable length: 3pt to 8pt, written as `5pt plus 3pt minus 2pt`
- Multiples: `1.5 \parindent`

	tiny	scriptsize	footnotesize	small	normalsize	large	Large	LARGE	huge	Huge
10pt	5pt	7pt	8pt	9pt	10pt	12pt	14pt	17pt	20pt	25pt
11pt	6pt	8pt	9pt	10pt	11pt	12pt	14pt	17pt	20pt	25pt
12pt	6pt	8pt	10pt	11pt	12pt	14pt	17pt	20pt	25pt	25pt

1.2 Common Macros

- The non-roman letters `\usepackage{tipa}`: tipa manural
- orphan heading `\usepackage{needspace}`: `\needspace{5\baselineskip} \section{Title}` — starts a new page if there is less than 5 lines of space left.
- custom header style `\usepackage{fancyhdr}`: fancyhdr manural
- `\usepackage{ifthen}`: ifthen manural

1.3 icon or logo

- `\usepackage{fontawesome}`: fontawesome manural
- `\usepackage{fontawesome5}`: fontawesome5 manural
- `\usepackage{academicons}` academicons manural

1.4 First Line Indentation

Globally: `\setlength{\parindent}{0pt}`
Single paragraph: `\noindent`

1.5 Command Abbreviations

`\newcommand{\ab}{\abcdef}`

2 Mathematical typesetting

2.1 Spaces and Whitespace

Negative: `\!`
Thin: `\ ,`
Medium: `\:`
Thick: `\;`
Inter-word: `\ `
Quad: `\quad`
Double-quad: `\qquad`
Horizontal: `\hspace{2cm}`
Vertical: `\vspace{-2cm}`

Reduce the space between formulas and text

```
\AtBeginDocument{
\addtolength{\abovedisplayskip}{-2ex}
\addtolength{\abovedisplayshortskip}{-2ex}
\addtolength{\belowdisplayskip}{-2ex}
\addtolength{\belowdisplayshortskip}{-2ex}}
```

2.2 Equation and text

`f_{[x_{i-1},x_i]} \text{ is monotonic,} \quad i = 1,\dots,c+1`

$f_{[x_{i-1},x_i]} \text{ is monotonic,} \quad i = 1,\dots,c+1$

`\gcd(n,m\bmod n) ;\quad x\equiv y\pmod b ;\quad x\equiv y\mod c ;\quad x\equiv y\pod d`

$\gcd(n,m\bmod n) ;\quad x\equiv y\pmod b ;\quad x\equiv y\mod c ;\quad x\equiv y\pod d$

2.3 Math Font

`\mathcal{}`(no lowercase) $\mathcal{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$
`\mathscr{}`(no lowercase, need `mathrsfs`) $\mathscr{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$
`\mathbb{}`(no lowercase, need `amssymb`) $\mathbb{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$
`\mathfrak{}` (uppercase and lowercase, need `amssymb`) $\mathfrak{ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz}$
Upright letters: e (log base), `\mathrm{e}`; i (imaginary), `\mathrm{i}`; d (differential), `\mathrm{d}`; custom: `\newcommand{\ue}{\mathrm{e}}`.

2.4 Brackets

P18 of amsmath

Preferred order:

```
\bigl, \bigr etc. from amsmath
\big, \Big, \bigg required by some journals
\left(, \right) minimum standard
```

For double brackets $[\![1;n]\!]$: `[\![1;n]\!]`

2.5 Virtual Binomial Coefficients

${}^{12}_{6}\mathrm{C}$ `{}^{12}_{6}\mathrm{C}`
${}^{12}_{6}\mathrm{C}$ `{}^{12}_{\phantom{1}6}\mathrm{C}`
${}^{12}_{6}\mathrm{C}$ `\prescript{12}{6}{\mathrm{C}}`
$\binom{n}{2}$: `\binom{n}{2}` or `{n\choose 2}`

Taller $\dfrac{\pi^2}{6}$: `\dfrac{\pi^2}{6}` Shorter $\tfrac{\pi^2}{6}$: `\tfrac{\pi^2}{6}`
$\sqrt[3]{5}$: `\sqrt[3]{5}`

2.6 Limit, Summation, Product, Integral

`\lim_{n\to\infty}`	$\lim_{n\to\infty}$
`\varlimsup_{n\to\infty}`	$\varlimsup_{n\to\infty}$
`\varliminf_{n\to\infty}`	$\varliminf_{n\to\infty}$
`\sum_{n=1}^{\infty}`	$\sum_{n=1}^{\infty}$
`\prod_{n=1}^{\infty}`	$\prod_{n=1}^{\infty}$
`\int_{0}^{+\infty}`	$\int_{0}^{+\infty}$

Multiple

```
\lim\limits_{n\to\infty}
\lim\limits_{x\to x_0 \atop y\to y_0}
\lim\limits_{\substack{w\to w_0\\ x\to x_0\\ y\to y_0\\ z\to z_0}}
```

$$\lim\limits_{n\to\infty} \quad \lim\limits_{x\to x_0 \atop y\to y_0} \quad \lim\limits_{\substack{w\to w_0\\ x\to x_0\\ y\to y_0\\ z\to z_0}}$$

2.7 Stacking and Overlays

```
\overline{m+n}
\underbrace{a_1+\ldots+a_n}_{n}
\overbrace{a_1+\ldots+a_n}^{n}
\underbracket[0.4pt][1ex]{a_1+\cdots+a_n}_n
b+\rlap{$\overbrace{\phantom{c+d+e+f}}^x$}c+d+\underbrace{e+f+g}_y+\,h
```

$$\overline{m+n} \quad \underbrace{a_1+\ldots+a_n}_{n} \quad \overbrace{a_1+\ldots+a_n}^{n} \quad \underbracket[0.4pt][1ex]{a_1+\cdots+a_n}_n \quad b+\mathrlap{\overbrace{}^{x}}c+d+\underbrace{e+f+g}_{y}+\,h$$

$\vec a$ `\vec a` $\overrightarrow{PQ}$ `\overrightarrow{PQ}` $\hat{A}$ `\hat{A}` $\widehat{AB}$ `\widehat{AB}`
$\tilde{C}$ `\tilde{C}` $\widetilde{CD}$ `\widetilde{CD}` $\tilde{C}$ `\tilde{C}`

2.8 Equation Alignment

Use $*$ to suppress numbering

```
$$\begin{split}
a& =b+c-d\\
& \quad +e-f\\
& =g+h\\
& =i
\end{split}$$
```

$$\begin{split} a &= b+c-d\\ &\quad +e-f\\ &= g+h\\ &= i \end{split} \tag{1}$$

```
\begin{multline}
a+b+c+d+e+f\\
+i+j+k+l+m+n\\
+o+p+q+r+s
\end{multline}
```

$$a_1 = b_1 + c_1 \tag{2}$$
$$a_2 = b_2 + c_2 - d_2 + e_2 \tag{3}$$

```
\begin{align}
a_1& =b_1+c_1\\
a_2& =b_2+c_2-d_2+e_2
\end{align}
```

$$\begin{align} a_1 &= b_1 + c_1 \tag{4}\\ a_2 &= b_2 + c_2 - d_2 + e_2 \tag{5} \end{align}$$

```
\begin{align}
a_{11}&=b_{11}&a_{12}&=b_{12}\\
a_{21}&=b_{21}&a_{22}&=b_{22}+c_{22}
\end{align}
```

$$\begin{align} a_{11} &= b_{11} & a_{12} &= b_{12} \tag{6}\\ a_{21} &= b_{21} & a_{22} &= b_{22} \tag{7} \end{align}$$

```
\begin{alignat}{2}
a_1& =b_1+c_1& &+e_1-f_1\\
a_2& =b_2+c_2&{}-d_2&+e_2
\end{alignat}
```

$$\begin{alignat}{2} a_1 &= b_1 + c_1 & &+ e_1 - f_1 \tag{8}\\ a_2 &= b_2 + c_2 &{}- d_2 &+ e_2 \tag{9} \end{alignat}$$

```
\begin{flalign}
a_{11}& =b_{11}& a_{12}& =b_{12}\\
a_{21}& =b_{21}& a_{22}& =b_{22}
\end{flalign}
```

$$\begin{flalign} a_{11} &= b_{11} & a_{12} &= b_{12} \tag{10}\\ a_{21} &= b_{21} & a_{22} &= b_{22} + c_{22} \tag{11} \end{flalign}$$

2.9 Theorem

`\newtheorem{envname}[counter]{text}[section]`

2.10 Greek Alphabet (with var)

ϑ	\vartheta	ς	\varsigma	$\varXi$	\varXi	$\varOmega$	\varOmega
ϖ	varpi	$\varGamma$	\varGamma	$\varPi$	\varPi	$\digamma$	\digamma
φ	\varphi	$\varDelta$	\varDelta	$\varUpsilon$	\varUpsilon		
ϱ	\varrho	$\varTheta$	\varTheta	$\varPhi$	\varPhi		
ε	\varepsilon	$\varLambda$	\varLambda	$\varPsi$	\varPsi		

search
learn

2.11 Symbol

$+$	+	$\times$	\times	$\neq$	\neq
$\odot$	\odot,\bigodot	$\otimes$	\otimes,\bigotimes	$\leq$	\leq
$\oplus$	\oplus,\bigoplus	$\div$	\div	$\leqslant$	\leqslant

amssyb

esint

$\geq$	`\geq`
$\geqslant$	`\geqslant`
$\gg$	`\gg`
$\ll$	`\ll`
$\equiv$	`\equiv`
$\sim$	`\sim`
$\backsim$	`\backsim`
$\approx$	`\approx`
$\cong$	`\cong`
$\pm$	`\pm`
$\mp$	`\mp`
$\in$	`\in`
$\cap$	`\cap,\bigcap`
$\cup$	`\cup,\bigcup`
$\wedge$	`\wedge,\bigwedge`
$\vee$	`\vee,\bigvee`
$\subset$	`\subset`
$\supset$	`\supset`
$\subseteq$	`\subseteq`
$\supseteq$	`\supseteq`
$\int$	`\int`
$\iint$	`\iint`
$\oint$	`\oint,\bigoint`
$\varoiint$	`\varoiint`
$\ointctrclockwise$	`\ointctrclockwise`
$\varointclockwise$	`\varointclockwise`
$\exists$	`\exists`
$\forall$	`\forall`
$\bullet$	`\bullet`
∞	`\infty`
$\varnothing$	`\varnothing`
∇	`\nabla`
$\circ$	`\circ`
$\angle$	`\angle`
$\perp$	`\perp`

Another

`\DeclareMathOperator{\Hom}{Hom}` define Hom, and use `\Hom(V, W) a_1,a_2,\dots,a_n` and `\a_1+a_2+\cdots+a_n`

2.12 Matrix

```
\bigl( \begin{smallmatrix} a&b\\ c&d \end{smallmatrix} \bigr)
```

There is a smallmatrix environment $\bigl(\begin{smallmatrix} a&b\\ c&d \end{smallmatrix}\bigr)$

2.13 Underlines

```
\uline{Underlined}
\uuline{Double Underlined}
\dashuline{Dashed Underline}
\usepackage{ulem}
```

$\underline{Underlined}$
$\underline{\underline{DoubleUnderlined}}$
$\underline{DashedUnderline}$

3 TikZ

3.1 References

- Latex Draw Template
- Mathcha, Tikzedt
- offical manuscript, online manuscript, Visual Tikz

3.2 Github

- DeTikZify

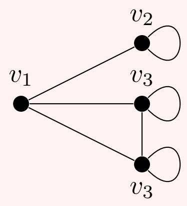
3.3 node style

- `font=`

3.4 Graph Theory

```
\begin{tikzpicture}[scale=.8,vertex/.style={minimum width=6pt,circle,inner sep=0pt}]
\node at (-2,0){$G$:};
\node[vertex,fill,label=above:$v_1$] (1) at (-1,0) {};
\node[vertex,fill,label=above:$v_2$] (2) at (1,1) {};
\node[vertex,fill,label=above:$v_3$] (3) at (1,0) {};
\node[vertex,fill,label=below:$v_3$] (4) at (1,-1) {};
\draw (2) to [out=45, in=315, loop, min distance=1cm](2);
\draw (3) to [out=45, in=315, loop, min distance=1cm](3);
```

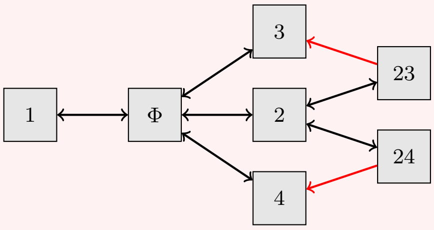
```
\draw (4) to [out=45, in=315, loop, min distance=1cm](4);
\draw (2)--(1)--(3)--(4)--(1);
\end{tikzpicture}
```



3.5 Markov Chain

```
\begin{tikzpicture}[scale=1.1,
state/.style={minimum width=7mm,
minimum height=7mm,
draw=black, fill=gray!20,
inner sep=0pt, font=\footnotesize}]
\node[state] (0) at (0,0) {$\Phi$};
\node[state] (1) at (-1.5,0) {$1$};
%\node[state] (11) at (-3,0) {$11$};
%\node (111) at (-3.8,0) {$\cdots$};
\node[state] (3) at (1.5,1) {$3$};
\node[state] (2) at (1.5,0) {$2$};
\node[state] (4) at (1.5,-1) {$4$};
\node[state] (23) at (3,0.5) {$23$};
\node[state] (24) at (3,-0.5) {$24$};

\draw[thick,<->](0)--(1);
%\draw[thick,<->](11)--(1);
\draw[thick,<->](0)--(3);
\draw[thick,<->](0)--(2);
\draw[thick,<->](0)--(4);
\draw[thick,<->](2)--(24);
\draw[thick,<->](2)--(23);
\draw[thick,red,->](32)--(2);
\draw[thick,red,->](42)--(2);
\draw[thick,red,->](23)--(3);
\draw[thick,red,->](24)--(4);
\end{tikzpicture}
```



4 Beamer

4.1 Basic

- Matrix: Choose a Theme
- For Beautiful Presentations (EN)

4.2 Github

- CN

4.3 Font Color

`\setbeamercolor{frametitle}{fg=green}` `\setbeamercolor{title}{fg=green}`, or `\setbeamercolor{palette primary}{fg=red, bg=black}`

4.4 the height of headline

EX: `\usetheme[height=3cm]{Rochester}`

5 Template

5.1 Template Collection

- KeepResearch: CN, more simple and clearer than overleaf
- Latextemplates: EN, more simple and clearer than overleaf

5.1.1 Github

- Elegant
- ElegantBook: Anime-themed
- ExBook: Problem Set

A Remark

- The cover is from Wechat
- This section 2 is based on references such as [1, 2].

References

[1] M. Downes. Short Math Guide for LATEX. AMS, 2017.

[2] K. Wu. Simple and Efficient LaTeX. 2020. Note-by-LaTeX.