LaTeX 2ε Cheat Sheet

Document classes

`book` Default is two-sided.
`report` No `\part` divisions.
`article` No `\part` or `\chapter` divisions.
`letter` Letter (?).
`slides` Large sans-serif font.

Used at the very beginning of a document: `\documentclass{`*class*`}`. Use `\begin{document}` to start contents and `\end{document}` to end the document.

Common `documentclass` options

`10pt/11pt/12pt` Font size.
`letterpaper/a4paper` Paper size.
`twocolumn` Use two columns.
`twoside` Set margins for two-sided.
`landscape` Landscape orientation. Must use `dvips -t landscape`.
`draft` Double-space lines.

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

Packages

`fullpage` Use 1 inch margins.
`anysize` Set margins: `\marginsize{`*l*`}{`*r*`}{`*t*`}{`*b*`}`.
`multicol` Use *n* columns: `\begin{multicols}{`*n*`}`.
`latexsym` Use LaTeX symbol font.
`graphicx` Show image: `\includegraphics[width=`*x*`]{`*file*`}`.
`url` Insert URL: `\url{`*http://...*`}`.

Use before `\begin{document}`. Usage: `\usepackage{`*package*`}`

Title

`\author{`*text*`}` Author of document.
`\title{`*text*`}` Title of document.
`\date{`*text*`}` Date.

These commands go before `\begin{document}`. The declaration `\maketitle` goes at the top of the document.

Miscellaneous

`\pagestyle{empty}` Empty header, footer and no page numbers.

Document structure

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

Section commands can be followed with an `*`, like `\section*{`*title*`}`, to supress heading numbers.
`\setcounter{secnumdepth}{`*x*`}` supresses heading numbers of depth $> x$, where `chapter` has depth 0.

Text environments

`\begin{comment}` Comment block (not printed).
`\begin{quote}` Indented quotation block.
`\begin{quotation}` Like `quote` with indented paragraphs.
`\begin{verse}` Quotation block for verse.

Lists

`\begin{enumerate}` Numbered list.
`\begin{itemize}` Bulleted list.
`\begin{description}` Description list.
`\item` *text* Add an item.
`\item[`*x*`]` *text* Use *x* instead of normal bullet or number. Required for descriptions.

References

`\label{`*marker*`}` Set a marker for cross-reference, often of the form `\label{sec:item}`.
`\ref{`*marker*`}` Give section/body number of marker.
`\pageref{`*marker*`}` Give page number of marker.
`\footnote{`*text*`}` Print footnote at bottom of page.

Floating bodies

`\begin{table}[`*place*`]` Add numbered table.
`\begin{figure}[`*place*`]` Add numbered figure.
`\begin{equation}[`*place*`]` Add numbered equation.
`\caption{`*text*`}` Caption for the body.

The *place* is a list valid placements for the body. `t`=top, `h`=here, `b`=bottom, `p`=separate page, `!`=place even if ugly. Captions and label markers should be within the environment.

Text properties

Font face

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

The command (t*ttt*) form handles spacing better than the declaration (t*ttt*) form.

Font size

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

These are declarations and should be used in the form `{\small ...}`, or without braces to affect the entire document.

Verbatim text

`\begin{verbatim}` Verbatim environment.
`\begin{verbatim*}` Spaces are shown as ␣.
`\verb!text!` Text between the delimiting characters (in this case '`!`') is verbatim.

Justification

Environment	*Declaration*
`\begin{center}`	`\centering`
`\begin{flushleft}`	`\raggedright`
`\begin{flushright}`	`\raggedleft`

Miscellaneous

`\linespread{`*x*`}` changes the line spacing by the multiplier *x*.

Text-mode symbols

Symbols

&	`\&`	_	`\_`	...	`\ldots`	•	`\textbullet`
$	`\$`	^	`\^{}`	|	`\textbar`	\	`\textbackslash`
%	`\%`	~	`\~{}`	#	`\#`	§	`\S`

Accents

ò	`\‘o`	ó	`\’o`	ô	`\^o`	õ	`\~o`	ō	`\=o`
ȯ	`\.o`	ö	`\"o`	o̧	`\c o`	ŏ	`\v o`	ő	`\H o`
ç	`\c c`	o̩	`\d o`	o̲	`\b o`	o͡o	`\t oo`	œ	`\oe`
Œ	`\OE`	æ	`\ae`	Æ	`\AE`	å	`\aa`	Å	`\AA`
ø	`\o`	Ø	`\O`	ł	`\l`	Ł	`\L`	ı	`\i`
ȷ	`\j`	¡	`~‘`	¿	`?‘`				

Delimiters

‘ ‘ “ ‘‘ { `\{` [`[` (`(` < `\textless`
’ ’ ” ’’ } `\}`] `]`) `)` > `\textgreater`

Dashes

Name	*Source*	*Example*	*Usage*
hyphen	`-`	X-ray	In words.
en-dash	`--`	1–5	Between numbers.
em-dash	`---`	Yes—or no?	Punctuation.

Line and page breaks

`\\` Begin new line without new paragraph.
`\\*` Prohibit pagebreak after linebreak.
`\kill` Don't print current line.
`\pagebreak` Start new page.
`\noindent` Do not indent current line.

Miscellaneous

`\today` January 11, 2010.
`$\sim$` Prints ∼ instead of `\~{}`, which makes ˜.
`~` Space, disallow linebreak (`W.J.~Clinton`).
`\@.` Indicate that the `.` ends a sentence when following an uppercase letter.
`\hspace{`*l*`}` Horizontal space of length *l* (Ex: *l* = `20pt`).
`\vspace{`*l*`}` Vertical space of length *l*.
`\rule{`*w*`}{`*h*`}` Line of width *w* and height *h*.

Tabular environments

`tabbing` environment

`\=` Set tab stop. `\>` Go to tab stop.

Tab stops can be set on "invisible" lines with `\kill` at the end of the line. Normally `\\` is used to separate lines.

tabular environment

```
\begin{array}[pos]{cols}
\begin{tabular}[pos]{cols}
\begin{tabular*}{width}[pos]{cols}
```

tabular column specification

`l`	Left-justified column.
`c`	Centered column.
`r`	Right-justified column.
`p{`*width*`}`	Same as `\parbox[t]{`*width*`}`.
`@{`*decl*`}`	Insert *decl* instead of inter-column space.
`|`	Inserts a vertical line between columns.

tabular elements

`\hline`	Horizontal line between rows.
`\cline{`x-y`}`	Horizontal line across columns x through y.
`\multicolumn{`n`}{`*cols*`}{`*text*`}`	A cell that spans n columns, with *cols* column specification.

Math mode

To use math mode, surround text with `$` or use `\begin{equation}`.

Superscript^x	`^{x}`	Subscript$_x$	`_{x}`
$\frac{x}{y}$	`\frac{x}{y}`	$\sum_{k=1}^{n}$	`\sum_{k=1}^n`
$\sqrt[n]{x}$	`\sqrt[n]{x}`	$\prod_{k=1}^{n}$	`\prod_{k=1}^n`

Math-mode symbols

$\leq$	`\leq`	$\geq$	`\geq`	$\neq$	`\neq`
$\approx$	`\approx`	$\times$	`\times`	$\div$	`\div`
$\pm$	`\pm`	$\cdot$	`\cdot`	$\circ$	`\circ`
$\circ$	`^{\circ}`	$\prime$	`\prime`	$\cdots$	`\cdots`
∞	`\infty`	$\neg$	`\neg`	$\wedge$	`\wedge`
$\vee$	`\vee`	$\supset$	`\supset`	$\forall$	`\forall`
$\in$	`\in`	$\rightarrow$	`\rightarrow`	$\subset$	`\subset`
$\exists$	`\exists`	$\notin$	`\notin`	$\Rightarrow$	`\Rightarrow`
$\cup$	`\cup`	$\cap$	`\cap`	$\mid$	`\mid`
$\Leftrightarrow$	`\Leftrightarrow`	$\dot{a}$	`\dot a`	$\hat{a}$	`\hat a`
$\bar{a}$	`\bar a`	$\tilde{a}$	`\tilde a`	α	`\alpha`
β	`\beta`	γ	`\gamma`	δ	`\delta`
ϵ	`\epsilon`	ζ	`\zeta`	η	`\eta`
ε	`\varepsilon`	θ	`\theta`	ι	`\iota`
κ	`\kappa`	ϑ	`\vartheta`	λ	`\lambda`
μ	`\mu`	ν	`\nu`	ξ	`\xi`
π	`\pi`	ρ	`\rho`	σ	`\sigma`
τ	`\tau`	υ	`\upsilon`	ϕ	`\phi`
χ	`\chi`	ψ	`\psi`	ω	`\omega`
Γ	`\Gamma`	Δ	`\Delta`	Θ	`\Theta`
Λ	`\Lambda`	Ξ	`\Xi`	Π	`\Pi`
Σ	`\Sigma`	Υ	`\Upsilon`	Φ	`\Phi`
Ψ	`\Psi`	Ω	`\Omega`		

Bibliography and citations

When using BibTeX, you need to run `latex`, `bibtex`, and `latex` twice more to resolve dependencies.

Citation types

`\cite{`*key*`}`	Full author list and year. (Watson and Crick 1953)
`\citeA{`*key*`}`	Full author list. (Watson and Crick)
`\citeN{`*key*`}`	Full author list and year. Watson and Crick (1953)
`\shortcite{`*key*`}`	Abbreviated author list and year. ?
`\shortciteA{`*key*`}`	Abbreviated author list. ?
`\shortciteN{`*key*`}`	Abbreviated author list and year. ?
`\citeyear{`*key*`}`	Cite year only. (1953)

All the above have an `NP` variant without parentheses; Ex. `\citeNP`.

BibTeX entry types

`@article`	Journal or magazine article.
`@book`	Book with publisher.
`@booklet`	Book without publisher.
`@conference`	Article in conference proceedings.
`@inbook`	A part of a book and/or range of pages.
`@incollection`	A part of book with its own title.
`@misc`	If nothing else fits.
`@phdthesis`	PhD. thesis.
`@proceedings`	Proceedings of a conference.
`@techreport`	Tech report, usually numbered in series.
`@unpublished`	Unpublished.

BibTeX fields

`address`	Address of publisher. Not necessary for major publishers.
`author`	Names of authors, of format ....
`booktitle`	Title of book when part of it is cited.
`chapter`	Chapter or section number.
`edition`	Edition of a book.
`editor`	Names of editors.
`institution`	Sponsoring institution of tech. report.
`journal`	Journal name.
`key`	Used for cross ref. when no author.
`month`	Month published. Use 3-letter abbreviation.
`note`	Any additional information.
`number`	Number of journal or magazine.
`organization`	Organization that sponsors a conference.
`pages`	Page range (`2,6,9--12`).
`publisher`	Publisher's name.
`school`	Name of school (for thesis).
`series`	Name of series of books.
`title`	Title of work.
`type`	Type of tech. report, ex. "Research Note".
`volume`	Volume of a journal or book.
`year`	Year of publication.

Not all fields need to be filled. See example below.

Common BibTeX style files

`abbrv`	Standard	`abstract`	`alpha` with abstract
`alpha`	Standard	`apa`	APA
`plain`	Standard	`unsrt`	Unsorted

The LaTeX document should have the following two lines just before `\end{document}`, where `bibfile.bib` is the name of the BibTeX file.

```
\bibliographystyle{plain}
\bibliography{bibfile}
```

BibTeX example

The BibTeX database goes in a file called *file*`.bib`, which is processed with `bibtex file`.

```
@String{N = {Na\-ture}}
@Article{WC:1953,
  author  = {James Watson and Francis Crick},
  title   = {A structure for Deoxyribose Nucleic Acid},
  journal = N,
  volume  = {171},
  pages   = {737},
  year    = 1953
}
```

Sample LaTeX document

```
\documentclass[11pt]{article}
\usepackage{fullpage}
\title{Template}
\author{Name}
\begin{document}
\maketitle

\section{section}
\subsection*{subsection without number}
text \textbf{bold text} text. Some math: $2+2=5$
\subsection{subsection}
text \emph{emphasized text} text. \cite{WC:1953}
discovered the structure of DNA.

A table:
\begin{table}[!th]
\begin{tabular}{|l|c|r|}
\hline
first  &  row  &  data \\
second &  row  &  data \\
\hline
\end{tabular}
\caption{This is the caption}
\label{ex:table}
\end{table}

The table is numbered \ref{ex:table}.
\end{document}
```

$\mathcal{AMS}$-LaTeX Reference Card #1

See the TeX Reference Card for additional commands.
Required packages are indicated as (package).

Document Structure

- **Preamble**
  - `\documentclass[option(s)]{class}`
  - `\usepackage[option(s)]{package(s)}`

`\begin{document}`

- **Body**
  - **Front Matter** (`\frontmatter` in `book` classes)
    - **Top Matter**
      - `\title{...}`
      - `\title[running head]{...}` alternative headline
      - `\date{...}`
      - `\date{\today}` gives current date
      - `\author{...}`
      - `\maketitle` (not in `book` classes)
      - **Additional items — ams classes only**
      - `\translator{...}`
      - `\dedicatory{...}`
      - `\address[optional name]{...}`
      - `\curraddress{...}`
      - `\email[optional name]{...}`
      - `\thanks{...}`
      - `\subjclass{Primary: XXX; Secondary: XXX}`
      - `\keywords{...}`
      - `\thanks{...}`
    - `\tableofcontents`
    - `\chapter{Introduction}` (in `book` classes)
    - **Abstract** (not in `book` classes)
      - `\begin{abstract}...\end{abstract}`
  - **Main Matter** (`\mainmatter` in `book` classes)
    - `\chapter{...}`
    - `\section{...}`
    - `\subsection{...}`
    - `\appendix`
  - **Back Matter** (`\backmatter` in `book` classes)
    - `\begin{thebibliography}{99}...\end{...}`

`\end{document}`

Page Style

`\pagestyle{style}`	set page style to one of:
`plain`	empty header, page number in footer
`empty`	empty header and footer
`headings`	header filled by doc class, empty footer
`myheadings`	empty footer, fill header with info in `\markboth{lefthead}{righthead}` and `\markright{righthead}`
`\thispagestyle{style}`	set `\pagestyle`, only current page
`\enlargethispage{\baselineskip}`	force an extra line
`\renewcommand{\baselinestretch}{2}`	doublespaced
fancyheadings	package allows custom headers and footers

- **Page Style Parameters**

`\hoffset`, `\voffset` move page right, down
`\paperwidth`, `\paperheight`, `\textheight`, `\textwidth`
`\topmargin`, `\headheight`, `\headsep`, `\footskip`
`\pagenumbering{...}` e.g., arabic, roman

Classes and Packages

`\documentclass[option(s)]{class}`
`\usepackage[option(s)]{package(s)}`
`\NeedsTeXFormat{LaTeX2e}[1994/12/01]`

- **Document Classes**

`article, book, letter, report, slides`
`amsart, amsbook, amsproc` (all autoload amsmath)

- **Useful Packages**

`amsmath,amsthm,amscd,amssymb,latexsym`	
`fancyheadings`	allows custom headers and footers
`alltt`	all teletype, even \,{,}
`makeidx,showidx`	create index, show in margin
`graphics,graphicx`	inclusion of graphics
`enumerate`	extends the enumerate environment
`layout`	shows page layout of doc class
`multicol`	flexible multicolumn typesetting
`showkeys`	print label keys in margin
`verbatim`	extends verbatim environment
`url`	typeset URLs allowing line breaks
`graphpap`	`\graphpaper` command for `\picture` environ.

- **Document and Package Options**

Font Size
`8pt, 9pt, 10pt, 11pt, 12pt`
Paper Size
`a4paper,a5paper,b5paper,legalpaper,letterpaper`
Document Preparation
`draft,final,notitlepage,titlepage`
Page Formatting
`onecolumn,twocolumn,oneside,twoside,openany,openright`
Equation Numbering
`fleqn,leqno,reqno,centertags,tbtags`
Equation Limits
`intlimits,sumlimits,nonamelimits`
AMS (Postscript) Fonts
`psamsfonts,noamsfonts`

Bibliography (see also BibTeX)

`\begin{thebibliography}{99}...\end{...}`
bibliography with widest label specified

`\bibitem{name}`	named bibliography item
`\bibitem[label]{name}`	with alternative label to print
`\bysame`	use long line for same author
`\renewcommand{\bibname}{title}`	use custom title
`\cite{name}`	print number of named bib item
`\cite[text]{name}`	with extra text

Cross Referencing and Numbering

`\label{name}`	assign label name to numbered item
`\ref{name}`	print number of named item
`\eqref{name}`	print number in parentheses (amsmath)
`\pageref{name}`	print page location of named item
`\cite{name}`	print number of named bibliography item
`\cite[text]{name}`	with extra text
`\numberwithinsection{equation}{section}`	number by section

Sectioning and Table of Contents

- **Sectioning commands**

`\command{title}`	sectioning command with title
`\command[head]{title}`	with alternative running head
`\command*{title}`	with number supressed

`\part`	`\section`	`\paragraph`
`\chapter`	`\subsection`	`\subparagraph`
	`\subsubsection`	

`\appendix` start appendix

- **Table of Contents**

`\tableofcontents`	create and print contents
`filename.toc`	contents associated to `filename.tex`
`\addcontentsline{toc}{section}{line to add}`	
`\addtocontents{toc}{material to add}`	
`\setcounter{tocdepth}{...}`	set amount to print

Tables and Figures

`\begin{table} ... \caption{text} \label{name} \end{table}`

`\listoftables`	create and print list of tables
`\begin{figure} ... \caption{text} \label{name} \end{figure}`	
`\includegraphics{filename}`	include image (graphics)
`\scaledbox{.5}{\includegraphics{filename}}`	scaled graphic
`\listoffigures`	create and print list of figures

Lists

`\item`	item within list
`\item[label]`	item with label
`\begin{enumerate}...\end{...}`	numbered items
`\begin{itemize}...\end{...}`	bulleted items
`\begin{description}...\end{...}`	captioned items
`\setlength{\itemsep}{0pt}`	move items closer
enumerate package	extends `enumerate`

Displayed Text Material

`\begin{center}...\end{...}`	centered matrial
`\begin{flushright}...\end{...}`	flush right matrial
`\begin{flushleft}...\end{...}`	flush left matrial
`\begin{quote}...\end{...}`	short quote
`\begin{quotation}...\end{...}`	long quote
`\begin{verse}...\end{...}`	poetry
`\begin{verbatim}...\end{...}`	verbatim material
`\verb|...|`	verbatim material
`\verb*|...|`	verbatim with spaces marked
verbatim package	extends `verbatim`

Footnotes, Comments, Other Stuff

`\footnote{text}`	numbered footnote
`%`	comment out a line
`\begin{comment}...\end{...}`	long comment (verbatim)
`\typeout{text}`	print to terminal
`\typein{text}`	get input from keyboard
`\typein[\cmd]{text}`	assign input to `\cmd`
`\protect`	protects fragile commands
`\-`	optional hyphen
`\hyphenation{hypenated words}`	extra hyphenated words

Dimensions, Spacing, and Glue

Dimensions are specified as ⟨number⟩⟨unit of measure⟩.
Glue is specified as ⟨dimen⟩ `plus`⟨dimen⟩ `minus`⟨dimen⟩.

point	`pt`	pica	`pc`	inch	`in`	centimeter	`cm`
m width	`em`	x height	`ex`	math unit	`mu`	millimeter	`mm`
1 pc = 12 pt		1 in = 72.72 pt		2.54 cm = 1 in		18 mu = 1 em	

`\ \quad \qquad`	white space (1 space, 1 em, 2 em)
`\hspace{10pt}`	specified horizontal space
`\hspace*{10pt}`	space even at line start

Horizontal Spacing (Math): `\,` thin space `\:` med space `\;` thick space `\!` neg. thin space `\mspace`⟨muglue⟩

`\strut`,`\mathstrut`	invisible vertical space
`\phantom{...}`	invisible space
`\vphantom{...}`	invisible vertical space
`\smash[bt]{...}`	typeset w/zero height,depth
`\hfill`	fill with space
`\dotfill`	fill with dots
`\hrulefill`	fill with rule (line)
`\par`	new paragraph
`\newline` or `\\`	force a new line
`\\*`	new line, prohibit page break
`\\[5pt]`	new line skipping 5 pts
`\vspace{1in}`	specified vertical space
`\vspace*{1in}`	space even at page start
`\newpage`	force a new page

• Length Variables

`\newlength{\lngth}`	create length varible `\lngth`
`\setlength{\lngth}{`dimen`}`	set value of `\lngth`
`\addtolength{\lngth}{`dimen`}`	increase `\lngth`

• Useful Length Assignments

`\enlargethispage{\baselineskip}`	force extra line
`\setlength{\hangindent}{30pt}`	indentation
`\setlength{\hangafter}{3}`	indent after
`\renewcommand{\baselinestretch}{2}`	doublespaced

Accents

Type	Example	In Math	In Text
hat	$\hat{a}$	`\hat`	`\^`
expanding hat	$\widehat{abc}$	`\widehat`	none
check	$\check{a}$	`\check`	`\v`
tilde	$\tilde{a}$	`\tilde`	`\~`
expanding tilde	$\widetilde{abc}$	`\widetilde`	none
acute	$\acute{a}$	`\acute`	`\'`
grave	$\grave{a}$	`\grave`	`\‘`
dot	$\dot{a}$	`\dot`	`\.`
double dot	$\ddot{a}$	`\ddot`	`\"`
breve	$\breve{a}$	`\breve`	`\u`
bar	$\bar{a}$	`\bar`	`\=`
vector	$\vec{a}$	`\vec`	none
cedilla	ç	none	`\c`

Additional Text Symbols

`\dag`	†	`\copyright`	©	`\pounds`	£
`\ddag`	‡	`\textcircled{r}`	ⓡ		
`\P`	¶	`\textvisiblespace`	␣		
`\S`	§	`\textbullet`	•		

Fonts

• Text Fonts

`\textnormal{...}`	`{\normalfont...}`	document font
`\textrm{...}`	`{\rmfamily...}`	roman
`\textsf{...}`	`{\sffamily...}`	sans serif font
`\texttt{...}`	`{\ttfamily...}`	`typewriter style`
`\textbf{...}`	`{\bfseries...}`	**bold**
`\textup{...}`	`{\upshape...}`	upright
`\textit{...}`	`{\itshape...}`	*italic*
`\textsl{...}`	`{\slshape...}`	*slanted*
`\textsc{...}`	`{\scshape...}`	Small Capitals
`\emph{...}`	`{\em...}`	*emphasize*
`\fbox{...}`		framed text

• Font Environments exist for above types, e.g., `\begin{ttfamily}...\end{...}`

• Changing Font Sizes

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

• Math Fonts

`\mathrm{...}`	roman
`\mathbf{...}`	**bold** (letters)
`\boldsymbol{...}`	**bold** (symbol) (amsmath)
`\mathit{...}`	*italic*
`\mathcal{...}`	caligraphic $\mathcal{A}, \mathcal{B}, \mathcal{C}$
`\usepacakge{eucal}`	redef `\mathcal` to script $\mathcal{A}$, $\mathcal{B}$, $\mathcal{C}$
`\mathfrak{...}`	Fraktur $\mathfrak{A}$, $\mathfrak{a}$, $\mathfrak{B}$, $\mathfrak{b}$ (amsfonts)
`\mathbb{...}`	Blackboard bold $\mathbb{A}$, $\mathbb{B}$, $\mathbb{C}$ (amsfonts)
`\boxed{...}`	framed math

• Math Font Sizes

`\displaystyle`	display size
`\textstyle`	text size
`\scriptsize`	sub/superscript size
`\scriptscriptsize`	doubly sub/superscripted size

Boxes

`\mbox{...}`	one line of text
`\text{...}`	one line of text (amsmath)
`\parbox{width}{text}`	paragraph of text
`\parbox[align][height][inner align]{width}{text}`	
`\marginpar{...}`	marginal comment
`\rule[-1pt]{20pt}{10pt}`	solid box ■
`\raisebox{5pt}{text}`	raised box
`\makebox[width][alignment]{text}`	box of text
`\framebox[width][alignment]{text}`	framed text
`\setlength{\fboxsep}{5pt}`	space around text
`\setlength{\fboxrule}{3pt}`	width of box borders

Overfull and Underfull Boxes

`draft`	document class marks overfulls
`\overfullrule`	width of overfull marker
`\begin{setlength}{\hfuzz}{2pt}...\end{...}`	allow small overfulls

Multicolumn Printing

`\twocolumn`	double column on new page
`\onecolumn`	single column on new page
`\begin{multicols}{`*n*`}[title]...\end{...}`	multicolumn environment (multicol)

Array and Tabular Environments

`\begin{tabular}[POS]{COLS}...\end{...}`
`\begin{array}[POS]{COLS}...\end{...}`
Use `tabular` for text, `array` for mathematics

`&, \\`	column and row separators

POS aligns top (`t`), bottom (`b`), center (default)
COLS gives formats for columns:

`l,c,r`	left, center, right justified
`|`	vertical rule
`@{...}`	material between columns
`@{}`	no space between columns
`*{n}{...}`	*n* copies of material
`p{width}`	set column width
`\hline`	horizontal line between rows
`\cline{i-j}`	line across columns *i* to *j*
`\multicolumn{n}{COLS}{...}`	span *n* columns using format in COLS
`\setlength{\tabcolsep}{0pt}`	set column separation
`\setlength{\itemsep}{0pt}`	set item separation
`\renewcommand{\arraystretch}{1.25}`	open up array

• Example of a table using `\tabular`

```
\begin{table}
  \begin{center}
    \begin{tabular}{|l|c|c|} \hline
      Name & Exam & Grade \\ \hline
      Dan & 97\% & A \\ \hline
    \end{tabular}
    \caption{Math 101 Final Grades}
    \label{GradeTable}
  \end{center}
\end{table}
```

Name	Exam	Grade
Dan	97%	A

Math 101 Final Grades

Tabbing Environment

`\begin{tabbing}...\end{...}`	tabbing environment
`\=`	set tab
`\\`	end line
`\>`	move to next tab
`\kill`	do not print line

File Suffixes and Types

• LaTeXSource Files

`.tex`	File containing a LaTeXdocument
`.sty`, `.cls`	LaTeX style and document class files
`.fd`	Font definition file

• Files Written by LaTeX
(See also BibTeXand MakeIndex)

`.aux`	cross-referencing and list information
`.dvi`	device independent typeset file
`.glo`	list of glossary entries
`.lof`	list of figures (read by `\listoffigures`)
`.lot`	list of tables (read by `\listoftables`)
`.toc`	table of contents (read by `\tableofcontents`)
`.log`	LaTeX log file
`\nofiles`	supresses all except `.log` and `.dvi`

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$\mathcal{AMS}$-LaTeX Reference Card #2

See the TeX Reference Card for additional commands.
The notation (package) indicates a required package.

Math Environments

`\(...\)` or `$...$`	inline math
`\[...\]` or `$$...$$`	displayed math
`\begin{equation}\label{eqname}...\end{...}`	numbered and labeled equation
`\ref{eqname}`	refer to labeled eqn
`\mbox{...}`	text in math

• The following require amsmath

`\text{...}`	text in math
`\begin{equation*}...\end{...}`	unnumbered eqn
`\tag{eqtag}`	use eqtag instead of number
`\notag`	supress equation tag
`\eqref{eqname}`	ref with parens
`\begin{subequations}...\end{...}`	group equations for numbering
`\numberwithin{equation}{section}`	number equations within sections

Theorems, Lemmas, Etc.

• Defining Theorem-Like Environments

`\newtheorem{name}{label}`	theorem environment
`\newtheorem*{name}{label}`	unnumbered (amsthm)
`\newtheorem{name}[other name]{label}`	numbered consecutively with other environment
`\newtheorem{name}{label}[section]`	numbered by section (or `chapter`, etc.)
`\swapnumbers`	put numbers on left

• Theorem-Like Environment Styles (amsthm)

`\theoremstyle{plain}`	most emphatic
`\theoremstyle{defintion}`	medium emphasis
`\theoremstyle{remark}`	least emphatic

• Invoking Theorem-Like Environments

`\begin{name}...\end{...}`	invoke environment
`\begin{name}[label]...`	invoke with new label

If proclamation starts with a list, put in `\hfill`

`\begin{proof}...\end{...}`	proof environment
`\begin{proof}[label]...\end{...}`	proof with label
`\qedsymbol`	end of proof marker
`\renewcommand{\qedsymbol}{...}`	redefine marker

Commutative Diagrams (amscd)

Separate lines with `\\`, do not use `&`s

`\begin{CD}...\end{CD}`	commutative diagram
`@>#1>#2>`	right arrow with labels
`@<#1<#2<`	left arrow with labels
`@V#1V#2V`	down arrow with labels
`@A#1A#2A`	up arrow with labels
`@=`	long horizontal equal sign
`@|`	long vertical equal sign
`@.`	leave out an arrow

Multiline Math Displays (amsmath)

```
Use as \begin{command}...\end{command}
Separate items with &, separate lines with \\
No \\ on last line, \\[dim] to skip space
```

• Full Math Environments (full line)

`gather`	centered, numbered equations
`gather*`	centered, unnumbered equations
`multline`	first line left, last line right, rest centered
`multline*`	same as multline, but unnumbered
`align`	formulas aligned at `&` signs
`align*`	same as align, but unnumbered
`flalign`	flush left and right align
`alignat`	`align` without space, needs argument `\begin{alignat}{# of cols}`
`\intertext{text}`	text between lines
`\shoveleft,\shoveright`	move `multline` line left, right
`\allowdisplaybreaks`	allow page breaks (`\\*` prohibits)
`\displaybreak`	force page break (before `\\`)

• Math Subenvironments (within math display)

`gathered`	centered equations
`aligned`	formulas aligned at `&` signs
`split`	split long formula within other environment
`cases`	cases, with { on left
`matrix`	matrix (of up to 10 columns)
`pmatrix, bmatrix, vmatrix, Vmatrix`	matrix variants enclosed by $(\cdots)$, $[\cdots]$, $\vert\cdots\vert$, $\Vert\cdots\Vert$
`\setcounter{MaxMatrixCols}{12}`	increase number of matrix columns
`\hdotsfor{num}`	dots across columns

Overlines, Underlines, and Arrows

`\underline{...}`	underline
`\overline{...}`	overline
`\overbrace{...}^{...}`	overbrace
`\underbrace{...}_{...}`	underbrace
`\overrightarrow{...}`	over right arrow
`\overleftarrow{...}`	over left arrow
`\overleftrightarrow{...}`	over left-right arrow

`\underrightarrow{...}`,`\underleftarrow{...}`, etc.

`\xrightarrow[bot]{top}`	stretchable w/sub/supscripts
`\xleftarrow[bot]{top}`	stretchable w/sub/supscripts

Operator Names

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

`a \equiv b \pmod{m}`	$a \equiv b \pmod{m}$
`a \equiv b \mod{m}`	$a \equiv b \mod{m}$
`a \bmod m`	$a \bmod m$
`\DeclareMathOperator{\cmd}{opname}`	create operator
`\DeclareMathOperator*{\cmd}{opname}`	with limits
`\operatorname{...}`	typeset as an operator
`\operatorname*{...}`	with limits

Large Operators

$\sum$	`\sum`	$\bigcap$	`\bigcap`	$\bigodot$	`\bigodot`
$\prod$	`\prod`	$\bigcup$	`\bigcup`	$\bigotimes$	`\bigotimes`
$\coprod$	`\coprod`	$\bigsqcup$	`\bigsqcup`	$\bigoplus$	`\bigoplus`
$\int$	`\int`	$\bigvee$	`\bigvee`	$\biguplus$	`\biguplus`
$\oint$	`\oint`	$\bigwedge$	`\bigwedge`		

`\substack{xxx\\ yyy}`	stacked sub or superscripts
`\limits,\nolimits`	force or forbid displayed limits
`\oint,\iint,\iiint,\iiiint,\idotsint`	integral variants (amsmath)

Delimiters

$[$	`\lbrack` or `\[`	$\{$	`\lbrace` or `\{`	$\langle$	`\langle`
$]$	`\rbrack` or `\]`	$\}$	`\rbrace` or `\}`	$\rangle$	`\rangle`
$\vert$	`\vert` or `\\|`	$\lfloor$	`\lfloor`	$\lceil$	`\lceil`
$\Vert$	`\Vert` or `\\|`	$\rfloor$	`\rfloor`	$\rceil$	`\rceil`
$\uparrow$	`\uparrow`	$\Uparrow$	`\Uparrow`	$\updownarrow$	`\updownarrow`
$\downarrow$	`\downarrow`	$\Downarrow$	`\Downarrow`	$\Updownarrow$	`\Updownarrow`

`\left(  \right)`	expanding delimiters
`\left.  \right.`	empty delimiters
`\bigl(  \bigr)`	big delimiters
`\Bigl(  \Bigr)`	bigger delimiters
`\biggl(  \biggr)`	even bigger delimiters
`\bigm|,\biggm|`	big binary relation delimiters

Roots

`\sqrt{...}`	square root $\sqrt{\ }$
`\sqrt[n]{...}`	nth root $\sqrt[n]{\ }$
`\leftroot{2},\uproot{2}`	move root left or up

Ellipses

`\ldots,\cdots,\dots`	ellipses
`\vdots,\ddots`	vertical and diagonal dots
`\dotsc,\dotsb,\dotsm,\dotsi`	more ellipses (amsmath)

Fractions and Stacked Relations

`\frac{n}{d}`	fraction $\frac{n}{d}$
`\dfrac{n}{d}`	displaystyle fraction
`\tfrac{n}{d}`	textstyle fraction
`\binom{n}{d}`	binomial coefficient $\binom{n}{d}$
`\genfrac{ldelim}{rdelim}{thick}{style}{num}{den}`	
`\cfrac{...}{...}`	continued fraction
`\stackrel{top}{bot}`	stacked relation
`\overset{top}{bot}`	stacked symbol (amsmath)
`\underset{bot}{top}`	stacked relation (amsmath)
`\sideset{_{ll}^{ul}}{_{lr}^{ur}}{largeop}`	large operator with left/right sub/supscripts

Negated Relations

`\not`	negate a relation
`\ne`	not equal $\neq$
`\notin`	not a member of $\notin$
`\nmid`	not divisible $\nmid$

User Defined Commands

`\newcommand{\name}{`replacement text`}` new command
`\newcommand{\name}[`n`]{`text with `#1,#2,...,#`n`}`
new command with n arguments
Example: `\newcommand{\vect}[2]{#1_1,\ldots,#1_{#2}}`
`\newcommand{\name}[`n`][`default`]{...}`
command with args and default value for `#1`
`\renewcommand{...}{...}` redefine existing command
`\providecommand{...}{...}` define if doesn't exist
`\newcommand*{...}{...}` command with one par arg
`\ensuremath{...}` forces math mode
`\show\command` print definition of `\command`
`\showthe\paramname` print value of a parameter

User Defined Environments

`\newenvironment{`name`}{`pretext`}{`posttext`}`
new environment with material before and after
`\newenvironment[`n`]{`name`}{...}{...}`
environment with n arguments
`\newenvironment[`n`][`default`]{`name`}{...}{...}`
environment with default value for `#1`
`\renewenvironment{`name`}{...}{...}` redefine envrment

MakeIndex

• **MakeIndex** File Suffixes
`.idx`, `.ind`, `.ilg` entry listing, index file, log file
• **MakeIndex** Commands in Document File
`\usepackage{makeidx}` use indexing package
(Do not include this line if using AMS packages.)
`\makeindex` tell LaTeX to create an `.idx` file
`\printindex` tell LaTeX to print index here
`\nofiles` supresses creation of `.idx` and `.glo` files
• Creating **MakeIndex** `.idx` File
`\index{`entry`}` main entry
`\index{`entry`!`entry`}` subentry
`\index{`entry`!`entry`!`entry`}` subsubentry
`\index{`text`@`entry`}` with placement info
`\index{`entry`|see{`entry`}}` cross referenced entry
`\index{`entry`|`modifier`}` entry with page modifier
e.g. `\index{gnats|textbf}` give bold page number
`\index{`entry`|(}` ... `\index{`entry`|)}` page range
Special Characters: `"!` `"@` `"|` `""`
• Creating An Index With **MakeIndex**
(1) Typeset document containing `\makeindex` command.
(2) Run MakeIndex on `.idx` file to create `.ind` file.
(3) Typeset document containing `\printindex` command.

Glossary

`\makeglossary` tell LaTeX to create a `.glo` file
`\glossary{`entry`}` create a glossary entry
`\glossaryentry{`entry`}{`page no.`}` entries in `.glo` file
`\input filename.glo` read glossary file
User must define `\makeglossary`, e.g.,
`\newcommand{\glossaryentry}[2]{#1, page #2\par}`

Time and Date

`\today` current date
Use `\the` to display the following items
`\day`, `\month`, `\year`, `\time` (minutes since midnight)

Counters

`\newcounter{cntr}` create new counter named `cntr`
`\newcounter{cntr}[cntr1]` reset `cntr` when `cntr1` changes
`\setcounter{cntr}{`value`}` set value of `cntr`
`\stepcounter{cntr}` increment `cntr`
`\refstepcounter{cntr}` increment and reset `\label`
`\addtocounter{cntr}{`n`}` increment by n
`\value{cntr}` value stored in `\cntr`
`\thecntr` the value of `cntr`
calc package to do counter arithmetic
• **Counter Styles**
`\arabic{}` `\roman{}` `\Roman{}` `\alph{}` `\Alph{}`
• **Standard Counters**
`equation footnote figure page table`
`part chapter section subsection subsubsection`
`paragraph subparagraph enumi enumii enumiii enumiv`
`secnumdepth` depth to which sections are numbered
`tocdepth` depth to which sections are put into toc

Customized List Environments

`\begin{list}{`default label`}{`declarations`}`
`\item` item 1 text
`\item` item 2 text
`\end{list}`
`\begin{trivlist}...\end{trivlist}`
list with no labels or declarations, trivial lengths
•**Declarations**
`\setlength{`length parameter`}{`length`}`
`\usecounter{`counter name`}`
[Create counter first using `\newcounter{`counter name`}`.]
•**Length Parameters** (see page 113 of Lamport for more)
`\topsep` separate preceding text and first item
`\itemsep` separate items
`\leftmargin` indent of item box from left margin
`\labelwidth` width of box for item label
`\labelsep` separate label box from item box

The picture Environment

`\begin{picture}(`w`,`h`)...\end{picture}` picture
`\begin{picture}(`w`,`h`)(`Δx`,`Δy`)...` with offset
`\put(`x`,`y`){`picture object`}` place object
`\multiput(`x`,`y`)(`Δx`,`Δy`){`n`}{`object`}` n times
Picture Objects:
`\makebox(`x`,`y`)[tblr]{`text`}` box with text
`\line(`Δx`,`Δy`){`x length`}` line of slope $\Delta y/\Delta x$
`\vector(`Δx`,`Δy`){`x length`}` arrow of slope $\Delta y/\Delta x$
`\circle{`r`}` circle of radius r
`\circle*{`r`}` filled circle
`\oval(`x`,`y`)[lrtb]` oval (part or whole)
`\shortstack{abc\\xyz\\}` stacked text
`\framebox(`x`,`y`)[tblr]{`text`}` framed text
`\frame{`text`},fbox{`text`}` other framed boxes
`\dashbox{`d`}(`x`,`y`){`text`}` dashed box
`\qbezier(`x_1`,`y_1`)(`x_2`,`y_2`)(`x_3`,`y_3`)` quadratic curve
`\savebox{\name}(`x`,`y`){...}` store material
`\usebox{\name}` retrieve material
`\graphpaper[`n`]{`x`,`y`}{`w`,`h`}` print grid (graphpap)
`\setlength{\unitlength}{1pt}` change size of picture
`\thinlines,\thicklines` adjust line thickness

Color (color)

`\color{`color`}` change color
`\textcolor{`color`}{`text`}` colored text
`\colorbox{`color`}{`text`}` colored background
`\fcolorbox{`col_1`}{`col_2`}{`text`}` colored border & background
`\setlength{\fboxsep}{5pt}` put space around text
`\setlength{\fboxrule}{3pt}` width of border of box
`\pagecolor{`color`}` set background color of page
`\definecolor{`name`}{rgb}{`r,g,b`}` define an RGB color
`\definecolor{`name`}{cmyk}{`c,m,y,k`}` define a CMYK color
Predefined Colors
`black, white, red, green, blue, yellow, cyan, magenta`

BibTeX

• **BibTeX** File Suffixes
`.bib` BibTeX bibliographic database file
`.bst` BibTeX bibliographic style file
`.blg` BibTeX log file
`.bbl` BibTeX document bibliography file
• **BibTeX** Commands in Document File
`\bibliographystyle{`bib style file`}`
Examples: `plain`, `amsplain`, `unsrt`, `alpha`, `abbrv`
`\bibliography{`bib database file(s)`}`
`\cite{`label`}` cite a reference
`\nocite{`label`}` include ref in bib without citation
`\nocite{*}` include all references in bibliography
• Creating **BibTeX** Database File
`@STRING{name = "text"}` define an abbreviation
Put braces around non-initial capitalized title words.
Use `and` to separate multiple authors in `author` field
•**General Format of a Database Entry**

```
@ENTRYTYPE{label,
    fieldtype1 = {entry1},
    fieldtype2 = {entry2},
        ⋮
        ⋮
}
```

•**Database Entry Types**

`@ARTICLE{...}`		`@MASTERSTHESIS{...}`	
`@BOOK{...}`		`@MISC{...}`	
`@BOOKLET{...}`		`@PHDTHESIS{...}`	
`@INBOOK{...}`		`@PROCEEDINGS{...}`	
`@INCOLLECTION{...}`		`@TECHREPORT{...}`	
`@INPROCEEDINGS{...}`		`@UNPUBLISHED{...}`	
`@MANUAL{...}`		`@COMMENT{...}`	

•**Field Types Within Entries**

`address`	`editor`	`month`	`school`
`author`	`howpublished`	`note`	`series`
`booktitle`	`institution`	`number`	`title`
`chapter`	`journal`	`organization`	`type`
`crossref`	`key`	`pages`	`volume`
`edition`	`language`	`publisher`	`year`

• Creating Document Bibliography With **BibTeX**
(1) Typeset document to get new `.aux` file.
(2) Run BibTeX on `.aux` file to create `.bbl` file.
(3) Retypeset document twice.

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