

# $\mathcal{M}\mathcal{S}$ - $\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$ Reference Card #1

See the  $\mathcal{T}\mathcal{E}\mathcal{X}$  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]{...}`
    - `\curaddress{...}`
    - `\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`, `nonamlimits`

AMS (Postscript) Fonts

`psamsfonts`, `noamsfonts`

## Bibliography (see also $\mathcal{B}\mathcal{I}\mathcal{B}\mathcal{T}\mathcal{E}\mathcal{X}$ )

```
\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

<code>\command{title}</code>	sectioning command with title	
<code>\command[head]{title}</code>	with alternative running head	
<code>\command*{title}</code>	with number suppressed	
<code>\part</code>	<code>\section</code>	<code>\paragraph</code>
<code>\chapter</code>	<code>\subsection</code>	<code>\subparagraph</code>
	<code>\subsubsection</code>	
<code>\appendix</code>	start appendix	

### • Table of Contents

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

## Tables and Figures

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

## Lists

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

## Displayed Text Material

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

## Footnotes, Comments, Other Stuff

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

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## 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

<code>\quad</code>	<code>\qqquad</code>	white space (1 space, 1 em, 2 em)
<code>\hspace{10pt}</code>		specified horizontal space
<code>\hspace*{10pt}</code>		space even at line start
Horizontal Spacing (Math): <code>\</code> , thin space <code>\:</code> med space		
<code>\;</code>	thick space	<code>\!</code> neg. thin space <code>\mspace{muglue}</code>

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

### • Length Variables

<code>\newlength{&lt;length&gt;}</code>	create length variable <code>\length</code>
<code>\setlength{&lt;length&gt;}{&lt;dimen&gt;}</code>	set value of <code>\length</code>
<code>\addtolength{&lt;length&gt;}{&lt;dimen&gt;}</code>	increase <code>\length</code>

### • Useful Length Assignments

<code>\enlargethispage{&lt;baselineskip&gt;}</code>	force extra line
<code>\setlength{&lt;hangindent&gt;}{30pt}</code>	indentation
<code>\setlength{&lt;hangafter&gt;}{3}</code>	indent after
<code>\renewcommand{&lt;baselinestretch&gt;}{2}</code>	doublespaced

## Accents

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

## Additional Text Symbols

<code>\dag</code>	†	<code>\copyright</code>	©	<code>\pounds</code>	£
<code>\ddag</code>	‡	<code>\textcircled{r}</code>	⒓		
<code>\P</code>	¶	<code>\textvisiblespace</code>	␣		
<code>\S</code>	§	<code>\textbullet</code>	•		

## 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{...}` calligraphic *A, B, C*  
`\usepackage{eucal}` redefine `\mathcal` to script *A, B, C*  
`\mathfrak{...}` Fraktur *A, a, B, b* (amsfonts)  
`\mathbb{...}` Blackboard bold *A, B, 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

### • L<sup>A</sup>T<sub>E</sub>X Source Files

`.tex` File containing a L<sup>A</sup>T<sub>E</sub>X document  
`.sty`, `.cls` L<sup>A</sup>T<sub>E</sub>X style and document class files  
`.fd` Font definition file

### • Files Written by L<sup>A</sup>T<sub>E</sub>X

(See also BIB<sub>T</sub>E<sub>X</sub> and 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` L<sup>A</sup>T<sub>E</sub>X log file  
`\nofiles` suppresses all except `.log` and `.dvi`

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$\mathcal{A}_M$ S-L<sup>A</sup>T<sub>E</sub>X Reference Card #2

See the T<sub>E</sub>X Reference Card for additional commands.  
The notation (**package**) indicates a required package.

## Math Environments

<code>\(...\) or <math>\dots</math></code>	inline math
<code>\[...] or <math>\dots</math></code>	displayed math
<code>\begin{equation}\label{eqname}...\end{...}</code>	numbered and labeled equation
<code>\ref{eqname}</code>	refer to labeled eqn
<code>\mbox{...}</code>	text in math
• The following require <code>amsmath</code>	
<code>\text{...}</code>	text in math
<code>\begin{equation*}...\end{...}</code>	unnumbered eqn
<code>\tag{eqtag}</code>	use eqtag instead of number
<code>\notag</code>	suppress equation tag
<code>\eqref{eqname}</code>	ref with parens
<code>\begin{subequations}...\end{...}</code>	group equations for numbering
<code>\numberwithin{equation}{section}</code>	number equations within sections

## Theorems, Lemmas, Etc.

### • Defining Theorem-Like Environments

<code>\newtheorem{name}{label}</code>	theorem environment
<code>\newtheorem*{name}{label}</code>	unnumbered (amsthm)
<code>\newtheorem{name}{other name}{label}</code>	numbered consecutively with other environment
<code>\newtheorem{name}{label}[section]</code>	numbered by section (or <b>chapter</b> , etc.)
<code>\swapnumbers</code>	put numbers on left
<b>• Theorem-Like Environment Styles (amsthm)</b>	
<code>\theoremstyle{plain}</code>	most emphatic
<code>\theoremstyle{definition}</code>	medium emphasis
<code>\theoremstyle{remark}</code>	least emphatic
<b>• Invoking Theorem-Like Environments</b>	
<code>\begin{name}...\end{...}</code>	invoke environment
<code>\begin{name}[label]...</code>	invoke with new label
If proclamation starts with a list, put in <code>\hfill</code>	
<code>\begin{proof}...\end{...}</code>	proof environment
<code>\begin{proof}[label]...\end{...}</code>	proof with label
<code>\qedsymbol</code>	end of proof marker
<code>\renewcommand{\qedsymbol}{...}</code>	redefine marker

## Commutative Diagrams (amscd)

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

<code>\begin{CD}...\end{CD}</code>	commutative diagram
<code>@&gt;\#1&gt;\#2&gt;</code>	right arrow with labels
<code>@&lt;\#1&lt;\#2&lt;</code>	left arrow with labels
<code>@V\#1V\#2V</code>	down arrow with labels
<code>@A\#1A\#2A</code>	up arrow with labels
<code>@=</code>	long horizontal equal sign
<code>@ </code>	long vertical equal sign
<code>@.</code>	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 (· · ·), [· · ·],   · · ·  ,    · · ·
\setcounter{MaxMatrixCols}{12}	increase number of matrix columns
\hdotsfor{num}	dots across columns

## Overlines, Underlines, and Arrows

<code>\underline{...}</code>	underline
<code>\overline{...}</code>	overline
<code>\overbrace{...}^{...}</code>	overbrace
<code>\underbrace{...}_{...}</code>	underbrace
<code>\overrightarrow{...}</code>	over right arrow
<code>\overleftarrow{...}</code>	over left arrow
<code>\overleftrightarrow{...}</code>	over left-right arrow
<code>\underrightarrow{...}, \underleftarrow{...}</code>	, etc.
<code>\xrightarrow[bot]{top}</code>	stretchable w/sub/supscripts
<code>\xleftarrow[bot]{top}</code>	stretchable w/sub/supscripts

## Operator Names

<code>\arccos</code>	<code>\cos</code>	<code>\csc</code>	<code>\exp</code>	<code>\ker</code>	<code>\liminf</code>	<code>\min</code>	<code>\sinh</code>
<code>\arcsin</code>	<code>\cosh</code>	<code>\deg</code>	<code>\gcd</code>	<code>\lg</code>	<code>\limsup</code>	<code>\Pr</code>	<code>\sup</code>
<code>\arctan</code>	<code>\cot</code>	<code>\det</code>	<code>\hom</code>	<code>\lim</code>	<code>\log</code>	<code>\sec</code>	<code>\tan</code>
<code>\arg</code>	<code>\coth</code>	<code>\dim</code>	<code>\inf</code>	<code>\ln</code>	<code>\max</code>	<code>\sin</code>	<code>\tanh</code>
<code>a \equiv b \pmod{m}</code>	$a \equiv b \pmod{m}$						
<code>a \equiv b \pmod{m}</code>	$a \equiv b \pmod{m}$						
<code>a \bmod m</code>	$a \bmod m$						
<code>\DeclareMathOperator{cmd}{opname}</code>	create operator						
<code>\DeclareMathOperator*{cmd}{opname}</code>	with limits						
<code>\operatorname{...}</code>	typeset as an operator						
<code>\operatorname*{...}</code>	with limits						

## Large Operators

$\sum$	<code>\sum</code>	$\bigcap$	<code>\bigcap</code>	$\bigodot$	<code>\bigodot</code>
$\prod$	<code>\prod</code>	$\bigcup$	<code>\bigcup</code>	$\bigotimes$	<code>\bigotimes</code>
$\coprod$	<code>\coprod</code>	$\bigsqcup$	<code>\bigsqcup</code>	$\bigoplus$	<code>\bigoplus</code>
$\int$	<code>\int</code>	$\bigvee$	<code>\bigvee</code>	$\biguplus$	<code>\biguplus</code>
$\oint$	<code>\oint</code>	$\bigwedge$	<code>\bigwedge</code>		
$\substack{xxx\\yyy}$	<code>\substack{xxx\\yyy}</code>				
$\limits$ , $\nolimits$	<code>\limits</code> , <code>\nolimits</code>				
$\oint$ , $\iint$ , $\iiint$ , $\iiint$ , $\idotsint$	<code>\oint</code> , <code>\iint</code> , <code>\iiint</code> , <code>\iiint</code> , <code>\idotsint</code>				
					integral variants (amsmath)

## Delimiters

$[$	<code>\lbrack</code> or <code>\l</code>	$\{$	<code>\lbrace</code> or <code>\{</code>	$\langle$	<code>\langle</code>
$]$	<code>\rbrack</code> or <code>\]</code>	$\}$	<code>\rbrace</code> or <code>\}</code>	$\rangle$	<code>\rangle</code>
$ $	<code>\vert</code> or <code>\lvert</code>	$\lfloor$	<code>\lfloor</code>	$\lceil$	<code>\lceil</code>
$\ $	<code>\Vert</code> or <code>\lVert</code>	$\rfloor$	<code>\rfloor</code>	$\rceil$	<code>\rceil</code>
$\uparrow$	<code>\uparrow</code>	$\Uparrow$	<code>\Uparrow</code>	$\updownarrow$	<code>\updownarrow</code>
$\downarrow$	<code>\downarrow</code>	$\Downarrow$	<code>\Downarrow</code>	$\Updownarrow$	<code>\Updownarrow</code>
$\left($	<code>\left(</code>	$\right)$	<code>\right)</code>		
$\left.$	<code>\left.</code>	$\right.$	<code>\right.</code>		
$\bigl($	<code>\bigl(</code>	$\bigr)$	<code>\bigr)</code>		
$\Bigl($	<code>\Bigl(</code>	$\Bigr)$	<code>\Bigr)</code>		
$\biggl($	<code>\biggl(</code>	$\biggr)$	<code>\biggr)</code>		
$\bigl $ , $\biggm $	<code>\bigl </code> , <code>\biggm </code>				

## Roots

$\sqrt{\dots}$	<code>\sqrt{\dots}</code>	square root $\sqrt{\phantom{x}}$
$\sqrt[n]{\dots}$	<code>\sqrt[n]{\dots}</code>	$n$ th root $\sqrt[n]{\phantom{x}}$
$\leftroot{2}, \uproot{2}$	<code>\leftroot{2}, \uproot{2}</code>	move root left or up

## Ellipses

$\ldots$ , $\cdots$ , $\dots$	<code>\ldots</code> , <code>\cdots</code> , <code>\dots</code>	ellipses
$\vdots$ , $\ddots$	<code>\vdots</code> , <code>\ddots</code>	vertical and diagonal dots
$\dotsc$ , $\dotscb$ , $\dotscm$ , $\dotsci$	<code>\dotsc</code> , <code>\dotscb</code> , <code>\dotscm</code> , <code>\dotsci</code>	more ellipses (amsmath)

## Fractions and Stacked Relations

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

## Negated Relations

$\not$	<code>\not</code>	negate a relation
$\neq$	<code>\neq</code>	not equal $\neq$
$\notin$	<code>\notin</code>	not a member of $\notin$
$\nmid$	<code>\nmid</code>	not divisible $\nmid$

## User Defined Commands

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

## User Defined Environments

$\newenvironment{\name}{pretext}{posttext}$	<code>\newenvironment{\name}{pretext}{posttext}</code>	new environment with material before and after
$\newenvironment[n]{\name}{\dots}{\dots}$	<code>\newenvironment[n]{\name}{\dots}{\dots}</code>	environment with $n$ arguments
$\newenvironment[n][default]{\name}{\dots}{\dots}$	<code>\newenvironment[n][default]{\name}{\dots}{\dots}</code>	environment with default value for $\#1$
$\renewenvironment{\name}{\dots}{\dots}$	<code>\renewenvironment{\name}{\dots}{\dots}</code>	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 L<sup>A</sup>T<sub>E</sub>X to create an .idx file  
`\printindex` tell L<sup>A</sup>T<sub>E</sub>X to print index here  
`\nofiles` suppresses 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

$\makeglossary$	<code>\makeglossary</code>	tell L <sup>A</sup> T <sub>E</sub> X to create a .glo file
$\glossary{entry}$	<code>\glossary{entry}</code>	create a glossary entry
$\glossaryentry{entry}{page\ no.}$	<code>\glossaryentry{entry}{page\ no.}</code>	entries in .glo file
$\input filename.glo$	<code>\input filename.glo</code>	read glossary file
User must define <code>\makeglossary</code> , e.g., $\newcommand{\glossaryentry}[2]{\#1, \text{page } \#2\par}$	<code>\newcommand{\glossaryentry}[2]{\#1, \text{page } \#2\par}</code>	

## Time and Date

$\today$	<code>\today</code>	current date
Use <code>\the</code> to display the following items		
$\day$ , $\month$ , $\year$ , $\time$	<code>\day</code> , <code>\month</code> , <code>\year</code> , <code>\time</code>	(minutes since midnight)

## Counters

`\newcounter{cnt}` create new counter named `cnt`  
`\newcounter{cnt}[cnt1]` reset `cnt` when `cnt1` changes  
`\setcounter{cnt}{value}` set value of `cnt`  
`\stepcounter{cnt}` increment `cnt`  
`\refstepcounter{cnt}` increment and reset `\label`  
`\addtocounter{cnt}{n}` increment by  $n$   
`\value{cnt}` value stored in `cnt`  
`\thecnt` the value of `cnt`  
`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)(\Delta x,\Delta y)...` with offset  
`\put(x,y){picture object}` place object  
`\multiput(x,y)(\Delta x,\Delta y){n}{object}`  $n$  times

### Picture Objects:

`\makebox(x,y)[tblr]{text}` box with text  
`\line(\Delta x,\Delta y){x length}` line of slope  $\Delta y/\Delta x$   
`\vector(\Delta x,\Delta y){x length}` arrow of slope  $\Delta y/\Delta x$   
`\circle{r}` circle of radius  $r$   
`\circle*{r}` filled circle  
`\oval(x,y)[lr tb]` oval (part or whole)  
`\shortstack{abc\backslash xyz\backslash}` 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{col1}{col2}{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}{cmk}{c,m,y,k}` define a CMYK color

### Predefined Colors

black, white, red, green, blue, yellow, cyan, magenta

## BIB<sub>TEX</sub>

### • BIB<sub>TEX</sub> File Suffixes

`.bib` BIB<sub>TEX</sub> bibliographic database file  
`.bst` BIB<sub>TEX</sub> bibliographic style file  
`.blg` BIB<sub>TEX</sub> log file  
`.bbl` BIB<sub>TEX</sub> document bibliography file

### • BIB<sub>TEX</sub> 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 BIB<sub>TEX</sub> 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

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

### • Creating Document Bibliography With BIB<sub>TEX</sub>

- (1) Typeset document to get new `.aux` file.
- (2) Run BIB<sub>TEX</sub> on `.aux` file to create `.bbl` file.
- (3) Retypeset document twice.

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