George Grätzer

Practical LaTeX

A

Text symbol tables

A.1   Some European characters

Name	Type	Typeset	Type	Typeset
a-ring	\aa	å	\AA	Å
aesc	\ae	æ	\AE	Æ
ethel	\oe	œ	\OE	Œ
eszett	\ss	ß	\SS	SS
inverted question mark	?`	¿		
inverted exclamation mark	!`	¡		
slashed L	\l	ł	\L	Ł
slashed O	\o	ø	\O	Ø

A.2   Text accents

Name	Type	Typeset	Name	Type	Typeset
acute	`\'{o}`	ó	macron	`\={o}`	ō
breve	`\u{o}`	ŏ	overdot	`\.{g}`	ġ
caron/haček	`\v{o}`	ǒ	ring	`\r{u}`	ů
cedilla	`\c{c}`	ç	tie	`\t{oo}`	o͡o
circumflex	`\^{o}`	ô	tilde	`\~{n}`	ñ
dieresis/umlaut	`\"{u}`	ü	underdot	`\d{m}`	ṃ
double acute	`\H{o}`	ő	underbar	`\b{o}`	o̲
grave	`` \`{o} ``	ò			
dotless i	`\i`	ı	dotless j	`\j`	ȷ
	`\'{\i}`	í		`\v{\j}`	ǰ

A.3   Text font commands

A.3.1   Text font family commands

Command with Argument	Command Declaration	Switches to the font family
`\textnormal{...}`	`{\normalfont ...}`	document
`\emph{...}`	`{\em ...}`	*emphasis*
`\textrm{...}`	`{\rmfamily ...}`	roman
`\textsf{...}`	`{\sffamily ...}`	sans serif
`\texttt{...}`	`{\ttfamily ...}`	`typewriter style`
`\textup{...}`	`{\upshape ...}`	upright shape
`\textit{...}`	`{\itshape ...}`	*italic shape*
`\textsl{...}`	`{\slshape ...}`	*slanted shape*
`\textsc{...}`	`{\scshape ...}`	SMALL CAPITALS
`\textbf{...}`	`{\bfseries ...}`	**bold**
`\textmd{...}`	`{\mdseries ...}`	normal weight and width

A.3.2   Text font size changes

Command	AMS sample text
\Tiny	sample text
\tiny	sample text
\SMALL or \scriptsize	sample text
\Small or \footnotesize	sample text
\small	sample text
\normalsize sample text	
\large	sample text
\Large	sample text
\LARGE	sample text
\huge	sample text
\Huge	sample text

A.3.3   Special characters

Name	Type	Typeset
Ampersand	\&	&
Caret	\^{}	^
Dollar Sign	\$	$
Left Brace	\{	{
Right Brace	\}	}
Underscore (or Lowline)	_	_
Octothorp	\#	#
Percent	\%	%
Tilde	\~{}	~

A.4 Additional text symbols

Name	Type	Typeset
ampersand	\&	&
asterisk bullet	\textasteriskcentered	∗
backslash	\textbackslash	\
bar (caesura)	\textbar	|
brace left	\{	{
brace right	\}	}
bullet	\textbullet	•
circled a	\textcircled{a}	ⓐ
circumflex	\textasciicircum	ˆ
copyright	\copyright	©
dagger	\dag	†
double dagger (diesis)	\ddag	‡
dollar	\$	$
double quotation left	\textquotedblleft or ``	"
double quotation right	\textquotedblright or ''	"
em dash	\textemdash or ---	—
en dash	\textendash or --	–
exclamation down	\textexclamdown or !`	¡
greater than	\textgreater	>
less than	\textless	<
lowline	_	_
midpoint	\textperiodcentered	·
octothorp	\#	#
percent	\%	%
pilcrow (paragraph)	\P	¶
question down	\textquestiondown or ?`	¿
registered trademark	\textregistered	®
section	\S	§

Additional text symbols, *continued*

Name	Type	Typeset
single quote left	`\textquoteleft` or `	'
single quote right	`\textquoteright` or '	'
sterling	`\pounds`	£
superscript	`\textsuperscript{a}`	a
tilde	`\textasciitilde`	~
trademark	`\texttrademark`	TM
visible space	`\textvisiblespace`	␣

B

Math symbol tables

B.1 Hebrew and Greek letters

Hebrew letters

Type	Typeset
\aleph	א
\beth	ב
\daleth	ד
\gimel	ג

Greek letters

Lowercase

Type	Typeset	Type	Typeset	Type	Typeset
\alpha	α	\iota	ι	\sigma	σ
\beta	β	\kappa	κ	\tau	τ
\gamma	γ	\lambda	λ	\upsilon	υ
\delta	δ	\mu	μ	\phi	ϕ
\epsilon	ϵ	\nu	ν	\chi	χ
\zeta	ζ	\xi	ξ	\psi	ψ
\eta	η	\pi	π	\omega	ω
\theta	θ	\rho	ρ		
\varepsilon	ε	\varpi	ϖ	\varsigma	ς
\vartheta	ϑ	\varrho	ϱ	\varphi	φ
	\digamma	$\digamma$	\varkappa	$\varkappa$	

Uppercase

Type	Typeset	Type	Typeset	Type	Typeset
\Gamma	Γ	\Xi	Ξ	\Phi	Φ
\Delta	Δ	\Pi	Π	\Psi	Ψ
\Theta	Θ	\Sigma	Σ	\Omega	Ω
\Lambda	Λ	\Upsilon	Υ		
\varGamma	$\varGamma$	\varXi	$\varXi$	\varPhi	$\varPhi$
\varDelta	$\varDelta$	\varPi	$\varPi$	\varPsi	$\varPsi$
\varTheta	$\varTheta$	\varSigma	$\varSigma$	\varOmega	$\varOmega$
\varLambda	$\varLambda$	\varUpsilon	$\varUpsilon$		

B.2   Binary relations

Type	Typeset	Type	Typeset
<	$<$	>	$>$
=	$=$	:	$:$
\in	$\in$	\ni or \owns	$\ni$
\leq or \le	$\leq$	\geq or \ge	$\geq$
\ll	$\ll$	\gg	$\gg$
\prec	$\prec$	\succ	$\succ$
\preceq	$\preceq$	\succeq	$\succeq$
\sim	$\sim$	\approx	$\approx$
\simeq	$\simeq$	\cong	$\cong$
\equiv	$\equiv$	\doteq	$\doteq$
\subset	$\subset$	\supset	$\supset$
\subseteq	$\subseteq$	\supseteq	$\supseteq$
\sqsubseteq	$\sqsubseteq$	\sqsupseteq	$\sqsupseteq$
\smile	$\smile$	\frown	$\frown$
\perp	$\perp$	\models	$\models$
\mid	$\mid$	\parallel	$\parallel$
\vdash	$\vdash$	\dashv	$\dashv$
\propto	$\propto$	\asymp	$\asymp$
\bowtie	$\bowtie$		
\sqsubset	$\sqsubset$	\sqsupset	$\sqsupset$
\Join	$\Join$		

Note the \colon command used in $f \colon x \to x^2$, typed as

```
f \colon x \to x^2
```

More binary relations

Type	Typeset	Type	Typeset
\leqq	≦	\geqq	≧
\leqslant	⩽	\geqslant	⩾
\eqslantless	⪕	\eqslantgtr	⪖
\lesssim	≲	\gtrsim	≳
\lessapprox	⪅	\gtrapprox	⪆
\approxeq	≊		
\lessdot	⋖	\gtrdot	⋗
\lll	⋘	\ggg	⋙
\lessgtr	≶	\gtrless	≷
\lesseqgtr	⋚	\gtreqless	⋛
\lesseqqgtr	⪋	\gtreqqless	⪌
\doteqdot	≑	\eqcirc	≖
\circeq	≗	\triangleq	≜
\risingdotseq	≓	\fallingdotseq	≒
\backsim	∽	\thicksim	∼
\backsimeq	⋍	\thickapprox	≈
\preccurlyeq	≼	\succcurlyeq	≽
\curlyeqprec	⋞	\curlyeqsucc	⋟
\precsim	≾	\succsim	≿
\precapprox	⪷	\succapprox	⪸
\subseteqq	⊆	\supseteqq	⊇
\Subset	⋐	\Supset	⋑
\vartriangleleft	◁	\vartriangleright	▷
\trianglelefteq	⊴	\trianglerighteq	⊵
\vDash	⊨	\Vdash	⊩
\Vvdash	⊪		
\smallsmile	⌣	\smallfrown	⌢
\shortmid	∣	\shortparallel	∥
\bumpeq	≏	\Bumpeq	≎
\between	≬	\pitchfork	⋔
\varpropto	∝	\backepsilon	϶
\blacktriangleleft	◀	\blacktriangleright	▶
\therefore	∴	\because	∵

Negated binary relations

Type	Typeset	Type	Typeset
\neq or \ne	$\neq$	\notin	$\notin$
\nless	$\nless$	\ngtr	$\ngtr$
\nleq	$\nleq$	\ngeq	$\ngeq$
\nleqslant	$\nleqslant$	\ngeqslant	$\ngeqslant$
\nleqq	$\nleqq$	\ngeqq	$\ngeqq$
\lneq	$\lneq$	\gneq	$\gneq$
\lneqq	$\lneqq$	\gneqq	$\gneqq$
\lvertneqq	$\lvertneqq$	\gvertneqq	$\gvertneqq$
\lnsim	$\lnsim$	\gnsim	$\gnsim$
\lnapprox	$\lnapprox$	\gnapprox	$\gnapprox$
\nprec	$\nprec$	\nsucc	$\nsucc$
\npreceq	$\npreceq$	\nsucceq	$\nsucceq$
\precneqq	$\precneqq$	\succneqq	$\succneqq$
\precnsim	$\precnsim$	\succnsim	$\succnsim$
\precnapprox	$\precnapprox$	\succnapprox	$\succnapprox$
\nsim	$\nsim$	\ncong	$\ncong$
\nshortmid	$\nshortmid$	\nshortparallel	$\nshortparallel$
\nmid	$\nmid$	\nparallel	$\nparallel$
\nvdash	$\nvdash$	\nvDash	$\nvDash$
\nVdash	$\nVdash$	\nVDash	$\nVDash$
\ntriangleleft	$\ntriangleleft$	\ntriangleright	$\ntriangleright$
\ntrianglelefteq	$\ntrianglelefteq$	\ntrianglerighteq	$\ntrianglerighteq$
\nsubseteq	$\nsubseteq$	\nsupseteq	$\nsupseteq$
\nsubseteqq	$\nsubseteqq$	\nsupseteqq	$\nsupseteqq$
\subsetneq	$\subsetneq$	\supsetneq	$\supsetneq$
\varsubsetneq	$\varsubsetneq$	\varsupsetneq	$\varsupsetneq$
\subsetneqq	$\subsetneqq$	\supsetneqq	$\supsetneqq$
\varsubsetneqq	$\varsubsetneqq$	\varsupsetneqq	$\varsupsetneqq$

B.3   Binary operations

Type	Typeset	Type	Typeset
+	$+$	-	$-$
\pm	$\pm$	\mp	$\mp$
\times	$\times$	\cdot	$\cdot$
\circ	$\circ$	\bigcirc	$\bigcirc$
\div	$\div$	\bmod	mod
\cap	$\cap$	\cup	$\cup$
\sqcap	$\sqcap$	\sqcup	$\sqcup$
\wedge or \land	$\wedge$	\vee or \lor	$\vee$
\triangleleft	$\triangleleft$	\triangleright	$\triangleright$
\bigtriangleup	$\bigtriangleup$	\bigtriangledown	$\bigtriangledown$
\oplus	$\oplus$	\ominus	$\ominus$
\otimes	$\otimes$	\oslash	$\oslash$
\odot	$\odot$	\bullet	$\bullet$
\dagger	$\dagger$	\ddagger	$\ddagger$
\setminus	$\setminus$	\smallsetminus	$\smallsetminus$
\wr	$\wr$	\amalg	$\amalg$
\ast	$\ast$	\star	$\star$
\diamond	$\diamond$		
\lhd	$\lhd$	\rhd	$\rhd$
\unlhd	$\unlhd$	\unrhd	$\unrhd$
\dotplus	$\dotplus$	\centerdot	$\centerdot$
\ltimes	$\ltimes$	\rtimes	$\rtimes$
\leftthreetimes	$\leftthreetimes$	\rightthreetimes	$\rightthreetimes$
\circleddash	$\circleddash$	\uplus	$\uplus$
\barwedge	$\barwedge$	\doublebarwedge	$\doublebarwedge$
\curlywedge	$\curlywedge$	\curlyvee	$\curlyvee$
\veebar	$\veebar$	\intercal	$\intercal$
\doublecap or \Cap	$\Cap$	\doublecup or \Cup	$\Cup$
\circledast	$\circledast$	\circledcirc	$\circledcirc$
\boxminus	$\boxminus$	\boxtimes	$\boxtimes$
\boxdot	$\boxdot$	\boxplus	$\boxplus$
\divideontimes	$\divideontimes$	\vartriangle	$\vartriangle$
\And	$\&$		

B.4   Arrows

Type	Typeset	Type	Typeset
`\leftarrow`	←	`\rightarrow` or `\to`	→
`\longleftarrow`	⟵	`\longrightarrow`	⟶
`\Leftarrow`	⇐	`\Rightarrow`	⇒
`\Longleftarrow`	⟸	`\Longrightarrow`	⟹
`\leftrightarrow`	↔	`\longleftrightarrow`	⟷
`\Leftrightarrow`	⇔	`\Longleftrightarrow`	⟺
`\uparrow`	↑	`\downarrow`	↓
`\Uparrow`	⇑	`\Downarrow`	⇓
`\updownarrow`	↕	`\Updownarrow`	⇕
`\nearrow`	↗	`\searrow`	↘
`\swarrow`	↙	`\nwarrow`	↖
`\iff`	⟺	`\mapstochar`	↦
`\mapsto`	↦	`\longmapsto`	⟼
`\hookleftarrow`	↩	`\hookrightarrow`	↪
`\leftharpoonup`	↼	`\rightharpoonup`	⇀
`\leftharpoondown`	↽	`\rightharpoondown`	⇁
`\leadsto`	⇝		
`\leftleftarrows`	⇇	`\rightrightarrows`	⇉
`\leftrightarrows`	⇆	`\rightleftarrows`	⇄
`\Lleftarrow`	⇚	`\Rrightarrow`	⇛
`\twoheadleftarrow`	↞	`\twoheadrightarrow`	↠
`\leftarrowtail`	↢	`\rightarrowtail`	↣
`\looparrowleft`	↫	`\looparrowright`	↬
`\upuparrows`	⇈	`\downdownarrows`	⇊
`\upharpoonleft`	↿	`\upharpoonright`	↾
`\downharpoonleft`	⇃	`\downharpoonright`	⇂
`\leftrightsquigarrow`	↭	`\rightsquigarrow`	⇝
`\multimap`	⊸		
`\nleftarrow`	↚	`\nrightarrow`	↛
`\nLeftarrow`	⇍	`\nRightarrow`	⇏
`\nleftrightarrow`	↮	`\nLeftrightarrow`	⇎
`\dashleftarrow`	⇠	`\dashrightarrow`	⇢
`\curvearrowleft`	↶	`\curvearrowright`	↷
`\circlearrowleft`	↺	`\circlearrowright`	↻
`\leftrightharpoons`	⇋	`\rightleftharpoons`	⇌
`\Lsh`	↰	`\Rsh`	↱

B.5   *Miscellaneous symbols*

Type	Typeset	Type	Typeset
\hbar	$\hbar$	\ell	ℓ
\imath	$\imath$	\jmath	$\jmath$
\wp	$\wp$	\partial	∂
\Im	$\Im$	\Re	$\Re$
\infty	∞	\prime	$\prime$
\emptyset	$\emptyset$	\varnothing	$\varnothing$
\forall	$\forall$	\exists	$\exists$
\smallint	$\smallint$	\triangle	$\triangle$
\top	$\top$	\bot	$\bot$
\P	¶	\S	§
\dag	†	\ddag	‡
\flat	$\flat$	\natural	$\natural$
\sharp	$\sharp$	\angle	$\angle$
\clubsuit	$\clubsuit$	\diamondsuit	$\diamondsuit$
\heartsuit	$\heartsuit$	\spadesuit	$\spadesuit$
\surd	$\surd$	\nabla	∇
\pounds	$\pounds$	\neg or \lnot	$\neg$
\Box	$\Box$	\Diamond	$\Diamond$
\mho	$\mho$		
\hslash	$\hslash$	\complement	$\complement$
\backprime	$\backprime$	\nexists	$\nexists$
\Bbbk	$\Bbbk$		
\diagup	$\diagup$	\diagdown	$\diagdown$
\blacktriangle	▲	\blacktriangledown	▼
\triangledown	$\triangledown$	\eth	$\eth$
\square	$\square$	\blacksquare	■
\lozenge	$\lozenge$	\blacklozenge	◆
\measuredangle	$\measuredangle$	\sphericalangle	$\sphericalangle$
\circledS	Ⓢ	\bigstar	★
\Finv	$\Finv$	\Game	$\Game$

B.6   Delimiters

Name	Type	Typeset
left parenthesis	(	(
right parenthesis	)	)
left bracket	[or \lbrack	[
right bracket	] or \rbrack	]
left brace	\{ or \lbrace	{
right brace	\} or \rbrace	}
backslash	\backslash	\
forward slash	/	/
left angle bracket	\langle	⟨
right angle bracket	\rangle	⟩
vertical line	| or \vert	|
double vertical line	\\| or \Vert	‖
left floor	\lfloor	⌊
right floor	\rfloor	⌋
left ceiling	\lceil	⌈
right ceiling	\rceil	⌉
upward	\uparrow	↑
double upward	\Uparrow	⇑
downward	\downarrow	↓
double downward	\Downarrow	⇓
up-and-down	\updownarrow	↕
double up-and-down	\Updownarrow	⇕
upper-left corner	\ulcorner	⌜
upper-right corner	\urcorner	⌝
lower-left corner	\llcorner	⌞
lower-right corner	\lrcorner	⌟

B.7   Operators

"Pure" operators, with no limits

Type	Typeset	Type	Typeset	Type	Typeset	Type	Typeset
\arccos	arccos	\cot	cot	\hom	hom	\sin	sin
\arcsin	arcsin	\coth	coth	\ker	ker	\sinh	sinh
\arctan	arctan	\csc	csc	\lg	lg	\tan	tan
\arg	arg	\deg	deg	\ln	ln	\tanh	tanh
\cos	cos	\dim	dim	\log	log		
\cosh	cosh	\exp	exp	\sec	sec		

Operators with limits

Type	Typeset	Type	Typeset
\det	det	\limsup	lim sup
\gcd	gcd	\max	max
\inf	inf	\min	min
\lim	lim	\Pr	Pr
\liminf	lim inf	\sup	sup
\injlim	inj lim	\projlim	proj lim
\varliminf	$\varliminf$	\varlimsup	$\varlimsup$
\varinjlim	$\varinjlim$	\varprojlim	$\varprojlim$

B.7.1   Large operators

Type	Inline	Displayed
`\int_{a}^{b}`	$\int_a^b$	$\displaystyle\int_a^b$
`\oint_{a}^{b}`	$\oint_a^b$	$\displaystyle\oint_a^b$
`\iint_{a}^{b}`	$\iint_a^b$	$\displaystyle\iint_a^b$
`\iiint_{a}^{b}`	$\iiint_a^b$	$\displaystyle\iiint_a^b$
`\iiiint_{a}^{b}`	$\iiiint_a^b$	$\displaystyle\iiiint_a^b$
`\idotsint_{a}^{b}`	$\int\cdots\int_a^b$	$\displaystyle\int\cdots\int_a^b$
`\prod_{i=1}^{n}`	$\prod_{i=1}^n$	$\displaystyle\prod_{i=1}^n$
`\coprod_{i=1}^{n}`	$\coprod_{i=1}^n$	$\displaystyle\coprod_{i=1}^n$
`\bigcap_{i=1}^{n}`	$\bigcap_{i=1}^n$	$\displaystyle\bigcap_{i=1}^n$
`\bigcup_{i=1}^{n}`	$\bigcup_{i=1}^n$	$\displaystyle\bigcup_{i=1}^n$
`\bigwedge_{i=1}^{n}`	$\bigwedge_{i=1}^n$	$\displaystyle\bigwedge_{i=1}^n$
`\bigvee_{i=1}^{n}`	$\bigvee_{i=1}^n$	$\displaystyle\bigvee_{i=1}^n$
`\bigsqcup_{i=1}^{n}`	$\bigsqcup_{i=1}^n$	$\displaystyle\bigsqcup_{i=1}^n$
`\biguplus_{i=1}^{n}`	$\biguplus_{i=1}^n$	$\displaystyle\biguplus_{i=1}^n$
`\bigotimes_{i=1}^{n}`	$\bigotimes_{i=1}^n$	$\displaystyle\bigotimes_{i=1}^n$
`\bigoplus_{i=1}^{n}`	$\bigoplus_{i=1}^n$	$\displaystyle\bigoplus_{i=1}^n$
`\bigodot_{i=1}^{n}`	$\bigodot_{i=1}^n$	$\displaystyle\bigodot_{i=1}^n$
`\sum_{i=1}^{n}`	$\sum_{i=1}^n$	$\displaystyle\sum_{i=1}^n$

B.8   Math accents and fonts

Math accents

		amsxtra	
Type	Typeset	Type	Typeset
\acute{a}	á		
\bar{a}	ā		
\breve{a}	ă	\spbreve	˘
\check{a}	ǎ	\spcheck	∨
\dot{a}	ȧ	\spdot	˙
\ddot{a}	ä	\spddot	¨
\dddot{a}	⃛a	\spdddot	⃛
\ddddot{a}	⃜a		
\grave{a}	à		
\hat{a}	â		
\widehat{a}	â	\sphat	⌢
\mathring{a}	å		
\tilde{a}	ã		
\widetilde{a}	ã	\sptilde	~
\vec{a}	a⃗		

Math fonts

Type	Typeset
LATEX	
\mathbf{A}	**A**
\mathcal{A}	𝒜
\mathit{A}	*A*
\mathnormal{A}	*A*
\mathrm{A}	A
\mathsf{A}	A
\mathtt{A}	A
\boldsymbol{\alpha}	**α**
\mathbb{A}	𝔸
\mathfrak{A}	𝔄
\mathscr{a}	𝒜

\mathscr requires the eucal package with the mathscr option

B.9   Math spacing commands

Name	Width	Short	Long
1 mu (math unit)	ı	\mspace{1mu}	
thinspace	ıı	\,	\thinspace
medspace	ıı	\:	\medspace
thickspace	ıı	\;	\thickspace
interword space	ıı	\␣	
1 em	∟⌐		\quad
2 em	∟⌐		\qquad
Negative space			
1 mu	ı		\mspace{-1mu}
thinspace	ıı	\!	\negthinspace
medspace	ıı		\negmedspace
thickspace	ıı		\negthickspace