

# $\mathcal{M}\mathcal{S}$ - $\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$ 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
\byname 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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Math. Dept., Brown Univ., Providence, RI 02912 USA

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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 or \\\</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{\length}</code>	create length variable <code>\length</code>
<code>\setlength{\length}{dimen}</code>	set value of <code>\length</code>
<code>\addtolength{\length}{dimen}</code>	increase <code>\length</code>

### • Useful Length Assignments

<code>\enlargethispage{\baselineskip}</code>	force extra line
<code>\setlength{hangindent}{30pt}</code>	indentation
<code>\setlength{hangafter}{3}</code>	indent after
<code>\renewcommand{\baselinestretch}{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	$\text{¸}$	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}

```

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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Send comments and corrections to J.H. Silverman, Math. Dept., Brown Univ., Providence, RI 02912 USA. (jhs@math.brown.edu)

# $\mathcal{M}\mathcal{S}$ - $\mathcal{E}\mathcal{T}\mathcal{E}\mathcal{X}$ Reference Card #2

See the  $\mathcal{T}\mathcal{E}\mathcal{X}$  Reference Card for additional commands.  
The notation (package) indicates a required package.

## Math Environments

$\backslash(\dots\backslash)$  or  $\$...\$$  inline math  
 $\backslash[\dots\backslash]$  or  $\$...\$$  displayed math  
 $\backslashbegin{equation}\backslashlabel{eqname}...\backslashend{\dots}$   
numbered and labeled equation  
 $\backslashref{eqname}$  refer to labeled eqn  
 $\backslashmbox{\dots}$  text in math  
• The following require `amsmath`  
 $\backslashtext{\dots}$  text in math  
 $\backslashbegin{equation*}...\backslashend{\dots}$  unnumbered eqn  
 $\backslashtag{eqtag}$  use eqtag instead of number  
 $\backslashnotag$  suppress equation tag  
 $\backslasheqref{eqname}$  ref with parens  
 $\backslashbegin{subequations}...\backslashend{\dots}$   
group equations for numbering  
 $\backslashnumberwithin{equation}{section}$   
number equations within sections

## Theorems, Lemmas, Etc.

• **Defining Theorem-Like Environments**  
 $\backslashnewtheorem{name}{label}$  theorem environment  
 $\backslashnewtheorem*{name}{label}$  unnumbered (amsthm)  
 $\backslashnewtheorem{name}{other name}{label}$   
numbered consecutively with other environment  
 $\backslashnewtheorem{name}{label}[section]$   
numbered by section (or chapter, etc.)  
 $\backslashswapnumbers$  put numbers on left  
• **Theorem-Like Environment Styles (amsthm)**  
 $\backslashtheoremstyle{plain}$  most emphatic  
 $\backslashtheoremstyle{definition}$  medium emphasis  
 $\backslashtheoremstyle{remark}$  least emphatic  
• **Invoking Theorem-Like Environments**  
 $\backslashbegin{name}...\backslashend{\dots}$  invoke environment  
 $\backslashbegin{name}[label]...$  invoke with new label  
If proclamation starts with a list, put in  $\backslashhfill$   
 $\backslashbegin{proof}...\backslashend{\dots}$  proof environment  
 $\backslashbegin{proof}[label]...\backslashend{\dots}$  proof with label  
 $\backslashqedsymbol$  end of proof marker  
 $\backslashrenewcommand{\backslashqedsymbol}{\dots}$  redefine marker

## Commutative Diagrams (amscd)

Separate lines with  $\backslash\backslash$ , do not use  $\&s$   
 $\backslashbegin{CD}...\backslashend{CD}$  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  $\backslashbegin{command}...\backslashend{command}$   
Separate items with  $\&$ , separate lines with  $\backslash\backslash$   
No  $\backslash\backslash$  on last line,  $\backslash\backslash[dim]$  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  $\backslashbegin{alignat}{\#}$  of cols  
 $\backslashintertext{text}$  text between lines  
 $\backslashshoveleft,\backslashshoveright$  move multline line left, right  
 $\backslashallowdisplaybreaks$  allow page breaks ( $\backslash\backslash*$  prohibits)  
 $\backslashdisplaybreak$  force page break (before  $\backslash\backslash$ )  
• **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  $(\dots)$ ,  $[\dots]$ ,  $|\dots|$ ,  $\|\dots\|$   
 $\backslashsetcounter{MaxMatrixCols}{12}$   
increase number of matrix columns  
 $\backslashhdotsfor{num}$  dots across columns

## Overlines, Underlines, and Arrows

$\backslashunderline{\dots}$  underline  
 $\backslashoverline{\dots}$  overline  
 $\backslashoverbrace{\dots}^{\dots}$  overbrace  
 $\backslashunderbrace{\dots}_{\dots}$  underbrace  
 $\backslashoverrightarrow{\dots}$  over right arrow  
 $\backslashoverleftarrow{\dots}$  over left arrow  
 $\backslashoverleftrightarrow{\dots}$  over left-right arrow  
 $\backslashunderrightarrow{\dots}, \backslashunderleftarrow{\dots}$ , etc.  
 $\backslashxrightarrow[bot]{top}$  stretchable w/sub/supscripts  
 $\backslashxleftarrow[bot]{top}$  stretchable w/sub/supscripts

## Operator Names

$\backslasharccos$   $\backslashcos$   $\backslashcsc$   $\backslashexp$   $\backslashker$   $\backslashliminf$   $\backslashmin$   $\backslashsinh$   
 $\backslasharcsin$   $\backslashcosh$   $\backslashdeg$   $\backslashgcd$   $\backslashlg$   $\backslashlimsup$   $\backslashPr$   $\backslashsup$   
 $\backslasharctan$   $\backslashcot$   $\backslashdet$   $\backslashhom$   $\backslashlim$   $\backslashlog$   $\backslashsec$   $\backslashtan$   
 $\backslasharg$   $\backslashcoth$   $\backslashdim$   $\backslashinf$   $\backslashln$   $\backslashmax$   $\backslashsin$   $\backslashtanh$   
 $a \backslashequiv b \backslashpmod{m}$   $a \equiv b \pmod{m}$   
 $a \backslashequiv b \backslashmod{m}$   $a \equiv b \mod m$   
 $a \backslashbmod m$   $a \bmod m$   
 $\backslashDeclareMathOperator{\cmd}{opname}$  create operator  
 $\backslashDeclareMathOperator*{\cmd}{opname}$  with limits  
 $\backslashoperatorname{\dots}$  typeset as an operator  
 $\backslashoperatorname*{\dots}$  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>		
$\biggl $	<code>\biggl </code>	$\biggm $	<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
$\dotsc$ , $\dotscb$ , $\dotscm$ , $\dotscsi$	<code>\dotsc</code> , <code>\dotscb</code> , <code>\dotscm</code> , <code>\dotscsi</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

$\newenvironment{\name}{\text{pre}}{\text{post}}$	<code>\newenvironment{\name}{\text{pre}}{\text{post}}</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  
 $\index{\text{entry}}$  main entry  
 $\index{\text{entry}!\text{entry}}$  subentry  
 $\index{\text{entry}!\text{entry}!\text{entry}}$  subsubentry  
 $\index{\text{text@entry}}$  with placement info  
 $\index{\text{entry}|\text{see}{\text{entry}}}$  cross referenced entry  
 $\index{\text{entry}|\text{modifier}}$  entry with page modifier  
e.g.  $\index{\text{gnats}|\text{textbf}}$  give bold page number  
 $\index{\text{entry}|(\dots)\text{entry}|)}$  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 <code>.glo</code> file
$\glossary{\text{entry}}$	<code>\glossary{\text{entry}}</code>	create a glossary entry
$\glossaryentry{\text{entry}}{\text{page no.}}$	<code>\glossaryentry{\text{entry}}{\text{page no.}}</code>	entries in <code>.glo</code> file
$\input \text{filename.glo}$	<code>\input \text{filename.glo}</code>	read glossary file
User must define $\makeglossary$ , 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 $\the$ 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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Send comments and corrections to J.H. Silverman, Math. Dept., Brown Univ., Providence, RI 02912 USA. {jhs@math.brown.edu}