APPENDIX

A

Math symbol tables

References to AMS sources are marked by Ⓐ.

A.1 Hebrew and Greek letters

A.1.1 Hebrew letters

Source	Type	Typeset
LaTeX		
	`\aleph`	ℵ
amssymbⒶ		
	`\beth`	ℶ
	`\daleth`	ℸ
	`\gimel`	ℷ

A.1.2 Greek letters

Lowercase

Source	Type	Typeset	Type	Typeset	Type	Typeset
LaTeX						
	`\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		
LaTeX variants						
	`\varepsilon`	ε	`\varpi`	ϖ	`\varsigma`	ς
	`\vartheta`	ϑ	`\varrho`	ϱ	`\varphi`	φ
amssymb Ⓐ						
	`\digamma`	$\digamma$	`\varkappa`	$\varkappa$		

Uppercase

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

A.2 Binary relations

A.2.1 LaTeX binary relations

Source	Type	Typeset	Type	Typeset
LaTeX				
	`<`	$<$	`>`	$>$
	`=`	$=$	`:`	$:$
	`\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`	$\bowtie$		
latexsym				
	`\sqsubset`	$\sqsubset$	`\sqsupset`	$\sqsupset$
	`\Join`	$\Join$		

A.2.2 AMS binary relations

Source	Type	Typeset	Type	Typeset
amssymb Ⓐ				
	`\leqq`	$\leqq$	`\geqq`	$\geqq$
	`\leqslant`	$\leqslant$	`\geqslant`	$\geqslant$
	`\eqslantless`	$\eqslantless$	`\eqslantgtr`	$\eqslantgtr$
	`\lesssim`	$\lesssim$	`\gtrsim`	$\gtrsim$
	`\lessapprox`	$\lessapprox$	`\gtrapprox`	$\gtrapprox$
	`\approxeq`	$\approx$		
	`\lessdot`	$\lessdot$	`\gtrdot`	$\gtrdot$
	`\lll`	$\lll$	`\ggg`	$\ggg$
	`\lessgtr`	$\lessgtr$	`\gtrless`	$\gtrless$
	`\lesseqgtr`	$\lesseqgtr$	`\gtreqless`	$\gtreqless$
	`\lesseqgtr`	$\lesseqgtr$	`\gtreqless`	$\gtreqless$
	`\doteqdot`	$\doteqdot$	`\eqcirc`	$\eqcirc$
	`\circeq`	$\circeq$	`\triangleq`	$\triangleq$
	`\risingdotseq`	$\risingdotseq$	`\fallingdotseq`	$\fallingdotseq$
	`\backsim`	$\backsim$	`\thicksim`	$\thicksim$
	`\backsimeq`	$\backsimeq$	`\thickapprox`	$\thickapprox$
	`\preccurlyeq`	$\preccurlyeq$	`\succcurlyeq`	$\succcurlyeq$
	`\curlyeqprec`	$\curlyeqprec$	`\curlyeqsucc`	$\curlyeqsucc$
	`\precsim`	$\precsim$	`\succsim`	$\succsim$
	`\precapprox`	$\precapprox$	`\succapprox`	$\succapprox$
	`\subseteqq`	$\subseteqq$	`\supseteqq`	$\supseteqq$
	`\Subset`	$\Subset$	`\Supset`	$\Supset$
	`\vartriangleleft`	$\vartriangleleft$	`\vartriangleright`	$\vartriangleright$
	`\trianglelefteq`	$\trianglelefteq$	`\trianglerighteq`	$\trianglerighteq$
	`\vDash`	$\vDash$	`\Vdash`	$\Vdash$
	`\Vvdash`	$\Vvdash$		
	`\smallsmile`	$\smallsmile$	`\smallfrown`	$\smallfrown$
	`\shortmid`	$\shortmid$	`\shortparallel`	$\shortparallel$
	`\bumpeq`	$\bumpeq$	`\Bumpeq`	$\Bumpeq$
	`\between`	$\between$	`\pitchfork`	$\pitchfork$
	`\varpropto`	$\varpropto$	`\backepsilon`	$\backepsilon$
	`\blacktriangleleft`	$\blacktriangleleft$	`\blacktriangleright`	$\blacktriangleright$
	`\therefore`	$\therefore$	`\because`	$\because$

A.2.3 Negated binary relations

Source	Type	Typeset	Type	Typeset
LaTeX				
	`\neq` or `\ne`	$\neq$	`\notin`	$\notin$
amssymb Ⓐ				
	`\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`	$\varsupsetneqq$

A.3 Binary operations

Source	Type	Typeset	Type	Typeset
LaTeX				
	`+`	$+$	`-`	$-$
	`\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`	$\setminus$	`\uplus`	$\uplus$
	`\wr`	$\wr$	`\amalg`	$\amalg$
	`\ast`	$\ast$	`\star`	$\star$
	`\diamond`	$\diamond$		
latexsym				
	`\lhd`	$\lhd$	`\rhd`	$\rhd$
	`\unlhd`	$\unlhd$	`\unrhd`	$\unrhd$
amssymb(A)				
	`\dotplus`	$\dotplus$	`\centerdot`	$\centerdot$
	`\ltimes`	$\ltimes$	`\rtimes`	$\rtimes$
	`\leftthreetimes`	$\leftthreetimes$	`\rightthreetimes`	$\rightthreetimes$
	`\circleddash`	$\circleddash$	`\smallsetminus`	$\smallsetminus$
	`\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`	$\vartriangle$
amsmath(A)				
	`\And`	$\&$		

A.4 Arrows

A.4.1 LaTeX arrows

Source	Type	Typeset	Type	Typeset
LaTeX				
	`\leftarrow`	$\leftarrow$	`\rightarrow` or `\to`	$\rightarrow$
	`\longleftarrow`	$\longleftarrow$	`\longrightarrow`	$\longrightarrow$
	`\Leftarrow`	$\Leftarrow$	`\Rightarrow`	$\Rightarrow$
	`\Longleftarrow`	$\Longleftarrow$	`\Longrightarrow`	$\Longrightarrow$
	`\leftrightarrow`	$\leftrightarrow$	`\longleftrightarrow`	$\longleftrightarrow$
	`\Leftrightarrow`	$\Leftrightarrow$	`\Longleftrightarrow`	$\Longleftrightarrow$
	`\uparrow`	$\uparrow$	`\downarrow`	$\downarrow$
	`\Uparrow`	$\Uparrow$	`\Downarrow`	$\Downarrow$
	`\updownarrow`	$\updownarrow$	`\Updownarrow`	$\Updownarrow$
	`\nearrow`	$\nearrow$	`\searrow`	$\searrow$
	`\swarrow`	$\swarrow$	`\nwarrow`	$\nwarrow$
	`\iff`	$\iff$	`\mapstochar`	$\mapsto$
	`\mapsto`	$\mapsto$	`\longmapsto`	$\longmapsto$
	`\hookleftarrow`	$\hookleftarrow$	`\hookrightarrow`	$\hookrightarrow$
	`\leftharpoonup`	$\leftharpoonup$	`\rightharpoonup`	$\rightharpoonup$
	`\leftharpoondown`	$\leftharpoondown$	`\rightharpoondown`	$\rightharpoondown$
latexsym				
	`\leadsto`	$\leadsto$		

A.4.2 AMS arrows

Source	Type	Typeset	Type	Typeset
amssymb Ⓐ				
	`\leftleftarrows`	$\leftleftarrows$	`\rightrightarrows`	$\rightrightarrows$
	`\leftrightarrows`	$\leftrightarrows$	`\rightleftarrows`	$\rightleftarrows$
	`\Lleftarrow`	$\Lleftarrow$	`\Rrightarrow`	$\Rrightarrow$
	`\twoheadleftarrow`	$\twoheadleftarrow$	`\twoheadrightarrow`	$\twoheadrightarrow$
	`\leftarrowtail`	$\leftarrowtail$	`\rightarrowtail`	$\rightarrowtail$
	`\looparrowleft`	$\looparrowleft$	`\looparrowright`	$\looparrowright$
	`\upuparrows`	$\upuparrows$	`\downdownarrows`	$\downdownarrows$
	`\upharpoonleft`	$\upharpoonleft$	`\upharpoonright`	$\upharpoonright$
	`\downharpoonleft`	$\downharpoonleft$	`\downharpoonright`	$\downharpoonright$
	`\leftrightsquigarrow`	$\leftrightsquigarrow$	`\rightsquigarrow`	$\rightsquigarrow$
	`\multimap`	$\multimap$		
	`\nleftarrow`	$\nleftarrow$	`\nrightarrow`	$\nrightarrow$
	`\nLeftarrow`	$\nLeftarrow$	`\nRightarrow`	$\nRightarrow$
	`\nleftrightarrow`	$\nleftrightarrow$	`\nLeftrightarrow`	$\nLeftrightarrow$
	`\dashleftarrow`	$\dashleftarrow$	`\dashrightarrow`	$\dashrightarrow$
	`\curvearrowleft`	$\curvearrowleft$	`\curvearrowright`	$\curvearrowright$
	`\circlearrowleft`	$\circlearrowleft$	`\circlearrowright`	$\circlearrowright$
	`\leftrightharpoons`	$\leftrightharpoons$	`\rightleftharpoons`	$\rightleftharpoons$
	`\Lsh`	$\Lsh$	`\Rsh`	$\Rsh$

A.5 Miscellaneous symbols

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

A.6 Delimiters

Source	Name	Type	Typeset
LaTeX			
	left parenthesis	`(`	$($
	right parenthesis	`)`	$)$
	left bracket	`[` or `\lbrack`	$[$
	right bracket	`]` or `\rbrack`	$]$
	left brace	`\{` or `\lbrace`	$\{$
	right brace	`\}` or `\rbrace`	$\}$
	backslash	`\backslash`	$\backslash$
	forward slash	`/`	$/$
	left angle bracket	`\langle`	$\langle$
	right angle bracket	`\rangle`	$\rangle$
	vertical line	`|` or `\vert`	$\vert$
	double vertical line	`\\|` or `\Vert`	$\Vert$
	left floor	`\lfloor`	$\lfloor$
	right floor	`\rfloor`	$\rfloor$
	left ceiling	`\lceil`	$\lceil$
	right ceiling	`\rceil`	$\rceil$
	upward	`\uparrow`	$\uparrow$
	double upward	`\Uparrow`	$\Uparrow$
	downward	`\downarrow`	$\downarrow$
	double downward	`\Downarrow`	$\Downarrow$
	up-and-down	`\updownarrow`	$\updownarrow$
	double up-and-down	`\Updownarrow`	$\Updownarrow$
amsmath Ⓐ			
	upper-left corner	`\ulcorner`	$\ulcorner$
	upper-right corner	`\urcorner`	$\urcorner$
	lower-left corner	`\llcorner`	$\llcorner$
	lower-right corner	`\lrcorner`	$\lrcorner$

A.7 Operators

A.7.1 "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		

A.7.2 Operators with limits

Source	Type	Typeset	Type	Typeset
LaTeX				
	`\det`	det	`\limsup`	lim sup
	`\gcd`	gcd	`\max`	max
	`\inf`	inf	`\min`	min
	`\lim`	lim	`\Pr`	Pr
	`\liminf`	lim inf	`\sup`	sup
amsmath Ⓐ				
	`\injlim`	inj lim	`\projlim`	proj lim
	`\varliminf`	$\underline{\lim}$	`\varlimsup`	$\overline{\lim}$
	`\varinjlim`	$\varinjlim$	`\varprojlim`	$\varprojlim$

A.7.3 Large operators

Type	Inline	Displayed
`\int_{a}^{b}`	$\int_a^b$	$\int_a^b$
`\oint_{a}^{b}`	$\oint_a^b$	$\oint_a^b$
`\prod_{i=1}^{n}`	$\prod_{i=1}^n$	$\prod_{i=1}^n$
`\coprod_{i=1}^{n}`	$\coprod_{i=1}^n$	$\coprod_{i=1}^n$
`\bigcap_{i=1}^{n}`	$\bigcap_{i=1}^n$	$\bigcap_{i=1}^n$
`\bigcup_{i=1}^{n}`	$\bigcup_{i=1}^n$	$\bigcup_{i=1}^n$
`\bigwedge_{i=1}^{n}`	$\bigwedge_{i=1}^n$	$\bigwedge_{i=1}^n$
`\bigvee_{i=1}^{n}`	$\bigvee_{i=1}^n$	$\bigvee_{i=1}^n$
`\bigsqcup_{i=1}^{n}`	$\bigsqcup_{i=1}^n$	$\bigsqcup_{i=1}^n$
`\biguplus_{i=1}^{n}`	$\biguplus_{i=1}^n$	$\biguplus_{i=1}^n$
`\bigotimes_{i=1}^{n}`	$\bigotimes_{i=1}^n$	$\bigotimes_{i=1}^n$
`\bigoplus_{i=1}^{n}`	$\bigoplus_{i=1}^n$	$\bigoplus_{i=1}^n$
`\bigodot_{i=1}^{n}`	$\bigodot_{i=1}^n$	$\bigodot_{i=1}^n$
`\sum_{i=1}^{n}`	$\sum_{i=1}^n$	$\sum_{i=1}^n$

A.8 Math accents and fonts

A.8.1 Math accents

LaTeX		amsmath Ⓐ		amsxtra Ⓐ	
Type	Typeset	Type	Typeset	Type	Typeset
`\acute{a}`	$\acute{a}$				
`\bar{a}`	$\bar{a}$				
`\breve{a}`	$\breve{a}$			`\spbreve`	$\breve{}$
`\check{a}`	$\check{a}$			`\spcheck`	$\check{}$
`\dot{a}`	$\dot{a}$			`\spdot`	$\dot{}$
`\ddot{a}`	$\ddot{a}$			`\spddot`	$\ddot{}$
		`\dddot{a}`	$\dddot{a}$	`\spdddot`	$\dddot{}$
		`\ddddot{a}`	$\ddddot{a}$		
`\grave{a}`	$\grave{a}$				
`\hat{a}`	$\hat{a}$				
`\widehat{a}`	$\widehat{a}$			`\sphat`	$\widehat{}$
`\mathring{a}`	$\mathring{a}$				
`\tilde{a}`	$\tilde{a}$				
`\widetilde{a}`	$\widetilde{a}$			`\sptilde`	$\widetilde{}$
`\vec{a}`	$\vec{a}$				

A.8.2 Math fonts

Source	Type	Typeset
LaTeX		
	`\mathbf{A}`	$\mathbf{A}$
	`\mathcal{A}`	$\mathcal{A}$
	`\mathit{A}`	A
	`\mathnormal{A}`	$\mathnormal{A}$
	`\mathrm{A}`	A
	`\mathsf{A}`	A
	`\mathtt{A}`	$\mathtt{A}$
amsmath Ⓐ		
	`\boldsymbol{\alpha}`	$\boldsymbol{\alpha}$
amssymb Ⓐ		
	`\mathbb{A}`	$\mathbb{A}$
	`\mathfrak{A}`	$\mathfrak{A}$
eucal Ⓐ (with `mathscr` option)		
	`\mathscr{a}`	$\mathscr{A}$

A.9 Math spacing commands

		LaTeX		amsmath Ⓐ	
Name	Width	Short	Long	Short	Long
Positive space					
1 mu (math unit)	ı				`\mspace{1mu}`
thinspace	⊔	`\,`	`\thinspace`		
medspace	⊔	`\:`			`\medspace`
thickspace	⊔	`\;`			`\thickspace`
1 em	⌴		`\quad`		
2 em	⌴⌴		`\qquad`		
Negative space					
1 mu	ı				`\mspace{-1mu}`
thinspace	⊔	`\!`	`\negthinspace`		
medspace	⊔				`\negmedspace`
thickspace	⊔				`\negthickspace`

APPENDIX

B

Text symbol tables

B.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

B.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}`	o̱
grave	`\`{o}`	ò			
dotless i	`\i`	ı	dotless j	`\j`	ȷ
	`\'{\i}`	í		`\v{\j}`	ǰ

B.3 Text font commands

B.3.1 Text font family commands

Command with Argument	Command Declaration	Switches to
`\textnormal{...}`	`{\normalfont ...}`	document font family
`\emph{...}`	`{\em ...}`	*emphasis*
`\textrm{...}`	`{\rmfamily ...}`	roman font family
`\textsf{...}`	`{\sffamily ...}`	sans-serif font family
`\texttt{...}`	`{\ttfamily ...}`	`typewriter-style font family`
`\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

B.3.2 Text font size changes (LaTeX and AMS)

Command	LaTeX sample text	AMS sample text Ⓐ
`\Tiny`	[not available]	sample text
`\tiny`	sample text	sample text
`\SMALL` or `\scriptsize`	sample text	sample text
`\Small` or `\footnotesize`	sample text	sample text
`\small`	sample text	sample text
`\normalsize`	sample text	sample text
`\large`	sample text	sample text
`\Large`	sample text	sample text
`\LARGE`	sample text	sample text
`\huge`	sample text	sample text
`\Huge`	sample text	sample text

B.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`	™
visible space	`\textvisiblespace`	␣

B.5 Additional text symbols with T1 encoding

B.5.1 Accents

Name	Type	Typeset
ogonek	`\k{e}`	ę

B.5.2 European characters

Name	Type	Typeset	Type	Typeset
eth	`\dh`	ð	`\DH`	Ð
dyet	`\dj`	đ	`\DJ`	Đ
eng	`\ng`	ŋ	`\NG`	Ŋ
thor n	`\th`	þ	`\TH`	Þ

B.5.3 Quotation marks

Name	Type	Typeset	Type	Typeset
single guillemet	`\guilsinglleft`	‹	`\guilsinglright`	›
double guillemet	`\guillemotleft`	«	`\guillemotright`	»
single quotation	`\quotesinglbase`	‚	`\textquoteright`	’
double quotation	`\quotedblbase`	„	`\textquotedbl`	"

B.6 Text spacing commands

		LaTeX		amsmath Ⓐ	
Name	Width	Short	Long	Short	Long
Positive Space					
Normal	varies	␣			
Intersentence	varies	`\@.`␣			
Interword	varies	`\`␣			
Italic Corr.	varies	`\/`␣			
Tie	varies	`~`			
Thinspace	␣	`\,`	`\thinspace`		
Medspace	␣			`\:`	`\medspace`
Thickspace	␣			`\;`	`\thickspace`
1 em	␣		`\quad`		
2 em	␣		`\qquad`		
Negative Space					
Thinspace	␣			`\!`	`\negthinspace`
Medspace	␣				`\negmedspace`
Thickspace	␣				`\negthickspace`

APPENDIX

C

Background

While you do not need to know anything about LaTeX's structure and history to use it, such knowledge may help you understand how and why LaTeX works the way it does.

C.1 A short history

Donald E. Knuth's multivolume work, *The Art of Computer Programming* [33], caused its author a great deal of frustration because it was very difficult to keep the volumes typographically uniform. To solve this problem, Knuth decided to create his own typesetting language; the result is described in *The TeXbook* [34].[1]

A mathematical typesetting language takes care of the multitude of details that are so important in mathematical typesetting, including

- Spacing formulas properly
- Breaking text into pleasingly typeset lines and paragraphs
- Hyphenating words where necessary
- Providing hundreds of symbols for typesetting mathematics

[1] In Software Practice and Experience **19** (1989), 607–685, Knuth writes that "[I] realized that a central aspect of printing has been reduced to bit manipulation. As a computer scientist, I could not resist the challenge of improving print quality by manipulating bits better."

TEX does all this and more on almost any computer: PC, Macintosh, Atari, Amiga, UNIX, workstation, minicomputer, or mainframe. You can write your document on a PC and e-mail it to a coworker who makes corrections on a Macintosh. The final manuscript might be sent to a publisher who uses a minicomputer to prepare the document for printing.

Knuth realized that typesetting is only half the solution to the manuscript production problem. You also need a style designer—a specialist who determines what fonts will be used, how large a vertical space to put before and after a theorem, and numerous other design issues.

Knuth also realized that typesetting a complex document in TEX requires a very knowledgeable user. So TEX was designed as a platform on which *convenient work environments*—macro packages—could be built, which would be more suitable for the average user to work with. It is somewhat unfortunate that *two* such macro packages were made available to the mathematical community in the early 1980s: $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX and LATEX.

$\mathcal{A}\mathcal{M}\mathcal{S}$-TEX was written by Michael D. Spivak for the American Mathematical Society, whereas LATEX was developed by Leslie Lamport. The strengths of the two systems were somewhat complementary. $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX provided many features needed by mathematical articles, including

- Extensive options for formatting aligned and other multiline formulas
- Flexible bibliographic references

LATEX also provided many features, including

- The use of logical units to separate the logical and the visual design of an article
- Automatic numbering and cross-referencing
- Bibliographic databases

Both $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX and LATEX became very popular, causing a split in the mathematical community as some chose one system over the other.

C.1.1 *LATEX3*

When Lamport decided not to develop LATEX any further, the *LATEX3 team*[2] took over with the aim of actively supporting, maintaining, and updating LATEX.

The goals for LATEX3 are very ambitious; LATEX3 will

- Provide high-quality typesetting for a wide variety of document types and typographic requirements

[2] A talented group of mathematicians and programmers, Frank Mittelbach, Chris Rowley, and Rainer Schöpf. The group has since expanded with the addition of Johannes Braams, David Carlisle, Michael Downes, Denys Duchier, Robin Fairbairns, Alan Jeffrey, and Martin Schröder; many volunteers have also contributed to the project.

- Support direct formatting commands for editors and designers, which are essential to the fine-tuning of document layout and page design
- Process complex structured documents and support a document syntax that allows automatic translation of documents conforming to the international document-type definition standard SGML (Standard Generalized Markup Language, ISO 8879)
- Provide a common foundation for a number of incompatible LaTeX variants that have been developed, including LaTeX with the New Font Selection Scheme and the AMS packages

See two articles by Frank Mittelbach and Chris Rowley, *LaTeX 2.09 → LaTeX3* [44] and *The LaTeX3 Project* [46], for a complete statement of goals and a progress report.

A number of projects have already been completed that will be part of LaTeX3, including the following:

The New Font Selection Scheme. LaTeX uses Knuth's Computer Modern fonts. In 1989, Frank Mittelbach and Rainer Schöpf wrote the New Font Selection Scheme, NFSS, which allows the *independent changing* of font attributes and the integration of new font families into LaTeX. With the proliferation of PostScript fonts and printers, more and more users want to use PostScript fonts in their LaTeX documents.

$\mathcal{A}\mathcal{M}\mathcal{S}$-TeX as a LaTeX package. Frank Mittelbach, Rainer Schöpf, and Michael Downes recoded $\mathcal{A}\mathcal{M}\mathcal{S}$-TeX so that it would work as a LaTeX package.

Proclamations with style. All proclamations in LaTeX were typeset in the same style, whether they were a **Main Theorem** or a lowly *Comment.* Mittelbach and Schöpf created a sophisticated scheme that allowed proclamation styles to be specified.

New and improved environments. Rainer Schöpf improved the `verbatim` and `comment` environments and Frank Mittelbach wrote a new multicolumn environment. There have also been several improvements made to the `tabular` and `array` environments.

The first interim solution

In 1990, the AMS released $\mathcal{A}\mathcal{M}\mathcal{S}$-LaTeX, version 1.0. This release contained

- $\mathcal{A}\mathcal{M}\mathcal{S}$-TeX recoded to work with LaTeX
- The NFSS styles for proclamations
- The new `verbatim` environment

$\mathcal{A}\mathcal{M}\mathcal{S}$-LaTeX, version 1.0, was a LaTeX *dialect,* incompatible with the then current LaTeX (version 2.09).

While the LaTeX3 team wanted to unify the mathematical community, their first attempt split it even further apart. Many $\mathcal{A}\mathcal{M}\mathcal{S}$-TeX users simply refused to switch. Even the LaTeX community was split into users of the old LaTeX, those whose LaTeX incorporated the NFSS, and $\mathcal{A}\mathcal{M}\mathcal{S}$-LaTeX users.

The second interim solution

When it became obvious that the LaTeX3's goals could not be fulfilled any time soon, the LaTeX3 team decided to issue a new version of LaTeX, version 2e (also called LaTeX 2_ε) in June of 1994. This version replaced LaTeX 2.09; see the two Mittelbach and Rowley articles cited above. This interim release accomplished some of LaTeX3's goals, including the projects listed previously. Since then, LaTeX 2_ε (called LaTeX in this book) has become accepted as the standard LaTeX.

In February of 1995, the AMS released version 1.2 of $\mathcal{A}\mathcal{M}\mathcal{S}$-LaTeX (which I call the AMS packages in this book) built on top of LaTeX. Michael Downes was the project leader.

The changes in $\mathcal{A}\mathcal{M}\mathcal{S}$-LaTeX were substantial. The `align` environment, for example, was completely rewritten by David M. Jones. The recoded $\mathcal{A}\mathcal{M}\mathcal{S}$-TeX had now become a LaTeX package, amsmath.

It is extremely important to note that while $\mathcal{A}\mathcal{M}\mathcal{S}$-LaTeX 1.1, was a monolithic structure, versions 1.2 and 2.0 (see Section C.1.2) are just collections of packages that fit nicely into the LaTeX model. You can use one AMS package or all, by themselves or mixed with other LaTeX packages. This book uses a LaTeX document class (`book`) and the AMS packages, version 2.0, along with a number of other LaTeX (non-AMS) packages.

C.1.2 Recent developments

Since 1996, changes to LaTeX have been minor. A few new symbols have been added. Much work has been done to extend LaTeX to languages other than American English (character encoding and the EM fonts; see Appendixes D and E); all file names used by LaTeX were made lowercase.

In 1999, the American Mathematical Society has released version 2.0 of the AMS packages. This third edition covers the changes made in that release.

The big news was that a consortium (made up of the AMS, Blue Sky Research, and Y&Y) released free PostScript versions of the CM and AMS fonts, discussed in Section D.1.

Interestingly, there are still those who argue that the AMS packages are not part and parcel of LaTeX and typesetting math. In life, almost everything is a compromise; in software design, even more so. Using the AMS packages to typeset math is an exception. It costs you nothing—if you do not need their features for a document, then you don't have to use them. You need not sacrifice anything in order to have the power of the AMS packages available when you need them.

I trust that this attitude will also change in time, just as LaTeX 2.09 won out over Plain TeX, and LaTeX has taken the place of LaTeX 2.09. Maybe this third edition will help this process along.

C.2 How does LaTeX work?

In this section, I present a very simplified overview of the inner workings of LaTeX.

C.2.1 The layers

TeX and LaTeX consist of many layers. These include

`virtex` TeX's core, containing about 350 primitive commands such as `\input`, `\accent`, and `\hsize`. `virtex` can also read *format files,* which are precompiled sets of macros. LaTeX is nothing more than `virtex` reading in a large set of macros, built layer upon layer.

`plain.tex` The most basic layer built on `virtex`, written by Donald E. Knuth. It adds about 600 commands to `virtex`. When you type the `tex` command, `virtex` loads the `plain` format, which is the default; the core TeX commands combined with the commands defined by the `plain` format are called Plain TeX.

`plain.tex` is described in detail in Appendix B of Knuth's *The TeXbook* [34]. You can also read `plain.tex`, a text file in the TeX distribution. Plain TeX is powerful enough that you could do all your work in it. This approach is advocated by many, including Michael Doob in his book, *TeX Starting from* 1 [14].

`virtex` cannot build (compile) format files. For that you need another version of TeX called `initex`, which loads the most basic information a format needs, such as the hyphenation tables and `plain.tex`, and creates a format file.

LaTeX

LaTeX is a format file containing a compiled set of macros written by Leslie Lamport and others. It provides tools for logical document design, automatic numbering and cross-referencing, tables of contents, and many other features.

Document classes

The document class forms the next layer. You may choose to use a standard LaTeX document class, such as `article`, `book`, `letter`, `proc`, `report`, or `slides`; one provided by the AMS, such as `amsart`, `amsbook`, or `amsproc`; or any one of a large (and growing) number of other document classes provided by publishers of books and journals, universities, and other interested parties.

Packages

The next layer is made up of the packages loaded by the document. You can use standard LaTeX packages, AMS packages, or any of hundreds of other packages in the LaTeX universe, mixed together as necessary. Any package may require other packages, or may automatically load other packages.

Documents

At the top of this hierarchy sit your documents, with their user-defined commands and environments, utilizing all the power derived from the layers below.

C.2.2 *Typesetting*

When typesetting, TeX uses two basic types of files: the source files and the font metric files.

A font metric file is designed to hold the information for a font of a given size and style. Each TeX font metric file, called a `tfm` file, contains the size of each character, the kerning (the space placed between two adjacent characters), the length of the italic correction, the size of the interword space, and so on. A typical `tfm` file is `cmr10.tfm`, which is the TeX font metric file for the font `cmr` (CM roman) at 10-point size.

TeX reads the source file one line at a time. It converts the characters of each line into a *token sequence;* a token is either a character (together with an indication of what role the character plays) or a macro. The argument of a macro is the token following the macro unless a group enclosed in braces follows the macro, in which case the contents of the group becomes the argument.[3] (An example of this behavior can be seen when you specify an exponent; TeX looks for the next token as the exponent unless a group enclosed in braces follows the ^ symbol. Now you should understand why `$2^3$` and `$2^\alpha$` work, but `$2^\mathfrak{m}$` does not: 3 and `\alpha` each become a single token but `\mathfrak{m}` becomes more than one (four, in fact). Of course, if you *always* use braces, as in

```
$ 2^{3}$, $2^{\alpha}$, $2^{ \mathfrak{m} }$
```

then you will never have to think about tokens in order to type such expressions.)

After tokenizing the text, TeX hyphenates it and attempts to split the paragraph into lines of the required width. The measurements of the characters (also called glyphs) are absolute, as are the distances between characters (kerning). The spaces (interword space, intersentence space, and so on) are made of *glue* (rubber length in Section 9.5.2). Glue has three parameters: the length of the space, stretchability (the amount by which it can be made longer), and shrinkability (the

[3] Delimited commands work somewhat differently; see Section 9.1.8.

amount by which it can be made shorter). TeX will stretch and shrink glue to do its best to form lines of equal length.

TeX employs a formula to measure how much stretching and shrinking is necessary in a line. The result is called badness. A badness of 0 is perfect; a badness of 10,000 is very bad. Lines that are too wide are reported with messages such as

```
Overfull \hbox (5.61168pt too wide) in paragraph at lines 49--57
```

The badness of a line that is stretched too much is reported as follows:

```
Underfull \hbox (badness 1189) in paragraph at lines 93--93
```

Once enough paragraphs are put together, TeX composes a page from the typeset paragraphs using vertical glue. A short page will generate a warning message such as

```
Underfull \vbox (badness 10000) has
occurred while \output is active
```

The typeset file is stored as a `dvi` (Device Independent) file.

C.2.3 Viewing and printing

Viewing and printing TeX's typeset output are not really part of TeX proper, but they are obviously an important part of your work environment. The DVI printer driver prints the `dvi` files, and the DVI video driver lets you view them on your monitor.

C.2.4 LaTeX's files

LaTeX is a *one-pass compiler,* that is, it reads the source file only once for typesetting. As a result, LaTeX must use auxiliary files to store information it generates during a run. For each typesetting run, LaTeX uses the auxiliary files compiled during the *last* typesetting run. This mechanism explains why you have to typeset twice (or more—see Section 12.2) to make sure that changes you have made to the source files are reflected in the typeset document. These auxiliary files have the same base name as the source file; their extensions indicate their types.

The most important auxiliary file, the `aux` file, contains a great deal of information about the document, most importantly, the data needed for symbolic referencing. Here are two typical entries:

```
\newlabel{struct}{{5}{2}}
\bibcite{eM57a}{4}
```

The first entry indicates that a new symbolic reference was introduced on page 2 of the typeset document in Section 5 using the command

```
\label{struct}
```

The command `\ref{struct}` produces 5, while `\pageref{struct}` yields 2.

The second entry indicates that the bibliographic entry with label `eM57a` has been assigned the number 4, so `\cite{eM57a}` produces [4].

There is an aux file for the source file being processed, and another one for each file included in the main file by an `\include` command.

No auxiliary file will be written if the `\nofiles` command is given. The message

```
No auxiliary output files.
```

in the log file reminds you that `\nofiles` is in effect.

The log file contains all the information shown on your monitor during the typesetting. The `dvi` file contains the typeset version of the source file.

There are five auxiliary files that store information for special tasks. They are written only if that special task is invoked by a command and there is no `\nofiles` command. The additional auxiliary files are

`glo` Contains the glossary entries produced by `\glossary` commands. A new file is written only if there is a

```
\makeglossary
```

command in the source file (see Section 11.5).

`idx` Contains the index entries produced by `\index` commands. A new file is written only if there is a

```
\makeindex
```

command in the source file (see Section 11.3).

`lof` Contains the entries used to compile a list of figures. A new file is written only if there is a

```
\listoffigures
```

command in the source file (see Section 6.4.3).

`lot` Contains the entries used to compile a list of tables. A new file is written only if there is a

```
\listoftables
```

command in the source file (see Section 6.4.3).

`toc` Contains the entries used to compile a table of contents. A new file is written only if there is a

```
\tableofcontents
```

command in the source file (see Section 12.2).

For information about the auxiliary files created by BibTeX and *MakeIndex*, see Sections 10.2.4 and 11.3, respectively. Some classes and packages create additional auxiliary files (see Section 14.3.3 for an example).

APPENDIX

D

PostScript fonts

As we mentioned in Section C.1.2, the big news of the last few years was that a consortium (the AMS, Blue Sky Research, and Y&Y) released a free PostScript version of the CM and AMS fonts, so everyone could switch to PostScript fonts. Section D.1 discusses these PostScript fonts.

The Computer Modern fonts were originally "hardwired" into LaTeX. Many users liked LaTeX but disliked Computer Modern, and with the spread of personal computers and PostScript laser printers, it was imperative that PostScript fonts be integrated into LaTeX. In Section D.2, I illustrate how easy it is to use standard PostScript fonts, such as Times, with LaTeX with two examples. Finally, in Section D.3, I show you how to replace the CM and AMS fonts in a LaTeX document with the Lucida Bright fonts.

And now an apology: "PostScript fonts" is the terminology that lay people, like myself, use. The proper terminology is *Adobe Type 1 format fonts.* PostScript has provisions for a wide range of fonts including Type 3 and Type 1 (as well as Type 42 and Type 5, and so on). The Type 3 font category is very general and includes bitmap fonts, grayscaled fonts, and so on. Type 1 fonts are tightly constrained *outline* fonts, which can be accurately rendered at almost any resolution, and have special purpose code that deals only with Type 1 fonts.

D.1 CM, AMS, and EM PostScript Fonts

The CM and AMS fonts are available in PostScript format from the CTAN FTP servers in the directories
`/tex-archive/fonts/amsfonts/ps-type1/`
`/tex-archive/fonts/cm/ps-type1/bluesky/`
on the CTAN Web servers in the directories
`http://ctan.tug.org/tex-archive/fonts/cm/ps-type1/bluesky/`
`http://ctan.tug.org/tex-archive/fonts/amsfonts/ps-type1/`
on the AMS FTP server (`ftp.ams.org`) in the directories
`/pub/tex/psfonts/cm/`
`/pub/tex/psfonts/ams/`
and on the AMS Web server from
`http://www.ams.org/tex/type1-fonts.html`

The advantages of using PostScript fonts include

Size Traditionally, CM and AMS fonts were distributed rasterized as pk fonts; the size of the distribution goes up geometrically as the printer resolution increases. For instance, the AMS fonts as bitmaps at 300 dpi occupy 4.7 MB, at 600 DPI they occupy 8.8 MB. Today, many laser printers are 1200 dpi, and the size of the bitmap fonts would be excessive. In contrast, the PostScript font set occupies less than 1 MB.

Illustrations As we discussed in Section 13.2, you need PostScript fonts to be able to copy formulas from the typeset document to illustrations.

PDF files If you use pk fonts, PDF files can be read easily on your monitor or print well—but not both.

Flexibility Bitmapped fonts are made for one resolution and when printed or displayed at another resolution they look bad; hence a PostScript file using pk fonts must be made for a specific resolution. When sending a PostScript job to a printer or service bureau, you may not know what resolution device will be used.

There is only one disadvantage to using the PostScript fonts: the AMS font set does not include some of the small font sizes required by LaTeX and the AMS packages. There are several remedies:

- If you use an AMS document class, use the `psamsfonts` option of the document class.
- As we discussed in Section 8.5.1, if you use a non-AMS document class with the
  - amsmath package, use the `cmex10` option of the package
  - amsfonts package, use the `psamsfonts` option of the package

  and use the exscale package if necessary.

- At the LaTeX level, use David Carlisle's typelcm package, available from CTAN in the directory
  `/tex-archive/macros/latex/contrib/supported/typelcm/`
- Buy Y&Y's complete AMS font set, which provides the missing fonts.
- Most TeX implementations support virtual fonts; you can provide the missing fonts as virtual fonts. The correction is then made at the Plain TeX level. Gary L. Gray's Macintosh TeX/LaTeX software page
  `http://www.esm.psu.edu/mac-tex/`
  contains a number of AMS virtual metrics provided by Arthur Ogawa, Simon Mang Cao, and Uwe Schmock; these virtual metrics can be used for all platforms.

You can buy the European Modern (EM) PostScript font set from Y&Y; it is based on the CM font set but has many more glyphs, including over 90 ready-made accented and composite characters.

D.2 The Times font and MathTime

In this section, we step through the process of incorporating the Adobe Times font into a LaTeX document to replace the Computer Modern text fonts, and, optionally, of using the *MathTime* math fonts to replace the Computer Modern math fonts. To do so, we use the PSNFSS packages; see Section 13.1.

Recall from Section 2.6.2 that a document class specifies three standard font families:

- A roman (or serif) font family
- A sans-serif font family
- A typewriter-style font family

The times package (in the PSNFSS distribution) makes Times the roman font family, Helvetica the sans-serif font family, and Courier the typewriter-style font family.

Setting up Times First install the Adobe Times, Helvetica, and Courier PostScript fonts and their TeX font metric files.

Now typeset the `psfonts.ins` file (in the PSNFSS distribution)—using the `LaTeX` format, of course. Doing so will produce style (`sty`) files for the standard PostScript fonts. The Times style file is called times.sty. Copy it into your TeX input directory.

To use the times package, you must have the *font definition* (`fd`) files for the fonts specified. By checking the `times.sty` file, you will see that you need three files for the three fonts: Times, Helvetica, and Courier. In the `times` package these are named `ptm`, `phv`, and `pcr`, respectively; these are the font names in the naming scheme devised by Karl Berry. In `ptm`, `p` stands for the foundry's name (in this case, Adobe), `tm` stands for Times, `hv` for Helvetica, and `cr` for Courier. The corre-

sponding font definition files are named `ot1ptm.fd`, `ot1phv.fd`, and `ot1pcr.fd`, respectively. (`OT1` designates the old TEX font encoding scheme, which is not discussed here.) You can get these files from CTAN (see Section 13.1). Place all these font files in your TEX input directory.

Using Times In the preamble of your document, type

```
\usepackage{times}
```

after the `\documentclass` line. Then Times will become the roman, Helvetica the sans-serif, and Courier the typewriter-style document font family.

That is all there is to it.

Using the times package changes the document font family throughout your document. To switch to Times only occasionally, type

```
{\fontfamily{ptm}\selectfont
phrase}
```

The text preceding and following this construct will not be affected. For example,

```
{\fontfamily{ptm}\selectfont
This text is typeset in the Times font.}
```

will typeset as

This text is typeset in the Times font.

Similarly,

```
\fontfamily{ptm}\selectfont
This text is typeset in the Times font.
\normalfont
```

will also typeset the same phrase in Times. (The `\normalfont` command restores the document font family—see Section 2.6.2.)

Setting up *MathTime* Looking at a mathematical article typeset with the Times text font, you may find that the Computer Modern math symbols look too thin. To more closely match Times (and other PostScript fonts) Michael Spivak modified the CM math symbols, calling these modified fonts *MathTime*. You can purchase the *MathTime* fonts from Y&Y; e-mail: `sales@YandY.com`; Web address: `http://www.YandY.com`.

Install the *MathTime* PostScript fonts and the TEX font metric files for the *MathTime* fonts. From PSNFSS, copy the `mathtime.ins`, `mathtime.dtx` files, and `mtfonts.fdd` into your TEX input directory. Typeset `mathtime.ins` with the LaTeX format to produce the necessary `fd` files and the `mathtime.sty` file.

Using *MathTime* If you want to use Times as the document font family and *MathTime* as the default math font, specify

```
\usepackage[LY1]{fontenc}          %specify font encoding
\usepackage[LY1,mtbold]{mathtime}  %switch math fonts
\usepackage{times}                 %switch text fonts
```

in the preamble of your document. With TEXTURES, you should specify LM1 instead of LY1.

The mathtime package has many of options; see its documentation for more information—typeset mathtime.dtx to get it.

D.3 Lucida Bright fonts

Another alternative to Computer Modern fonts is *Lucida Bright* for both text and math fonts. You can purchase the Lucida Bright fonts from Y&Y.

Copy lucidabr.ins, lucidabr.dtx, lucidabr.fdd, lucidabr.yy into your TEX input directory. Typeset lucidabr.yy with the LaTeX format, producing the lucidabr.sty file and a large number of fd files.

Now add the lines

```
\usepackage[LY1]{fontenc}    %specify font encoding
\usepackage[LY1]{lucidabr}   %switch text and math fonts
```

in the preamble of your document. With TEXTURES, you should specify LM1 rather than LY1. The lucidabr package has many options; see its documentation (typeset lucidabr.dtx to get it).

D.4 More PostScript fonts

You can obtain PostScript fonts from a wide variety of sources. You will find many free PostScript fonts on CTAN. Table D.1 is a short list of the more prominent commercial vendors.

See also the Web page at http://www.microsoft.com/typography/ for a lot of useful information and links.

Foundry	URL
Adobe	`http://www.adobe.com/type/`
Agfa/Monotype	`http://www.agfamonotype.com/`
Berthold	`http://www.bertholdtypes.com/`
Bitstream	`http://www.bitstream.com/`
Coniglio	`http://www.conigliotype.com/`
Emigre	`http://www.emigre.com/`
Hoefler	`http://www.typography.com/`
ITC	`http://www.itcfonts.com/`
Linotype	`http://www.linotypelibrary.com/`
Monotype	`http://www.monotype.com/`
P22	`http://www.p22.com/`
Scriptorium	`http://www.ragnarokpress.com/`
Tiro	`http://www.tiro.com/`
URW	`http://www.urwpp.de/home_e.htm`
Vintage	`http://www.vintagetype.com/`
Y&Y	`http://www.yandy.com/products.htm#fonts`

Table D.1: Some type foundries on the World Wide Web.

APPENDIX

E

LaTeX localized

Many of the improvements to LaTeX in recent years have been related to the increased ability to localize LaTeX; that is, to adapt LaTeX for use with languages other than American English. The babel, fontenc, and inputenc packages are the major players, along with new font-encoding schemes, including the T1 encoding. You will find fontenc and inputenc in the base directory and babel in the required directory of the standard LaTeX distribution (see Section 13.1).

The babel package is described in detail in Chapter 9 of *The LaTeX Companion* [17], and although much has happened since 1994, that description is still quite up-to-date.

If you are interested in using a localized LaTeX, you should turn to the TeX user group for that linguistic group to find out what is available. You should also consult the babel user guide.

At a minimum, a supported language has translated redefinable names (see Table 9.1), and a localized variant of the \today command. Two very advanced language adaptations are German and French.

We illustrate the use and installation of the babel package with the German language, which gives you a rich set of features, including

- Allows you to type `"a` for `\"{a}`
- Introduces `"s` for sharp s (eszett)
- Introduces `"ck` for ck-s that becomes k-k when hyphenated

To install babel

1. Start with a system with no TeX fonts installed.
2. Install the EC fonts (from CTAN: `/tex-archive/fonts/ec/`). A complete set of pk fonts is almost 90 MB in size.
3. Rename `hyphen.tex` (in your TeX inputs directory) to, say, `ushyphen.tex`.
4. Get the German hyphenation patterns, `dehypht.tex`, from CTAN's `/tex-archive/languages/hyphenation/` directory and put it in the TeX inputs directory.
5. Put the babel package in your TeX input directory and install it.
6. Modify the `language.dat` file in the babel package to indicate that you want to use German as the primary language.
7. Create a new LaTeX format by typesetting `latex.ltx` with `initex`.
8. Typeset the following test file (in the `samples` directory):

```
\documentclass{article}
\usepackage[german]{babel}
\usepackage[T1]{fontenc}

\begin{document}
\section{H"ullenoperatoren}
Es sei $P$ eine teilweise geordnete Menge. Wir
sagen, da"s in $P$ ein \emph{H"ullenoperator}
$\lambda$ erkl"art ist, wenn sich jedem $a \in  P$
ein eindeuting bestimmtes $\lambda(a) \in P$
zuordnen l"a"st, so  da"s die folgenden
Bedingungen erf"ullt sind.
\end{document}
```

If you see the same material shown in Figure E.1, your setup works!

1 Hüllenoperatoren

Es sei P eine teilweise geordnete Menge. Wir sagen, daß in P ein *Hüllenoperator* λ erklärt ist, wenn sich jedem $a \in P$ ein eindeuting bestimmtes $\lambda(a) \in P$ zuordnen läßt, so daß die folgenden Bedingungen erfüllt sind.

Figure E.1: German test for Babel.

APPENDIX

F

A book document class

To produce an attractive looking book, you should follow the instructions in Chapter 12 (especially, Section 12.5) and choose a well-designed book document class.

By way of an example, in this appendix, we utilize the Springer-Verlag book class, `svsing6.cls`. To produce a book with this document class, you first create a "master document," let us call it `master.tex` (in the `samples` directory; see page 4), which may read as follows:

```
%Master document for svsing6
\documentclass{svsing6}
\usepackage{author}
\makeindex

\begin{document}
\frontmatter
\include{frontmatter}
\tableofcontents
\include{introduction}

\mainmatter
```

```
\include{chapter1}
\include{chapter2}
\include{chapter3}
\include{chapter4}
\include{chapter5}

\appendix
\include{appendix1}
\include{appendix2}

\backmatter
\include{references}
\include{afterword}

\printindex
```

The `author.sty` command file collects the packages and commands utilized by the author. It contains lines like

```
\RequirePackage{amsmath}
\RequirePackage{amssymb}
\RequirePackage{latexsym}
```

to instruct LaTeX to load the named packages.

`frontmatter.tex` will be provided by Springer-Verlag, and it will produce the first four pages of the book. This is followed by `introduction.tex`, the introduction. These pages are numbered with lower case roman numerals (because the `\frontmatter` command was given).

The `\mainmatter` command starts the page numbering from 1, using arabic numerals. `chapter1.tex`, ..., `chapter5.tex` are the five chapters.

The `\appendix` command introduces the appendices, there are two in this example, named `appendix1.tex` and `appendix2.tex`.

Finally, the `\backmatter` command introduces the references, in the document `references.tex`, and the afterword, in the document `afterword.tex`.

To illustrate what such a book document class can do for your book, in this appendix, you find the first four pages of the first chapter and the first page of the bibliography from Gabriel P. Paternain's *Geodesic Flows*, published by Birkhäuser Boston in 1999. These pages illustrate the formatting of

- The first page of a chapter (using the `\chapter` command)
- A section, a subsection, and a definition (using the `\section` and `\subsection` commands and the `definition` proclamation)
- A list (using the `enumerate` environment)
- A lemma with its proof (using the `lemma` proclamation and the `proof` environment)

- The bibliography (using the `thebibliography` environment)

The facing pages show the corresponding source code.

In the `samples` directory (see page 4), you will find the Springer-Verlag book class, `svsing6.cls`, and svsing2e.sty, a package that can be used with LaTeX's standard `book` document class.

1
Introduction to Geodesic Flows

Our aim in this chapter is to introduce the geodesic flow on the tangent bundle of a complete Riemannian manifold from several points of view. Geodesic flows have the remarkable property of being at the intersection of various branches in mathematics; this gives them a rich structure and makes them an exciting subject of research with a long tradition.

In Section 1.1 we define the geodesic flow of a complete Riemannian manifold. We also recall that geodesics can be obtained as solutions of the Euler-Lagrange equation of a Lagrangian given by the kinetic energy. In Section 1.2 we define symplectic and contact manifolds. In Section 1.3 we set up the basic geometry of the tangent bundle: we introduce the connection map, horizontal and vertical subbundles, the Sasaki metric, the symplectic form and the contact form. We describe the main properties of these objects, and we show that the geodesic flow is a Hamiltonian flow and that when we restrict it to the unit sphere bundle of the manifold we then obtain a contact flow. The contact form naturally induces a probability measure that is invariant under the geodesic flow and is called the Liouville measure. In Section 1.4 we describe the canonical symplectic form of the cotangent bundle and, using the musical isomorphisms, we shall describe its relations with the symplectic form defined in Section 1.3. In Section 1.5 we write the differential of the geodesic flow in terms of Jacobi fields. In the last section we define the asymptotic cycle of an invariant probability measure and the stable norm. We show that the asymptotic cycle of the Liouville measure vanishes and that the same holds for the measure of maximal entropy if the latter is unique. Finally we show that the unit

```
\chapter{Introduction to Geodesic Flows}\label{C:Introduction}

Our aim in this  chapter is to introduce the geodesic flow on the
tangent bundle of a complete Riemannian manifold from several
points of view. Geodesic flows have the remarkable property of
being at the intersection of various branches in mathematics;
this gives them a rich structure and makes them an exciting
subject of research with a long tradition.

In Section~\ref{S:Riemannian} we define the geodesic flow of a
complete Riemannian manifold. We also recall that geodesics can
be obtained as solutions of the Euler-Lagrange equation of a
Lagrangian given by the kinetic energy. In
Section~\ref{S:Sym_con} we define symplectic and
contact manifolds. In Section~\ref{S:geometry} we set up the
basic geometry of the tangent bundle: we introduce the
connection map, horizontal and vertical subbundles, the Sasaki
metric, the symplectic form and the contact form. We describe
the main properties of these objects,  and we  show that the
geodesic flow is a Hamiltonian flow and that when we restrict it
to the unit sphere bundle of the manifold we then obtain a
contact flow. The contact form naturally induces a probability
measure that is invariant under the geodesic flow and is called
the Liouville measure. In Section~\ref{S:cotangent_bundle} we
describe the canonical symplectic form  of the cotangent bundle
and,  using the musical isomorphisms, we shall describe its
relations with the symplectic form  defined in
Section~\ref{S:geometry}. In Section~\ref{S:geodesic_flow} we
write the differential of the geodesic  flow in terms of Jacobi
fields. In the last section we define the asymptotic cycle of an
invariant probability measure and the stable norm. We show that
the asymptotic cycle of the Liouville measure vanishes and that
the same holds for the measure of maximal entropy if the latter
is unique. Finally we show that the unit
```

ball of the stable norm coincides with the set of asymptotic cycles of all invariant probability measures.

Chapter 1 of Besse's book [Be], Chapter 3 of Klingenberg's book [Kl1], Chapter II of Sakai's book [Sa] and Chapter IV in Ballmann's lecture notes [Ba] also contain introductions to the geometry of the tangent and unit tangent bundles as well as some basic facts about geodesic flows.

1.1 Geodesic flow of a complete Riemannian manifold

Let M be a complete Riemannian manifold and let $\gamma_{(x,v)}(t)$ be the unique geodesic with initial conditions as follows:

$$\begin{cases} \gamma_{(x,v)}(0) = x; \\ \dot{\gamma}_{(x,v)}(0) = v. \end{cases}$$

Definition 1.1. For a given $t \in \mathbb{R}$, we define a diffeomorphism of the tangent bundle TM

$$\phi_t : TM \to TM,$$

as follows

$$\phi_t(x,v) := \left(\gamma_{(x,v)}(t), \dot{\gamma}_{(x,v)}(t)\right).$$

The family of diffeomorphisms ϕ_t is in fact a *flow*, that is, it satisfies $\phi_{t+s} = \phi_t \circ \phi_s$. This last property is an easy consequence of the uniqueness of the geodesic with respect to the initial conditions. Let SM be the *unit tangent bundle* of M, that is, the subset of TM given by those pairs (x,v) such that v has norm one. Since geodesics travel with constant speed, we see that ϕ_t leaves SM invariant, that is, given $(x,v) \in SM$, for all $t \in \mathbb{R}$ we have that $\phi_t(x,v) \in SM$.

1.1.1 Euler-Lagrange flows

Let $L : TM \to \mathbb{R}$ be a smooth function and let Ω_{xy} be the space

$$\Omega_{xy} := \{u : [0,1] \to M, \text{piecewise differentiable and } u(0) = x, u(1) = y\}.$$

The *action* A of L over a path from x to y is the map,

$$A : \Omega_{xy} \to \mathbb{R}, \quad A(u) := \int_0^1 L(u(t), \dot{u}(t))dt.$$

Let us try to find the critical points or extremals of A. Consider a variation $s \mapsto u_s \in \Omega_{xy}$ with $s \in (-\varepsilon, \varepsilon)$ such that $\frac{d}{ds}A(s)|_{s=0} = 0$. If we set $W(t) := \frac{\partial u_s}{\partial s}(t)|_{s=0}$, then a computation in local coordinates shows that u is a critical point if and only if

```
ball of the stable norm coincides with the set of asymptotic
cycles of all invariant probability measures.

Chapter 1 of Besse's book \cite{Be}, Chapter 3 of Klingenberg's
book \cite{K1}, Chapter II of Sakai's book \cite{Sakai} and
Chapter IV in Ballmann's lecture notes \cite{Ball} also contain
introductions to the geometry of the tangent and unit tangent
bundles as well as some basic facts about geodesic flows.

\section{Geodesic flow of a complete Riemannian
manifold}\label{S:Riemannian}  Let $M$ be a complete Riemannian
manifold and let $\gamma_{(x,v)}(t)$ be the unique geodesic with
initial conditions as follows: \[\left\{\begin{matrix}
\gamma_{(x,v)}(0)=x;\\\dot{\gamma}_{(x,v)}(0)=v.
\end{matrix}\right.\]
\begin{definition}  For a given $t \in \R$, we define a
diffeomorphism of  the tangent bundle $TM$  \[ \phi_t \colon TM
\rightarrow TM, \] as follows \[ \phi_t (x,v)\, :=\,  \left(
\gamma_{(x,v)}(t) , \dot{ \gamma}_{(x,v)}(t) \right). \]
\end{definition}
The family of diffeomorphisms $\phi_{t}$ is in fact a \emph{flow},
that is, it satisfies $\phi_{t+s} = \phi_t \circ \phi_s$. This
last property is an easy consequence of the uniqueness
of the geodesic with respect to the initial conditions. Let $SM$
be the \emph{unit tangent bundle} of $M$, that is, the subset of
$TM$ given by those pairs $(x,v)$ such that $v$ has norm one.
Since geodesics travel with constant speed, we see that
$\phi_{t}$ leaves $SM$ invariant, that is, given $(x,v)\in SM$,
for all $t\in\R$ we have that $\phi_{t}(x,v)\in SM$.

\subsection{Euler-Lagrange flows}\label{S:Euler-Lagrange}
Let $L:TM \rightarrow \R $ be a smooth function and let
$\Omega_{xy}$ be the space \[ \Omega_{xy}\,:=\, \{ u\,:\,[0,1]
\rightarrow M, \mbox{piecewise differentiable and } u(0)=x,
u(1)=y \}.\] The \emph{action} $A$ of $L$ over a path from $x$
to $y$ is the map,  \[ A\colon \Omega_{xy} \rightarrow \R
,\qquad A(u)\,:=\, \int_0^1 L(u(t), \dot{u}(t))\, dt. \]

Let us try to find the critical points or extremals of $A$.
Consider a variation $s \mapsto u_s \in \Omega_{xy}$ with $s \in
( -\varepsilon, \varepsilon )$ such that $\frac{d}{ds}
A(s)|_{s=0} =0$.  If we set
```

$$\int_0^1 \left\{ \frac{\partial L}{\partial x}(u, \dot{u}) - \frac{d}{dt}\frac{\partial L}{\partial v}(u, \dot{u}) \right\} (W) dt = 0.$$

If we assume that this equation is satisfied for all variational vector fields $W(t)$ arising from variations with $u = u_0$, we have

$$\frac{\partial L}{\partial x}(u, \dot{u}) - \frac{d}{dt}\frac{\partial L}{\partial v}(u, \dot{u}) = 0.$$

This is known as the Euler-Lagrange equation.

There is a class of Lagrangians that has received lots of attention in recent years. We shall say that a Lagrangian L is *convex and superlinear* if the following two properties are satisfied.

1. Convexity. We require that $L|_{T_xM} : T_xM \to \mathbb{R}$ has positive definite Hessian for all $x \in M$. This condition is usually known as *Legendre's condition.* In local coordinates this means that

$$\frac{\partial^2 L}{\partial v_i \partial v_j} \text{ is positive definite.}$$

2. Superlinearity. There exists a Riemannian metric such that

$$\lim_{|v| \to +\infty} \frac{L(x, v)}{|v|} = +\infty,$$

uniformly on x.

If M is compact, the extremals of A give rise to a complete flow $\phi_t : TM \to TM$ called the Euler-Lagrange flow of the Lagrangian. A very interesting aspect of the dynamics of the Euler-Lagrange flows is given by those orbits or invariant measures that satisfy some global variational properties. Research on the dynamics of these special orbits and measures goes back to M. Morse and G.A. Hedlund and has reappeared in recent years in the work of J. Mather, trying to generalize to higher dimensions the theory of twist maps on the annulus. See [Mat, Fa] and references therein for an account of this theory.

It is well-known that geodesics can be seen as the solutions of the Euler-Lagrange equation of the following convex and superlinear Lagrangian:

$$L(x, v) := \frac{1}{2} g_x(v, v)$$

where g denotes the Riemannian metric of M.

```
$W(t)\,:=\, \frac{\partial u_s}{\partial s} (t) |_{s=0}$, then a
computation in local coordinates shows that $u$ is a critical
point if and only if \[ \int_0^1 \left\{ \frac{\partial
L}{\partial x} (u, \dot{u}) - \frac{d}{dt} \frac{\partial
L}{\partial v} (u, \dot{u} ) \right\} (W)\, dt = 0 .\] If we
assume that this equation is satisfied for all variational vector
fields $W(t)$ arising from variations with $u= u_0$, we have
\[\frac{\partial L}{\partial x} (u, \dot{u}) - \frac{d}{dt}
\frac{\partial L}{\partial v} (u, \dot{u} ) =0.\]
This is known as the Euler-Lagrange equation.

There is a class of Lagrangians that has received lots of
attention in recent years.  We shall say that a Lagrangian $L$
is \emph{convex and superlinear} if the following two properties
are satisfied.

\begin{enumerate} \item Convexity. We require that $L|_{T_x
M}\colon T_x M \rightarrow \R$ has positive definite Hessian for
all $x\in M$. This condition is usually known as \emph{Legendre's
condition}. In local coordinates this  means that \[
\frac{\partial ^2 L}{\partial v_i \partial v_j}\; \mbox{is
positive definite}.\]

\item Superlinearity. There exists a Riemannian metric such that
\[\lim _{ |v| \rightarrow +\infty} \frac{L(x,v)}{|v|} = +
\infty,\] uniformly on $x$. \end{enumerate}

If $M$ is compact, the extremals of $A$ give rise to a complete
flow $\phi_{t}\colon TM\to TM$ called the Euler-Lagrange flow of
the Lagrangian. A very interesting aspect of the dynamics of the
Euler-Lagrange flows is given by those orbits or invariant
measures that satisfy some global variational properties.
Research on the dynamics of these special orbits and measures
goes back to M. Morse and G.A. Hedlund and has reappeared in
recent years in the work of J. Mather,  trying to generalize to
higher dimensions the theory of twist maps on the annulus. See
\cite{M,Fa} and references therein for an account of this theory.

It is well-known that geodesics can be seen as the solutions of
the Euler-Lagrange equation of the following convex and
superlinear Lagrangian: \[ L(x,v)\,:=\, \frac{1}{2} g_x(v,v),\]
where $g$ denotes the Riemannian metric of $M$
```

```
\section{Symplectic and contact manifolds}\label{S:Sym_con}
\subsection{Symplectic manifolds}\label{S:Symplectic}
\begin{definition}\label{D:symplectic} A $2$-form $w$ is said
to be \emph{symplectic} if $w$ is:
\begin{itemize} \item closed, $dw=0$; \item nondegenerate,
that is,  if $w_{p}(X,Y)=0$, for all
$Y \in T_p M$, then $X=0$. \end{itemize}
A pair $(M,w)$ of a smooth manifold and a symplectic form is
called a \emph{symplectic manifold}.
\end{definition}
\begin{remark} The existence of a symplectic form in a manifold
$M$ implies that $M$ is even dimensional. \end{remark}
\begin{definition}\label{D:Hamiltonian}  Let $(M,w)$ be a
symplectic manifold and $H:M \rightarrow \R$ a given $C^r$
function. The vector field $X_H$ determined by the condition
\[ w(X_H , Y ) = dH(Y) \mbox{ or equivalently } i_{X_H} w = dH
\]  is called the \emph{Hamiltonian vector field} associated
with $H$ or the \emph{symplectic gradient} of $H$. The flow
$\varphi_t$ of the vector field $X_H$ is called the
\emph{Hamiltonian flow} of $H$.
\end{definition}
The nondegeneracy of $w$ ensures that $X_H$ exists and that it
is a $C^{r-1}$ vector field. In the next lemma we shall see
that the Hamiltonian flow of $H$ preserves the sympletic form
$w$. Let us denote by $L_{X_{H}}w$ the Lie derivative of $w$
with respect to $X_{H}$. \begin{lemma} $L_{X_{H}}w=0$.
\end{lemma} \begin{proof} Using Cartan's formula \[ L_{X_H} w =
d i_{X_H} w + i_{X_H} dw, \] and the fact that $dw=0$ and
$di_{X_H}w= ddH =0$,  we get $L_{X_H} w =0$.
\end{proof}
\begin{xca}\label{1-One}
 Show that $L_{X_{H}}w=0$ if and only if for all $t\in\R$,
$\varphi_{t}^{*}w=w$, where $\varphi_{t}$ is the flow of
$X_{H}$. \end{xca} \subsection{Contact
manifolds}\label{S:contact}  \begin{definition}  A $1$-form
$\alpha$ on a $(2n-1)$-dimensional orientable manifold $M$ is
called a \emph{contact form} if the $(2n-1)$-form $\alpha
\wedge (d \alpha )^{n-1}$ never vanishes. A pair $(M, \alpha )$
of a smooth odd-dimensional manifold and a contact form is
called a \emph{contact manifold}.  A \emph{contact flow} is a
flow on $M$ that preserves the contact form on $M$.
\end{definition}
```

References

[An] D.V. Anosov, *Geodesic flows on closed manifolds of negative curvature,* Proc. Steklov Inst. Math. **90** (1967), 23–29.

[Ba1] I. Babenko, *Analytic properties of Poincaré series of a loop space,* (Russian) Mat. Zametki **27** (1980), 751–765.

[Ba2] I. Babenko, *Topological entropy of geodesic flows on simply connected manifolds, and related problems,* (Russian) Izv. Ross. Akad. Nauk. Ser. Mat. **61** (1997), 57–74.

[BBB] W. Ballmann, M. Brin, K. Burns, *On surfaces without conjugate points,* J. Diff. Geom. **25** (1987), 249–273.

[Ba] W. Ballmann, *Lectures on spaces of nonpositive curvature,* with an appendix by Misha Brin. DMV Seminar, 25, Birkhäuser, Basel, 1995.

[BGS] W. Ballmann, M. Gromov, M. Schroeder, *Manifolds of nonpositive curvature,* Progress in Mathematics, 61, Birkhäuser Boston, Cambridge, MA, 1985.

[Ban] V. Bangert, *Minimal geodesics,* Ergod. Th. and Dynam. Sys. **10** (1989), 263–286.

[BB] M. Berger, R. Bott, *Sur les variétés à courbure strictement positive,* Topology **1** (1962), 302–311.

```
\begin{thebibliography}{DGMS}

\bibitem[An]{A}
D.V. Anosov, \emph{Geodesic flows on closed manifolds of
negative curvature}, Proc. Steklov Inst. Math. \textbf{90}
(1967), 23--29.

\bibitem[Ba1]{Ba1}
I. Babenko, \emph{Analytic properties of Poincar\'e
series of a loop space}, (Russian) Mat. Zametki \textbf{27}
(1980), 751--765.

\bibitem[Ba2]{Ba}
I. Babenko, \emph{Topological entropy of geodesic flows
on simply connected manifolds, and related problems}, (Russian)
Izv. Ross. Akad. Nauk. Ser. Mat. \textbf{61} (1997),  57--74.

\bibitem[BBB]{BBB}
W. Ballmann, M. Brin, K.Burns,
\emph{On surfaces without conjugate points},
J. Diff. Geom.  \textbf{25} (1987),  249--273.

\bibitem[Ba]{Ball}
W. Ballmann,
\emph{Lectures on spaces of nonpositive curvature}, with an
appendix by Misha Brin.  DMV Seminar, 25, Birkh\"auser,
Basel, 1995.

\bibitem[BGS]{BGS}
W. Ballmann, M. Gromov, M. Schroeder,
\emph{Manifolds of nonpositive curvature}, Progress in
Mathematics, 61,  Birkh\"auser Boston,  Cambridge, MA, 1985.

\bibitem[Ban]{Ban}
V. Bangert,
\emph{Minimal geodesics},
Ergod. Th. and Dynam. Sys. \textbf{10} (1989), 263--286.

\bibitem[BB]{BB}
M. Berger, R. Bott,
\emph{Sur les vari\'et\'es \`a courbure strictement positive},
Topology \textbf{1} (1962), 302--311.
```

APPENDIX

G

Conversions

If you want to do a conversion, chances are that you have a LaTeX document and you want to convert it to use the `amsart` document class. You can do so in two steps: First, add the amsmath package as described in Section G.2.1, then use your AMS article template—created in Section 8.4—to complete the conversion (see Section G.3.1).

Theoretically, however, there are dozens of possible conversions. We group them into three sections.

Section G.1 discusses how to convert documents to LaTeX. For converting from

1. Plain TeX, see Section G.1.1
2. LaTeX 2.09, see Section G.1.2

You may want to convert to LaTeX utilizing the AMS packages (version 2.0). For converting

1. A LaTeX document, see Section G.2.1
2. An $\mathcal{A}\mathcal{M}\mathcal{S}$-TeX document, see Section G.2.2
3. A document using version 1.2 of the AMS packages, see Section G.2.3

Finally, in Section G.3, we discuss how to convert a document to use version 2.0 of an AMS document class. To convert from

1. A LaTeX document, see Section G.3.1
2. An $\mathcal{A}\mathcal{M}\mathcal{S}$-LaTeX 1.1 document, see Section G.3.2

G.1 Converting to LaTeX

You may want to convert to LaTeX from Plain TeX or from LaTeX 2.09.

G.1.1 Converting Plain TeX to LaTeX

To convert a document from Plain TeX,

- Watch out for any commands listed in Table G.1. Replace them with their LaTeX equivalents.
- Copy your personalized template file (see Section 1.8), save it under a new name, and enter the appropriate information for the new document. Then paste your TeX document into the `document` environment of the new file.
- Replace TeX's displayed-math delimiters (`$$`) with `\[` and `\]`.
- Retype all the sectioning titles as discussed in Section 1.9.2, and add any cross-references.
- Retype your bibliography as shown in Section 1.9.4; adding `\cite` commands where necessary.
- Define and invoke any proclamations as described in Section 3.4.
- Convert tables to `tabular` form.

Using TeX code in LaTeX

Nearly all document and page design problems are addressed by LaTeX itself or by a package. Therefore, mixing TeX and LaTeX code is seldom necessary, and requires a deep understanding of the underlying code. Avoid using TeX code in LaTeX unless you have mastered the internals of both languages.

There are a number of reasons why a Plain TeX command may not work as expected in LaTeX:

- LaTeX rewrites TeX's output routines; that is, the way that paragraphs and pages are formatted. Avoid using any TeX command that directly affects output (see Chapter 15 of Donald E. Knuth's *The TeXbook* [34]).
- LaTeX provides a number of environments that make some TeX commands obsolete ; `tabbing` and `center` are two examples.
- A number of TeX commands that change the font size are not defined in LaTeX.
- Some TeX commands change parameters that are also used by LaTeX. For instance, using the `\hangindent` command within a LaTeX list environment will change the shape of the list.

\+	\folio	\pageinsert
\advancepageno	\footline	\pageno
\beginsection	\footstrut	\plainoutput
\bye	\headline	\settabs
\centering	\leqalignno	\sevenbf
\cleartabs	\line	\seveni
\dosuperejject	\magnification	\sevensy
\endinsert	\makefootline	\tabalign
\end	\makeheadline	\tabsdone
\eqalignno	\midinsert	\tabset
\eqalign	\nopagenumbers	\tabs
\fivebf	\normalbottom	\teni
\fivei	\oldstyle	\topinsert
\fiverm	\pagebody	\topins
\fivesy	\pagecontents	\vfootnote

Table G.1: TeX commands to avoid using in LaTeX documents.

Table G.1 provides a short list of Plain TeX commands to avoid.

Ⓐ The amsmath package strongly discourages the use of TeX's generalized fraction commands; namely,

```
\above   \abovewithdelims
\atop    \atopwithdelims
\over    \overwithdelims
```

G.1.2 Converting LaTeX 2.09 to LaTeX

In the preamble of your document, you must change the `\documentstyle` command to `\documentclass`. Most of the document style options have become packages that are loaded with the `\usepackage` command. You may change any two-letter font commands (see Section 2.6.9) to their LaTeX equivalents, but doing so is not really necessary (see Section 2.6).

In some cases no conversion is needed at all: LaTeX can typeset many LaTeX 2.09 documents in compatibility mode. If you plan to update your file or plan to share it with others, however, I recommend that you take the time to update it to LaTeX.

LaTeX symbols

The latexsym package defines 11 math symbols that were once part of LaTeX 2.09. To use any of these symbols, you will have to load the latexsym package. The only

frequently used symbol in this set is \Box, which some writers use as the end-of-proof symbol. You will find these 11 symbols in the tables in Appendix A with Source latexsym.

G.2 Converting to LaTeX with the AMS packages

If you are starting with a Plain TeX or LaTeX 2.09 document, first convert it to LaTeX, as described in Section G.1, then go on to Section G.2.1.

If you are starting with an $\mathcal{A}\mathcal{M}\mathcal{S}$-TeX document, do the conversion in Section G.2.2.

G.2.1 Using the AMS packages in a LaTeX document

There are only a few adjustments you need to make when using the AMS packages.

To convert a LaTeX document to use the amsmath package, simply add the lines

```
\usepackage{amsmath}
```

after the \documentclass line in the preamble of the document. Typically, the LaTeX document will typeset with no change in the typeset result. There is one minor consideration: LaTeX allows page breaks in multiline math environments, whereas the amsmath package prohibits them by default. If you add the line

```
\allowdisplaybreaks[1]
```

in the preamble of your document, the amsmath package will allow page breaks as LaTeX does.

Make use of the many features of the AMS packages in typesetting math. In particular, redesign, as necessary, any multiline formulas using the multiline math environments provided by the amsmath package—you should change any LaTeX eqnarray math environments to an appropriate AMS multiline math environments.

G.2.2 Converting from $\mathcal{A}\mathcal{M}\mathcal{S}$-TeX

Although the amsmath package is essentially $\mathcal{A}\mathcal{M}\mathcal{S}$-TeX recoded for use with LaTeX, there are a number of differences. These differences seldom cause problems since most mistakes are caught by LaTeX during typesetting.

The major differences are

- $\mathcal{A}\mathcal{M}\mathcal{S}$-TeX uses pairs of commands of the form

  command and \end*command*

  to delimit environments; for instance,

`\document`	and	`\enddocument`
`\proclaim`	and	`\endproclaim`

LaTeX uses `\begin{`*name*`}` and `\end{`*name*`}` to delimit environments.

- Some $\mathcal{A}\mathcal{M}\mathcal{S}$-TeX commands
  - were dropped because there were LaTeX commands that accomplished the same task.
  - became optional parameters of packages or commands.
  - were renamed because there were already LaTeX commands using those names.
- There are no bibliographic formatting commands in LaTeX.

Here are the steps to take when converting a document from $\mathcal{A}\mathcal{M}\mathcal{S}$-TeX:

1. Take a personalized template (see Section 1.8); save it under a new name, and type in the appropriate information. Then copy the entire $\mathcal{A}\mathcal{M}\mathcal{S}$-TeX article from `\document` to `\enddocument` and paste it in the body of your new document.
2. Replace the $\mathcal{A}\mathcal{M}\mathcal{S}$-TeX displayed-math delimiters (`$$`) by `\[` and `\]`.
3. Look for $\mathcal{A}\mathcal{M}\mathcal{S}$-TeX commands that start with `\end`. Change command pairs to the corresponding LaTeX environments. In particular, be sure to rewrite each proclamation as an environment.
4. Retype your bibliography. Change the `\cite` commands to reference the labels you specify.
5. Rewrite any user-defined commands. Notice the change in syntax: `\define` and `\redefine` have become `\newcommand` and `\renewcommand`.

If your document is long, first create an appropriate master document for it (see Section 12.3.2 and Appendix F), and then proceed to step 1.

A number of $\mathcal{A}\mathcal{M}\mathcal{S}$-TeX commands that affect the style of the whole document have become document class or amsmath package options (two were dropped). These commands are listed in Table G.2.

The $\mathcal{A}\mathcal{M}\mathcal{S}$-TeX commands listed in Table G.3 may also cause some difficulties if you have used them in the document.

G.2.3 Converting from version 1.2 of the AMS packages

Converting a document that uses version 1.2 of the amsmath packages to version 2.0 requires almost no changes. Some errors in a version 1.2 document were not caught by version 1.2 of amsmath, but will be caught by version 2.0. For example,

```
\[
   \begin{align*}
     ...
   \end{align*}
\]
```

$\mathcal{A}\mathcal{M}\mathcal{S}$-TEX Command	AMS Package Equivalent
\CenteredTagsOnSplits	centertags document class option
\LimitsOnInts	intlimits amsmath option
\LimitsOnNames	namelimits amsmath option
\LimitsOnSums	sumlimits amsmath option
\NoLimitsOnInts	nointlimits amsmath option
\NoLimitsOnNames	nonamelimits amsmath option
\NoLimitsOnSums	nosumlimits amsmath option
\TagsAsMath	dropped
\TagsAsText	dropped
\TagsOnLeft	leqno document class option
\TagsOnRight	reqno document class option
\TopOrBottomTagsOnSplits	tbtags document class option

Table G.2: AMS package equivalents of $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX style commands.

was accepted by version 1.2, but version 2.0 gives the error message

```
! Package amsmath Error: Erroneous nesting of equation structures;
(amsmath)                trying to recover with 'aligned'.
```

In version 1.2 of amsmath you had to use the capitalized versions of the math accent commands (\Acute, \Bar, \Breve, \Check, \Dot, \Ddot, \Grave, \Hat, \Tilde, and \Vec), for double accents to work properly. Version 2.0 of amsmath no longer requires you to use the capitalized commands; however, for compatibility, the capitalized versions are still available.

G.3 Converting to an AMS document class

If you have a LATEX article and the journal you submit it to requires an amsart submission, you will have to perform the conversion in Section G.3.1. Finally, I describe how to convert from version 1.1 of $\mathcal{A}\mathcal{M}\mathcal{S}$-LATEX in Section G.3.2.

G.3.1 Converting from LATEX

To convert a document to use a version 2.0 AMS document class, first convert it to a LATEX document using the AMS packages as described in Section G.2.1. Then convert the top matter. For an article, this conversion becomes easy if you utilize the template file you created in Section 8.4 by customizing amsart.tpl.

To convert a LATEX document to use an AMS document class (along with amssymb and latexsym), do the following steps:

	AMS Packages	
$\mathcal{A}\mathcal{M}\mathcal{S}$-TEX Command	Status	Workaround
\:	Conflict	Renamed; use \colon
\adjustfootnotemark	Dropped	Reset the counter footnote
\and	Conflict	Renamed; use \And
\boldkey (math style change)	Dropped	Use \boldsymbol
\botsmash	Dropped	Use the optional parameter b of \smash
\caption	Changed	Use the figure environment and the \caption command
\captionwidth	Dropped	Use the figure environment, the \caption command, and the \captionindent length command
\cite	Changed	Use new syntax
\displaybreak	Trap	Place it before \\
\dsize (math size change)	Dropped	Use \displaystyle
\foldedtext	Dropped	Use \parbox
\hdotsfor	Changed	Use new syntax
\innerhdotsfor	Dropped	
\italic (math style change)	Dropped	Use \mathit
\midspace	Dropped	Use the figure environment
\nopagebreak in multiline math environments	Dropped	
\pretend ... \haswidth	Dropped	Pad the label with blanks
\roman (math style change)	Conflict	Use \mathrm
\slanted (math style change)	Dropped	Use \mathsl
\ssize (math size change)	Dropped	Use \scriptstyle
\sssize (math size change)	Dropped	Use \scriptscriptstyle
\spacehdotsfor	Dropped	Use the optional parameter of \hdotsfor
\spaceinnerhdotsfor	Dropped	Use the optional parameter of \hdotsfor
\spreadlines	Dropped	
\thickfrac	Dropped	Use the \genfrac command
\thickfracwithdelims	Dropped	Use the \genfrac command
\topsmash	Dropped	Use the optional parameter t of \smash
\topspace	Dropped	Use the figure environment
\tsize (math size change)	Dropped	Use \textstyle
\vspace in multiline math environments	Dropped	Use the optional argument of the \\ command

Table G.3: $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX commands to avoid when using the AMS packages.

1. Take your personalized template (see Section 8.4), save it under a new name, and enter the article information. Paste the contents of the `document` environment of your LaTeX article into the `document` environment of your new file.
2. Define and invoke any declarations using the forms described in Section 3.4.
3. Do not use a LaTeX bibliographic style if you use an AMS document class; use an AMS bibliographic style instead.

G.3.2 *Converting from AMS-LaTeX, version 1.1*

Despite the dramatic changes behind the scenes, you will have to change very little to make an AMS-LaTeX 1.1 document work with an AMS document class. The changes you will have to make include

- The `\documentstyle` command must be changed to `\documentclass` in the preamble.
- Most of the document-style options have become packages, and should be loaded with the `\usepackage` command. See Sections 8.5 and 12.1.3 for information about the options of the AMS document classes.
- The aligned math environments have been redesigned. You should replace any
  - `xalignat` environments with `align`
  - `xxalignat` environments with `flalign`

  The `align` and `flalign` environments do not require an argument to specify the number of columns (see Section 5.5).
- `@` is no longer a special character—typing `@` yields @ (make sure that you replace `@@` by `@` in the `\email` command in the top matter of the document). As a result, the `@-` command had to be renamed (it is now `\nobreakdash`—see Section 2.4.9) and the `@>>>` and `@<<<` arrow commands can only be used in commutative diagrams (elsewhere, use the `\xleftarrow` and `\xrightarrow` commands; see Section 4.10.3).
- There are additional commands for changing font sizes in version 2.0. You may want to change `\small` to `\Small`, `\tiny` to `\Tiny`, and `\large` to `\Large` (see Section 8.1.1).
- The `\bold` command has been renamed `\mathbf` (see Section 4.13.3).
- The commands

  `\newsymbol`, `\frak`, and `\Bbb`

  have been renamed to

  `\DeclareMathSymbol`, `\mathfrak`, and `\mathbb`

  respectively. They are provided by the amsfonts package, which is automatically loaded by amssymb.

- The following eight rarely used commands have been moved to the amsxtra package:

`\accentedsymbol`	`\spdot`	`\sphat`
`\spbreve`	`\spddot`	`\sptilde`
`\spcheck`	`\spdddot`	

  See Section 4.9 for information about these commands. If you need to use any of them, add the line

  ```
  \usepackage{amsxtra}
  ```

  to the preamble of your document.
- `\fracwithdelims` has been removed. Use the `\genfrac` command (see Section 4.16) to rewrite constructs using the `\fracwithdelims` command.
- `\lcfrac` and `\rcfrac` are now options of the `\cfrac` command: Replace
  - `\lcfrac` with `\cfrac[l]`
  - `\rcfrac` with `\cfrac[r]`

  (see Section 4.16).
- The functionality of the multiline subscript and superscript environments, `Sb` and `Sp`, has been taken over by the `\substack` command (see Section 4.8.1).
- The environments `pf` and `pf*` have been replaced by the `proof` environment.
- The names of most font commands have changed; you may wish to update any font commands that appear in your document. If you only use the CM fonts, however, there is no hurry; the old commands should continue to work.

APPENDIX

H

Final word

In this final appendix, I will outline some of the material I did not discuss, and suggest some additional reading to learn more about LaTeX, typesetting, and writing.

H.1 What was left out?

The mission statement in the introduction stated that my goal for this book was to provide you with a good foundation in LaTeX and the AMS packages, and that we would not cover programming or visual design. As a result, I have omitted a great deal of material.

H.1.1 LaTeX omissions

LaTeX has some additional features that I have not discussed in this book:

1. The `picture` environment allows you to draw simple pictures with lines and circles.
2. The `array`, `tabular`, and `tabbing` environments have a number of additional features.

3. LaTeX makes the style parameters of a document and of most LaTeX constructs available to the user for modification. Very few of these parameters have been mentioned in this book.
4. Low-level NFSS commands provide finer control over fonts.

The following are some pointers to additional information on these topics:

1. Drawing with the `picture` environment has the advantage of portability. This environment is described in Leslie Lamport's *LaTeX: A Document Preparation System* [39]; many extensions are discussed in Chapter 10 of *The LaTeX Companion* [17]. However, I believe that the best approach is to use a drawing application that can save your illustrations in EPS format so that you can include them in your document using the graphics package (see Section 6.4.3).
2. The `tabbing`, `tabular`, and `array` environments—and their extensions—are described in detail in Leslie Lamport's *LaTeX: A Document Preparation System* [39] and Chapter 5 of *The LaTeX Companion* [17].
3. The style parameters for LaTeX are set by the document class. When a publisher changes the document class loaded by your document, the style parameters are changed to its specifications. If you explicitly change style parameters in your document, a publisher will have trouble getting your source file to conform to their publishing style. If you must change any basic style parameters, be sure to explain what you did with comments.
4. There are two types of commands defined in the NFSS: high-level and low-level commands. The latter are, by and large, meant for style designers and package writers. Nevertheless, anyone who wants to use fonts other than Computer Modern (the default) would do well to read Chapters 7 and 11 of *The LaTeX Companion* [17].

   Low-level NFSS commands are briefly mentioned in Section 2.6.10 and are used in Appendix D.

H.1.2 TeX omissions

Almost all discussion of Plain TeX was omitted from this book. TeX is a powerful programming language, allowing you to design any page layout or formula. Remember, however, that to change any design feature, you should be knowledgeable not only about TeX, but also about document design. Also keep in mind that making such changes may make it difficult or impossible for a publisher to make your document conform to its own specifications.

H.2 Further reading

Much documentation is included with the LaTeX and the AMS distributions; many third-party packages are also well documented. You will also find a great deal of documentation on CTAN.

As you have no doubt noticed, there are many references to *The LaTeX Companion* [17] in this book; while it is not a beginner's book, it is indispensable for advanced LaTeX users with special needs not served by existing document classes and packages. It is also the best overview of more than a hundred important packages. For package writers and students of NFSS, *The LaTeX Companion* [17] is *the* basic textbook. For graphics work, we now have *The LaTeX Graphics Companion* [18]; and on Web publishing *The LaTeX Web Companion* [19]. Consult these definitive books if your work requires them.

Learning TeX is a bit more complicated than learning LaTeX. You may want to start with Wynter Snow's *TeX for the Beginner* [55]. It introduces many of TeX's basic concepts in a very relaxed style with many examples; the notes on LaTeX make the book especially useful, and the author gives many examples of writing macros. The use of TeX as a programming language is not discussed.

Raymond Seroul and Silvio Levy's *A Beginner's Book of TeX* [54] is another good introduction; this book also includes a chapter on TeX programming. Donald E. Knuth's *The TeXbook* [34] provides an easy introduction to TeX, as long as you avoid the difficult parts marked by dangerous bend signs. Paul W. Abrahams, Karl Berry, and Kathryn A. Hargreaves' *TeX for the Impatient* [1] explains many TeX commands, grouped by topic. This book has a very useful, nonsequential approach. Finally, Victor Eijkhout's *TeX by Topic: A TeXnician's Reference* [16] is an excellent reference book on TeX, mainly for experts. For many tutorial examples, see the articles and columns in *TUGboat* (see Section 13.4).

For advice to authors of mathematical articles and books, see *Mathematics into Type. Updated edition* [58] by Ellen Swanson (updated by Arlene Ann O'Sean and Antoinette Tingley Schleyer); you may find it interesting to see how many of the rules in Swanson's book have been incorporated into LaTeX. The definitive book on style (in North America) is *The Chicago Manual of Style* [12]. Two other views on copy editing are presented in Judith Butcher's *Copy Editing: The Cambridge Handbook* [10] and *Hart's Rules for Compositors and Readers at the University Press, Oxford* by Horace Hart [32]. The special problems of writing about math and computer science are admirably dissected in Lyn Dupré's *BUGS in Writing: A Guide to Debugging Your Prose* [15]. Her advice is indispensable for anyone doing nonfiction writing.

Most people who write math have little or no background in typography, the art of printing with type. But when you become a typesetter, it can be useful to learn a little bit about typography. I would highly recommend Robert Bringhurst's *The Elements of Typographic Style* [9]. See also Ruari McLean's *The Thames and Hudson Manual of Typography* [40] and Alison Black's *Typefaces for Desktop Publishing: A User Guide* [8].

Harley Hahn's *A Student's Guide to Unix* [31] provides an excellent introduction to UNIX; and Kiersten Conner and Ed Krol's *Whole Internet: The Next Generation* [13] is a good first book on the Internet.

Bibliography

[1] Paul W. Abrahams, Karl Berry, and Kathryn A. Hargreaves, *TEX for the Impatient.* Addison-Wesley, Reading, MA, 1990.

[2] Adobe Systems, *PostScript Language Reference Manual.* Third edition. Addison-Wesley, Reading, MA, 1999.

[3] Adobe Systems, *Portable Document Format Reference Manual.* Addison-Wesley, Reading, MA, 1993.

[4] Adobe Systems, *Adobe Acrobat 4.0 Classroom in a Book.* Adobe Press, 1999.

[5] American Mathematical Society, *AMS-LATEX, Version 1.1—User's Guide.* Providence, RI, 1991.

[6] ———, *AMSFonts, Version* 2.2 *User's Guide.* Providence, RI, 1997.

[7] ———, *User's guide for the* `amsmath` *package* (*version* 2.0). Providence, RI, 1999.

[8] Alison Black, *Typefaces for Desktop Publishing: A User Guide.* Architecture Design and Technology Press, London, 1990.

[9] Robert Bringhurst, *The Elements of Typographic Style.* Second edition. Point Roberts, WA: Hartley & Marks, 1996.

[10] Judith Butcher, *Copy Editing: The Cambridge Handbook.* Second edition. Cambridge University Press, London, 1981.

[11] Pehong Chen and Michael A. Harrison, *Index preparation and processing.* Software Practice and Experience **19** (9) (1988), 897–915

[12] *The Chicago Manual of Style.* 14th edition. University of Chicago Press, Chicago, 1993.

[13] Kiersten Conner and Ed Krol, *Whole Internet: The Next Generation.* Third edition. O'Reilly & Associates, Sebastopol, CA, 1999.

[14] Michael Doob, *TEX Starting from* [1]. Springer-Verlag New York, 1993.

[15] Lyn Dupré, *BUGS in Writing. A Guide to Debugging Your Prose.* Revised edition. Addison-Wesley, Reading, MA, 1998.

[16] Victor Eijkhout, *TEX by Topic: A TEXnician's Reference.* Addison-Wesley, Reading, MA, 1991.

[17] Michel Goossens, Frank Mittelbach, and Alexander Samarin, *The LATEX Companion.* Addison-Wesley, Reading, MA, 1994.

[18] Michel Goossens, Sebastian Rahtz, and Frank Mittelbach, *The LATEX Graphics Companion.* Addison-Wesley, Reading, MA, 1997.

[19] Michel Goossens and Sebastian Rahtz (with Eitan Gurari, Ross Moore, and Robert Sutor), *The LATEX Web Companion: Integrating TEX, HTML and XML.* Addison-Wesley, Reading, MA, 1999.

[20] George Grätzer, *Math into TEX: A Simple Introduction to AMS-LATEX.* Birkhäuser Boston, 1993.

[21] ———, *AMS-LATEX.* Notices Amer. Math. Soc. **40** (1993), 148–150.

[22] ———, *Advances in TEX implementations. I. PostScript fonts.* Notices Amer. Math. Soc. **40** (1993), 834–838.

[23] ———, *Advances in TEX implementations. II. Integrated environments.* Notices Amer. Math. Soc. **41** (1994), 106–111.

[24] ———, *Advances in TEX implementations. III. A new version of LATEX, finally.* Notices Amer. Math. Soc. **41** (1994), 611–615.

[25] ———, *Advances in TEX. IV. Header and footer control in LATEX.* Notices Amer. Math. Soc. **41** (1994), 772–777.

[26] ———, *Advances in TEX. V. Using text fonts in the new standard LATEX.* Notices Amer. Math. Soc. **41** (1994), 927–929.

[27] ———, *Advances in TEX. VI. Using math fonts in the new standard LATEX.* Notices Amer. Math. Soc. **41** (1994), 1164–1165.

[28] ———, *Math into LATEX: An Introduction to LATEX and AMS-LATEX.* Birkhäuser Boston, 1996. Second printing 1998.

[29] ———, *General Lattice Theory.* Second Edition. Birkhäuser Verlag, Basel, 1998. xix+663 pp.

[30] ———, *First Steps in LATEX.* Birkhäuser Boston, Springer-Verlag New York, 1999.

[31] Harley Hahn, *Harley Hahn's Student's Guide to Unix.* Second edition. McGraw-Hill, New York, 1993.

[32] Horace Hart, *Hart's Rules For Compositors and Readers at the University Press, Oxford.* Oxford University Press, Oxford, 1991.

[33] Donald E. Knuth, *The Art of Computer Programming.* Volumes 1–3. Addison-Wesley, Reading, MA, 1968–1998.

[34] Donald E. Knuth, *The TEXbook*. Computers and Typesetting. Vol. A. Addison-Wesley, Reading, MA, 1984, 1990.

[35] ———, *TEX: The Program*. Computers and Typesetting. Vol. B. Addison-Wesley, Reading, MA, 1986.

[36] ———, *The Metafontbook*. Computers and Typesetting. Vol. C. Addison-Wesley, Reading, MA, 1986.

[37] ———, *METAFONT: The Program*. Computers and Typesetting. Vol. D. Addison-Wesley, Reading, MA, 1986.

[38] ———, *Computer Modern Typefaces*. Computers and Typesetting. Vol. E. Addison-Wesley, Reading, MA, 1987.

[39] Leslie Lamport, *LATEX: A Document Preparation System*. Second edition. Addison-Wesley, Reading, MA, 1994.

[40] Ruari McLean, *The Thames and Hudson Manual of Typography*. Thames and Hudson, London, 1980.

[41] Thomas Merz, *Web Publishing with Acrobat PDF*. Springer-Verlag New York, 1998.

[42] Robert Miner and Jeff Schaefer, *Gentle Introduction to MathML 1.0*. `http://www.webeq.com/mathml/gitmml/`

[43] Frank Mittelbach, *An extension of the LATEX theorem environment*. *TUGboat* **10** (1989), 416–426.

[44] Frank Mittelbach and Chris Rowley, *LATEX 2.09 → LATEX3*. *TUGboat*, **13** (1) (1992), 96–101.

[45] ———, *LATEX 2ε—A new version of LATEX*. TEX and TUG NEWS, **2** (4) (1993), 10–11.

[46] ———, *The LATEX3 project*. Euromath Bulletin, **1** (1994), 117–125.

[47] ———, *LATEX3 in '93*. TEX and TUG NEWS, **3** (1) (1994), 7–11.

[48] Frank Mittelbach and Rainer Schöpf, *The new font family selection—user interface to standard LATEX*. *TUGboat* **11** (1990), 297–305.

[49] Chuck Musciano, Bill Kennedy, Mike Loukides (Editor), *HTML: The Definitive Guide*. Third edition. O'Reilly & Associates, Sebastopol, CA, 1998.

[50] Ted Padova, *Acrobat PDF Bible*. IDG Books, Foster City, CA, 1998.

[51] Oren Patashnik, *BIBTEXing*. Document in the BIBTEX distribution.

[52] ———, *BIBTEX 1.0*. *TUGboat* **15** (1994), 269–273.

[53] Rainer Schöpf, *A new implementation of the LATEX* `verbatim` *and* `verbatim*` *environments*. *TUGboat* **11** (1990), 284–296.

[54] Raymond Seroul and Silvio Levy, *A Beginner's Book of TEX*. Springer-Verlag New York, 1991.

[55] Wynter Snow, *TEX for the Beginner*. Addison-Wesley, Reading, MA, 1992.

[56] W3C's Math Home Page, *Mathematical Markup Language (MathML)*. `http://www.w3.org/Math/`

[57] Michael Spivak, *The Joy of TEX*. Second edition. American Mathematical Society, Providence, RI, 1990.

[58] Ellen Swanson, *Mathematics into Type. Updated edition*. Updated by Arlene Ann O'Sean and Antoinette Tingley Schleyer. American Mathematical Society, Providence, RI, 1999.

[59] Ed Tittel and Natanya Pitts, *HTML4 for Dummies*. Second edition. IDG Books, Foster City, CA, 1999.

[60] Gabriel Valiente Feruglio, *Typesetting commutative diagrams. TUGboat* **15** (1994), 466–484.

Index

The Ⓐ symbol indicates an AMS enhancement to LaTeX; *italic* numbers indicate figures or tables.

␣ (space), 69, **70**
  in arguments of commands, 90
  in `\bibitem` labels, 257
  in `\cite` commands, 256
  in command names, 74
  in `tabular` environments, 147
  text symbol, *473*
  and `\verb*` commands, 134
\␣ (interword space), 7, **71**, 72, 76, 108, 373, *474*
! (exclamation mark), 5, 68
  float control, **252**, 427
  in `\index` commands, 397, 398, 400
¡ (Spanish exclamation mark), 68, *84, 85, 469, 472*
\! (negthinspace), 28, **185**, *185, 468, 474*
#
  key, 5, 69
  in user-defined commands, 318, 326
\# (# octothorp), *81, 85, 472*
$
  as inline math delim., 12, 53, 79, **157**
    act as braces, 77, 156
    must be balanced, 157–158
  key, 5, 69
\$ ($ dollar sign), **5**, *81, 85, 472*
$$
  AMS-TeX displayed math delimiter, 511
  TeX displayed math delimiter, 508
%
  in BibTeX databases, 91
  as comment character, 6, 7, 14, 52, 61, **89**, 90, 91, 127, 298, 402, 417
    in BibTeX databases, 389
  key, 5, 69
\% (% percent), **5**, 81, 91, *85, 472*
  in electronic mail addresses, 279
&
  as alignment point, 34, 36, 38, 210, 212, 214
  as column separator, 20, 147, 214, 229
  key, 5, 69
\& (& ampersand), *81, 85, 472*
&&, alignment point for annotations, 36
(
  in BibTeX database entries, 370
  in index entries, 399
  key, 5, 68
  as math delimiter (), *169, 464*
\((start inline math mode), 12, 79
  acts as special brace, 77, 156
  must be balanced, 157–158
)
  in BibTeX database entries, 370
  in index entries, 399
  key, 5, 68
  as math delimiter ()), *169, 464*
\) (end inline math mode), 12, 79
  acts as special brace, 77, 156
  must be balanced, 157–158
* (* asterisk), 82
  interactive prompt, **61**, 117, 323–325
  key, 5, 68
** prompt, 60
*-forms
  of commands, 48, **74**, 103, 107, 109, 111, 134, 139, 142, 175, 190, 192, 234, 245, 320, 329, 330, 412, 452
  of environments, 161, 197, 206, 207, 209, 250, 332, 515

+ key, 5
\+ (obs. TEX com.), 509
+ (plus), 16, 68, 162, 183, 186, 187, 211, 212
  as binary operation, *460*
+ and – rule, **183**, 186, 187, 212
  in `gather` environments Ⓐ, 207
  and subformulas, 210
, (comma), 5, 68
  in `\bibitem` commands, 257
  in BIBTEX databases, 371, 372, 391
  and italic corrections, 97
  use in formulas, 159
- (dash, hyphen, minus), 5, 16, 68, 80, 162, 183, 186, 187, 191, 211, 212
  as binary operation, *460*
  in `\hyphenation` commands, 87
\- (– opt. hyphen), 9, **86**, 102
-- (number ranges, en dash), **10**, **80**, *85*, *472*
  in BIBTEX databases, 373
--- (— em dash), **10**, 80, *85*, *472*
. (period), 5, 68
  in BIBTEX databases, 373
  and italic corrections, 97
... (ellipsis), **19**, 29, 31, **83**, **165–166**, 227
  centered (· · ·), **19**, 165
  diagonal, 228
  vertical, 228
\. overdot text accent (˙), *84*, *470*
/ (slash)
  as divisor, 16, 68, 162
  key, 5
  as math delimiter (/), *169*, *464*
\/ (italic correction), **97**, *474*
  and font commands, 95
: (colon), 5, 68
  as binary relation, 68, 186, *457*
\:
  medspace spacing command, **185**, *185*, *468*, *474*
  obsolete $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX command, *513*
; (semicolon), 5, 68
\; (thickspace), **185**, *185*, *468*, *474*
< (less than)
  as binary relation (<), *457*
  key, 11, 68
> (greater than)
  as binary relation (>), *457*
  key, 11, 68
\> (tabbing com.), 127, 128
= (equal sign)
  in BIBTEX database fields, 370
  key, 5, 68
\=
  macron text accent (¯), *84*, *470*
  tab set command, 127
" (double quote), 5, 69, **80**
  in BIBTEX database fields, **371**, 391, 392
  in `\index` commands, 400–401
  key, 82
\" dieresis/umlaut text accent (¨), 5, 492, *84*, *470*
"`ck` (European character), 492
"`s` (eszett), 492
?
  prompt, 14, 51, 60
  question mark, 5, 68
¿ (Spanish question mark), 68, *84*, *85*, *469*, *472*
@ (@ at sign), 69, **82**, 514
  in BIBTEX database (`bib` files), 370
  in `\index` commands, 399, 400
\@ (intersentence space), *474*
@- (obs. form of `\nobreakdash`), 514
@-expression, 148
@. (blank math symbol for comm. diagrams) Ⓐ, 232
@<<< (stretchable left arrow math sym.) Ⓐ, **232**, 514
@= (stretchable equals sign math sym.) Ⓐ, 232
@>>> (stretchable right arrow math sym.) Ⓐ, **232**, 514
@@, in older versions of $\mathcal{A}\mathcal{M}\mathcal{S}$-LATEX, **82**, 514
@AAA (stretchable up arrow math sym.) Ⓐ, 233
@VVV (stretchable down arrow math sym.) Ⓐ, 233
@\vert (stretchable double vertical line) Ⓐ, 233
@| (stretchable double vertical line) Ⓐ, 233
[
  with `\item` commands, 126
  key, 5, 68
  math delimiter, *169*, *464*
  with `\newcommand`, 318
  and optional arguments, **10**, 21, **74**, **75**, 139, 144, 148
\[(start displayed math mode), 12, **156**, **159**, 508, 511
  acts as special brace, 77, 156
]
  with `\item` commands, 126
  key, 5, 68
  math delimiter, *169*, *464*
  with `\newcommand`, 318
  and optional arguments, **10**, 21, **74**, **75**, 139, 144, 148
\] (end displayed math mode), 12, **156**, **159**, 508, 511
  acts as special brace, 77, 156

{
in BibTeX entries, 374
with \def, 325
key, 5, 69
must be balanced, 77, 82
in \index commands, 406
for required arguments, 4, 10, 13, 17, **74**, 75, 163, 313, 480
for scoping, 76–78
\{
as math delimiter ({), *169*, *464*
text brace ({), 82, *81*, *85*, *472*
}
in BibTeX entries, 374
with \def, 325
key, 5, 69
must be balanced, 77, 82
in \index commands, 406
for required arguments, 4, 10, 13, 17, **74**, 75, 163, 313, 480
for scoping, 76–78
\}
math delimiter (}), *169*, *464*
text brace (}), 82, *81*, *85*, *472*
\ (backslash)
key, 5, 69
starts commands, 4, 10, **74**, 81
text symbol, 81–82
\\ (new line), **10**, 32, **102**, **104**, 146
in arguments of commands, **104**, 234
breaking lines with, 20, 34, 36, 38, 48, 103, 127, 128, 179, 206, 207, 209, 220, 224, 275–277, 301, 427
in environments, **104**, 131, 147, 153, 268
and \kill commands, 128
optional argument of, **10**, 32, **103**, 146, *513*
in text, 104
* (new line), **103**, 234
^ (caret)
key, 5, 69, 81
for superscripts, **17**, 19, 27, **163–164**, 166, 179
\^ circumflex text accent (^), *84*, *85*, *470*, *472*
_ (underscore)
key, 5, 69
for subscripts, **17**, 19, 27, **163–164**, 166
_ (_ underscore), **5**, *81*, *85*, *472*
in electronic mail addresses, 279
‘ (left single quote), 5, 7, 68, **80**
\‘ grave text accent (`), *68*, *84*, *470*
’ (right single quote), 5, 7, 68, **80**
for primes (′), 163, 189
\’ acute text accent (´), *84*, *470*
| (| vertical line), 5, 11, 26, 69, **82**, 184
as absolute value sign (|x|), 26
as binary relation, 172, 184
in \index commands, 398, 400
as math delimiter, 18, 21, 26, 28, 169, 184, 186, *169*, *464*
in tabular environments, 147
\| (|| math delim.), 31, 169, *169*, *464*
~ (tilde)
key, 5, 7, 69, 81
tie/unbreakable space, 7, 33, 69, 71, 72, 80, **81**, 104, *474*
in AMS documents, 81
in BibTeX databases, 374
with cross-references, 33, **72**, 248
\~ tilde text accent (~), *81*, *84*, *470*, *473*

8pt (doc. class opt.) Ⓐ, 98, **301**
9pt (doc. class opt.) Ⓐ, 98, **301**
10pt (doc. class opt.), 98, **264**
AMS variant, 301
11pt (doc. class opt.), 98, **264**
AMS variant, 301
12pt (doc. class opt.), 98, **264**
AMS variant, 301

a4paper (doc. class opt.), 265
AMS variant, 302
a5paper (doc. class opt.), 265
\aa (å), *84*, *469*
\AA (Å), *84*, *469*
abbreviations
in bibliographic entries, 382–383
defining, 383
periods in, 71–72
using small caps for, 96
using ties (~) with, 72
abbrv (BibTeX style), *369*
abbrv.bst (BibTeX style file), *369*
\above (obs. TeX com.), *509*
\abovewithdelims (obs. TeX com.), *509*
Abrahams, Paul W., 519
absolute
names for equations, 197
units, 8, 10, 98, 102, 111, 113, 115, 349
values (|x|), 26
abstract (struct. text env.), 40, 51, 73, **243**, 264, 274, 285, *38*
placement of, 243, 274, 285
in report document class, 264
\abstractname (redef. name), *324*
abstracts, **243**, 274, *38*
in articles, 40
in documents using AMS packages, 285
in report document class, 264
separate page for, 266, 303

accents
  in bibliographies, 374
  European, 11, **83–84**, *470*, *473*
  hyphenation of words with, 87
  math, **19**, 30, **179–180**, 305, 324, 467, 512, 515
    double, **179**, 512
  text, 5, 75, 81, **83–84**, *470*
accents (pack.), 180
Acrobat Distiller, 445
Acrobat PDF Bible (Padova), 446
Acrobat Reader, **445**, 449, 450, 452
  font encoding used by, 452
  plug-in for Web browsers, 446
acronyms, using small caps for, 96
acute (´)
  math accent, *180*, *467*
  text accent, *84*, *470*
\acute (ǵ math accent), *180*, *467*
\Acute (ǵ obs. math accent), 512
\addcontentsline (table of contents com.)
  arguments of, 413, 416
  and lists of figures and tables, 416
adding lines
  to lists of figures and tables, 416
  to table of contents, 413–414
addition, 16, 68, 162
address (BIBTEX database field), 371, 378
\address
  AMS top matter command, 281
    optional arguments of, 277, 279
    rules for using, 277–278
  in letters, 268
  top matter command Ⓐ, 300
addresses
  of authors in articles, 48, 277, 281, 300
  in letters, 268
\addtocontents (table of contents com.)
  arguments of, 414, 416
  and lists of figures and tables, 416
\addtocounter (counter incr. com.), 348
\addtolength (counter setting com.), 351
adjusted
  columns, 225–234
  formulas, 204, **225–234**
    flush left and right, 208
\adjustfootnotemark (obs. AMS-TEX com.), *513*
adjusting
  interline spacing, **100**, 118
  placement of root with \sqrt, 167
Adobe, 487
  Acrobat
    Capture, 446
    Distiller, 445
    Exchange, 446
    Reader, *see* Acrobat Reader
  Illustrator, 436, 447
  PDF Writer (print driver), 445
  Portable Document Format (PDF), *see under* PDF
  PostScript (PS), *see* PostScript
Adobe Acrobat 4.0 Classroom in a Book (Adobe Systems), 446
Adobe Systems, 444–446
\advancepageno (obs. TEX com.), *509*
\ae aesc (æ), *84*, *469*
\AE Aesc (Æ), *84*, *469*
\afterpage (delay com.), 269
afterpage (pack.), 269
afterwords, of books, 411
\aleph (ℵ Hebrew char.), *455*
algorithms, LATEX font-substitution, 99
align (math align. env.) Ⓐ, 34–37, 204, **213–217**, 220, 223, 478, 514, *205*
  page breaks in, 234
alignat (math align. env.) Ⓐ, 204, **217–219**, *205*
  argument of, 219
aligned
  formulas, 34, 36, 37, 203–205, 213–217, 219–221, 223, 225, 234, 302, 478, 510, 514
    text in, 219–220
  math environments, 234
    align Ⓐ, 34–37, 204, **213–217**, 220, 223, **234**, 478, 514, *205*
    alignat Ⓐ, 204, **217–219**, *205*
    eqnarray, 203, **215–216**, 510
    flalign Ⓐ, 204, **215**, 514, *205*
    intercolumn space in, 35
    and \verb commands, 134
  subsidiary math environments, 220–225
    aligned Ⓐ, 204, **221–223**, **235**
    alignedat Ⓐ, 221–223, 235
    split Ⓐ, 36, 204, **223–225**, **235**, 302, *205*
aligned (subsid. math align. env.) Ⓐ, 204, **221–223**
  and \allowdisplaybreaks commands, 235
alignedat (subsid. math align. env.) Ⓐ, 221–223
  and \allowdisplaybreaks commands, 235
alignment
  of columns in tabular environments, 147
    on decimals, 148, 270
  of formulas, *see also under* adjusted, 213–225
    annotated, 36, *37*
    commands for, 208, 209

flush left and right, 215
multiline, 34–38, **204**, **211–212**
simple, 34–36, *35*
of large symbols, 222–223
point
for annotations (`&&`), 36
for subformulas (`&`), 34, 36, 38, 210, 212, 214
of text, **4**, 73, 112, 146, **153**, 220, 352, 360, 508
centering, 4, 10, 146, 149, 153, **154**, 220, 360
command declarations for, 149, **154**, 220
flush left, 4, 10, 153
flush right, 4, 10, 112, 153
with `trivlist` environments, 360
of text boxes, vertical, 115, 116
within text boxes, 113, 116
`\allowdisplaybreaks` (display-break com.) Ⓐ, **234**, 510
optional argument of, 235
and subsidiary math environments, 235
`alltt` (disp. text env.), 62, 133, 164
alltt (pack.), 269
`\alph` (lowercase letter counter style com.), *347*
`\Alph` (uppercase letter counter style com.), *347*
`alpha` (BIBTEX style), *368*
`\alpha` (α Greek char.), *456*
`alpha.bst` (BIBTEX style file), *368*
alphabets (counter style), *347*
alphabets, math, 190–192
blackboard bold Ⓐ, 27, **193**, 337, 514, *468*
calligraphic, 31, **192**, 306, 337, *468*
Euler Fraktur Ⓐ, 26, 28, **193**, 306, 337, 514, *468*
Euler Script Ⓐ, **192**, 306, 337, *468*
Greek, 192
symbol, 192–193
alphanumeric keys, 4–5
`\amalg` (II math op.), *460*
American Standard Code for Information Interchange, *see* ASCII
ampersand (`&`)
as alignment point
for annotations, 36
for subformulas, 34, 36, 38, 210, 212, 214
as column separator, 20, 147, 214, 229
text symbol, *81*, *85*, *472*
AMS (American Mathematical Society), **437**, 478, 484
AMSFonts, *see* AMSFonts
bibliographies, 50
database files, 383
fields, 371
sample files, 383, **384–385**
styles, **257**, **367**, 373, 383–385, *368*
document classes, *see also under* document classes, xxxiii, xxxvi, 16, 50, 55, 56, 58, 81, 86, 87, 93, 135, 243, **274–306**, 409, **410–413**, 454, 479, 508
and indexing, 394
and numbered lists, 122
options, *see under* document class options
environments, *see under* displayed math environments, subsidiary math environments, *and* text environments
front matter, 285
packages, *see* AMS packages
sample files, *see under* sample files
Subject Classification, 280
technical support provided by, 437
templates, 297–301
top matter
AMS-specific information, 279–281
article information, 275–277
author information, 277–279
commands, 86, 93, **275–285**, 300, 301, 454, 514
examples of, 281–284
with multiple authors, 281
rules for, 277, 278
Web site, 486
AMS packages, xxxii–xxxiii, xxxvi, 58–61, 269, **305–307**, 477–478
amsbsy, 60, 192–194, **305**, 307
amscd, **232**, 305
amsfonts, xxxiii, 13, 26, 28, 60, 193, **306–307**, 486, 514
amsgen, 304, **305**, 306
amsmath, 16–20, 22, 25, 27–29, 31–35, 60, 61, 88, 112, 113, 134, 160, 161, 163–168, 170, 175, 176, 178–180, 182, 185, 187–190, 192–195, 197–199, 203, 230, 241, 242, 247, **304–305**, 319, 327, 349, 406, 478, 486, 509–511, *169*, *174*, *180*, *185*, *456*, *460*, *464*, *465*, *467*, *468*, *474*
amsopn, 305
amssymb, xxxvi, 13, 25, 27, 32, 60, 298, 306, 322, 514, *456*, *458–460*, *462*, *463*, *468*
amstext, 60, 112, 233, **305**
amsthm, 139, 143, 145, 270, 306, 329
amsxtra, 179, 305, **515**, *180*, *467*
automatic loading of, 58, 60
converting documents to use, 510–512

AMS packages (*continued*)
distribution, 383, 384
documentation for, 171, 204, **307**, 518
eucal, **192**, 306, 337, *468*
eufrak, 26, 28, **193**, 306
obtaining, 435
options of, 192, 241, 304–306, 468, 486, 512
preventing loading of, 304
source files, 204, 242, **268**, 307, 384
updates to, 61
upref, 305
using in LaTeX documents, 273–307, 510
\AmS (AMS logo com.) Ⓐ, 85
ams-c1.ins (AMS pack. distr. file), 384
AMS-LaTeX, *see also* AMS packages, 273, **305–307**, 477
history of, 475–479
version 1.0, 477–478
version 1.1
commands, 514, 515
converting from, 514–515
environments, **514**, 515
two-letter font commands, **100**, 315
version 1.2, 478
converting from, 511–512
version 2.0, 478
AMS-TeX, **476**, 477
commands to avoid using, **511**, *512, 513*
converting from, 510–511
displayed math delimiters ($$), 511
environment delimiters, 510, 511
history of, 475–479
amsalpha (BibTeX style) Ⓐ, *368*
amsalpha.bst (BibTeX style file) Ⓐ, *368*
amsart (doc. class) Ⓐ, xxxiii, xxxvi, 16, 55, 56, 93, 135, **274–305**, 409, 413, 454, 479
front matter of, 285
sample article, xxxiii, 55, 56, 135, 139, **140–142**, 143, 223, 257, 275, **281–297**, 298, 319, 323, 331, **338–344**, 361, 367, 383, 385, 386, 388, 389, 512
sectioning commands provided by, *246*
top matter of, 275–285
amsart.tpl (sample file) Ⓐ, **140–142**, 298, 512
amsbook (doc. class) Ⓐ, 409, **410–413**, 479
top-matter commands supported by, 413
amsbsy (pack.) Ⓐ, 60, 192–194, **305**
amscd (pack.) Ⓐ, **232**, 305
amsfndoc.tex (AMS pack. distr. file), 307
AMSFonts, xxxiii, xxxvi, 58, 187, 192, 194, 303, **306–307**
amsmath package options for, 304–305
document class options for, 303
documentation for, 307
obtaining, 435
PostScript versions of, 303, 306, 436, 478, **485, 486**
updates to, 61
amsfonts (pack.) Ⓐ, xxxiii, 13, 26, 28, 60, 193, **306–307**, 486, 514
options of, **306**, 486
amsgen (pack.) Ⓐ, 304, **305**, 306
amslatex (LaTeX distr. dir.), 268
amsldoc.tex (AMS pack. distr. file), 307
amsmath (pack.) Ⓐ, 16–20, 22, 25, 27–29, 31–35, 60, 61, 88, 112, 113, 134, 160, 161, 163–168, 170, 175, 176, 178–180, 182, 185, 187–190, 192–195, 197–199, 203, 230, 241, 242, 247, 304, **305**, 319, 327, 349, 406, 478, 486, 509–511, *169, 174, 180, 185, 456, 460, 464, 465, 467, 468, 474*
document class options affecting, 304
options of, 241, **304, 305**, 486, *512*
for AMSFonts, 304–305
amsmath.dtx (AMS pack. distr. file), 204
amsmath.sty (AMS pack. distr. file), 242
\AMSname (hyperref redef. name), *453*
amsopn (pack.) Ⓐ, 305
amsplain (BibTeX style) Ⓐ, 373, 383, 385, *368*
amsplain.bst (BibTeX style file) Ⓐ, **367**, 373, 384, 385, *368*
amsproc (doc. class) Ⓐ, **274–305**, 479
front matter of, 285
top matter of, 275–285
amssymb (pack.) Ⓐ, xxxvi, 13, 25, 27, 32, 60, 298, 306, 322, 514, *456, 458–460, 462, 463, 468*
amstext (pack.) Ⓐ, 60, 112, 233, **305**
amsthdoc.tex (AMS pack. distr. file), 307
amsthm (pack.) Ⓐ, 139, 143, 145, 270, 306, 329
amsxtra (pack.) Ⓐ, 179, 305, **515**, *180, 467*
Anarchie Pro (Macintosh FTP client), 434
and, in bibliographies, 372
\and
obsolete AMS-TeX command, *513*
top matter command, 47, 48
\And (& math op.) Ⓐ, *460, 513*
\angle (∠ math sym.), *463*
annotations
alignment of, 36, *37*
alignment point for (&&), 36
of formulas, 218
apalike (BibTeX style), 383, *369*

apalike (pack.), 383
apalike.bst (BibTeX style file), *369*
apostrophe ('), 68
  key, 163, 189
appendices, 245–246, 412
  numbering of, 246, 412
\appendix (struct. com.), 245–246, 412
\appendixname (redef. name), *324*
  and hyperref package, *453*
applets, Java, *see* WebEQ
\approx (≈ binary rel.), *457*
\approxeq (≋ binary rel.) Ⓐ, *458*
\arabic (numeric counter style com.), 356, *347*
\arccos (arccos math op.), *174*, *465*
\arcsin (arcsin math op.), *174*, *465*
\arctan (arctan math op.), *174*, *465*
\arg (arg math op.), *174*, *465*
arguments
  of commands, *see also under* specific commands
  of commutative diagram symbols Ⓐ, 232
  empty ({}), 76, 164, 183, 184, 189, 199, 210, 211, 279
  of environments, *see also under* specific environments
  movable, 79
  optional, 10, **74**, **75**, 104, 117, 119, 124, 126, 135, 167, 227
    of commands, 138, 139, 148, 235, 252, 256, 346, 347, 354, 355, 416
    of environments, **75**, 108, 116, 135, 144, **252**, 330, 427
    of sectioning commands, 245
    of structural commands, **245**, 410
    of top-matter commands, 275, 277, 279, 280, 282, 301
    use square brackets ([ ]), **10**, 21, **74**, **75**, 139, 144, 148
    of user-defined commands, 321
  required, 10, 15, 115, 117, 119, 149, 189, 480
    of commands, 10, 15, 115, 117, 119, 149, 189, 248, 259, 413, 414, 416, 480
    of environments, 20, 42, 75, 108, 147, 179, 217, 219, 229, 231, 255–256, 329, **331–333**, 355
    use braces ({}), 4, 10, 13, 17, **74**, 75, 163, 313, 480
  and tokens, 480
  of user-defined commands, 318–321
    multiple, 318
    optional, 321
    short, 320–321
  of user-defined environments
    optional, 331–332
    short, 332
  specifying zero in, 118
arithmetic
  with counters, 270, **347–349**
  with length commands, 270, **351**
  operations, 16–17, 162–164
array (subsid. math env.), 19, 29, 203–205, 225, **229–231**, 270, 477, 517, 518
  arguments of, 229, 231
  large delimiters with, 270
array (pack.), 270
arrays, 19–21, 229–231
\arraystretch (table com.), 151
  adjusting vertical spacing with, 151
arrows, math, **182**, 232, 514, *461*, *462*
  as delimiters, **169**, *169*, *464*
  stretchable, **182**, 232, 514
  vertical, 233
Art of Computer Programming, The (Knuth), 475
article (doc. class), xxxi, xxxiii, 7, 13, 16, 38, 39, 43, 46, 47, 86, 241, 242, 245, 259, **263–266**, 306, 409, 479
  anatomy of, 38–46
  sectioning commands provided by, *246*
ARTICLE (bibl. entry type), 371, **374–375**
article.cls (doc. class file), 242
article.tpl (template file), 46–47, 49, 253
article2.tpl (template file), 46–47
articles
  bibliographies in, **42–43**, 49, **253–255**, 370, 383, **384–385**, 392
  in BibTeX database files, 374–375, 382
  sectioning of, 48, **243–246**
  creating templates for, 46–47, 297–301
  top-matter information, 47–48
    AMS-specific, 275–285
    AMS Subject Classification, 280
    author addresses, 48, 277, 281, 300
    author names, 48, 277, 300
    current addresses Ⓐ, 278, 281
    dedications, 276
    e-mail addresses Ⓐ, 278, 281, 300
    keywords Ⓐ, 280, 301
    research support, 48, 279, 281, 300
    title, 48, 275, 301
    World Wide Web addresses Ⓐ, 279, 281, 300
ASCII (American Standard Code for Information Interchange), *see also* plain text, 5
askinclude (pack.), 418
\ast (* math op.), *460*

asterisk (* text sym.), *85*, *472*
\asymp (≍ binary rel.), *457*
at sign (@)
  in BibTeX database (bib files), 370
  in \index commands, 399, 400
\atop (obs. TeX com.), *509*
\atopwithdelims (obs. TeX com.), 18, 164, *509*
  warnings generated by use of, 18
author (BibTeX database field), 371, 372
\author (top-matter com.), 40, 47, 48, 413
  AMS variant, 281, 300
    optional arguments of, 277
  multiple authors in, 47
authoring tools, for HTML, 442
authors
  information about, 48
    in AMS top matter, 277–279, 281
  multiple, 48
    in AMS documents, 281
    in bibliographies, 372
  names of
    in articles, 48, 277, 300
    in running heads, 277
automatic
  numbering, xxxii, 33, 34, 39, 49, 122, 135, 224, 244
  renumbering, 33, 56
\autoref (hyperref cross-ref. com.), **453**, *451*
  names supported by, *453*
aux (aux. files), 33, **58**, 386, 389, 429, 481, 482
  cross-references recorded in, 481
auxiliary files, *see also* aux, bbl, bib, blg, bst, glo, idx, ilg, ind, lof, log, lot, out, *and* toc, 415, 428, 482
  names of, 481
  polishing, 428–429

\b underscore text accent (_), *84*, *470*
b5paper (doc. class opt.), 265
babel (LaTeX distr. dir.), 268
babel (pack.), 269, 491, 492
  options of, 491
back matter, 241, **252–258**, 411
  bibliographies in, 241
  numbering of chapters in, 411
  index in, 394
\backepsilon (∍ binary rel.) Ⓐ, *458*
\backmatter (struct. com.), 411
\backprime (‵ math sym.) Ⓐ, *463*
backref (opt. of hyperref pack.), 451
backref (pack.), 451
\backsim (∽ binary rel.) Ⓐ, *458*
\backsimeq (≌ binary rel.) Ⓐ, *458*
backslash (\ text sym.), *85*, *472*
\backslash (\ math delim.), *169*, *464*
badness, 481
balancing
  braces, *77*, 82
    errors with, *77–78*
    in \index commands, 406
  inline math delimiters, 157–158
  math delimiters, 171, 211
\bar ($\bar{x}$ math accent), 19, 30, **179**, *180*, *467*
\Bar ($\bar{x}$ obs. math accent), 512
bar, vertical (|)
  text symbol, *85*, *472*
\barwedge ($\barwedge$ math op.) Ⓐ, *460*
base (LaTeX distr. dir.), **268**, 435, 491
  packages in, 269
base names (of files), 481
baseline, of text, 351
  adjusting with setspace, 105
\baselineskip (length com.), 100, 107
\baselinestretch (length com.), 105
\Bbb (obs. AMS com.), 514
\Bbbk (𝕜 math sym.) Ⓐ, *463*
bbl (proc. bibl. files), 386, **388**, 389
\because (∵ binary rel.) Ⓐ, *458*
\begin (start of env.), **73**, *77*, 511
Beginners Book of TeX, A (Seroul & Levy), 519
\beginsection (obs. TeX com.), *509*
Berry, Karl, 487, 519
  font-naming scheme, 487
\beta (β Greek char.), *456*
\beth (ℶ Hebrew char.) Ⓐ, *455*
\between (≬ binary rel.) Ⓐ, *458*
Bezos, Javier, 180
\bf (obs. LaTeX 2.09 font com.), **100**, 315
bfseries (font weight env.), 153
\bfseries (font weight com. dec.), **98**, *95*, *470*
bib (BibTeX database files), 367, **370–383**, 386
  accents in, 374
  AMS, 383, **384–385**
  commas (,) in, 371, 372, 391
  comments in, 389
  cross-referencing within, 378–379
  delimited with parentheses (( )), 370
  delimiters in, 370
  double quote (") in, **371**, 391, 392
  en dashes (–) in, 373
  entries
    abbreviations in, 382–383
    capitalization in, 373
    Jr. in, 372
    multiple authors in, 372
    von in, 373

entry types, 370–383
case-sensitivity of, 372
start with @, 370
equals signs (=) in, 370
fields in, 371, 372, 377–380, 382
adding your own, 372
used by AMS bibliography styles, 371
case-sensitivity of, 372
optional, 372, 374–382
required, 372, 374–382
rules for typing, 372–383
termination of, 391
location of, 386
number ranges in, 373
numbers in, 371
periods (.) in, 373
portability of, 373
samples of, 370, 383, 392
ties (unbreakable spaces) in, 374
\bibcite (aux. file com.), 389, 481
\bibdata (aux. file com.), 387
\bibitem (bibl. com.), 34, 50, **255**, 256
commas in, 257
labels for, 255
optional argument of, 256
spaces in, 257
bibl.tpl (sample file), 49
bibliographies, *see also under* BibTeX, 34, 49–50, **252–258**, 511, *38*
AMS support for, 383, **384–385**
appear in back matter, 241
in articles, *see also* bibliographies, sample files for, **42–43**, 370, 383, 392
citing references from, 34, 50, **256**, **385**, 387, 508, 511, *513*
with BibTeX, 385
as hyperlinks in PDF files, 451
commands for, 50, **383**, 385
conventions, for labels, 50
converting from
AMS-TeX, 511
Plain TeX, 508
defining, 34, 42–43, 50, 72, **253–258**, 322, 352, **370–383**, 388
document class options affecting, **266**, *267*
entries made in auxiliary files for, 387, 389, 481
examples of, **42–43**, **45**, 49, **253–255**, **367–369**, 505
multiple, in a document, 258
numbering of, 50, **256**
portability of, 373
processed files, *see* bbl
sample files for, 370, 383, **384–385**, 392
styles, 383, 514, *368, 369*
AMS, **257**, 373, 383, 385, 514, *368*
templates, 253
\bibliography (bibl. com.), **383**, 385
\bibliographystyle (bibl. com.), **383**, 385
\bibname (redef. name), 258, *324*
\bibstyle (aux. file com.), 387
BibTeX, xxxii, 367–392
AMS support for, 383
citing references with, 385
commands, **383**, 385
in auxiliary files, 387
database files, *see* bib
log files, *see* blg
processed bibliography files, *see* bbl
running, 383–392
sample files for, 370, 383, **384–385**, 392
style files, *see* bst
styles, 373, 383, 385, *368, 369*
BibTeX 1.0, 374, 377, 379, 392
BibTeXing (Patashnik), 392
\big (math delim. size com.), 170
\Big (math delim. size com.), 170
\bigcap ($\bigcap$ large math op.), *177*, *466*
\bigcirc ($\bigcirc$ math op.), *460*
\bigcup ($\bigcup$ large math op.), *177*, *466*
\bigg (math delim. size com.), 170
\Bigg (math delim. size com.), 170
\biggl (math delim. size com.), 30, **170**
\Biggl (math delim. size com.), 170
\biggm (math delim. as binary rel. size com.), 173
\biggr (math delim. size com.), 30, **170**
\Biggr (math delim. size com.), 170
\bigl (math delim. size com.), 170
\Bigl (math delim. size com.), 170
\bigm (math delim. as binary rel. size com.), 173
\bigodot ($\bigodot$ large math op.), *177*, *466*
\bigoplus ($\bigoplus$ large math op.), *177*, *466*
\bigotimes ($\bigotimes$ large math op.), *177*, *466*
\bigr (math delim. size com.), 170
\Bigr (math delim. size com.), 170
\bigskip (spacing com.), 110
\bigsqcup ($\bigsqcup$ large math op.), *177*, *466*
\bigstar ($\bigstar$ math sym.) Ⓐ, *463*
\bigtriangledown ($\bigtriangledown$ math op.), *460*
\bigtriangleup ($\bigtriangleup$ math op.), *460*
\biguplus ($\biguplus$ large math op.), *177*, *466*
\bigvee ($\bigvee$ large math op.), *177*, *466*
\bigwedge ($\bigwedge$ large math op.), *177*, *466*
binary operations, 183, 190
adding white space around, 159
and alignment of displayed formulas, 212
and breaking displayed formulas, 211

binary operations (*continued*)
for congruences, 176
created with \overset, 189
defining, 190
and subformulas, 210
binary relations, 26, 28, **172**, 183, **184**, 190, *457, 458*
adding white space around, 159
and alignment of displayed formulas, 212
and breaking displayed formulas, 211
created with \overset, 188
created with \stackrel, 188
defining, 190
delimiters as, 172–173
math delimiters as, 173
negated, 27, **189**, *459*
\binom (math com.) Ⓐ, 17, 22, 164
binomial coefficients, 17–18, 164
in inline and displayed math environments, 164
Birkhäuser Boston, 494
bitmaps
fonts, 485
resolution of, 449, **486**
size of, 486, 492
using in PDF files, 486
preview images in EPS files, 447
Black, Alison, 519
blackboard bold (math alphabet), 27, **193**, 337, 514, *468*
\blacklozenge (◆ math sym.) Ⓐ, *463*
\blacksquare (■ math sym.) Ⓐ, *463*
\blacktriangle (▲ math sym.) Ⓐ, *463*
\blacktriangledown (▼ math sym.) Ⓐ, *463*
\blacktriangleleft (◀ binary rel.) Ⓐ, *458*
\blacktriangleright (▶ binary rel.) Ⓐ, *458*
blank
lines
in displayed math environments, 53, **161**, 206, 207, 209
terminating paragraphs with, 7, **70**, 105
in text environments, 145–146
in top-matter commands, 275
in verbatim environments, 145
math delimiters, 28, 171
math symbol for commutative diagrams (@.) Ⓐ, 232
blg (BibTeX log files), 386, **388**
Blue Sky Research, 435, 478, 485
blue space, *see also* tie, unbreakable spaces, non-breakable spaces, 81
bm (pack.), 270
bmatrix (subsid. math env.) Ⓐ, 228
Bmatrix (subsid. math env.) Ⓐ, 228
\bmod (mod math op.), **176**, *176, 460*
body, 39–42
of books, 411–412
of documents, 7, 23, 39, 43, 54, 73, **240–258**, *38*
of environments, 73
of page, 259
of theorem environment, 49
bold
font weight, 10, 30, 93, **98**, **153**, 168, 188, 192, **193**, 305, 315, 337, *95, 468, 470, 513*
math symbols, **193–195**, 270
\bold (obs. AMS com.), 514
\boldkey (obs. AMS-TEX com.), *513*
\boldsymbol (math font weight com.) Ⓐ, 30, 188, 192, **193**, 305, *468, 513*
book (doc. class), 98, 244, 409, **410–413**, 414, 479, 495–506
top-matter commands supported by, 413
BOOK (bibl. entry type), 371, **375–376**
BOOKLET (bibl. entry type), 371, **382**
booklets, in BibTeX database files, 382
bookmarks, in PDF documents, 452
bookmarks=true (opt. of hyperref pack.), 452
books
in BibTeX database files, 375–376
bodies of, 411–412
document classes for, 98, 244, 409, **410–413**, 414, 479, 492–506
options of, 412–413
final preparation of, 424–429
front matter of, 242
logical design of, 422–424
numbering of structures in, 411
sectioning of, **410–412**, 422
structure of, 411–412
writing with LaTeX, 409–429
booktabs (pack.), 153
booktitle (BibTeX database field), 371, 379
\bot (⊥ math sym.), *463*
\botsmash (obs. AMS-TEX com.), *513*
bottoms, of text boxes, 351
bounding boxes (of EPS figures), 447
\bowtie (⋈ binary rel.), *457*
\Box (□ math sym.), 510, *463*
\boxdot (⊡ math op.) Ⓐ, *460*
boxes, 112–119
bounding, *see* bounding boxes
commands for measuring, 351
around formulas, 200–201
framed, 114
invisible, *see* struts
and length commands, 351
multiline, 112
paragraph, 115–116

solid, *see also* struts, 117–118
text, 101
alignment of contents in, 113, 116
behave as characters, 112
commands for, 12, 22, 26, 28, 60, 87, 101, 104, 112–119, 150, 151, 159, 167, 168, 192, 233, 305, 351, 513
environments for, 101, 112, 116, 330, 331
fine-tuning placement of, 119
measurements of, 351
single line, 12, 22, 26, 28, 60, 87, 104, **112–114**, 159, 167, 168, 192, 233, 305
vertical alignment of, 115, 116
`\boxminus` (⊟ math op.) Ⓐ, *460*
`\boxplus` (⊞ math op.) Ⓐ, *460*
`\boxtimes` (⊠ math op.) Ⓐ, *460*
Braams, Johannes, 476
braces
must be balanced, 77, 82
special, 12, 77, 79, 156, 332, 333
act as environments, 77
cannot overlap, 77–78
stretchable horizontal, 180–181
braces, curly (`{}`), 4, 10, 13, 17, **74**, 75, 76, 163, 164, 183, 184, 189, 199, 210, 211, 279, 313, 480
in BIBTEX entries, 374
and command declarations, 314
with `\def`, 325
define scope, 76–78
in `\index` commands, 406
as math delimiters, *169*, *464*
in text (`{ }`), 82, *81*, *85*, *472*
unbalanced, 15
brackets, square (`[ ]`)
enclose optional arguments, **10**, 21, **74**, **75**, 135, 138, 139, 144, 148
as math delimiters, 18, 27, 168, *169*, *464*
with `\newcommand`, 318
breaking
formulas, *see under* formulas
lines, *see under* lines
pages, *see under* pages
paragraphs, *see under* paragraphs
breve (˘ text accent), *84*, *470*
`\breve` ($\breve{x}$ math accent), *180*, *467*
`\Breve` ($\breve{x}$ obs. math accent), 512
Bringhurst, Robert, 72, 96, 519
browsers, *see under* World Wide Web
`bst` (BIBTEX style files), **367**, 373, 384, 385, *368*, *369*
determine use of fields, 372
form of citations created by, 374
location of, 386
BUGS in Writing: A Guide to Debugging Your Prose (Dupré), 89, 519
bullet (• text sym.), *85*, *472*
`\bullet` (• math op.), *460*
bulleted lists, 122–123
`\bumpeq` (≏ binary rel.) Ⓐ, *458*
`\Bumpeq` (≎ binary rel.) Ⓐ, *458*
Butcher, Judith, 519
`\bye` (obs. TEX com.), *509*
`\bysame` (bibl. com.), **257**, 322

`\c` cedilla text accent (ç), *84*, *470*
© (copyright text sym.), *85*, *472*
`calc` (pack.), 270, 348, 351
calligraphic (math alphabet), 31, **192**, 306, 337, *468*
`\cap` (∩ math op.), *460*
`\Cap` (⋒ math op.) Ⓐ, *460*
capitalization, in bibliographic databases, 373
`\caption`
float command, *513*
in figures, 250
optional argument of, 416
in tables, 250
obsolete $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX command, *513*
`\captionindent` (length com.), *513*
captions, 146, 416, 513
in figures, 250
in lists, **123–124**, 416
multiple, 250
in tables, 250
`\captionwidth` (obs. $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX com.), *513*
caret (ˆ), *81*
Carlisle, David, 127, 148, 249, 251, 315, 362, 451, 476, 487
caron (ˇ text accent), *84*, *470*
case-sensitivity
of BIBTEX fields and entry types, 372
of command names, 10, **74**
of environment names, 74
of `\label` arguments, 248
of sort keys in `\index` commands, 406
`cases` (subsid. math env.) Ⓐ, 37–38, 204, 226, **231**, *205*
page breaks in, 234
`\ccname` (redef. name), *324*
`CD` (subsid. math env.) Ⓐ, 232
`\cdot` (· math op.), 16, **162**, *460*
`\cdots` (centered ellipsis), **19**, 165
cedilla (ç text accent), *84*, *470*
ceiling math delimiters, *169*, *464*
`center` (text align. env.), **4**, 112, 146, **153**, 220, 352, 360, 508
breaking lines in, 153

\centerdot (· math op.) Ⓐ, *460*
centered ellipses, **19**, 165
\CenteredTagsOnSplits (obs. $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX com.), *512*
centering text, 4, 10, 153
  in columns in tabular environments, 147
  in tables, 146, 149
\centering
  alignment command declaration, 149, **154**, 220
  obsolete TEX command, 509
centertags
  AMS document class option, **302**, 304, *512*
  amsmath package option Ⓐ, 304
centimeter (cm abs. unit), 10, 111, 113, 115, 349
\cfrac (math com.) Ⓐ, **195**, 515
chapter
  BIBTEX database field, 371
  counter, 345, *345*
\chapter (struct. com.), 244, 264, **410**
  arguments of, 410
  numbering of
    equations in, 411
    in front and back matter, 411
\chaptername (redef. name), *324*
  and hyperref package, *453*
chapters
  in BIBTEX database files, 382
  in books, 410
  document class options to set start pages for, 412–413
  grouping into parts, 410
  numbering of, in front and back matter, 411
characters, *see also* glyphs
  accented, **19**, 30, 75, **179–180**, 324, 467, 512, 515
  European, 11, **83–84**, *469–470*, *473*
  following verbatim environments, 132
  Greek, 27, 335, 456
  Hebrew, 455
  invalid, 5, 69
  line-ending, *see* line-ending characters
  math, 11, 68
  special, **5**, **69**, **81–83**, *469–473*
    in HTML, **441**, 442
    in \index commands, 400
    accessing with \symbol, **82**, 269
  treating text boxes as, 112
\check ($\check{x}$ math accent), *180*, *467*
\Check ($\check{x}$ obs. math accent), 512
checkers, spelling, 50, 62–63
Chen, Pehong, 393, 407
\chi (χ Greek char.), *456*
Chicago Manual of Style, The, 89, 152, 393, 429, 519
\choose (math com.), 164
\choose (LATEX binomial com.), 17, 22, 164
  obsolete in amsmath, 18, 164
\circ (∘ math op.), *460*
\circeq (≗ binary rel.) Ⓐ, *458*
\circlearrowleft (↺ math arrow) Ⓐ, *462*
\circlearrowright (↻ math arrow) Ⓐ, *462*
\circledast (⊛ math op.) Ⓐ, *460*
\circledcirc (⊚ math op.) Ⓐ, *460*
\circleddash (⊝ math op.) Ⓐ, *460*
\circledS (Ⓢ math sym.) Ⓐ, *463*
circumflex (ˆ)
  text accent, *84*, *470*
  text symbol, *85*, *472*
\citation (aux. file com.), 387
citations, bibliographic, 34, 50, **256**, **385**, 387, 508, 511, *513*
  created by BIBTEX styles, 374, **385**
  hyperlinks in PDF files for, 451
  showing in margins, 249
\cite
  bibliographic command, 34, 50, **256**, 387, 508, 511, *513*
    with BIBTEX, 385
    multiple citations, 256
    optional argument of, 256
    showing contents, in margin, 270
    showing labels in margins, 249
    spaces in, 256
  obsolete $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX command, *513*
classes (AMS pack. distr. dir.), 383, 384
classes, document, *see* document classes
classification of math symbols, 183–184, 190
\cleardoublepage (page-breaking com.), 107
\clearpage (page-breaking com.), **107**, 252
\cleartabs (obs. TEX com.), *509*
clients, FTP, *see under* FTP
\cline (table com.), 149–151, *151*
cls (doc. class files), 242, 323, 356
\clubsuit (♣ math sym.), *463*
cm (centimeter abs. unit), 10, 111, 113, 115, 349
CM (Computer Modern) fonts, *see* Computer Modern fonts
CMacTEX (Macintosh TEX system), 436
cmex10 (opt. of amsmath pack.) Ⓐ, **304**, **305**, 486
cmr10.tfm (TEX font metric file), 480
coefficients, binomial, *see* binomial coefficients
collections, in BIBTEX database files, 377–379
\colon (: math com.), **186**, *513*
colophons, of books, 411
colorlinks (opt. of hyperref pack.), 452

columns
  double
    document class options for, 265, 303
    figures spanning, 250
    footnotes in, 270
    tables spanning, 250
  math
    adjusted, 225–234
    adjusting with `flalign` environment, 215
    in aligned formulas, 213–225
    specifying in `matrix` subsidiary environments, 227
  multiple, **107–108**, 270, 477
  separator (&), 20, 147, 214, 229
  width, in `tabular` environments, 148
combining
  document class options, 266
  encapsulators in `\index` commands, 399
  files with `filecontents` environment, 421
command declarations, **78**, **94**, 149, **154**, 220
  affecting multiple paragraphs, 95
  do not take arguments, 78
  for fonts, *see* font command declarations
  scope of, **94**, **314–315**, 329
  using in user-defined commands, 95, 314–315
command files, *see also* `sty` files *and* packages, 242, **313**, **333–338**, 487
  commands in, 333, 334
  terminating, 338, 360
commands, 73–79
  *-ed forms, 48, **74**, 103, 107, 109, 111, 134, 139, 142, 175, 190, 192, 234, 245, 320, 329, 330, 412, 452
  arguments of, *see under* arguments *or* specific commands
  to avoid using, 18, 100, 164, 315, 424, 509, **511**, 512, 514, 515, *509*, *512*, *513*
  for boxes, *see under* boxes
  for dates and times, *see* time commands
  defining, *see* user-defined commands
  delimited, *see* delimited commands
  for figures, *see under* figures *or* floats
  for filling horizontal space, 31, **111–112**, 118, 137, 227, 229, 359, 513
  for floats, *see under* floats
  for fonts, *see* font commands
  fragile, 79
    protecting, 79, 410, 415
  generalized, *see* user-defined commands
  global, *see under* scope
  for graphics, *see under* graphics
  for indexing, *see under* indexing
  length, *see* length commands
  local, *see under* scope
  logical design using, 55–56
  long, 79
  math, *see* math commands
  names of, 74
    case-sensitivity of, 10, **74**
    choosing, 333
  in preamble, *see under* preamble
  primitive, *see* primitive commands
  providing, 322
  redefining, 322–323
  scope of, *see under* scope
  sectioning, *see* structural commands
  short, **79**, 94, 275
    defining, 320–321
  spacing, *see* spacing commands
  start with \, 4, 10, **74**, 81
  structural, *see* structural commands
  for tables, *see under* tables *or* floats
  terminating, 10, 12, **74**, **75**, 85, **86**, 271, 313
  TEX, *see under* TEX
  text style, *see* text style commands
  as tokens, 480
  top-matter, *see under* top matter
  types of, 78–79
  user-defined, *see* user-defined commands
  for expanding values, **85–86**, 117, **347**
commas (,)
  in argument of `\bibitem`, 257
  in BIBTEX databases, 371, 372, 391
  and italic correction, 97
  use in formulas, 159
`comment` (comment env.), 54, **91–92**, 133, 270, 334
  locating errors with, 92
  nesting, 91
comments, 89–92
  in BIBTEX database files, 389
  creating with `comment` environments, 54, **91–92**, 133, 270, 334
  creating with % characters, 6, 7, 14, 52, 61, **89**, 90, 91, 127, 298, 402, 417
  finding errors using, 91
  marginal, **116–117**, 427
    in double-sided documents, 116
    in equations, 116
    in multiline math environments, 116
    space between, 349
  wrapping, 90
commercial TEX systems, 435–436
commutative diagrams Ⓐ, **232–234**, 305, 514
`comp.text.tex` (newsgroup), 438
`\complement` (C math sym.) Ⓐ, *463*

components
  building formulas from, 22–25
  of formulas, 15–22, 162–182
  of pages, 259
Comprehensive TEX Archive Network, *see* CTAN
computer, *see also* Macintosh, PCs, *and* UNIX, xxxi
Computer Modern (CM) fonts, 57, 58, 93, 477
  bold extended, 93
  math bold italic, 192
  math italic, 191
  PostScript versions of, 436, 478, **484**, **486**
  roman, 94, 191, 480
  sans serif, 93, 94
  typewriter, 82, 94, *83*
conference proceedings, in BIBTEX database files, 376–377
\cong (≅ binary rel.), *457*
congruences, 18, 176
  as binary operations, 176
Conner, Kiersten, 519
consecutive numbering, of proclamations, 138–139
contents, tables of, *see under* tables
\contentsline (toc file com.), 414
\contentsname (redef. name), *324*
context, affects style of emphasized text, 95
continued fractions, 195
contrib (LATEX distr. dir.), 435
controls, float, 146, **251–252**
conventions
  for labels
    in bibliographies, 50
    of equations, 33
    of sections, 48
  typographical, xxxvii–xxxviii
converting documents
  from AMS-TEX, 510–511
  from DVI to PostScript, 444
  from PostScript to PDF, 445
  from LATEX to HTML, 442
  from LATEX 2.09 to LATEX 2ε, 509–510
  from Plain TEX to LATEX, 508–509
  to use the AMS packages, 510
\coprod (∐ large math op.), *177*, *466*
Copy Editing: The Cambridge Handbook (Butcher), 519
\copyright (© copyright), *85*, *472*
Cork (T1) font encoding, 87, 491, *473*
corner math delimiters, *169*, *464*
corollaries, *see* proclamations
corrections, italic, *see* italic corrections
\cos (cos math op.), *174*, *465*
\cosh (cosh math op.), *174*, *465*
\cot (cot math op.), *174*, *465*
\coth (coth math op.), *174*, *465*
counters, 127, 227, 325, **345–349**, *513*
  arithmetic with, 270, **347–349**
  defined in preamble, 346
  defining, 346
  and \include commands, 346
  incrementing, 348
  and \label commands, 348
  LATEX, *345*
  linking with other counters, 346, 347
  with list environments, 356
  names of, 139
  and proclamations, 345
  store numbers, 345
  styles for, 92, 127, 330, **346–347**, 356
  values of, 92, 347
    printing, **85–86**, 117, **347**
    setting, 345–346, 348
Courier, in LATEX documents, 487
cross-referencing, 49–50, **246–249**, **258**, 452, 508
  and automatic renumbering, 33, 56
  within BIBTEX databases, 378–379
  entries made in auxiliary files for, 389, 481
  of equations, **33**, 32–34, 36, 160, 199, 213, 247, 330
    groups of, 212–213
    in multiline math environments, 209
  in indexes, 401
  labels for, 33, 36, 48, 49, 52, 53, 160, 197, 209, 224, 244, **247**, 250, 348, 411
  of list items, 122, 127
  among multiple documents, 271
  page numbers, 33, 36, 197, **249**, 427, 482
    with varioref package, 270
  in proof environment titles, 144
  section numbers, 33, 36, 48, 49, 127, 144, 147, 160, 197, 209, 244, **247**, 305, 411, 482
  of tables, 147
  using ties (~) with, 33, **72**, 248
crossref (BIBTEX database field), 371
\csc (csc math op.), *174*, *465*
CTAN (Comprehensive TEX Archive Network), 204, 268, **433–435**, 436–438, 486, 488, 492, 518
  LATEX distribution on, 435
  mirrors of, 434
  packages on, 92, 105, 108, 153, 180, 204, 234, 261, 362, 418, 450, 487
  URLs for, 434
CTAN Catalogue (Web site), 438
\cup (∪ math op.), *460*
\Cup (⋓ math op.) Ⓐ, *460*

\curlyeqprec (⋞ binary rel.) Ⓐ, *458*
\curlyeqsucc (⋟ binary rel.) Ⓐ, *458*
\curlyvee (⋎ math op.) Ⓐ, *460*
\curlywedge (⋏ math op.) Ⓐ, *460*
\curraddr (top-matter com.) Ⓐ, 281
  rules for using, 278
\curvearrowleft (↶ math arrow) Ⓐ, *462*
\curvearrowright (↷ math arrow) Ⓐ, *462*
customizing
  article templates, 46–47
    for AMS document classes, 297–301
    preambles of, 47, 298
    top matter of, 47, 298
  bibliographies, by adding fields, 372
  indentation of text, 109
  LaTeX, 311–362
    formats, 360–362
  lists
    and counters, 356
    defining new, 352–360
cyrillic (LaTeX distr. dir.), 268
cyrillic (pack.), 269

\d underdot text accent (ạ), *84*, *470*
\dag († dagger)
  math symbol, *463*
  text symbol, *85*, *472*
\dagger († math op.), *460*
\daleth (ℸ Hebrew char.) Ⓐ, *455*
Dante (German TeX user group), 437
dashes, 68, **80**
  em dash (—), **10**, 80, *85*, *472*
  en dash (–), **10**, **80**, *85*, *472*
    in BibTeX databases, 373
\dashleftarrow (←-- math arrow) Ⓐ, *462*
\dashrightarrow (--→ math arrow) Ⓐ, *462*
\dashv (⊣ binary rel.), *457*
databases, BibTeX, *see also* bib, xxxii, 367, **370–383**, 386
\date (top-matter com.), 40, 47, 48, 86, 413
  AMS variant, **86**, 93
  with letter document class, 268
\datename (redef. name) Ⓐ, *324*
dates
  commands for, *see also* \date *and* time commands, 10, 48, 75, 76, **85–86**, 277, 491
  LaTeX release, 61
  of packages, 61
\day (time com.), 85
\dbinom (display-style binomial com.), 164
dcolumn (pack.), 148, 270
\ddag (‡ double dagger or diesis)
  math symbol, *463*
  text symbol, *85*, *472*
\ddagger (‡ math op.), *460*
\ddddot ($\ddddot{x}$ math accent) Ⓐ, *180*, *467*
\dddot ($\dddot{x}$ math accent) Ⓐ, *180*, *467*
\ddot ($\ddot{x}$ math accent), *180*, *467*
\Ddot ($\ddot{x}$ obs. math accent), 512
\ddots (diagonal ellipsis) Ⓐ, 228
decimals, alignment on, 148, 270
declarations, command, *see* command declarations
\DeclareMathOperator (op. def. com.) Ⓐ, 175, 192, 242, 305
\DeclareMathOperator* (op.-with-limits def. com.) Ⓐ, 175, 192
\DeclareMathSymbol (math sym. def. com.), 514
declaring, types of math symbols, 190
\dedicatory (top-matter com.) Ⓐ, 276
\def (TeX com.), 325–327
  defining arguments with, 326
  overwriting previously defined commands with, 326
\define (AMS-TeX user-defined command com.), 511
definition (procl. style) Ⓐ, **139**, 139–142
definition lists, 123–124
definitions, *see* proclamations
\deg (deg math op.), *174*, *465*
dehypht.tex (German hyph. pattern file), 492
delarray (pack.), 270
delimited commands, 325–327
  invoking, 326
delimiters
  in BibTeX database files, 370
  for displayed math environments, 508, 511
  for inline math environments, 12, 53, 79, 157–158
  math, *see* math delimiters
  for \verb commands, 133–134
\delta (δ Greek char.), *456*
\Delta (Δ Greek char.), *456*
depth
  of tables of contents, 349
  of text boxes, *351*
\depth (length com.), 116
description (text list env.), **123–124**, 126
design
  of document classes, 476
  logical, 55–56
    of books, 422–424
  visual, 55–56, 259–261
\det (det math op.), *174*, *465*
device independent files, *see* DVI files
\dfrac ($\frac{x}{y}$) Ⓐ, 31, **162**

\dh (eth Eur. char.), *473*
\DH (Eth Eur. char.), *473*
\diagdown (\ math sym.) Ⓐ, *463*
diagonal ellipses, 228
diagrams, commutative, *see* commutative diagrams
\diagup (/ math sym.) Ⓐ, *463*
\diamond (⋄ math op.), *460*
\Diamond (◇ math sym.), *463*
\diamondsuit (♢ math sym.), *463*
dieresis, *see* umlaut
diesis (‡)
  math symbol, *463*
  text symbol, *85*, *472*
\digamma (ϝ Greek char.) Ⓐ, *456*
\dim (dim math op.), *174*, *465*
dimensions, *see also* measurements
  units for measuring, 8, 10, 98, 102, 111, 113, 115, 185, 349, 468
    with length commands, 350
directories
  AMS distribution, *see under* AMS packages
  LaTeX distribution, *see under* LaTeX
  samples, *see* samples
  structure of, 420
  TeX inputs, *see under* TeX
  user-defined commands for manipulating, 317
  work, *see* work
\displaybreak (display-break com.), **234**, *513*
  optional argument of, 235
displayed formulas, *see* displayed math environments
displayed fractions, *see under* fractions
displayed math environments, 12, 16, 32–38, **156**, **203–235**
  $$ (start and end math mode)
    in AMS-TeX, 511
    in TeX, 508
  \[(start math mode), 12, **156**, **159**, 508, 511
  \] (end math mode), 12, **156**, **159**, 508, 511
  act as special braces, 77, 156
  align Ⓐ, 34–37, 204, **213–217**, 220, 223, **234**, 478, 514, *205*
  alignat Ⓐ, 204, **217–219**, *205*
  blank lines in, 53, **161**, 206, 207, 209
  breaking pages in, **234–235**, 510, *513*
  displaymath, 156
  eqnarray, 203, **215–216**, 510
  equation, 19, 32, 37, **160–161**, 197
  equation* Ⓐ, **161**, 197
  flalign Ⓐ, 204, **215**, 514, *205*
  font size in, 195, 513
  gather Ⓐ, 204, **206**, 213, *205*
  gather* Ⓐ, 206
  \index commands in Ⓐ, 406
  inline-style binomials in, 164
  multline Ⓐ, 204, **206–209**, *205*
  multline* Ⓐ, 207–209
  subequations Ⓐ, **198**, 213, 347
  visual guide to, **204**, *205*
displayed text environments, 129–133
  alltt, 62, 133, 164
  multicols, 107, 477
  proof Ⓐ, xxxiii, **143–145**, 306, 515
  quotation, **130**, 352
  quote, **129**, 352, 356
  and stretchable vertical space, 352
  tabbing, **127–129**, 508, 517, 518
  tabular, 127, **146–153**, 231, 250, 270, 477, 508, 517, 518
  theorem, 39, 49, 54, 55
  verbatim, **131–133**, 269, 270, 477
  verse, **130–131**, 352, 356
  xca Ⓐ, 142
  xcb Ⓐ, 142
displaymath (disp. math env.), 156
\displaystyle (math font size com.), **195**, *513*
dissertations, in BibTeX database files, 379–380
distributing files with filecontents environment, 242, **421**
distributions
  AMS packages, 204, 242, **268**, 307, 383, 384
  LaTeX, 58, 82, 86, 90, 249, **268–271**, 360, 384, 434, 435, 450, 479, 487–489, 491, 492
    on CTAN, 435
  PSNFSS, 487–489
  TeX, 479
\div (÷ math op.), **162**, *460*
\divideontimes (⋇ math op.) Ⓐ, *460*
division, 16, 68, 162, 460
\dj (dyet Eur. char.), *473*
\DJ (Dyet Eur. char.), *473*
doc (LaTeX distr. dir.), 268
document (struct. text env.), 7, 23, **39**, 43, 54, 73, 240
document class options, 58, 241, **264–266**, **301–305**, **412–413**
  8pt Ⓐ, 98, **301**
  9pt Ⓐ, 98, **301**
  10pt, 98, **264**
    AMS variant, 301
  11pt, 98, **264**
    AMS variant, 301

12pt, 98, **264**
AMS variant, 301
a4paper, 265
AMS variant, 302
a5paper, 265
for AMSFonts, 303
b5paper, 265
for bibliographies, **266**, *267*
centertags Ⓐ, **302**, 304, *512*
combining, 266
for double-column documents, 265, 303
for double-sided printing, 265, 303, 412
draft, 9, 102, 241, **265**
AMS variant, 302
executivepaper, 265
final, 265
AMS variant, 302
fleqn Ⓐ, **302**, 304
fleqno, 266
for font sizes, 264–265, 301–302
landscape, 265
legalpaper, 265
AMS variant, 302
leqno, 266
AMS variant, **302**, 304, *512*
letterpaper, 265
AMS variant, 302
noamsfonts Ⓐ, **303**, 304
nomath Ⓐ, 192, **304**
notitlepage, 266, 412
AMS variant, 303
onecolumn, 265
AMS variant, 303
oneside, 265, 412
AMS variant, 303
openany, 412
openbib, **266**, *267*
openright, 412
for page orientation, 265
are passed on to packages, **241**, 304
for position of equation numbers, 266, 302–303
psamsfonts Ⓐ, **303**, 305, 486
reqno, 266
AMS variant, 241, **302**, 304, *512*
for start of chapters, 412–413
tbtags Ⓐ, **302**, 304, *512*
for title pages, 266, 303, 412
titlepage, 266, 412
AMS variant, 303
twocolumn, 107, 241, **265**
AMS variant, 303
twoside, 107, **265**, **412**
AMS variant, 303
document classes, 55, 58, 241, 479
AMS, 86, 87, 243, **274–306**, 508
amsart, xxxiii, xxxvi, 16, 55, 56, 93, 135, 298, 409, 413, 454, 479
amsbook, 409, **410–413**, 479
amsproc, 479
anatomy of, 38–46
for books, 98, 244, 409, **410–413**, 414, 479, 492–506
changing, 56
cls files, 242, 323, 356
design of, 476
determine
placement of equation numbers, 33, 43, **160**, 266, 302–303
position of equations, 266, 303
spacing, 108
interdependencies of, 60
LaTeX, 262–268
article, xxxi, xxxiii, 7, 13, 16, 38, 39, 43, 46, 47, 86, 241, 242, 245, 259, **263–266**, 306, 409, 479
book, 98, 244, 409, **410–413**, 414, 479, 495–506
letter, **266–268**, 479
proc, 269, 479
report, 244, **263–266**, 479
slides, 268, 479
options of, *see* document class options
third party, 57, 409, 479
svsing6, 495–506
document font families, 4, 10, 41, 73, **94–95**, 96, **98**, **153**, 168, 305, 315, 337, 358, 488, *95*, *470*
normal, 94
roman, **94**, 487
sans serif, **94**, 487
typewriter style, **94**, 487
document parameters, for page design, 518
document style options, replaced by packages
for AMS-LaTeX 1.1, 514
for LaTeX 2.09, 509
documentation
for AMS document classes and packages, 171, 204, **307**, 518
for hyperref, 450
for LaTeX, 268, 518
packages, 271
for New Font Selection Scheme (NFSS), 519
\documentclass (preamble com.), 9, 16, 39, 89, 241, 509, 510, 514
and filecontents environment, 242, 421
and \NeedsTeXFormat command, 242

documents
  body of, 240–258
  cross-referencing among multiple, 271
  design of, 259–261
  LaTeX, 239–261
    using AMS packages in, 273–307, 510
    on the World Wide Web, 438–454
  master, 416, 418
  preamble of, 241–242
  printing and viewing, xxviii, xxix, 481
  splitting into multiple files, 416–418
\documentstyle (obs. AMS and LaTeX 2.09 preamble com.), 509, 514
dollar sign ($), *see also* $ *and* \$
  as displayed math delimiter, 508, 511
  as inline math delimiter, 53, **157**
  as text symbol ($), *81*, *85*, *472*
Doob, Michael, 114, 479
DOS, TeX systems for, 436
\dosuperject (obs. TeX com.), *509*
\dot ($\dot{x}$ math accent), *180*, *467*
\Dot ($\dot{x}$ obs. math accent), 512
\doteq ($\doteq$ binary rel.), *457*
\doteqdot ($\Ⓐ$ $\doteqdot$ binary rel.), *458*
\dotfill (space fill com.), 111
dotless i and j (ı ȷ), **84**, *84*, *470*
\dotplus ($\Ⓐ$ $\dotplus$ math op.), *460*
\dots (… math ellipsis com.), 165–166
  AMS variant, 19, 29, 31, 165
dots, filling lines with, 111
\dotsb (⋯ math com.) Ⓐ, 166
\dotsc (… math com.) Ⓐ, 166
\dotsi (⋯ math com.) Ⓐ, 166
\dotsm (⋯ math com.) Ⓐ, 166
\dotso (… math com.) Ⓐ, 166
double accents, in math, **179**, 512
double acute (˝ text accent), *84*, *470*
double dagger (‡)
  math symbol, *463*
  text symbol, *85*, *472*
double guillemet, *473*
double lines in CD environments Ⓐ, 233
double quote ("), *see also* quotation marks, **80**, *85*, *472*
  in BibTeX database fields, **371**, 391, 392
  in \index commands, 400–401
  key, 5, 69, **80**, 82
double spacing, 104–105
double subscripts and superscripts, font size of, **195**, *513*
double-column
  documents
    document class options for, 265, 303
    and footnotes, 270
  figures and tables, 250
double-sided printing
  document class options for, 265, 303, 412
  and marginal comments, 116
\doublebarwedge ($\Ⓐ$ $\doublebarwedge$ math op.), *460*
\doublecap ($\Ⓐ$ $\Cap$ math op.), *460*
\doublecup ($\Ⓐ$ $\Cup$ math op.), *460*
\doublespacing (setspace com.), 105
\downarrow ($\downarrow$)
  math arrow, *461*
  math delimiter, *169*, *464*
\Downarrow ($\Downarrow$)
  math arrow, *461*
  math delimiter, *169*, *464*
\downdownarrows ($\downdownarrows$ math arrow) Ⓐ, *462*
Downes, Michael, 476–478
\downharpoonleft ($\downharpoonleft$ math arrow) Ⓐ, *462*
\downharpoonright ($\downharpoonright$ math arrow) Ⓐ, *462*
draft (doc. class opt.), 9, 102, 241, **265**
  AMS variant, 302
drivers
  PostScript (DVI to PostScript converters), 58, 435, **444**
  printer, 58, 269, 435, **444**, **445**, 450–451
  video (DVI viewer), 435, 481
\dsize (obs. AMS-TeX com.), *513*
Duchier, Denys, 476
\dump (TeX com.), 360
duplexing, *see* double-sided printing
Dupré, Lyn, 89, 519
DVI files, 58, 389, 448, 481, 482
  converting to PostScript, 58, 435, **444**
  graphics in, 448
  printing, 481
  putting on the World Wide Web, 448
  viewing, 58, 435, 481
dvips
  DVI to PostScript converter, xxviii, 450
  option to hyperref package, 450
dvipsone (opt. of hyperref pack.), 450
dyet (Eur. char.), *473*

e-mail, *see* \email
EC fonts, *see* Extended Computer Modern fonts
edition (BibTeX database field), 371
editor (BibTeX database field), 371, 372
editors, text, xxvii, xxviii, xxx, 51, 58, 69, 89, 93, 435
Eijkhout, Victor, 519
electronic-mail address, *see* \email
Elements of Typographic Style, The (Bringhurst), 72, 96, 519
\ell (ℓ math sym.), *463*

ellipses (...)
  in math, **19**, 29, 31, **165–166**, 227, **228**
  in text, 83
em (font shape env.), 153
em (rel. unit), 113, 115
em dash (—), **10**, 80, *85*, *472*
EM fonts, *see* European Modern fonts
\em (font shape com. dec.), **95**, 98, *95*, *470*
  and italic correction, 98
\email (top-matter com.) Ⓐ, 278–279, 281, 300, 514
  rules for using, 278–279
\emph (font shape com.), 4, 10, 73, **95**, *95*, *470*
emphasized (font shape), xxx, 4, 10, 73, 93, **95**, 98, **153**, *95*, *470*
  context-dependence of, 95
empty (page style), 259
empty group ({}), 76, 164, 183, 184, 189, 199, 210, 211, 279
\emptyset (∅ math sym.), *463*
emTEX (DOS/Windows TEX system), 436
en dash (–), **10**, **80**, *85*, *472*
  in BIBTEX databases, 373
Encapsulated PostScript (EPS), *see* EPS
encapsulators in \index commands, 398
  combining, 399
\enclname (redef. name), *324*
encodings, font, *see* font encodings
\end
  AMS-TEX environment delimiter, 510, 511
  end of environment, **73**, 77, 511
  obsolete TEX command, 509
\endinput (input-ending com.), 338, 360, **417**
\endinsert (obs. TEX com.), *509*
eng (Eur. char.), *473*
\enlargethispage (spacing com.), 107, **426**, 429
\enlargethispage* (spacing com.), 107
\ensuremath (math mode com.), 92, **316**, 318, 322
Enter key, *see* Return key
entries
  bibliographic, *see under* bib
  glossary, *see under* glossaries
  index, *see under* indexing
enumerate (text list env.), **122**, 270, 330
  in AMS documents, 122
enumerate (pack.), 127, 270, 330, 334
enumi (counter), 127, *345*
enumii (counter), *345*
enumiii (counter), *345*
enumiv (counter), *345*
environments, 4, 10, **73–79**
  *-ed forms, 161, 197, 206, 207, 209, 250, 332, 515
  \\ in, 104
  act as braces, 77, **333**
  arguments of, *see under* arguments *or* specific environments
  to avoid using, 514, 515
  begin with \begin, **73**, 77, 511
  body of, 73
  case-sensitivity of names of, 74
  end with \end, **73**, 77, 511
  font size, 153
  indenting contents, in source file, 159
  list, *see* list text environments
  logical design using, 56
  math, *see under* inline and displayed math environments, subsidiary math environments, *and* displayed text environments
  modifying, 328–331
  \newline in, 104
  in preamble, 242
  for proclamations, *see under* proclamations
  short, 332
  subsidiary math, *see* subsidiary math environments
  for tables, *see* tables
  text, *see* displayed text environments, list text environments, *and* text environments
  user-defined, *see* user-defined environments
EPS (Encapsulated PostScript)
  files, 426
  format, **251**, 426, **447**, 518
\epsilon (ϵ Greek char.), *456*
\eqalign (obs. TEX com.), *509*
\eqalignno (obs. TEX com.), *509*
\eqcirc (≖ binary rel.) Ⓐ, *458*
eqnarray (math align. env.), 203, **215–216**, 510
\eqref (cross-ref. com.) Ⓐ, **33**, 36, 160, 199, 213, 247, 330
\eqslantgtr (⪖ binary rel.) Ⓐ, *458*
\eqslantless (⪕ binary rel.) Ⓐ, *458*
equals (=)
  in BIBTEX database fields, 370
  binary relation, 68, *457*
  key, 5
equation
  counter, *345*
  displayed math env., 19, 32, 37, **160–161**, 197
equation* (disp. math env.) Ⓐ, **161**, 197
\equationname (hyperref redef. name), *453*

equations, 32–34
grouping, 198–199
and Java applets, *see* WebEQ
labels for, **33**, 247
marginal comments in, 116
numbering of, **32–34**, **160–161**, 197, 206, 207, 209
in chapters of books, 411
groups, 212–213
in multiline math environments, 209
preventing, 35, 36, 206, 207, 209, 212, 224
within sections, 160, 242
variants, **198**, 212
placement of numbers, 33, 43, **160**
document class options for, 266, 302–303
position of, 266, 303
systems of, 218–219
tagging, 34, 161, **197–199**, 206, 207, 209, 212, 223, 224
`\equiv` (≡)
binary relation, *457*
math operator, 18
error messages, *see also* warning messages, 50–54
`\begin{`*xxx*`}` on input line *xx* ended by `\end{`*yyy*`}`, 51, 52, *77*, 329
`\begin{document}` ended by `\end{`*xxx*`}`, *77*, 132
`\begin{split}` won't work here, 225
`\tag` not allowed here, 209
`\verb` command ended by end of line, 134
Argument of `\`*xxx* has an extra `}`, 132, 217
Bad math environment delimiter, 15, 157, 415
Bad space factor (0), 91
with BibTeX, 390–392
in log (`blg`) files, 388
Command `\`*xxx* already defined, 314, 323, 328
Display math should end with `$$`, 53
Double superscript, 163
Environment *xxx* undefined, 207, 329
Erroneous nesting of equation structures, 512
Extra alignment tab has been changed to `\cr`, 230
Extra `}`, or forgotten `\`*xxx*, 78, 216
File '*xxx*' not found, 60
I was expecting a `,` or a `)`, 391, 392
Illegal character in array arg, 230
Illegal unit of measure (pt inserted), 118
Incomplete `\iffalse`; all text was ignored after line *xx*, 268
line numbers in, **54**, 136, 415
Misplaced `\`*xxx*, 148, 220, 227
Missing control sequence inserted, 350
Missing number, treated as zero, 104, 115, 118
Missing `$` inserted, 14, 53, 134, 157, 158, 161, 226
Missing `\begin{document}`, 136
Missing `\right.` inserted, 211
Missing `}` inserted, 15, 144
No counter '*xxx*' defined, 346
Paragraph ended before `\`*xxx* was complete, 53, 118, 136, 230, 231, 321, 327, 407
recorded in `log` file, **58**, 101
Runaway argument?, 51, 53, 136, 161, 230, 231, 284, 327, 407
Something's wrong--perhaps a missing `\item`, 54, 124, 144, 243, 256
TeX capacity exceeded, sorry, 406
Text line contains an invalid character, 5, 54, 69
Too many `}`'s, *77*, 284
Undefined control sequence, 52, 76, 284
Underfull `\hbox`, **103**, 481
Use of `\`*xxx* doesn't match its definition, 326
You're missing a field name, 390
escaping special characters, in `\index` commands, 400
eszett (ß, SS), 492, *84*, *469*
`\eta` (*η* Greek char.), *456*
eth (Eur. char.), *473*
`\eth` (ð math sym.) Ⓐ, *463*
ethel (œ, Œ), *84*, *469*
eucal (pack.) Ⓐ, **192**, 306, 337, *468*
options of, **192**, **306**, *468*
eufrak (pack.) Ⓐ, 26, 28, **193**, 306
Euler Fraktur (math alphabet) Ⓐ, 26, 28, **193**, 306, 337, 514, *468*
Euler Script (math alphabet) Ⓐ, **192**, 306, 337, *468*
European
accents, 11, **83–84**, *470*, *473*
characters, 11, **83–84**, *469–470*, *473*
quotation marks, *473*
European Modern (EM) fonts, 492
PostScript versions of, 487
ex (rel. unit), 113, 115

examples
of AMS top-matter commands, 281–284
of bibliographies, **42–43**, **45**, 49, **253–255**, **367–369**, 505
of book document class, 495–506
of HTML code, 440–441
of indexes, 394–397
of MathML, 443–444
of **svsing6** document class, 495–506
Excalibur (Macintosh spelling checker), 62
exclamation marks (!), 5, 68
as float controls, **252**, 427
in **\index** commands, 397, 398, 400
Spanish (¡), 68, *84*, *85*, *469*, *472*
terminating sentences with, 70–73
executivepaper (doc. class opt.), 265
exercises, 142–143
in books Ⓐ, 142
within a section Ⓐ, 142
\exists (∃ math sym.), *463*
exiting, from interactive mode, 61
\exp (exp math op.), *174*, *465*
expanding values of counters, **85–86**, 117, **347**
exscale (pack.), 269, 305, 306
Extended Computer Modern (EC) fonts, 478
extensibility of LaTeX and TeX, 57

Fairbairns, Robin, 476
\fallingdotseq (≒ binary rel.) Ⓐ, *458*
fancyhdr (pack.), 261
FAQ (Frequently Asked Questions), 437
\fboxrule (length com.), 114
\fboxsep (length com.), 114
fd (font def. file), **487**, **488**, 489
Fear, Simon, 153
Fetch (Macintosh FTP client), 434
fields, bibliographic, *see under* **bib**
figure (counter), *345*
figure (float env.), **250–251**, *513*
optional arguments of, **252**, 427
placement of, 426, 427
figure* (double-column float env.), 250
\figurename (redef. name), **323**, *324*
and hyperref package, *453*
figures, **250–251**, *513*
captions in, 416
fragile commands in, 79
commands for, **250**, **251**, 317, 416, **420**, 447
double-column, 250
forcing typesetting of, 107
lists of, 415–416
adding a line to, 416
fragile commands in, 79
numbering of, 250
old-style, 68
placement of, **252**, 426, 427
file formats
for graphics, 446–447
EPS, **251**, **447**, 518
GIF, 446, 449
JPEG, 446, 449
PNG, 446, 449
for publishing on the World Wide Web, 440–450
choosing, 447–450
file transfer protocol, *see* FTP
filecontents (packaging env.)
distributing files with, 421
placement of, 242, 421
warnings generated by, 421
files
AMS package source, *see under* AMS packages
auxiliary, *see* **aux**
BibTeX databases (**bib**), *see* **bib**
BibTeX log (**blg**), *see* **blg**
BibTeX style (**bst**), *see* **bst**
class (**cls**), *see under* document classes
command, *see* command files
distributing with **filecontents** environment, 242, **421**
DVI, *see* DVI files
Encapsulated PostScript (EPS), *see* EPS
font definition (**fd**), *see* **fd**
font metric, *see also* **tfm**, *see under* font metrics
glossary (**glo**), *see* **glo**
hyperref bookmarks (**out**), *see* **out**
hyphenation pattern, *see under* hyphenation
including in other files, 333, **416–418**
index entry (**idx**), *see* **idx**
list
of figures (**lof**), *see* **lof**
of tables (**lot**), *see* **lot**
listing those used by a document, 334
log, *see* **log** files
MakeIndex log (**ilg**), *see* **ilg**
naming of, 47
with **\graphicspath** commands, 420
organization of, 418–420
portability of, 5
Portable Document Format (PDF), *see* PDF
PostScript (PS), *see under* PostScript
processed bibliography (**bbl**), *see* **bbl**
processed index (**ind**), *see* **ind**
sample, *see* sample files
source, *see* source files

files (*continued*)
splitting documents into multiple, 416–418
start on new page with \include command, 416
style (sty), *see* sty files
tables of contents (toc), *see* toc
terminating, 338, 360, **417**
filling horizontal space, 31, **111–112**, 118, 137, 227, 229, 359, 513
final (doc. class opt.), 265
AMS variant, 302
final preparation, of books, 424–429
fine-tuning
of mathematical formulas, 186–187
placement of root with \sqrt, 167
placement of text boxes, 119
\Finv (⅃ math sym.) Ⓐ, *463*
First Steps in LaTeX (Grätzer), 54
\fivebf (obs. TeX com.), *509*
\fivei (obs. TeX com.), *509*
\fiverm (obs. TeX com.), *509*
\fivesy (obs. TeX com.), *509*
fixed-size math delimiters, 170
flalign (math align. env.) Ⓐ, 204, **215**, 514, *205*
\flat (♭ math sym.), *463*
fleqn
AMS document class option, **302**, 304
amsmath package option Ⓐ, 304
fleqno (doc. class opt.), 266
floats, *see also* tables *and* figures, 250–252
commands, 250, 252, 513
controls, 146, **251–252**
environments, 146, **250–251**, *513*
figure, **250–251**, *513*
figure*, 250
locating, 426, 427
table, 146, **250**, 251
table*, 250
forcing typesetting of, 107
specifying placement of, **252**, 427
floor math delimiters, *169*, *464*
flush left
alignment of formulas, 208, 215
columns in tabular environments, 147
setting equations, 266, 302
flush right
alignment of formulas, 208, 215
columns in tabular environments, 147
alignment of text, 112
flushleft (text align. env.), **4**, **153**, 352
breaking lines in, 153
flushright (text align. env.), **4**, 73, **153**, 352
breaking lines in, 153
\fnsymbol (footnote counter style com.), 92
\foldedtext (obs. AMS-TeX com.), *513*
folders, *see* directories
\folio (obs. TeX com.), *509*
font command declarations, *see also* font commands
for shape
\em, **95**, 98, *95*, *470*
\itshape, **95**, 98, 358, *95*, *470*
\normalfont, **94**, 488
\rmfamily, 94, *95*, *470*
\scshape, **95**, *95*, *470*
\sffamily, *95*, *470*
\slshape, **95**, 98, *95*, *470*
\ttfamily, *95*, *470*
\upshape, **95**, 358, *95*, *470*
for weight
\bfseries, **98**, *95*, *470*
\mdseries, **98**, *95*, *470*
font commands, *see also* font command declarations, 336–337, 515
and italic corrections, 95, 100
low-level, 100
and MakeIndex, 95
math, *see* math font commands
orthogonality of, **99**, 477
for selecting fonts using family names, 488
for series
\textmd, **98**, *95*, *470*
for shape, 95–96
\emph, 4, 10, 73, **95**, *95*, *470*
\textit, **95**, *95*, *470*
\textnormal, **94**, *95*, *470*
\textrm, 94, 305, *95*, *470*
\textsc, **95**, 96, *95*, *470*
\textsf, *95*, *470*
\textsl, **95**, *95*, *470*
\texttt, 10, *95*, *470*
\textup, 41, **95**, *95*, *470*
for size
\footnotesize, **98**, *275*, *471*
\huge, **98**, *275*, *471*
\HUGE, **98**, *275*, *471*
\large, **98**, 514, *275*, *471*
\Large, **98**, 514, *275*, *471*
\LARGE, **98**, *275*, *471*
\larger Ⓐ, 274
\normalsize, **98**, 274, *275*, *471*
\scriptsize, **98**, *275*, *471*
\small, **98**, 514, *275*, *471*
\Small, 514
\smaller Ⓐ, 274
\tiny, **98**, 514, *275*, *471*
\Tiny, 514
TeX, 508

two-letter (obs. LaTeX 2.09), **100**, 315, 509
and italic corrections, 100
using in math environments, 168
for weight
`\textbf`, 10, **98**, 168, 305, 315, 337, *95*, *470*
font encodings, **82**, *83*
LM1 (TEXTURES), 489
LY1 (TEX'n ANSI), 489
OT1 , 488
T1 (Cork), 87, 491, *473*
font environments
for series
`bfseries`, 153
for shape
`em`, 153
`itshape`, 153
`rmfamily`, 153
`scshape`, 153
`sffamily`, 153
`slshape`, 153
`ttfamily`, 153
`upshape`, 153
for weight
`bfseries`, 153
font families, document, *see* document font families
font metrics
files, **480**, 487, 488
virtual, 487
font series, 93, **98**
command declarations for, *see under* font command declarations
commands for, *see under* font commands
environments for, *see under* font environments
font shapes
command declarations for, *see under* font command declarations
commands for, *see under* font commands
environments for, *see under* font environments
and punctuation, typographic rules for, 96
sans serif, 93, 94
serif, 93
typewriter, 436, 478, **484**, **486**
font weight, 93
command declarations for, *see under* font command declarations
commands for, *see under* font commands
environments for, *see under* font environments
font width, 93
font-substitution algorithms, in LaTeX, 99
fontenc (pack.), 489, **491**
options of, 489
`\fontfamily` (font selection com.), 488
fonts
AMSFonts Ⓐ, xxxiii, xxxvi, 58, 187, 192, 194, 303–305, **306–307**
documentation for, 307
obtaining, 435
PostScript versions of, 303, 306, 436, 478, **485, 486**
bitmap, 485
resolution of, 486
size of, 486
using in PDF files, 486
blackboard bold Ⓐ, 27, **193**, 337, 514, *468*
bold math, 30, **191**, 193, 514, *191*, *468*
calligraphic, 31, **192**, 306, 337, *468*
commands, *see under* font commands *and* font command declarations
Computer Modern, *see* Computer Modern
Courier (typewriter shape), 487
encodings, *see* font encodings
Euler Fraktur Ⓐ, 26, 28, **193**, 306, 337, 514, *468*
Euler Script Ⓐ, **192**, 306, 337, *468*
European Modern (EM), *see* European Mod ern fonts
Extended Computer Modern (EC), *see* Extended Computer Modern fonts
Galliard, 94
Helvetica, 487
including in PostScript files, 444, 449
including in PDF files, 445
Lucida Bright, 489
math, 190–192
size of, **195**, 513
monospaced, 93
names of
LaTeX 2.09, 270
PSNFSS (Berry scheme), 487
PostScript, *see under* PostScript
proportional, 93
proprietary
using in PostScript files, 444
using in PDF files, 445
resolution of, 449
samples, 270
selecting, 93–100
with `\fontfamily` command, 488
with `\selectfont` command, 488
shapes, *see* font shapes

fonts (*continued*)
size of, 94, **98–99**, 153, 274, 275, 471, 514
document class options for, 264, 301–302
sources for, *490*
substitution of, 425, 426, 445
for text in math mode, 168
Times, 487–489
typewriter style, 93
virtual, 487
weight, *see* font weight
width, *see* font width
fontsmpl (pack.), 270
`fonttbl.tex` (sample file), 82, 147
footers, page, 259–261
`\footline` (obs. TEX com.), *509*
`footnote` (counter), *345*, *513*
`\footnote` (footnote com.), 92
footnotes, 92–93
and double-column documents, 270
fragile commands in, 79
indicated by symbols, 92
in `minipage` environments, 116
on title pages, 93
unmarked Ⓐ, 279, 280
`\footnotesize` (font size com.), **98**, *275*, *471*
`\footstrut` (obs. TEX com.), *509*
`\forall` (∀ math sym.), *463*
forcing
floats to typeset, 107
indentation, 105
formats, file, *see* file formats
formats, TEX
creating with `initex`, 479
custom, 360–362
LaTeX, 58, 90, 268, 271, 384, 450, **479**, 487–489, **492**
Plain TEX (`plain.fmt`), 479
files read by `virtex`, 479
formatting of documents, determined by
document classes, 108
Web browsers, 440, 442
`formula.tex` (sample file), 22–24
formulas, 12, 79
adjusted, 204, **225–234**
aligning, 34–38, 203–205, **213–225**, 234, 302, 478, 510, 514
multiline, 211–212
rules for, 211–212, 215
text in, 219–220
annotating, 218
boxed, *see under* boxes
breaking into multiple lines, 35–36, **211–212**
displayed, 426
rules for, 211
components of, 15–22, 162–182
building using, 22–25
displayed, *see* displayed math environments
fine-tuning, 186–187
specifying fonts for, 194
gallery, 25–32
grouping, 204, **206**
multiline, xxxii, **34–38**, 510
splitting, 206–209
numbering, *see under* equations
splitting, 206–209
foundries, type, 487, *490*
4allTEX, 436
`\frac` ($\frac{x}{y}$), 13, 15, 17, 31, **162**, *513*
fractions, 13, 15, 17, 31, **162**, *513*
continued, 195
displayed, 31, **162**
generalized, 199–201
inline, 162
`\fracwithdelims` (obs. AMS com.), 515
fragile commands, 79
protecting, **79**, 244, 410, 415
`\frak` (obs. AMS com.), 514
`\framebox` (box com.), 114
framing (boxing) text, 101, 114
freeware TEX systems, 436
`\frenchspacing` (spacing com.), 73
Frequently Asked Questions (FAQ), 437
front matter, 241, **242–243**, 411
of AMS documents, 285
of books, 242, **413–416**
numbering of chapters in, 411
`\frontmatter` (struct. com.), 411
`\frown` (⌢ binary rel.), *457*
ftnright (pack.), 270
FTP (File Transfer Protocol), 434
clients, 434

`gallery.tex` (sample file), 25–32
Galliard, 94
`\Game` (⅁ math sym.) Ⓐ, *463*
`\gamma` (γ Greek char.), *456*
`\Gamma` (Γ Greek char.), *456*
`gather` (math env.) Ⓐ, 204, **206**, 213, *205*
page breaks in, 234
rules for, 206
`gather*` (math env.) Ⓐ, 206
`gathered` (subsid. math env.) Ⓐ, 204, **221–223**
and `\allowdisplaybreaks` commands, 235
`\gcd` (gcd math op.), *174*, *465*
`\ge` (≥ binary rel.), *457*
General Lattice Theory (Grätzer), 427

generalized
commands, *see* user-defined commands
fractions, 199–201
TEX commands for, 509
\genfrac (math com.) Ⓐ, **199–201**, 515, *513*
Gentle Introduction to MathML (Miner & Schaefer), 443
Geodesic Flows (Paternain), example pages from, 494–506
Geometry Technologies, Inc., 443
\geq (≥ binary rel.), *457*
\geqq (≧ binary rel.) Ⓐ, *458*
\geqslant (⩾ binary rel.) Ⓐ, *458*
german (opt. of babel pack.), 491
\gg (≫ binary rel.), *457*
ggamsart.tpl (template file) Ⓐ, 301
ggart.tpl (template file), 47
ggart2.tpl (template file), 47
\ggg (⋙ binary rel.) Ⓐ, *458*
GIF (Graphics Interchange Format), 446, 449
\gimel (ג Hebrew char.) Ⓐ, *455*
glo (glossary files), 407, 482
global commands, *see under* scope
glossaries, 407
auxiliary file (**glo**), 407, 482
as a custom **list** environment, 359
defining, 407, 482
\glossary (glossary com.), 407, 482
glue, **325**, **352**, 354, 480–481
horizontal, 480–481
parameters of, 480
vertical, *see also under* vertical spacing, 481
glyphs, *see also* characters
measuring, 480
\gnapprox (⪊ neg. binary rel.) Ⓐ, *459*
\gneq (⪈ neg. binary rel.) Ⓐ, *459*
\gneqq (≩ neg. binary rel.) Ⓐ, *459*
\gnsim (⋧ neg. binary rel.) Ⓐ, *459*
Goossens, Michel, 439
graphics
commands for, **251**, 317, **420**, 447
and DVI files, 448
files, 317
LATEX documents as, 449
formats, 446–447
EPS, 251, 447, 518
GIF, 446, 449
JPEG, 446, 449
PNG, 446, 449
including in documents, **250–251**, 445
resolution of, 449
scaling, 251
graphics (LATEX distr. dir.), 268
graphics (pack.), **251**, 269, 420, 518
Graphics Interchange Format, *see* GIF
\graphicspath (graphics com.), 317, **420**
grave (` text accent), *68*, *84*, *470*
\grave (ȋ math accent), *180*, *467*
\Grave (ȋ obs. math accent), 512
Gray, Gary L., 487
greater than (>)
as binary relation, *457*
text symbol, *85*, *472*
Greek letters, 27, 335, 456
Greenwade, George D., 105
grouping
chapters into parts, 410
equations, 198–199
formulas, 204, **206**
symbols with math delimiters, 172
groups
of equations, 198–199
cross-referencing, 212–213
labels for, 199
numbering, 212–213
of tokens, 480
\gtrapprox (≳ binary rel.) Ⓐ, *458*
\gtrdot (⋗ binary rel.) Ⓐ, *458*
\gtreqless (⋛ binary rel.) Ⓐ, *458*
\gtreqless (⪌ binary rel.) Ⓐ, *458*
\gtrless (≷ binary rel.) Ⓐ, *458*
\gtrsim (≳ binary rel.) Ⓐ, *458*
guillemets, *473*
\guillemotleft (Eur. quot. mark), *473*
\guillemotright (Eur. quot. mark), *473*
\guilsinglleft (Eur. quot. mark), *473*
\guilsinglright (Eur. quot. mark), *473*
Gurari, Eitan, 439
GUTenberg (French TEX user group), 437
\gvertneqq (≩ neg. binary rel.) Ⓐ, *459*

\H double acute text accent (˝), *84*, *470*
Hahn, Harley, 519
Hán Thế Thánh, 445
\hangafter
length command, 106
TEX command, 325
\hangindent
length command, **105**, 508
TEX command, 508
hanging indentation, **105–106**, 131
Hargreaves, Kathryn A., 519
Harrison, Michael A., 393, 407
Hart's Rules for Compositors and Readers at the University Press, Oxford (Hart), 519
Hart, Horace, 519
\haswidth (obs. AMS-TEX com.), *513*
\hat (x̂ math accent), 19, *180*, *467*
\Hat (x̂ obs. math accent), 512

\hbar (ħ math sym.), *463*
\hdotsfor
AMS space fill command, 31, *227*, 229, *513*
optional argument of, *227*
obsolete $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX command, *513*
headers, page, *see* running heads
headings (page style), 259
\headline (obs. TEX com.), *509*
\headtoname (redef. name), *324*
\heartsuit (♡ math sym.), *463*
Hebrew letters, 455
\height (length com.), 116
height, of text boxes, *351*
Helvetica, in LATEX documents, 487
\hfill (space fill com.), 111, 137, 229, 359
\Hfootnotename (hyperref redef. name), *453*
\hfuzz (\hbox warning adjustment), 102
hhline (pack.), 152, 270
hierarchy, of structural commands, 244, 410
history of $\mathcal{A}\mathcal{M}\mathcal{S}$-LATEX, $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX, TEX, and LATEX, 475–479
\hline (table com.), 147, 149
\hom (hom math op.), *174*, *465*
\hookleftarrow (↩ math arrow), *461*
\hookrightarrow (↪ math arrow), *461*
horizontal lines (rules), in tabular environments, 147, 149
horizontal spacing, 271
commands
\! (negthinspace), 28, **185**, *185*, *468*, *474*
\␣ (interword space), 7, **71**, 72, 76, 108, 373, *474*
\, (thinspace), 19, 26, 72, 80, 183, **185**, *185*, *468*, *474*
\: (medspace), 185, 468, 474
\; (thickspace), **185**, *185*, *468*, *474*
\@. (intersentence), *474*
to avoid using, 424
\dotfill (fill com.), 111
\frenchspacing, 73
\hdotsfor (fill com.) Ⓐ, 31, 227, 229, *513*
\hfill (fill com.), 111, 137, 229, 359
\hrulefill (fill com.), 111, 118
\hspace, **108**, 128
\hspace*, 74, **109**
\medspace Ⓐ, *185*, *468*, *474*
\mspace Ⓐ, **185**, *185*, *468*
\negmedspace Ⓐ, *185*, *468*, *474*
\negthickspace Ⓐ, *185*, *468*, *474*
\negthinspace, 28, **185**, *185*, *468*, *474*
\nonfrenchspacing, 73
\phantom, 108, 184, **187**, 217, 351
\qquad, 22, 108, **185**, 218, *185*, *468*, *474*
\quad, 19, 22, 108, 158, **185**, 218, *185*, *468*, *474*
\thickspace Ⓐ, *185*, *468*, *474*
\thinspace, 19, 26, 72, 80, 183, **185**, *185*, *468*, *474*
\xspace, 315–316
intersentence, 7, 70–72, *474*
interword, 7, 70, **71**, 72, 76, 108, 330, 373, *474*
in math, **12**, 31, 35, **158–160**, **182–187**, 227, 229, 513
preventing removal of, 109
in text, 7, 12, **70–73**, **108–109**, **111–112**, 118, 137, 359
howpublished (BIBTEX database field), 371
\href (hyperref comm.), 453–454
\hrulefill (space fill com.), 111, 118
\hslash (ħ math sym.) Ⓐ, *463*
\hspace (spacing com.), **108**, 128
\hspace* (spacing com.), 74, **109**
HTML (HyperText Markup Language), 440–442
HTML 4 for Dummies (James & Tittel), 442
HTML: The Definitive Guide (Musciano & Kennedy), 442
HTTP (Hypertext Transfer Protocol), 434
\huge (font size com.), **98**, *275*, *471*
\HUGE (font size com.), **98**, *275*, *471*
hyperlinks
in HTML, 442
in PDF files, 450–454
for bibliographic citations, 451
commands for creating, **452–454**, *451*
increasing size of, 453
suppressing, 452
to Web sites, 453–454
hyperref (pack.), 450–454
bookmarks file (out), 452
documentation for, 450
options of, **450**, **451**, **452**, *451*
hypertex (opt. of hyperref pack.), 450
Hypertext Markup Language, *see* HTML
Hypertext Transfer Protocol, *see* HTTP
hyphen.tex (LATEX distr. file), 86, 492
hyphenation, **9**, **86–89**, 480
determined by optional hyphen, 86
displaying, 88
of German text, 492
of hyphenated words, 9
pattern files, 492
preventing, 87–88, 113

specifying, 87
tables, 479
of words with accents, 87
`\hyphenation` (hyph. word-list com.), 87
hyphens, 68, **80**
key, 5, 68
optional, 9, **86**, 102, 426
unbreakable, 88

`\i` (ı dotless i), **84**, *84*, *470*
IBM, 448
`\idotsint` ($\int\cdots\int$ large math op.) Ⓐ, 166
`idx` (index aux. file), 403, **404**, **482**
`ieeetr` (BibTeX style), *369*
`ieeetr.bst` (BibTeX style file), *369*
`\iff` ($\Longleftrightarrow$ math arrow), *461*
`\ignorespacesafterend` (spacing com.), 330
`\iiiint` ($\iiiint$ large math op.) Ⓐ, 166
`\iiint` ($\iiint$ large math op.) Ⓐ, 166
`\iint` ($\iint$ large math op.) Ⓐ, 166
`ilg` (MakeIndex log files), 405
illustrations
applications for creating, 436
Encapsulated PostScript (EPS), **251**, 426, **447**, 518
file formats for, 446–447
with the `picture` environment, 251, 517, **518**
portability of, 518
PostScript fonts in, 486
preparation of, 426
using typeset material, 436
Illustrator (Adobe), 436, 447
`\Im` (ℑ math sym.), *463*
`\imath` (ı math sym.), *463*
`in` (inch abs. unit), 10, 102, 111, 113, 115, 349
`\in` (∈ binary rel.), *457*
`inbibl.tpl` (sample file), 253–255
`INBOOK` (bibl. entry type), 371, **382**
inch (`in` abs. unit), 10, 102, 111, 113, 115, 349
`\include` (inclusion com.), 416–420
and auxiliary files, 482
and counters, 346
errors with, 417
files start on new pages, 416
`\includegraphics` (graphics com.), **251**, 317, 420, 447
`\includeonly` (preamble inclusion com.), **417**, 420
including
files in other files, 333, **416–418**
fonts
in PDF files, 445
in PostScript files, 444
graphics in documents, **250–251**, 445
`INCOLLECTION` (bibl. entry type), 371, **377–379**
incrementing counters, 348
`ind` (proc. index files), **404–405**, 429
`\indent` (indentation com.), 105
indentation
of first lines of paragraphs, 105, 270, **349**
hanging, **105–106**, 131
in `multline` and `multline*` environments, 207
in source files, 24
of environment bodies, 159
of subformulas, 211
of text, 105–106
customizing, 109
forcing, 105
preventing, 105
indentfirst (pack.), 270
`\index` (indexing com.), 318, **393**, 394, **397–402**, 482
at signs (`@`) in, 399, 400
defining cross-references in indexes with, 401
in displayed math environments Ⓐ, 406
double quote (`"`) in, 400–401
encapsulators, 398, 399
exclamation marks (`!`) in, 397, 398, 400
modifiers, 398, 399
page ranges in, 399
placement of commands, **401–402**, 428
spaces in argument of, 405–406
syntax of, 402
vertical line (`|`) in, 398, 400
indexes, 269, **392–407**
appear in back matter, 394
auxiliary files (`idx`), 403, **404**, **482**
cross-references in, 401
defining, *see* indexing
entries
stored in `idx` files, 403, **404**
sorting, 399–400
log files (`ilg`), 405
main entries, 258, 393
placement of, **394**, 405
processed files (`ind`), **404–405**, 429
processing, 402–405
sample, 394–397
simple, 258
subentries, 258, 393
subsubentries, 258, 393
typesetting, 402–405
vertical space in, 258, 393

indexing, *see also MakeIndex*, 392–407
  with AMS document classes, 394
  commands for, 258, 318, **393–402**, 405, 482
  entries
    main, **258**, **393**, 397
    subentries, **258**, **393**, 397, 398
    subsubentries, 398
  environment for, 258, 352, 393, 404
  page ranges, 398–399
  placement of commands for, 401–402
  processed index files (`ind`), **404–405**, 429
  rules for, 405–407
  typesetting entries in margins, 269
  with user-defined commands, 318–319
`\indexname` (redef. name), *324*
`\inf` (inf math op.), *174*, *465*
infix notation, in TEX commands, 164
information, top-matter
  AMS-specific, 279–281
    AMS Subject Classification, 280
    keywords, 280, 301
  for articles, 275–285
    author names, 48, 277, 300
    title, 48, 275, 301
  author, 48, 277–279, 281
    addresses, 48, 277, 281, 300
    current addresses Ⓐ, 278, 281
    e-mail addresses Ⓐ, 278, 281, 300
    research support, 48, 279, 281, 300
    World Wide Web addresses Ⓐ, 279, 281, 300
  for articles
    dedications, 276
`\infty` (∞ math sym.), 14, *463*
`initex` (TEX program), 361, 479, 492
initials
  periods in, 72–73
  typographic rules for, 72
`\injlim` (inj lim math op.) Ⓐ, *174*, *465*
inline
  fractions, 162
  math formulas, *see* inline math environments
  tables, 146
inline math environments, 12, **156**
  and `$`, 12, 53, 79, **157**
  `\(` (start math mode), 12, 79
  `\)` (end math mode), 12, 79
  act as special braces, 77, 156
  display-style binomials in, 164
  font size of, 195, 513
  `math`, 156
  matrices in, 228–229
  size of delimiters in, 172
`\innerhdotsfor` (obs. $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX com.), *513*
`INPROCEEDINGS` (bibl. entry type), 371, **376–377**
`\input` (inclusion com.), 333, **416–420**
  errors with, 417
inputenc (pack.), 491
`install.txt` (LATEX distr. file), 268
`institution` (BIBTEX database field), 371
`instr-l.tex` (AMS pack. distr. file), 307
instructions to LATEX, *see also* commands *and* environments, 73, 79
`\int` ($\int$ large math op.), **19**, *177*, *466*
integers, stored in counters, 325
integrals, 19, 166
integrated TEX systems, 58, **435**
interactive mode, **60–61**, 117, 323–325
`\intercal` (⊺ math op.) Ⓐ, *460*
intercharacter space, 480
intercolumn spacing, 218, 222, *214*
  in aligned math environments, 35
  in `tabular` environments, 148
interline spacing, 172, 234, 318, 425
  adjusting, 104–105
international TEX user groups, 437
Internet, *see also* World Wide Web
  downloading sample files from, 4
  and LATEX and TEX, 433–454
intersentence spaces (`\@.`), 7, 70–72, *474*
  and `\frenchspacing`, 73
  and `\nonfrenchspacing`, 73
`\intertext` (text-in-math com.) Ⓐ, 219–220
interword space, 7, 70–72, 330
  command (`\␣`), 7, **71**, 72, 76, 108, 373, *474*
  and `\frenchspacing`, 73
  and `\nonfrenchspacing`, 73
`intlimits` (opt. of amsmath pack.) Ⓐ, **304**, *512*
`intrart.tex` (sample file), xxxi, **38–45**, 51, 55, 135, 136, 252, 264, 394
  typeset, 43–45
`intrarti.idx` (index entry file), 403–404
`intrarti.ilg` (index log file), 405
`intrarti.ind` (proc. index file), 404–405
`intrarti.tex` (sample file), 394–397, 402–405
invalid characters, 5, 69
invisible boxes, *see* struts
invoking
  delimited commands, 326
  proclamations, 39, 49, 54, 55, 511
  user-defined commands, 313
`\iota` (ι Greek char.), *456*
ispell (spelling checker for UNIX), 63

\it (obs. LaTeX 2.09 font com.), 100
italic corrections, **97–98**, *474*
  and commas, 97
  and \em, 98
  and font commands, 95
  and \itshape, 98
  and periods, 97
  and \slshape, 98
  suppressing, 97–98
  with two-letter font commands, 100
\italic (obs. AMS-TeX com.), *513*
italics
  bold math, 192
  font shape, 4, 10, 73, 93, **95**, 98, **153**, 358, *95*, *470*
    in math mode, **191**, *191*, *468*, *513*
  in HTML documents, 441
  math font, 191
\item (list item com.), 122–127
  in simple indexes, 258, 393
  optional arguments of, 124, **126**, **354**, 355
  and square brackets ([ ]), 126
\itemindent (length com.), *353*
itemize (text list env.), 122–123
\Itemname (hyperref redef. name), *453*
\itemsep (length com.), **354**, 358
itshape (font shape env.), 153
\itshape (font shape com. dec.), **95**, 98, 358, *95*, *470*
  and italic correction, 98

\j (ȷ dotless j), **84**, *84*, *470*
James, Steve, 442
Java applets, *see* WebEQ
Jeffrey, Alan, 476
Jensen, Frank, 348, 351
\jmath (ȷ math sym.), *463*
\Join (⋈ binary rel.), *457*
Joint Photographic Experts Group format, *see* JPEG
Jones, David M., 478
journal (BibTeX database field), 371
JPEG (Joint Photographic Experts Group format), 446, 449
Jr., in bibliographic entries, 372
jspell (PC spelling checker), 63
justification of text
  left, 10
  right, 10, 73

\k (ogonek Eur. accent), *473*
\kappa (κ Greek char.), *456*
Kennedy, Bill, 442
\ker (ker math op.), *174*, *465*
kerning, 480
key (BibTeX database field), 371
keyboard, 4–5, **68–69**
keys, 11
  alphanumeric, 4–5
  Enter, *see* Return key
  letter, 4–5, **68**
  modifier, 69
  number, 68
  prohibited, 5, 69
  Return, 5, 51, 52, 60, 61, 69
  sorting (in \index commands), 399, 400
    case-sensitivity of, 406
  spacebar, 5, 69
  special, 5, 69
  Tab, 5, 69
\keywords (top-matter com.) Ⓐ, 301
  rules for using, 280
\keywordsname (redef. name) Ⓐ, *324*
\kill (tabbing com.), 127, 128
Knuth, Donald E., xxx, 57, 475–477, 479, 508, 519
Krol, Ed, 519

L, slashed (Ł, ł), *84*, *469*
\label (cross-ref. com.), 33, 36, 48, 49, 52, 53, 160, 197, 209, 224, 244, **247**, 250, 348, 411
  arguments of, 248
  assigning counters to, 348
  placement of commands, 428
  showing in margin, 249, 270
  and simple indexes, 258
  in table environments, 250
labels
  for \bibitem commands, 255
  for bibliographic items, 50
  for equations, 247
  for groups of equations, 199
  of items in a list environment, **354**, 355, *353*
  in list environment, 124, **126**
  setting with \label, 247
\labelsep (length com.), *353*
\labelwidth (length com.), *353*
\lambda (λ Greek char.), *456*
\Lambda (Λ Greek char.), *456*
Lamport, Leslie, xxx, 476, 479, 518
\land (∧ math op.), *460*
landscape (doc. class opt.), 265
\langle (⟨ math delim.), **171**, *169*, *464*
language (BibTeX field) Ⓐ, 371
language.dat (LaTeX distr. file), 492

large
  math delimiters
    in `array` subsidiary math environment, 270
  operators, 19, **21**, 166, **176–179**, 466
    limits of, **176**, 304
    sizing of math delimiters with, 172
  symbols, 146, 220, 221
    alignment of, 222–223
`\large` (font size com.), **98**, 514, *275*, *471*
`\Large` (font size com.), **98**, 514, *275*, *471*
`\LARGE` (font size com.), **98**, *275*, *471*
`\larger` (font size com.) Ⓐ, 274
LaTeX, xxxi–xxxii, 476, **478**, 479
  is based on TeX, 57
  writing books with, 409–429
  compatibility mode (for typesetting LaTeX 2.09 documents), 509
  converting
    to HTML, 442
    from LaTeX 2.09, 509–510
    from Plain TeX, 508–509
  counters, *345*
  customizing, 63, **311–362**
  distribution, 58, 82, 86, 90, **268–271**, **360**, 384, 434, 450, **479**, 487–489, **492**
    on CTAN, 435
    directories, 249, **268**, 435, 491
  document classes, *see under* document classes
  document structure, 239–258, 411–412
  documentation for, 268, 518
    packages, 271
  documents, 239–261
    as graphics files, 449
    printing and viewing, xxviii, xxix, 481
    on the World Wide Web, 438–454
  files created by, 481–483
  font-substitution algorithm, 99
  formats, 58, 90, 268, 271, 384, 450, **479**, 487–489, **492**
    custom, 360–362
    source files, **360**, 492
  history of, 475–479
  implementations of, *see under* TeX systems
  inner workings of, 479–483
  and the Internet, 433–454
  for languages other than American English, 491–492
  layers of, 58, **479–480**
  numbers stored by, 85–86
  omissions in discussion of, 517–518
  overview of, 57–63
  packages, *see under* packages
  platform independence of, 317
  portability of, 5
  release dates of, 61
  resources on the World Wide Web, 437–438
  source files, *see under* source files
  structure of, 58, **479–480**, *57*
  using TeX commands in, 508–509
  updates to, 61
  using, **58**, *59*
  using AMS packages with, 510
  versions of, 61–62
    specifying, in documents, 242
LaTeX 2.09, 99, 273, 477
  commands, 509, 514
  compatibility mode, 509
  converting to LaTeX 2_ε, 509–510
  font names, 270
  math symbols, 509
  two-letter font commands, 99, **100**, 315, 509
LaTeX3, **476–477**, 478
LaTeX: A Document Preparation System (Lamport), xxx, 349, 518
LaTeX Companion, The (Goossens, et al.), 82, 92, 99, 100, 105, 106, 108, 116, 117, 127, 129, 133, 152, 204, 245, 249, 252, 261, 269, 271, 348, 349, 351, 359, 392, 407, 414, 491, 518, 519
LaTeX Graphics Companion, The (Goossens, et al.), 252, 519
`\LaTeX` (LaTeX logo com.), 84
LaTeX Navigator (Web site), 438
LaTeX Web Companion, The (Goossens, et al.), xxxviii, 439, 442, 445, 450, 454, 519
LaTeX 2_ε, *see* LaTeX
`LaTeX.fmt` (LaTeX format file), 58, 90, 268, 271, 384, 450, **479**, 487–489, **492**
`latex.ltx` (LaTeX format source file), **360**, 492
`latex2html` (conversion program), 442
`\LaTeXe` (LaTeX 2_ε logo com.), 84
latexsym (pack.), xxxvi, 13, 16, 39, 269, 298, 509, *457*, *460*, *461*, *463*
lattice (pack.), 242, **333–338**
`lattice.sty` (sample file), 90, 257, 327, **333–338**
layers, of LaTeX and TeX, 479–480
layout
  of Computer Modern typewriter font, *83*
  of pages, **259–261**, 270
layout (pack.), 259, 270
`\layout` (page-layout diagram com.), 259
`\lbrace` ({ math delim.), *169*, *464*
`\lbrack` ([math delim.), *169*, *464*
`\lceil` (⌈ math delim.), *169*, *464*
`\lcfrac` (obs. AMS com.), 515

\ldots (...)
  in math, **19**, 165
  in text, 83
\le (≤ binary rel.), *457*
leading, *see* interline spacing
\leadsto (⇝ math arrow), *461*
\left (math delim.), 28, **168**, 170, **171**, 172, 211, 228, 229
  must be balanced, 171, 211
left double quote (“)
  text symbol, *85*, *472*
  typing, 7
left single quote (‘)
  key, 5, 7, 68, **80**
  text symbol, **80**, *473*
\left(((math delim.), 18, 21, 30, **168**, 211
\left. (blank math delim.), 28, 171
\left< (⟨ math delim.), 171
\leftarrow (← math arrow), *461*
\Leftarrow (⇐ math arrow), *461*
\leftarrowtail (↢ math arrow) Ⓐ, *462*
\leftharpoondown (↽ math arrow), *461*
\leftharpoonup (↼ math arrow), *461*
\leftleftarrows (⇇ math arrow) Ⓐ, *462*
\leftmargin (length com.), **354**, 357, *353*
\leftrightarrow (↔ math arrow), *461*
\Leftrightarrow (⇔ math arrow), *461*
\leftrightarrows (⇆ math arrow) Ⓐ, *462*
\leftrightharpoons (⇋ math arrow) Ⓐ, *462*
\leftrightsquigarrow (↭ math arrow) Ⓐ, *462*
\leftroot (root-adjustment com.), 167
\leftthreetimes (⋋ math op.) Ⓐ, *460*
\left[([math delim.), 18, 27, 168
\left| (| math delim.), 18, 21, 26, 184, 186
legalpaper (doc. class opt.), 265
  AMS variant, 302
legibility, of source files, 12, **24–25**, 71, 159, 214, 314
lemmas, *see* proclamations
length commands, 113, 261, **349–352**
  arithmetic with, 270, **351**
  \baselineskip, 100, 107
  \baselinestretch, 105
  and boxes, 351
  \captionindent, *513*
  defining new, 350
  \depth, 116
  \fboxrule, 114
  \fboxsep, 114
  \hangafter, 106
  \hangindent, **105**, 508
  \height, 116
  \itemindent, *353*
  \itemsep, **354**, 358
  \labelsep, *353*
  \labelwidth, *353*
  \leftmargin, **354**, 357, *353*
  in list environments, 352–354
  \listparindent, 360, *353*
  \marginparpush, 349
  \marginparwidth, 117
  \medskipamount, 325, 352
  \multlinegap, 207
  \oddsidemargin, 261
  \overfullrule, 102
  \parindent, 349, 360
  \parsep, **354**, 358, 360, *353*
  \parskip, 349, **354**, 360, *353*
  \partopsep, 354
  \rightmargin, **354**, 357, *353*
  setting, 105, 106, 117, **350–351**
  \textwidth, 261, 349
  \topsep, **352**, 354, *353*
  \totalheight, 114, 116
  \width, 116
lengths, rubber, *see* rubber lengths
\leq (≤ binary rel.), *457*
\leqalignno (obs. TEX com.), *509*
leqno
  AMS document class option, **302**, 304, *512*
  amsmath package option Ⓐ, 304
  LATEX document class option, 266
\leqq (≦ binary rel.) Ⓐ, *458*
\leqslant (⩽ binary rel.) Ⓐ, *458*
less than (<)
  as binary relation, *457*
  text symbol, *85*, *472*
\lesssapprox (⪅ binary rel.) Ⓐ, *458*
\lessdot (⋖ binary rel.) Ⓐ, *458*
\lesseqgtr (⋚ binary rel.) Ⓐ, *458*
\lesseqqgtr (⪋ binary rel.) Ⓐ, *458*
\lessgtr (≶ binary rel.) Ⓐ, *458*
\lesssim (≲ binary rel.) Ⓐ, *458*
letter (doc. class), **266–268**, 479
letter (letter env.), 267–268
  argument of, 268
  breaking lines in, 268
  errors with, 268
letter keys, 4–5, **68**
letter.tex (sample file), 266–268
letterpaper (doc. class opt.), 265
  AMS variant, 302
letters
  counter style, *347*
  Greek, 27, 335, 456
  Hebrew, 455
Levy, Silvio, 519
Lewis, Peter, 434

\lfloor (⌊ math delim.), *169*, *464*
\lg (lg math op.), *174*, *465*
\lhd (◁ math op.), *460*
ligatures, 26, **83**
  suppressing, 26, **83**, 312
\lim (lim math op.), 21
\liminf (lim inf math op.), *174*, *465*
limits
  large operators with, 19, 21, 166, **176**, 177, 304, 466
  multiline, 178–179
  operators with, 174, 304, 465
  placement of, 304
  as subscripts, **19**, 27, 28, **166**, 173, 175–177, 304
  as superscripts, **19**, 27, **166**, 173, 176, 177, 304
\limits (limit-control com.), **166**, 178
\LimitsOnInts (obs. $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX com.), *512*
\LimitsOnNames (obs. $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX com.), *512*
\LimitsOnSums (obs. $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX com.), *512*
\limsup (lim sup math op.), *174*, *465*
line boxes, *see under* boxes
line numbers
  in error messages, **54**, 136
  in warning messages, 8
\line (obs. TEX com.), *509*
line-and-a-half spacing, 105
line-ending characters, 5, 69, 71, 89
  on Macintosh, PCs, and UNIX systems, 420
  translation of, 69
\linebreak (line-breaking com.), **102**, 103, 104, 427, 428
  optional arguments of, 104
lines, 101–105
  adding to
    lists of figures and tables, 416
    tables of contents, 413–414
  blank
    in displayed math environments, 53, **161**, 206, 207, 209
    terminating paragraphs with, **70**, 105
    in text environments, 145–146
    in top-matter commands, 275
    in verbatim environments, 145
  breaking, **10**, 32, **102–104**, 146, 234
    with \\, 20, 34, 36, 38, 48, 103, 127, 128, 131, 147, 153, 179, 206, 207, 209, 220, 224, 234, 268, 275–277, 301, 427
    in HTML, 441
    preventing, 104, 112
  distance between (leading), 110
    adjusting, 118
  filling with space or dots, 31, 111, 112, 118, 137, 227, 229, 359, 513
  horizontal (rules)
    filling lines with, 111, 118
    in tabular environments, 147, 149
  intersecting, in tables, 152, **270**
  separating
    with \\, 20, 34, 36, 38, 48, 103, 127, 128, 131, 147, 153, 179, 206, 207, 209, 220, 224, 234, 268, 275–277, 301, 427
    with \linebreak, **102**, 103, 104, 427, 428
  stretchable, 181–182
  too wide warnings, 101–102
  vertical
    in CD environments Ⓐ, 233
    in tabular environments, 147
  wrapping, 89
links, hyper, *see* hyperlinks
Linux, *see also* UNIX, xxxi, 5, 436
list (text list env.), 352, **354–359**, *353*
  arguments of, 355
  using counters with, 356
  length commands in, 352–354
list text environments, *see also* specific environments, 56, **122–127**
  description, **123–124**, 126
  enumerate, **122**, 270, 330
  itemize, 122–123
  list, 352, **354–359**, *353*
  mixing, 124–127
  nesting, 124–127
  in proclamations, 137
  rules for, 124
  trivlist, 360
\listfigurename (redef. name), **323**, *324*
\listfiles (file-list com.), **61**, 334
listing files used by a document, 334
\listoffigures (front matter com.), **415**, 428, **482**
\listoftables (front matter com.), **415**, 428, **482**
\listparindent (length com.), 360, *353*
lists
  cross-referencing items in, 122, 127
  custom
    and counters, 356
    defining, 352–360
  environments for, *see* list text environments
  of figures, 415–416
    adding a line to, 416
    auxiliary file (lof), **415**, 428, **482**
    fragile commands in, 79
  of tables, 146, **415–416**

adding a line to, 416
auxiliary file (lot), **415**, 428, **482**
fragile commands in, 79
\listtablename (redef. name), *324*
\ll (≪ binary rel.), *457*
\llcorner (⌞ math delim.) Ⓐ, *169*, *464*
\Lleftarrow (⇚ math arrow) Ⓐ, *462*
\lll (⋘ binary rel.) Ⓐ, *458*
LM1 (pack. opt.), 489
LM1 (TEXTURES) font encoding, 489
\ln (ln math op.), *174*, *465*
\lnapprox (⪉ neg. binary rel.) Ⓐ, *459*
\lneq (⪇ neg. binary rel.) Ⓐ, *459*
\lneqq (≨ neg. binary rel.) Ⓐ, *459*
\lnot (¬ math sym.), *463*
\lnsim (⋦ neg. binary rel.) Ⓐ, *459*
local commands, *see under* scope
localization, of LaTeX, 491–492
locating, errors, 54
location, of BibTeX database and style files, 386
lof (list of figures files), **415**, 428, **482**
log (LaTeX log files), 5, 8, **58**, 61, 101, 386, 389, 415, 425, **482**
error and warning messages recorded in, **58**, 101
log files
for BibTeX, *see* blg
for indexes, *see* ilg
for LaTeX, *see* log
\log (log math op.), *174*, *465*
log-like functions, *see* operators
logical
design, 55–56
of books, 422–424
markup, 56
units, 7, 23, 38–40, 42, 43, 48, 50, 51, 54, 55, 57, 72, 73, 240, **243–246**, 253, 258, 264, 267–268, 274, 285, 352, 383, 388, 393, 404, **410–412**
hierarchy of, 244
numbering of, 56, **349**, **411**
numbering of proclamations within, 138–139
logos, 84–85
long commands, 79
\longleftarrow (⟵ math arrow), *461*
\Longleftarrow (⟸ math arrow), *461*
\longleftrightarrow (⟷ math arrow), *461*
\Longleftrightarrow (⟺ math arrow), *461*
\longmapsto (⟼ math arrow), *461*
\longrightarrow (⟶ math arrow), *461*
\Longrightarrow (⟹ math arrow), *461*
longtable (pack.), 270
\looparrowleft (↫ math arrow) Ⓐ, *462*
\looparrowright (↬ math arrow) Ⓐ, *462*
\lor (∨ math op.), *460*
lot (list of tables files), **415**, 428, **482**
low-level font commands, 100
for NFSS, 518
lowercase counter styles
letters (\alph), *347*
roman numerals (\roman), 127, *347*
lowline (_ text sym.), *81*, *85*, *472*
\lozenge (◊ math sym.) Ⓐ, *463*
\lrcorner (⌟ math delim.) Ⓐ, *169*, *464*
\Lsh (↰ math arrow) Ⓐ, *462*
\ltimes (⋉ math op.) Ⓐ, *460*
Lucida Bright, 489
lucidabr (pack.), 489
lucidabr.dtx (PSNFSS distr. file), 489
lucidabr.fdd (PSNFSS distr. file), 489
lucidabr.ins (PSNFSS distr. file), 489
lucidabr.sty (PSNFSS distr. file), 489
lucidabr.yy (PSNFSS distr. file), 489
\lvert (| math delim.) Ⓐ, 170
\lVert (‖ math delim.) Ⓐ, 170
\lvertneqq (≨ neg. binary rel.) Ⓐ, *459*
LY1 (pack. opt.), 489
LY1 (TeX'n ANSI) font encoding, 489

Macintosh, xxix, xxxi, 5, 317, 434, 476
TeX/LaTeX software page, 487
FTP clients for, 434
line-ending characters, 420
spelling checkers, 62
TeX systems for, xxix, 58, **435, 436**
macron (¯ text accent), *84*, *470*
macros, *see* commands *and* user-defined commands
\magnification (obs. TeX com.), *509*
main entries, in indexes, **258**, **393**, 397
main matter, 241, **243–252**, 411
\mainmatter (struct. com.), 411
\makebox (box com.), 112, **113**, 114, 116, 118
\makefootline (obs. TeX com.), *509*
\makeglossary (preamble glossary com.), 407, 482
\makeheadline (obs. TeX com.), *509*
makeidx (pack.), 269, **394**
MakeIndex, xxxii, 258, **392–407**, 482
and font commands, 95
\maketitle (title-page com.), 39, **413**
and page styles, 261
Mang Cao, Simon, 487
MANUAL (bibl. entry type), 371, **382**
manuals, in BibTeX database files, 382
manuscripts
in BibTeX database files, 381–382
preparing for publication, 410

Maple V, 444
\mapsto (↦ math arrow), *461*
\mapstochar (↦ math arrow modifier), 461
marginal comments, **116–117**, 427
  in double-sided documents, 116
  in equations, 116
  in multiline math environments, 116
  space between, 349
\marginpar (marginal comment com.), 116
  in double-sided documents, 116
\marginparpush (length com.), 349
\marginparwidth (length com.), 117
margins, 349, 354
  of nested lists, 354
  showing symbolic references in, **249**, 270
\markboth (left and right page header com.), **259**, 429
  arguments of, 259
\markright (right page header com.), 259
markup
  languages, xxx
    HTML, *see* HTML
    LaTeX, *see* LaTeX
    MathML, *see* MathML
    WebTeX, *see* WebTeX
  logical, 56
  visual, 56
master document, 416, 418
MASTERSTHESIS (bibl. entry type), 371, **379–380**
math
  accents, **19**, 30, **179–180**, 305, 324, 467, 512, 515
  alphabets, 26–28, 31, **190–192**, 193, 306, 337, 468, 514
  arrows, **182**, 232, 514, *461*, *462*
  binary relations, *see* binary relations
  characters, 11, 68
  commands, *see* math commands
  delimiters, *see* math delimiters
  environments, 156–158
    aligned, *see under* aligned
    displayed, *see* displayed math environments
    inline, *see* inline math environments
    multiline, **209–213**, 510
    page breaks in, 234
    and \verb commands, 134
  fonts, 190–192
    blackboard bold Ⓐ, 27, **193**, 337, 514, *468*
    bold, 30, **191**, 193, 514, *191*, *468*
    bold italic, 192
    calligraphic, 31, **192**, 306, 337, *468*
    Euler Fraktur Ⓐ, 26, 28, **193**, 306, 337, 514, *468*
    Euler Script Ⓐ, **192**, 306, 337, *468*
    italic, **191**, 468, 513
    roman, **191**, *191*, *468*, *513*
    size of, **195**, 513
    slanted, 513
  displaying using HTML, 442
  mode, 156
  multiline, 203–235
    visual guide to, **204**, *205*
  operators, 16, 18, 21, 162, **173–179**, 460, 465, 513
    declaring, 175–176
    large, 19, 21, 166, 177, 466
    with limits, 19, 21, 166, 174, 177, 465, 466
  subscripts and superscripts, font size of, **195**, *513*
  symbol alphabets and fonts, 192–193
    Greek, 192
  symbols, *see* math symbols
  text in, 12, **22**, 26, 28, 60, 87, 104, 112, 113, 159, **167–168**, 192, 233, 305
    specifying fonts for, 168
  typing, 11–38, 155–201
math (inline math env.), 156
math commands, 17, 21, 22, 164, 166, 178, 179, 186, 189, 190, 195, 199, 201, 319, 513, 515
  for alignment of formulas, 208, 209
math delimiters, **18–19**, 21, 26–28, 30, 31, **168–173**, 183, 184, 186, 211, 228, 229, 464, *464*
  arrows, 169
  balancing, 28, 171, 211
  as binary relations, 172–173
  blank, 28, 171
  fixed-size, 170
  for grouping, 172
  in inline math environments, 172
  and large operators, 172
  large, in array subsidiary math environment, 270
  left bracket ([ ), 18, 27, 168
  with matrix variants Ⓐ, 227–229
  right bracket( ]), 18, 27, 168
  specifying size of, 30, **170**
  in smallmatrix subsidiary math environments, 229
  stretchable, 171–172

math font commands, *see also* font command declarations *and* font commands
for bold
\boldsymbol Ⓐ, 30, 188, 192, **193**, 305, *468*, *513*
\mathbb Ⓐ, 27, **193**, 337, 514, *468*
\mathbf, 30, **191**, 193, 514, *191*, *468*
\pmb (poor man's bold) Ⓐ, **194–195**, 305
for italics
\mathit, **191**, *191*, *468*, *513*
for series
\mathnormal, **192**, *191*, *468*
for shape
\mathcal, 31, **192**, 306, 337, *468*
\mathfrak Ⓐ, 26, 28, **193**, 306, 337, 514, *468*
\mathrm, **191**, *191*, *468*, *513*
\mathscr Ⓐ, **192**, 306, *468*
\mathsf, **191**, *191*, *468*
\mathsl, *513*
\mathtt, **191**, *191*, *468*
for size
\displaystyle, **195**, *513*
\scriptscriptstyle, **195**, *513*
\scriptstyle, **195**, *513*
\textstyle, **195**, *513*
for weight
\boldsymbol Ⓐ, 30, 188, 192, **193**, 305, *468*, *513*
\mathbf, 30, **191**, 193, 514, *191*, *468*
\pmb (poor man's bold) Ⓐ, **194–195**, 305
Math into LaTeX, updates to, xxxvii
math mode, 3
math symbols, 13, 14, 30, 68, 143, 179, 181, 322, 509, 510, *455–469*
bold, **193–195**, 270
building new, 187–190
classification of, 183–184, 190
creating, 28, **188**, 319
declaring types of, 190
negated, 27, **189**, 459
shorthand commands for, 312
side-setting, 189
spacing of, 182–187
stacking, 188–189
stretchable, 180–182
suppressing, 143
in text, 316
types of, **183–184**, 194
math units, *see* mu
math.tex (sample file), 11–14
mathb.tex (sample file), 13–15
\mathbb ($\mathbb{X}$) Ⓐ, 27, **193**, 337, 514, *468*
\mathbf (math font weight com.), 30, **191**, 193, 514, *191*, *468*
\mathbin (binary-op. com.), 190
\mathcal ($\mathcal{X}$), 31, **192**, 306, 337, *468*
and Euler Script Ⓐ, 192
Mathematica, 444
Mathematical Reviews (AMS), 50, 164
Mathematics into Type (Swanson, et al.), 211, 519
\mathfrak ($\mathfrak{X}$) Ⓐ, 26, 28, **193**, 306, 337, 514, *468*
\mathit (math font shape com.), **191**, *191*, *468*, *513*
MathML, 443–444
Web browser support for, **444**
\mathnormal (math font shape com.), **192**, *191*, *468*
\mathop (op.-def. com.), **190**, 194
\mathrel (binary-rel. def. com.), 190
\mathring ($\mathring{x}$ math accent), *180*, *467*
\mathrm (math font shape com.), **191**, *191*, *468*, *513*
mathscr (opt. of eucal pack.) Ⓐ, **192**, **306**, *468*
\mathscr ($\mathscr{X}$ math font shape com.) Ⓐ, **192**, 306, *468*
\mathsf (math font shape com.), **191**, *191*, *468*
\mathsl (math font shape com.), *513*
\mathstrut (spacing com.), 196
MathTime, 488
mathtime (pack.), 489
mathtime.dtx (PSNFSS distr. file), 488, 489
mathtime.ins (PSNFSS distr. file), 488
mathtime.sty (PSNFSS distr. file), 488
\mathtt (math font shape com.), **191**, *191*, *468*
\mathversion (math font com.), 194
matrices, 19–21, 226–231
in inline math environments, 228–229
matrix (subsid. math env.) Ⓐ, 20, 21, 204, 225, **226–229**, *205*
variants, 227–229
matter
back, *see* back matter
front, *see* front matter
main, *see* main matter
top, *see* top matter
\max (max math op.), *174*, *465*
MaxMatrixCols (counter) Ⓐ, 227
\mbox (box com.), 12, 22, 26, 28, 87, 104, **112**, 113, **167**, 168, 192
spacing rules in, 159, 167
McLean, Ruari, 519
McPherson, Kent, 259

\mdseries (font weight com. dec.), **98**, *95*, *470*
\measuredangle (∡ math sym.) Ⓐ, *463*
measurements, of text boxes, 325, **351**
  commands for, 351
medium (font weight), **98**, *95*, *470*
\medskip (spacing com.), **110**, 325
\medskipamount (length com.), 325, 352
\medspace (spacing com.) Ⓐ, *185*, *468*, *474*
Merz, Thomas, 454
messages
  error, *see* error messages
  warning, *see* warning messages
metrics, font, *see* font metrics
\mho (℧ math sym.), *463*
Microsoft
  typography Web page, 491
  Windows, *see also* PCs, xxxi, 5, 435, 436
Microspell (PC spelling checker), 63
\mid (| binary rel.), 26, **172**, **184**, *457*
\midinsert (obs. TEX com.), *509*
midpoint (· text sym.), *85*, *472*
\midspace (obs. AMS-TEX com.), *513*
MiKTEX (Windows TEX system), 436
millimeter (mm abs. unit), 349
\min (min math op.), *174*, *465*
Miner, Robert, 443
minipage (text box env.), 101, 112, 116, 330, 331
  displaying footnotes in, 116
minus (−), 16, 68, 80, 162, 183, 186, 187, 191, 211, 212
  as binary operation, *460*
mirrors, of CTAN, 434
MISC (bibl. entry type), 371, **382**
Mittelbach, Frank, 107, 143, 476–478
mixing list text environments, 124–127
mm (millimeter abs. unit), 349
\mod (mod math op.) Ⓐ, **176**, *176*
\models (⊨ binary rel.), *457*
modes
  interactive, **60–61**, 117, 323–325
  math, 3, **156**
  quiet, 60
  text, 3, **156**
modifier keys, 69
modifiers, in \index commands, 398
  combining, 399
modifying environments, 328–331
monospaced fonts, 93
month (BIBTEX database field), 371, 382
\month (time com.), 85
Moore, Ross, 439
movable arguments of commands, *79*
\mp (∓ math op.), *460*
mpfootnote (counter), *345*
\MR (bibl. com.) Ⓐ, 50
mrabbrev.bib (BIBTEX database file) Ⓐ, 383
\mspace (spacing com.) Ⓐ, **185**, *185*, *468*
mtbold (opt. of mathtime pack.), 489
mtfonts.fdd (PSNFSS distr. file), 488
mu (math unit, rel.) Ⓐ, 185, 468
\mu (μ Greek char.), *456*
multicol (pack.), 107, 108, 270
multicols (disp. text env.), 107, 477
\multicolumn (table com.), 149–151, *150*, *151*
multicolumn text
  in documents, **107–108**, 270, 477
  in tables, 149–151
multiline
  table entries, 150
  formulas, xxxii, 34–38, **203–235**
    aligning, 211–212
    splitting, 206–209
    visual guide to, **204**, *205*
  limits, 178–179
  math environments, 510
    adjusting columns in, 204, **225–234**
    aligning, 204
    marginal comments in, 116
    page breaks in, 510
    rules for, 209–213
  subscripts and superscripts, 515
  text boxes, 112
\multimap (⊸ math arrow) Ⓐ, *462*
multipage tables, 270
multiple
  arguments, in user-defined commands, 318
  authors
    in AMS documents, 281
    in bibliographies, 372
    in LATEX documents, 48
  bibliographies in a document, 258
  captions, 250
  citations, 256
  documents, cross-referencing among, 271
  files, splitting documents into, 416–418
multiplication, 16, 68, 162
multline (math split env.) Ⓐ, 204, **206–209**, *205*
  indentation of lines in, 207
multline* (math split env.) Ⓐ, 207–209
  indentation of lines in, 207
multline.tpl (sample file), 203
\multlinegap (length com.), 207
Musciano, Chuck, 442
myams.tpl (template file) Ⓐ, 298–301
myheadings (page style), 259
mylatex (pack.), 362

\nabla (∇ math sym.), *463*
namelimits (opt. of amsmath pack.) Ⓐ, **304**, *512*
names
  for abstracts, 243
  of authors
    in articles, 48, 277, 300
    in bibliographies, 372–373
    in running heads, 277
  base (of files), 481
  of commands, 74, 333
  of counters, 139
  of files, 47
    with \graphicspath commands, 420
  of fonts
    LaTeX 2.09, 270
    PSNFSS (Berry scheme), 487
  for proclamations, 135, 139
  redefinable, 258, **323**, 491, *324*, *453*
  tagging equations with, 34, 161, **197–199**, 206, 207, 209, 212, 223, 224
\natural (♮ math sym.), *463*
\ncong (≇ neg. binary rel.) Ⓐ, *459*
\ne (≠ neg. binary rel.) Ⓐ, **189**, *459*
\nearrow (↗ math arrow), *461*
\NeedsTeXFormat (preamble com.), **61**, 90, 333
\neg (¬ math sym.), *463*
negated math symbols, 27, **189**, 459
\negmedspace (spacing com.) Ⓐ, *185*, *468*, *474*
\negthickspace (spacing com.) Ⓐ, *185*, *468*, *474*
\negthinspace (spacing com.), 28, **185**, *185*, *468*, *474*
\neq (≠ neg. binary rel.), *459*
nesting
  of comment environments, 91
  of list text environments, 124–127
New Font Selection Scheme, *see* NFSS *and* PSNFSS
\newcommand (user-defined command com.), **312–321**, 323, 511
  defining arguments with, 318
\newcommand* (user-defined command com.), 320
\newcounter (user-defined counter com.), 346
  optional argument of, **346**, 347
\newenvironment (user-defined environment com.), 328
\newenvironment* (user-defined environment com.), 332
\newlabel (aux. file com.), 481
\newlength (length-command defining com.), 350
\newline (line-breaking com.), *see also* \\, **102**, **104**, 146
\newpage (page-breaking com.), **10**, **106**, 252
\newsymbol (obs. AMS com.), 514
\newtheorem (procl. com.), 39, **135**, 138, 142, 298, 348
  optional arguments of, 138, 139
  syntax of, 138–139
\newtheorem* (procl. com.) Ⓐ, **139**, 329, 330
\nexists (∄ math sym.) Ⓐ, *463*
NFSS (New Font Selection Scheme), **477**, 518
  documentation for, 519
nfssfont.tex (LaTeX distr. file), 82, 269
\ng (eng Eur. char.), *473*
\NG (Eng Eur. char.), *473*
\ngeq (≱ neg. binary rel.) Ⓐ, *459*
\ngeqq (≱ neg. binary rel.) Ⓐ, *459*
\ngeqslant (≱ neg. binary rel.) Ⓐ, *459*
\ngtr (≯ neg. binary rel.) Ⓐ, *459*
\ni (∋ binary rel.), *457*
\nleftarrow (↚ math arrow) Ⓐ, *462*
\nLeftarrow (⇍ math arrow) Ⓐ, *462*
\nleftrightarrow (↮ math arrow) Ⓐ, *462*
\nLeftrightarrow (⇎ math arrow) Ⓐ, *462*
\nleq (≰ neg. binary rel.) Ⓐ, *459*
\nleqq (≰ neg. binary rel.) Ⓐ, *459*
\nleqslant (≰ neg. binary rel.) Ⓐ, *459*
\nless (≮ neg. binary rel.) Ⓐ, *459*
\nmid (∤ neg. binary rel.) Ⓐ, 189, *459*
noamsfonts (doc. class opt.) Ⓐ, **303**, 304
\nobreakdash (hyph. prev. com.) Ⓐ, **88**, 514
\nocite (bibl. com.), **385**, 387
\nofiles (preamble com.), 428
  and auxiliary files, 428, 482
\noindent (indentation-suppression com.), **105**, 427
nointlimits (opt. of amsmath pack.) Ⓐ, **304**, *512*
\nolimits (limit-control com.), 28, **166**, **175**, 177
\NoLimitsOnInts (obs. AMS-TeX com.), *512*
\NoLimitsOnNames (obs. AMS-TeX com.), *512*
\NoLimitsOnSums (obs. AMS-TeX com.), *512*
\nolinebreak (linebreak-suppression com.), 104
nomath (doc. class opt.) Ⓐ, 192, **304**
nonamelimits (opt. of amsmath pack.) Ⓐ, **304**, *512*
nonbreakable spaces (~ tie), 7, 33, 69, 71, 72, 80, **81**, 104, *474*
  in AMS documents, 81
  in BibTeX databases, 374
  with cross-references, 33, **72**, 248

\nonfrenchspacing (spacing com.), 73
nonintegrated TEX systems, 436
\nopagebreak
  obsolete AMS-TEX command, *513*
  page-break suppression command, 106
\nopagenumbers (obs. TEX com.), *509*
normal
  document font family, 94
  font shape
    command declarations for, **94**, 488
    commands for, **94**, *95*, *470*
    math commands for, **192**, *191*, *468*
\normalbottom (obs. TEX com.), *509*
\normalfont (font shape com. dec.), **94**, 488
\normalsize (font size com.), **98**, 274, *275*, *471*
nosumlimits (opt. of amsmath pack.) Ⓐ, **304**, *512*
\not (math com.), 189
\notag Ⓐ, 35, 36, 206, 207, 209, 212, 224
notation, infix, *see* infix notation
notations, *see* proclamations
notcite (opt. of showkeys pack.), 249
note (BIBTEX database field), 371
note1.tex (sample file), 6–7
note1b.tex (sample file), 8–9
note2.tex (sample file), 9–11
noteslug.tex (sample file), 9
\notin ($\notin$ neg. binary rel.), **189**, *459*
notitlepage (doc. class opt.), 266, 412
  AMS variant, 303
\nparallel ($\nparallel$ neg. binary rel.) Ⓐ, *459*
\nprec ($\nprec$ neg. binary rel.) Ⓐ, *459*
\npreceq ($\npreceq$ neg. binary rel.) Ⓐ, *459*
\nrightarrow ($\nrightarrow$ math arrow) Ⓐ, *462*
\nRightarrow ($\nRightarrow$ math arrow) Ⓐ, *462*
\nshortmid ($\nshortmid$ neg. binary rel.) Ⓐ, *459*
\nshortparallel ($\nshortparallel$ neg. binary rel.) Ⓐ, *459*
\nsim ($\nsim$ neg. binary rel.) Ⓐ, *459*
\nsubseteq ($\nsubseteq$ neg. binary rel.) Ⓐ, 27, *459*
\nsubseteqq ($\nsubseteqq$ neg. binary rel.) Ⓐ, *459*
\nsucc ($\nsucc$ neg. binary rel.) Ⓐ, *459*
\nsucceq ($\nsucceq$ neg. binary rel.) Ⓐ, *459*
\nsupseteq ($\nsupseteq$ neg. binary rel.) Ⓐ, *459*
\nsupseteqq ($\nsupseteqq$ neg. binary rel.) Ⓐ, *459*
NTG (Dutch TEX user group), 437
n-th root, 21, 167
\ntriangleleft ($\ntriangleleft$ neg. binary rel.) Ⓐ, *459*
\ntrianglelefteq ($\ntrianglelefteq$ neg. binary rel.) Ⓐ, *459*
\ntriangleright ($\ntriangleright$ neg. binary rel.) Ⓐ, *459*
\ntrianglerighteq ($\ntrianglerighteq$ neg. binary rel.) Ⓐ, *459*
\nu (ν Greek char.), *456*
number (BIBTEX database field), 371
numbered lists, *see* enumerate
numbering
  of appendices, 246, 412
  automatic, xxxii, 33, 34, 39, 49, 122, 135, 224, 244
  with counters, 344–352
    resetting, 346, 347
  of equations, **32–34**, **160–161**, 197, 206, 207, 209
    in chapters of books, 411
    groups, 212–213
    in multiline math environments, 209
    is relative, 197, 198
    within sections, 160, 242
    within split subsidiary alignment environments, 223–224
    suppressing, 35, 36, 161, 197, 206, 207, 209, 212, 224
    variations, **198**, 212
  of figures, 250
  of pages, style of, 347
  of proclamations, 135, **138–139**
    consecutively, 138–139
    within sections, 138
    suppressing, 139, 142, 329, 330
  renumbering, 33, 56
  of structural units, 56, 244, 346, 411
    in books, 411
    controlling, 349
    sections, 244
    suppressing, 48, 245, 412
  of subsidiary math environments, 223, 224
  of tables, 250
\numberline (toc file com.), 414
numbers
  in bibliographic fields, 371
  counter style for, 356, *347*
  for equations, placement of, 33, 43, **160**, 266, 302–303
  keys, 68
  line
    in error messages, **54**, 136
    in warning messages, 8
  in lists, 122
  page
    referencing, 249
    style of, 347
  for proclamations, position of, 142
  ranges, **10**, **80**, *85*, *472*
    in BIBTEX databases, 373
    in index entries, 398–399
  real, in length commands, 349
  stored by LATEX, 85–86

stored in
counters, 345
registers, 325
version, 61
\numberwithin Ⓐ, 160, 242
numeric counter style (\arabic), 356, *347*
\nvdash (⊬ neg. binary rel.)) Ⓐ, *459*
\nvDash (⊭ neg. binary rel.) Ⓐ, *459*
\nVdash (⊮ neg. binary rel.) Ⓐ, *459*
\nVDash (⊯ neg. binary rel.) Ⓐ, *459*
\nwarrow (↖ math arrow), *461*

O, slashed (Ø, ø), *84*, *469*
obtaining
AMS packages and AMSFonts, 435
sample files for this book, 435
octothorp (#), *81*, *85*, *472*
\oddsidemargin (length com.), 261
\odot (⊙ math op.), *460*
\oe (œ), *84*, *469*
\OE (Œ), *84*, *469*
Ogawa, Arthur, 487
ogonek (Eur. accent), *473*
\oint (∮ large math op.), **166**, *177*, *466*
old-style figures, 68
\oldstyle (obs. TEX com.), *509*
\oldstylenums (old-style figures com.), 68
\omega (ω Greek char.), *456*
\Omega (Ω Greek char.), *456*
\ominus (⊖ math op.), *460*
onecolumn (doc. class opt.), 265
AMS variant, 303
\onecolumn (single-column com.), 107
\onehalfspacing (setspace com.), 105
oneside (doc. class opt.), 265, 412
AMS variant, 303
openany (doc. class opt.), 412
openbib (doc. class opt.), **266**, *267*
openright (doc. class opt.), 412
operations
arithmetical, 16–17, 162–164
binary, *see* binary operations
\operatorname (op.-def. com.) Ⓐ, 190, 192
\operatorname* (op.-with-limits def. com.) Ⓐ, 190
operators, math, 16, 18, **21**, 162, **173–179**, 460, 465, 513
declaring, 175–176
large, 21, 176–179
with limits, 19, 21, 166, **176**, 177, 304, 466
with limits, **173**, 174, 304, 465
defining, 175, 190, 192
without limits, 173
defining, 175, 190, 192, 242, 305
sizing of math delimiters with, 172
\oplus (⊕ math op.), *460*
optimization, of PDF files, 445
optional
arguments, **10**, 21, **74**, **75**, 104, 108, 116, 117, 119, 135, 139, 144, 148, 167, 227
of \\, **10**, 32, **103**, 146, *513*
of commands, 124, **126**, 138, 139, 148, 235, 252, 256, 346, 347, 354, 355, 416
of environments, 135, 144, **252**, 330, 427
of sectioning commands, 245
of structural commands, **245**, 410
of top-matter commands, 275, 277, 279, 280, 282, 301
of user-defined commands, 321
of user-defined environments, 331–332
bibliographic fields, 372, 374–382
hyphens, 9, **86**, 102, 426
options
of AMS document classes, *see* document class options
of document classes, *see* document class options
document style, *see* document style options
of packages, *see* package options
organization (BIBTEX database field), 371, *377*
organization, of files, 418–420
orientation, of pages, document class options for, 265
orthogonality, of font commands, **99**, 477
O'Sean, Arlene Ann, 211, 519
\oslash (⊘ math op.), *460*
OT1 font encoding, 488
\otimes (⊗ math op.), *460*
out (hyperref bookmarks file), 452
output routines, TEX, 508
\over (obs. TEX com.), *509*
\overbrace (horizontal brace com.) Ⓐ, 29, **180**
with a superscript, 181
overdot (˙ text accent), *84*, *470*
\overfullrule (length com.), 102
overlapping braces, 77
\overleftarrow ($\overleftarrow{x}$ math arrow), 182
\overleftrightarrow ($\overleftrightarrow{x}$ math arrow) Ⓐ, 182
\overline ($\overline{x}$ math line sym.), 30, **179**, **181**
\overrightarrow ($\overrightarrow{x}$ math arrow), 182
\overset (math com.) Ⓐ, 319

\overset (symbol-building com.) Ⓐ, 28, **188**, 319
creating binary operations and relations with, 189
\overwithdelims (obs. TEX com.), *509*
\owns (∋ binary rel.), *457*
OzTEX (Macintosh TEX system), **436**, 450

\P (¶ pilcrow or paragraph)
math symbol, *463*
text symbol, *85*, *472*
package options, *see also* specific packages, 192, 241, 249, 304–306, 450–452, 468, 486, 489, 491, 512
for AMSFonts, 304–305
handled electively, 270
are passed down from document classes, **241**, 304
packages, 39, 58, 75, 241, 476, 480
AMS, xxxii–xxxiii, xxxvi, 58–61, 269, **305–307**, 477–478
amsbsy, 60, 192–194, **305**, 306, 307
amscd, **232**, 305
amsfonts, xxxiii, 13, 26, 28, 60, 193, **306–307**, 486, 514
amsgen, 304, **305**, 306
amsmath, 16–20, 22, 25, 27–29, 31–35, 60, 61, 88, 112, 113, 134, 160, 161, 163–168, 170, 175, 176, 178–180, 182, 185, 187–190, 192–195, 197–199, 203, 230, 241, 242, 247, **304–305**, 319, 327, 349, 406, 478, 486, 509–512, *169*, *174*, *180*, *185*, *456*, *460*, *464*, *465*, *467*, *468*, *474*
amsopn, **305**, 306
amssymb, xxxvi, 13, 25, 27, 32, 60, 298, 306, 322, 514, *456*, *458–460*, *462*, *463*, *468*
amstext, 60, 112, 233, **305**, 306
amsthm, 139, 143, 145, 270, 306, 329
amsxtra, 179, 305, **515**, *180*, *467*
converting documents to use, 510–512
documentation for, 171, 204, **307**
eucal, **192**, 306, 337, 468, *468*
eufrak, 26, 28, **193**, 306
obtaining, 435
source files, 204, 242, **268**, 307, 384
upref, 305
using in LATEX documents, 510
commands in, 333, 334
dates of, 61
LATEX
accents, 180
afterpage, 269
alltt, 269
apalike, 383
array, 270
askinclude, 418
babel, 269, 491, 492
backref, 451
in base directory, 269
bm, 270
booktabs, 153
calc, 270, 348, 351
cyrillic, 269
dcolumn, 148, 270
delarray, 270
documentation for, 271
enumerate, 127, 270, 330, 334
exscale, 269, 305, 306
fancyhdr, 261
fontenc, 489, **491**
fontsmpl, 270
ftnright, 270
graphics, **251**, 269, 420, 518
hhline, 152, 270
hyperref, 450–454
indentfirst, 270
inputenc, 491
latexsym, xxxvi, 13, 16, 39, 269, 298, 509, *457*, *460*, *461*, *463*
lattice, 242, **333–338**
layout, 259, 270
longtable, 270
lucidabr, 489
makeidx, 269, **394**
mathtime, 489
multicol, 107, 108, 270
mylatex, 362
rawfonts, 270
in required directory, 269
setspace, 105
showidx, 269
showkeys, **249**, 270, 271
somedefs, 270
svsing2e, 495
tabularx, 270
theorem, 143, 270
times, 487, 488
in tools directory, 269–271
typelcm, 487
varioref, 249, 270
verbatim, 91, 92, 133, 270, 334
xr, 249, 271
xspace, 271, **315–316**, 327
loading with \usepackage, 241
multiple, 241
options, *see* package options
versions of, 61–62
Padova, Ted, 446

page (counter), *345*
pagebackref (opt. of hyperref pack.), **451**, *451*
\pagebody (obs. TEX com.), *509*
\pagebreak (page-breaking com.), **106**, 107, 427, 428
  optional arguments of, 106
\pagecontents (obs. TEX com.), *509*
\pageinsert (obs. TEX com.), *509*
\pagename (redef. name), *324*
\pageno (obs. TEX com.), *509*
\pagenumbering (page-number style com.), 347
\pageref (cross-ref. com.), 33, 36, 197, **249**, 427, 452, 482
  and simple indexes, 258
\pageref* (hyperref cross-ref. com.), 452
pages
  breaking, **10**, **106–107**, 146, 252, **426–428**
    in align environment Ⓐ, 234
    in cases subsidiary math environment Ⓐ, 234
    in displayed math environments, **234–235**, 510, *513*
    in gather environment Ⓐ, 234
    and multiline math environments, 510
    preventing, **103**, 106, 234
  components of, 259
  headers, *see* running heads
  layout of, **259–261**, 270
    for article document class, *260*
  numbering, style of, 347
  odd, starting chapters on, 413
  orientation of, document class options for, 265
  referencing, 249
    with varioref package, 270
  size changing with \enlargethispage, 107, 429
  styles of, 259
  title
    of books, 413
    document class options for, 266, 303, 412
pages (BIBTEX database field), 371
\pagestyle (set page style), 259
pagination, 426–428
paper size, document class options for, 265, 302
\par (paragraph-breaking com.), 53, **70**, 71, 105, 145
  in error messages, 105
paragraph (counter), *345*
paragraph (¶ text sym.), *85*, *472*
paragraph boxes, 115–116
\paragraph (struct. com.), 48, **244**
\paragraph* (struct. com.), 48
\paragraphname (hyperref redef. name), *453*
paragraphs, 70, **105–106**
  indentation of first lines, 105, 270, 349
  terminating, 7
    with blank lines, **70**, 105
    in HTML, 441
    with \par command, 53, **70**, 71, 105, 145
  vertical spacing between, 349
\parallel (|| binary rel.), *457*
\parbox (box com.), 101, 112, **115**, **116**, 150, 351, *513*
  in tabular environments, 115
parentequation (counter), 347
parentheses (( )), 5, 68
  in BIBTEX database entries, 370
  as math delimiters, 18, 21, 30, **168**, 211
  in index entries, 399
  as math delimiters, *169*, *464*
  suppressing use of in tags, 198
\parindent (length com.), 349, 360
\parsep (length com.), **354**, 358, 360, *353*
\parskip (length com.), 349, **354**, 360, *353*
part (counter), *345*
\part (struct. com.), 244, 264, **410**
\partial (∂ math sym.), *463*
\partname (redef. name), *324*
  and hyperref package, *453*
\partopsep (length com.), 354
parts, in books, 410
Patashnik, Oren, 367, 392
Paternain, Gabriel P., 494
pathnames
  on Macintosh, PCs, and UNIX systems, 420
  user-defined commands for handling, 317
pc (pica abs. unit), 349
PCs, xxxi, 5, 317, 434, 476
  FTP clients, 434
  line-ending characters, 420
  spelling checkers, 63
  TEX systems for, 58, **435**, **436**
pcr (PSNFSS font name), 487
PCTEX for Windows (TEX system), 63, 435
PDF (Portable Document Format), 444–446
  and bitmap fonts, 486
  disadvantages of using, 445
  files
    bibliographic citations in, 451
    bookmarks in, 452
    creating, 445
    external hyperlinks in, 453–454
    hyperlinks in, 450–454
    optimization of, 445
    putting on the World Wide Web, 449

PDF (Portable Document Format) (*continued*)
size of, 445
viewing in Web browsers, 445, 446, 450
legal issues with, 445
PDFTEX, 445
percent (%)
as comment character, 6, 7, 14, 52, 61, **89**, 90, 91, 127, 298, 402, 417
as text symbol (%), *81*, *85*, *91*, *472*
in electronic mail addresses, 279
periods (.), 5, 68, **71–73**, *85*, *472*
in abbreviations, 71–72
in bibliographies, 72
in BIBTEX databases, 373
followed by capital letters, 72
end of sentences, 71
and initials, 72–73
and italic corrections, 97
and spacing rules, 71–73
terminating sentences with, **70–73**, *474*
`\perp` (⊥ binary rel.), *457*
personal computer, *see* computer, Macintosh, *or* PCs
Personal TEX, Inc., 435
personalized templates, 508, 511, 514
for AMS document classes, 297–301
for LATEX document classes, 46–47
`pf` (obs. AMS text env.), 515
`pf*` (obs. AMS text env.), 515
`\phantom` (spacing com.), 108, 184, **187**, 217, 351
`PHDTHESIS` (bibl. entry type), 371, **379–380**
`\phi` (ϕ Greek char.), *456*
`\Phi` (Φ Greek char.), *456*
`phv` (PSNFSS font name), 487
`\pi` (π Greek char.), *456*
`\Pi` (Π Greek char.), *456*
pica (pc abs. unit), 349
`picture` (drawing env.), 251, 517, **518**
pilcrow (¶ text sym.), *85*, *472*
`\pitchfork` (⋔ binary rel.) Ⓐ, *458*
`pk` (TEX bitmap fonts), 486
placement
of commas in formulas, 159
of equation numbers, 33, 43, **160**, 266, 302–303
of equations, 266, 303
of figures, **252**, 426, 427
of index in document, **394**, 405
of `\index` commands, **401–402**, 428
of `\label` commands, 428
of limits, 304
of roots, 167
of tables, **252**, 426, 427
of text boxes, 119
`plain`
BIBTEX style, *368*
page style, 259
theorem style Ⓐ, **139**, 139–142
Plain TEX, 479
converting to LATEX, 508–509
plain text, xxxi, 5
`plain.bst` (BIBTEX style file), *368*
`plain.fmt` (Plain TEX format file), 479
`plain.tex` (Plain TEX source file), 479
`\plainoutput` (obs. TEX com.), *509*
platform independence
of graphics files, 448
of `\graphicspath` command, 420
of source files, xxxi, 5
plug-ins (for Web browsers), 446, 448
plus (+), 16, 183, 186, 187, 211, 212
as binary operation, *460*
plus and minus rule, **183**, 186, 187, 212
in `gather` environments Ⓐ, 207
and subformulas, 210
`\pm` (± math op.), *460*
`pmatrix` (subsid. math env.) Ⓐ, 20, 21, **228**
`\pmb` (poor man's bold font com.) Ⓐ, **194–195**, 305
`\pmod` ((mod))
AMS math operator, 18, **176**
LATEX math operator, 18, **176**, *176*
PNG (Portable Network Graphics format), **446**, 449
`\pod` (() math op.) Ⓐ, 18, 176, *176*
poetry, typing, 130–131
point (pt abs. unit), 8, 10, 98, 102, 111, 113, 115, 349
poor man's bold Ⓐ, **194–195**, 305
portability
of bibliographic databases, 373, 374
of illustrations, 518
of LATEX files, 5
of TEX files, 5
Portable Document Format, *see* PDF
Portable Document Format Reference Manual (Adobe Systems), 445
Portable Network Graphics format, *see* PNG
position, of proclamation numbers, 142
PostScript (PS), 444
files
creating, 444
including fonts in, 444, 449
putting on the World Wide Web, 449
size of, 444, 449
fonts, 449, 477, **484–491**
AMSFonts, 303, 306, 436, 478, **485**, **486**
Computer Modern, 436, 478, **484**, **486**

European Modern, 487
in illustrations, 486
using with LaTeX, 269, 487, 488
legal issues with, 444
size of, 486
PostScript Language Reference Manual (Adobe Systems), 444
PostScript New Font Selection Scheme, *see* PSNFSS
\pounds
math symbol (£), *463*
pound sign or sterling (£), *473*
\Pr (Pr math op.), *174*, *465*
preamble, **38–39**, **240–242**, 315
commands in, xxxvi, 9, 16, 39, 61, 75, 89, 90, 105, 135, 138, 139, 142, 160, 175, 192, 234, 235, 241, 242, 298, 305, 313, 329, 330, 333, 348, 407, 417, 420, 428, 482, 509, 510, 514
customizing, in template files, 47, 298
defining counters in, 346
environments in, 242
proclamations defined in, 242
user-defined commands in, 242, 313
\prec ($\prec$ binary rel.), *457*
\precapprox ($\precapprox$ binary rel.) Ⓐ, *458*
\preccurlyeq ($\preccurlyeq$ binary rel.) Ⓐ, *458*
\preceq ($\preceq$ binary rel.), *457*
\precnapprox ($\precnapprox$ neg. binary rel.) Ⓐ, *459*
\precneqq ($\precneqq$ neg. binary rel.) Ⓐ, *459*
\precnsim ($\precnsim$ neg. binary rel.) Ⓐ, *459*
\precsim ($\precsim$ binary rel.) Ⓐ, *458*
preparation
final, for books, 424–429
of illustrations, 426
presentational tags, in MathML, 443–444
\pretend (obs. $\mathcal{A}\mathcal{M}\mathcal{S}$-TeX com.), *513*
preventing
case changes in bibliographic entries, 373
hyphenation, 87–88, 113
indentation of paragraphs, 105
line breaks, 104, 112
page breaks, **103**, 106, 234
removal
of horizontal space, 109
of vertical space, 111
spaces following environments, 330
prime (′), 163, 189, *463*
\prime (′ math sym.), *463*
primitive commands, 325, 479
printers
drivers for, **445**, 450–451
DVI drivers for, 269
resolution of, 449, **486**
\printindex (index com.), **394**, 405
printing, typeset (DVI) files, xxviii, xxix, 481
proc (doc. class), 269, 479
PROCEEDINGS (bibl. entry type), 371, **382**
proceedings, conference, in BibTeX database files, 376–377, 382
processed
bibliography files, *see* **bbl**
index files, *see* **ind**
processing
bibliographies, 383–392
indexes, 402–405
proclamations, 39, **135–143**, 352
commands for
\newtheorem (procl. com.), *39*, **135**, 138, 142, 298, 348
\newtheorem* Ⓐ, **139**, *329*, 330
\theoremstyle Ⓐ, 139–142
\theoremstyle* Ⓐ, 139–142
converting from older forms, 508, 514
counters for, 345
defining, 39, 49, **135**, 138, 139, 142, 298, 329, 330, 348, 511
in preamble, 242
with **theorem** package, 270
environments for
theorem, 39, 49, 54, 55
invoking, 39, 49, 54, 55, **135**, 511
lines following Ⓐ, 145
lists in, 137
logical design using, 56
names of, 139
numbering of, 135
consecutively, 138–139
within sections, 138–139
position of numbers, 142
styles of, **139–142**, 477
definition, **139**, 139–142
plain, **139**, 139–142
remark, **139**, 139–142
unnumbered, 139, 142, 329, 330
\prod ($\prod$ large math op.), 21, *177*, *466*
products, 21, 178
programming, in TeX, 519
programs, typing, 127–129, 131–133
prohibited keys, 5, 69
\projlim (proj lim math op.) Ⓐ, *174*, *465*
prompts, 60–61
* (interactive), **61**, 117, 323–325
**, 60
?, 14, 51, 60
file name, 60
responding to, 14, **60–61**
shell, xxviii

proof (text env.) Ⓐ, xxxiii, **143–145**, 306, 515
  lines following Ⓐ, 145
  lists in, 144
  optional arguments of, 144
  placement of q.e.d. symbol, 144
\proofname (redef. name) Ⓐ, *324*
proofs, 143–145
proportional fonts, 93
propositions, *see* proclamations
\propto (∝ binary rel.), *457*
\protect (protect fragile commands), **79**, 244, 410, 415
protecting
  capitalization in bibliographic entries, 373
  fragile commands, **79**, 244, 410, 415
protocols
  File Transfer, *see* FTP
  Hypertext Transfer, *see* HTTP
\providecommand (user-defined command com.), 257, **322**
\providecommand* (user-defined command com.), 320
\ProvidesPackage (pack. com.), 333
providing, commands, 322
PS, *see* PostScript
psamsfonts
  AMS document class option, **303**, 305, 486
  amsfonts package option Ⓐ, **306**, 486
psfonts.ins (PSNFSS distr. file), 487
\psi (ψ Greek char.), *456*
\Psi (Ψ Greek char.), *456*
psnfss (LaTeX distr. dir.), 268
PSNFSS (PostScript New Font Selection Scheme), 269, 487, 488
  distribution, 487–489
  font names (Berry scheme), 487
pt (point abs. unit), 8, 10, 98, 102, 111, 113, 115, 349
ptm (PSNFSS font name), 487
publisher (BibTeX database field), 371, 377
publishers, preparing manuscripts for, 410
punctuation
  in BibTeX databases, 371–373, 391, 392
  marks, 5, **10**, **68**, 69, **80**, *84*, *85*, *469*, *472*
    and font shape, typographic rules for, 96

q.e.d. symbol, 143
\qedhere (proof com.) Ⓐ, 145
\qedsymbol (□ math sym.) Ⓐ, 143, 322
\qquad (spacing com.), 22, 108, **185**, 218, *185*, *468*, *474*
\quad (spacing com.), 19, 22, 108, 158, **185**, 218, *185*, *468*, *474*
question marks (?), 5, 68
  Spanish (¿), 68, *84*, *85*, *469*, *472*
  terminating sentences with, 70–73
quiet mode, 60
quotation (disp. text env.), **130**, 352
quotation marks, 5, 69, **80**, *85*, *472*
  double quote key, 5, 68, 69, **80**
    in BibTeX database fields, **371**, 391, 392
    in \index commands, 400–401
  European, *473*
  single quote key, 5, 7, 68, **80**
  typing, 7
quotations, typing, 129–130
quote (disp. text env.), **129**, 352, 356
\quotedblbase (Eur. quot. mark), *473*
quoting, special characters in \index commands, 400

\r ring text accent (˚), *84*, *470*
\raggedleft (align. command decl.), 154
\raggedright (align. command decl.), 154
Raggett, Dave, 442
Rahtz, Sebastian, 251, 438, 439, 450
\raisebox (box com.), 119
ranges, numeric, **10**, **80**, *85*, *472*
  in BibTeX databases, 373
  in index entries, 398–399
\rangle (⟩ math delim.), **171**, *169*, *464*
rawfonts (pack.), 270
\rbrace (} math delim.), *169*, *464*
\rbrack (] math delim.), *169*, *464*
\rceil (⌉ math delim.), *169*, *464*
\rcfrac (obs. AMS com.), 515
\Re (ℜ math sym.), *463*
read-only, making templates, 301
Reader, Acrobat, *see* Acrobat Reader
real numbers, in length commands, 349
redefinable names, 258, **323**, 491, *324*, *453*
\redefine (AMS-TeX user-defined command com.), 511
redefining commands, 322–323
\ref (cross-ref. com.), 33, 36, 48, 49, 127, 144, 147, 160, 197, 209, 244, **247**, 305, 411, 452, 482
\ref* (hyperref cross-ref. com.), 452
references
  bibliographic, 34, 42–43, 50, 72, **253–258**, 322, 352, 383, 388
    citing, 34, 50, **256**, 387, 508, 511, *513*
    citing with BibTeX, 385
    including without citing, **385**, 387
  defining, 33, 36, 48, 49, 52, 53, 160, 197, 209, 224, 244, 247, 250, 348, 411
  to equations, 33, 36, 160, 199, 213, 247, 330

to pages, 33, 36, 197, 249, 427, 482
and varioref package, 270
to sections, 33, 36, 48, 49, 127, 144, 147, 160, 197, 209, 244, 247, 305, 411, 482
symbolic, showing in margins, **249**, 270
referencing, *see* cross-referencing *or* symbolic referencing
`\refname` (redef. name), *324*
`\refstepcounter` (cross-ref. counter incr. com.), 348
registered trademark (® text sym.), *85*, *472*
registers, 325
relations, binary, *see* binary relations
relative
numbering of equations, 197, 198
units, **111**, 113, 115, 185, 468
`\relax` (do nothing com.), 332, 333
release dates, of LaTeX, 61
`remark` (procl. style) Ⓐ, **139**, 139–142
`\renewcommand` (user-defined command com.), 92, 105, 143, 152, 258, **322–323**, 347, 511
`\renewcommand*` (user-defined command com.), 320
`\renewenvironment` (user-defined environment com.), 331
`\renewenvironment*` (user-defined environment com.), 332
renumbering, automatic, 33, 56
`report` (doc. class), 244, **263–266**, 479
reports, technical, in BibTeX database files, 380–381
`reqno`
AMS document class option, 241, **302**, 304, *512*
amsmath package option Ⓐ, 241, 304
LaTeX document class option, 266
required
arguments
of commands, 10, 15, 115, 117, 119, 149, 189, 480
of environments, 20, 42, 75, 108, 147, 179, 217, 219, 229, 231
use braces (`{}`), 4, 10, 13, 17, **74**, 75, 163, 313, 480
bibliographic fields, 372, 374–382
`required` (LaTeX distr. dir.), **268**, 435, 491
packages in, 269
`\RequirePackage` (pack. com.), 333, 334
research support (`\thanks` top-matter com.), 48, 281
AMS variant, 279, 300
resetting counters, 346, 347
resolution
of bitmap fonts, 449, **486**
of graphic images, 449
of printers, 449, **486**
of screens, 449
Return key, 5, 51, 52, 60, 61, 69
`\rfloor` (⌋ math delim.), *169*, *464*
`\rhd` (▷ math op.), *460*
`\rho` (ρ Greek char.), *456*
right
justification of text, 73
`\right` (math delim.), 28, **168**, 170, **171**, 172, 211, 228, 229
must be balanced, 171, 211
right double quote (")
text symbol, *85*, *472*
typing, 7
right single quote (')
key, 5, 7, 68, **80**
text symbol, **80**, *473*
`\right)` ( ) math delim.), 18, 21, 30, **168**
`\right.` (blank math delim.), 171
`\right>` (⟩ math delim.), 171
`\rightarrow` (→ math arrow), *461*
`\Rightarrow` (⇒ math arrow), *461*
`\rightarrowtail` (↣ math arrow) Ⓐ, *462*
`\rightharpoondown` (⇁ math arrow), *461*
`\rightharpoonup` (⇀ math arrow), *461*
`\rightleftarrows` (⇄ math arrow) Ⓐ, *462*
`\rightleftharpoons` (⇌ math arrow) Ⓐ, *462*
`\rightmargin` (length com.), **354**, 357, *353*
`\rightrightarrows` (⇉ math arrow) Ⓐ, *462*
`\rightsquigarrow` (⇝ math arrow) Ⓐ, *462*
`\rightthreetimes` (⋌ math op.) Ⓐ, *460*
`\right]` ( ] math delim.), 18, 27, 168
`\right|` (| math delim.), 18, 21, 26, 28, 184, 186
ring (° text accent), *84*, *470*
ring a (å), *84*, *469*
ring A (Å), *84*, *469*
`\risingdotseq` (≒ binary rel.) Ⓐ, *458*
`\rm` (obs. LaTeX 2.09 font com.), 100
`rmfamily` (font shape env.), 153
`\rmfamily` (font shape com. dec.), 94, *95*, *470*
roman
document font family, **94**, 487
font shape, 94, **153**, 305, *95*, *470*
math, **191**, *191*, *468*, *513*
`\roman`
lowercase roman-numeral counter-style command, 127, *347*
obsolete $\mathcal{A}\mathcal{M}\mathcal{S}$-TeX command, *513*
`\Roman` (uppercase roman-numeral counter style com.), *347*

roots, 21, 166–167
  n-th, 21, **167**
    placement of, 167
  square, 21, **166**
row separator (\\), 20, 34, 36, 38, 48, 103, 127, 128, 131, 147, 153, 179, 206, 207, 209, 220, 224, 234, 268, 275–277, 301, 427
Rowley, Chris, 476–478
\Rrightarrow (⇛ math arrow) Ⓐ, *462*
\Rsh (↱ math arrow) Ⓐ, *462*
\rtimes (⋊ math op.) Ⓐ, *460*
rubber lengths, **325**, **352**, 354, 480–481
\rule (box com.), 117, 118, 151
rules (lines), filling lines with, 111, 118
running
  BIBTEX, 383–392
  MakeIndex, 402–403
running heads, 244, **259–261**, 429
  author's name in, 277
  fragile commands in, 79
  title in, 276, 301
\rvert (| math delim.) Ⓐ, 170
\rVert (‖ math delim.) Ⓐ, 170

\S (§)
  math symbol, *463*
  section text sym.), *85*, *463*, *472*
sampart.tex (sample file) Ⓐ, xxxiii, 55, 56, 135, 139, 143, 223, 257, 275, **285–297**, 338, 383
  source file, 290–297
  typeset, 286–288
sampartb.aux (sample aux. file) Ⓐ, **386**, 388
sampartb.bbl (sample bibl. file) Ⓐ, 386, 388–389
sampartb.bib (sample bibl. file) Ⓐ, 383, **384–385**
sampartb.blg (sample BIBTEX log file) Ⓐ, 386, 388
sampartb.tex (sample file) Ⓐ, 367, 383, 385, 386, 388, 389
sampartu.tex (sample file) Ⓐ, 56, 319, 323, 331, **338–344**, 361
sample files
  amsart.tpl Ⓐ, **140–142**, 298, 512
  article.tpl, 46, 47, 253
  article2.tpl, 46, 47
  bibl.tpl, 49
  fonttbl.tex, 82, 147
  formula.tex, 22–24
  gallery.tex, 25–32
  ggamsart.tpl Ⓐ, 301
  ggart.tpl, 47
  ggart2.tpl, 47
  inbibl.tpl, 253–255
  intrart.tex, xxxi, **38–45**, 51, 55, 135, 136, 252, 264, 394
    typeset, 43–45
  intrarti.tex, 394–397, 402–405
  lattice.sty, 90, 257, 327, **333–338**
  letter.tex, 266–268
  math.tex, 11–14
  mathb.tex, 13–15
  multline.tpl, 203
  myams.tpl Ⓐ, 298–301
  note1.tex, 6–7
  note1b.tex, 8–9
  note2.tex, 9–11
  noteslug.tex, 9
  obtaining, 4, 435
  sampart.tex Ⓐ, xxxiii, 55, 56, 135, 139, 143, 223, 257, 275, **285–297**, 338, 383
    source file, 290–297
    typeset, 286–288
  sampartb.bib Ⓐ, 383, **384–385**
  sampartb.tex Ⓐ, 367, 383, 385, 386, 388, 389
  sampartu.tex Ⓐ, 56, 319, 323, 331, **338–344**, 361
  sample.html, 441
  svsing6.cls, 495
  template.bib, 370, 383, 392
  textenv.tpl, 121
  topmat.tpl Ⓐ, 281–284
sample.html (sample file), 441
samples
  of bibliographies, 49, **253–255**, 370, 383, **384–385**, 392
  of command (style) files, 91, 257, 327, **333–338**
  font, 270
  of indexes, 394–397
samples (dir.), **4**, 6, 8, 9, 11, 14, 23, 25, 38, 46, 49, 56, 90, 121, 140, 147, 204, 223, 266, 281, 298, 301, 323, 333, 338, 370, 383, 385, 394, 441, 492, 493, 495
  creating, 4
sans-serif
  document font family, **94**, 487
  font shape, 93, 94, **153**, **191**, *95*, *191*, *468*, *470*
\sb (math subscript com.), 164
Sb (obs. AMS math env.), 515
\sc (obs. LATEX 2.09 font com.), 100
\scalebox (graphics com.), 251
scaling graphics, math, and text, 251
Schaefer, Jeff, 443

scharf s (ß, SS), *84*, *469*
Schleyer, Antoinette Tingley, 211, 519
Schmock, Uwe, 487
`school` (BIBTEX database field), 371
Schröder, Martin, 476
Schöpf, Rainer, 476, 477
Scientific Word (Windows TEX system), 435
scope
of `\allowdisplaybreaks` commands Ⓐ, 234
of command declarations, 154, **314–315**, 329
of commands, **76–78**, 94
global and local, 79
delimited by braces, 76–78
setting, with environments, 102, 207
screen (monitor) resolution, 449
`\scriptscriptstyle` (math font size com.), **195**, *513*
`\scriptsize` (font size com.), **98**, *275*, *471*
`\scriptstyle` (math font size com.), **195**, *513*
`scshape` (font shape env.), 153
`\scshape` (font shape com. dec.), **95**, *95*, *470*
`\searrow` (↘ math arrow), *461*
`\sec` (sec math op.), *174*, *465*
`secnumdepth` (counter), 349
`section` (counter), *345*
section (§ text sym.), *85*, *472*, *473*
`\section` (struct. com.), 48, **243–244**
argument of, 244
`\section*` (struct. com.), 48, 245, 412
sectioning, 508
of articles, 48, **243–246**
of books, **410–412**, 422
commands, *see also* structural commands
optional arguments of, 245
provided by book document classes, 410–412
provided by the `amsart` document class, *246*
provided by the `article` document class, *246*
of documents, 7, 23, 38–40, 42, 43, 48, 50, 51, 54, 72, 73, 240, **243–246**, 253, 258, 264, 267–268, 274, 285, 352, 383, 388, 393, 404, 410–412
syntax of commands, 244–245
`\sectionname` (redef. name)
and hyperref package, *453*
sections, numbering of, 244
in books, 411
of equations within, 160, 242
of proclamations within, 138–139
`\see` (indexing cross-reference com.), 401
`\seename` (redef. name) Ⓐ, *324*
`\selectfont` (font selection com.), 488
selecting
files to include, **417**, **418**, 420
interactively, 418
fonts, 93–100
semantic tags, in MathML, 443–444
sentences, 70
terminating, 7, 70–72
with exclamation and question marks, 70–73
with periods, **70–73**, *474*
`series` (BIBTEX database field), 371
series commands, for fonts, *see under* font commands *and* font command declarations
serif (font shape), *see also under* roman, 93
Seroul, Raymond, 519
`\setcounter` (counter setting com.), 227, 345, **348**
`setlength` (scoped-command env.), 102, **207**
`\setlength` (length command setting com.), 105, 106, 117, **350**
`\setminus` (\ math op.), *460*
`setspace` (pack.), 105
`\settabs` (obs. TEX com.), *509*
`\settodepth` (measurement com.), 351
`\settoheight` (measurement com.), 351
`\settowidth` (measurement com.), 351
`\sevenbf` (obs. TEX com.), *509*
`\seveni` (obs. TEX com.), *509*
`\sevensy` (obs. TEX com.), *509*
`sffamily` (font shape env.), 153
`\sffamily` (font shape com. dec.), *95*, *470*
SGML (Standard Generalized Markup Language), 477
shape commands, for fonts, *see under* font commands *and* font command declarations
shareware TEX systems, 436
`\sharp` (♯ math sym.), *463*
shell prompt, xxviii
short
arguments, of user-defined commands, 320–321
arguments, of user-defined environments, 332
commands, **79**, 94, 275
pages, warnings about, 481
shorthand, *see under* user-defined commands
`\shortmid` (∣ binary rel.) Ⓐ, *458*
`\shortparallel` (∥ binary rel.) Ⓐ, *458*
`\shoveleft` (align. com.) Ⓐ, 208, 209
`\shoveright` (align. com.) Ⓐ, 208
`\show` (command-examination com.), 61, **323**, 324, 325

\showhyphens (hyph.-disp. com.), 88
showidx (pack.), 269
showkeys (pack.), **249**, 270, 271
  options of, 249
showkeys.sty (LaTeX distr. file), 271
\showthe (value-examination com.), 61, **325**
shrinkable lengths, **325**, **352**, 354, 480–481
siam (BibTeX style), *369*
siam.bst (BibTeX style file), *369*
side-setting, math symbols, 189
\sideset (math com.) Ⓐ, 189
\sigma (σ Greek char.), *456*
\Sigma (Σ Greek char.), *456*
\signature (letter com.), 268
\sim (∼ binary rel.), *457*
\simeq (≃ binary rel.), *457*
simple alignment, of formulas, 34–35, *35*
\sin (sin math op.), 21, 173, *174*, *465*
sines, 21, 173
single
  guillemet, *473*
  quote, 7
    keys, 5, 68, **80**
    text symbols (''), *473*
single-line boxes, *see under* boxes
\sinh (sinh math op.), *174*, *465*
size
  of files
    PDF, 445
    PostScript, **444**, 449
  of fonts, 94, **98–99**, 153
    bitmap, 486, 492
    commands for, *see under* font commands
    document class options for, 264, 301–302
    in math, **195**, 513
    PostScript, 486
  of hyperlinks in PDF files, 453
  of math delimiters, 30, **170–172**
  of paper, document class options for, 265, 302
\sl (obs. LaTeX 2.09 font com.), 100
slanted (font shape), 93, **95**, 98, **153**, *95*, *470*
  in math mode, *513*
\slanted (obs. AMS-TeX com.), *513*
slashed Ls and Os (ł, Ł, ø, Ø), *84*, *469*
slides (doc. class), 268, 479
slshape (font shape env.), 153
\slshape (font shape com. dec.), **95**, 98, *95*, *470*
  and italic correction, 98
slugs, 9, 102, 265, 302
\small (font size com.), **98**, 514, *275*, *471*
small caps (font shape), 93, **95**, 96, **153**, *95*, *470*
  for abbreviations and acronyms, 96
\Small (font size com.), 514
\smaller (font size com.) Ⓐ, 274
\smallfrown (⌢ binary rel.) Ⓐ, *458*
\smallint (∫ math sym.), *463*
smallmatrix (subsid. math env.) Ⓐ, 228–229
\smallsetminus (∖ math op.) Ⓐ, *460*
\smallskip (spacing com.), 110
\smallsmile (⌣ binary rel.) Ⓐ, *458*
\smash (spacing com.) Ⓐ, 119, **196**, 197, *513*
  optional argument of, **197**, *513*
\smile (⌣ binary rel.), *457*
Snow, Wynter, 519
Solaris, *see also* UNIX, xxxi, 5
solid boxes, *see also* struts, 117–118
somedefs (pack.), 270
sort keys, 399–400
  case-sensitivity of, 406
sorting, of index entries, 399–400
source files, xxvii, 3, 5–7, 9, 11, 25, 33, 54, 58, 60, 61, 63, 71, 89, 159, 240, 480, 481
  errors in, 13–15, 50–54
  legibility of, 12, **24–25**, 71, 159, 214, 314
  platform independence of, xxxi, 5
  putting on the World Wide Web, 447–448
    disadvantages of, 448
  white space in, 159
sources, for fonts, *490*
\sp (math superscript com.), 164
Sp (obs. AMS math env.), 515
spacebar, 5, 69
\spacehdotsfor (obs. AMS-TeX com.), *513*
\spaceinnerhdotsfor (obs. AMS-TeX com.), *513*
spaces
  in arguments of commands, 90
    \bibitem, 257
    \cite, 256
    \index, 405–406
  at the beginning of a line, 70
  blue, *see also* tie, unbreakable spaces, non-breakable spaces, 81
  in command names, 74
  in command definitions, 314
  consist of glue, 480–481
  in delimited commands, 326–327
  filling lines with, 111
  multiple, act as one, 70
  separating words with, 7, **70**, 71, 72, 76, 108, 330, 373, 474
  suppressing, 330
  in tabular environments, 147
  terminating commands with, 12, **74**, **158**

unbreakable (~ tie), 7, 33, 69, 71, 72, 80, **81**, 104, *474*
in AMS documents, 81
in BibTeX databases, 374
with cross-references, 33, **72**, 248
in user-defined commands, 271
in \verb commands, 134
in verbatim environments, 132
visible (␣), 69, *473*
and \verb* command, 134
spacing
between characters, 480
commands, *see* spacing commands
determined by document classes, 108
between dots with \hdotsfor commands, *227*
horizontal
adjusting, 183
interword, 7, 70–72, 76, 108, 330, 373, 474
in math, **12**, 31, 35, **158–160**, **182–187**, 227, 229, 513
preventing removal of, 109
in text, 7, 12, **70–73**, **108–109**, **111–112**, 118, 137, 359, 474
intercolumn, 218, 222, *214*
in tabular environments, 148
interline, 172, 234, 318, 425
adjusting, **100**, 118
double, 104–105
line-and-a-half, 105
between math symbols, 182–187
within an \mbox command, 26
rules
in arguments of \index commands, 406
for commands, 74, 158
and delimited commands, 326–327
in math, 12, 158–160, 182–187, 196–197
in \mbox commands, 159, 167
in text, 7, 10, 12, **70–73**, **108–111**
in \text commands Ⓐ, 159
in text, 108–112
vertical
adding to table of contents, 414
adjusting, 151, **196**, 425
adjusting with struts, 151
adjusting with the setspace package, 105
in indexes, 258, 393
in math, 119, **196–197**, 513
preventing removal of, 111
in text, 10, 107, **110–111**, 196, 325, 414, 426, 429
spacing commands
avoiding direct use of, 423
horizontal, *see* horizontal spacing
vertical, *see* vertical spacing
\spadesuit (♠ math sym.), *463*
\spbreve (˘ math accent), 180, 467, 515
\spcheck (ˇ math accent), 180, 467, 515
\spdddot (⃛ math accent), 180, 467, 515
\spddot (⃜ math accent), 180, 467, 515
\spdot (˙ math accent), 180, 467, 515
special
braces, 12, 77, 79, 156, 332, 333
balancing, 77
characters, **5**, **69**, **81–83**, *469–473*
in HTML, **441**, 442
in \index commands, 400
keys, 5, 69
\special, 252
spelling checkers, 50, 62–63
\sphat (⃗ math accent), 180, 467, 515
\sphericalangle (∢ math sym.) Ⓐ, *463*
Spivak, Michael D., 476, 488
split (subsid. math align. env.) Ⓐ, 36, 204, **223–225**, 302, *205*
and \allowdisplaybreaks commands, 235
numbering of equations within, 223–224
splitting
documents into multiple files, 416–418
formulas, across lines, 206–209
\spreadlines (obs. $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX com.), *513*
Springer-Verlag, 494
\sptilde (⃘ math accent), 180, 467, 515
\sqcap (⊓ math op.), *460*
\sqcup (⊔ math op.), *460*
\sqrt ($\sqrt{x}$ math com.), 21, 166
\sqsubset (⊏ binary rel.), *457*
\sqsubseteq (⊑ binary rel.), *457*
\sqsupset (⊐ binary rel.), *457*
\sqsupseteq (⊒ binary rel.), *457*
square roots, 21, **166**
\square (□ math sym.) Ⓐ, *463*
\ss (ß), *84*, *469*
\SS (SS), *84*, *469*
\ssize (obs. $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX com.), *513*
\sssize (obs. $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX com.), *513*
stacking, math symbols, 188–189
\stackrel (symbol-building com.), 28, **188**
Standard Generalized Markup Language (SGML), 477
\star (⋆ math op.), *460*
start, of chapters, document class options for, 412–413
\stepcounter (counter-incr. com.), 347
sterling (£ text sym.), *473*
\stop (interactive control com.), 61

stretchable
  horizontal braces, 180–181
  lengths, **325**, **352**, 354, 480–481
  lines, 181–182
  math arrows, **182**, 232, 514
  math delimiters, 171–172
  math symbols, 180–182
  vertical spacing, in displayed text environments, 352
`STRING` (bibl. entry type), 383
structural commands
  `\appendix`, 245–246, 412
  `\backmatter`, 411
  `\chapter`, 244, 264, **410**
  `\frontmatter`, 411
  hierarchy of, 244, 410
  `\mainmatter`, 411
  optional arguments of, 245
  `\paragraph`, 48, **244**
  `\paragraph*`, 48
  `\part`, 244, 264, **410**
  provided by book document classes, 410–412
  provided by the `amsart` document class, *246*
  provided by the `article` document class, *246*
  `\section`, 48, **243–244**
  `\section*`, 48, 245, 412
  `\subparagraph`, 48, **244**
  `\subparagraph*`, 48
  `\subsection`, 48, **244**
  `\subsection*`, 48, 412
  `\subsubsection`, 48, **244**
  `\subsubsection*`, 48
  syntax of, 244–245
structural text environments
  `abstract`, 40, 51, 73, **243**, 264, 274, 285, *38*
  `document`, 7, 23, **39**, 43, 54, 73, 240
  `letter`, 267–268
  `thebibliography`, 42–43, 50, 72, **253–258**, 352, 383, 388
  `theindex`, **258**, 352, **393**, 404
structures, theorem-like, *see* proclamations
struts, **118**, 151, 196
Student's Guide to Unix, A (Hahn), 519
style (`sty`) files, *see also* packages, 242, 313, **333–338**, 487
  commands in, 333, 334
  terminating, 338, 360
style files, BibTeX, *see* `bst`
styles
  bibliographical, *see also* `bst`, 257
  for counters, 92, 127, **346–347**, 356
  document parameters for, 518
  of pages, 259–261
  of proclamations Ⓐ, **139–142**, 477
  of tables, 152–153
  text environments, 153
`subarray` (subsid. math env.) Ⓐ, 179
subentries, in indexes, **258**, **393**, 397, 398
`subequations` (math env.) Ⓐ, **198**, 213, 347
subformulas
  indentation of, 211
  rules for, **209–211**, 216–217
  shorthand commands for, 312
  with user-defined commands, 319–320
`\subitem` (index com.), 258, 393
`\subjclass` (top-matter com.) Ⓐ
  optional arguments of, 280
  rules for using, 280
`\subjclassname` (redef. name) Ⓐ, *324*
Subject Classification, AMS, 280
`subparagraph` (counter), *345*
`\subparagraph` (struct. com.), 48, **244**
`\subparagraph*` (struct. com.), 48
subscripts, math, **17**, 19, 27, **163–164**, 166
  double, **195**, *513*
  font size of, **195**, *513*
  with horizontal braces, 181
  as limits, **19**, 27, 28, **166**, 173, 175–177, 304
  as multiline limits, **178–179**, 515
`subsection` (counter), *345*
`\subsection` (struct. com.), 48, **244**
`\subsection*` (struct. com.), 48, 412
`\subsectionname` (hyperref redef. name), *453*
`\subset` ($\subset$ binary rel.), *457*
`\Subset` ($\Subset$ binary rel.) Ⓐ, *458*
`\subseteq` ($\subseteq$ binary rel.), *457*
`\subseteqq` ($\subseteqq$ binary rel.) Ⓐ, *458*
`\subsetneq` ($\subsetneq$ neg. binary rel.) Ⓐ, *459*
`\subsetneqq` ($\subsetneqq$ neg. binary rel.) Ⓐ, *459*
subsidiary math environments
  `aligned` Ⓐ, 204, **221–223**, **235**
  `alignedat` Ⓐ, 221–223, 235
  for aligning formulas, 36, 204, 205, **220–225**, 235, 302
  and `\allowdisplaybreaks` commands, 235
  `array`, 19, 29, 203–205, 225, **229–231**, 270, 477, 517, 518
  `bmatrix` Ⓐ, 228
  `Bmatrix` Ⓐ, 228
  `cases` Ⓐ, 37–38, 204, 226, **231**, **234**, *205*
  `CD` Ⓐ, 232
  `gathered` Ⓐ, 204, **221–223**, **235**
  `matrix` Ⓐ, 20, 21, 204, 225, **226–229**, *205*

numbering of, 223, 224
page breaks in, 234
pmatrix Ⓐ, 20, 21, **228**
smallmatrix Ⓐ, 228–229
split Ⓐ, 36, 204, **223–225**, **235**, 302, *205*
subarray Ⓐ, 179
vmatrix Ⓐ, 20, 21, 29, **228**
Vmatrix Ⓐ, 29, **228**
\substack (math com.) Ⓐ, **178**, 179, 515
substitution, of fonts, 425, 426, 445
subsubentries, in indexes, **258**, **393**, 398
\subsubitem (index com.), 258, 393
subsubsection (counter), *345*
\subsubsection (struct. com.), 48, **244**
\subsubsection* (struct. com.), 48
subtraction, 16, 68, 162, 191
\succ (≻ binary rel.), *457*
\succapprox (⪸ binary rel.) Ⓐ, *458*
\succcurlyeq (≽ binary rel.) Ⓐ, *458*
\succeq (⪰ binary rel.), *457*
\succnapprox (⪺ neg. binary rel.) Ⓐ, *459*
\succneqq (⪶ neg. binary rel.) Ⓐ, *459*
\succnsim (⋩ neg. binary rel.) Ⓐ, *459*
\succsim (≿ binary rel.) Ⓐ, *458*
\sum (∑ large math op.), 21, *177*, *466*
sumlimits (opt. of amsmath pack.) Ⓐ, **304**, *512*
sums, 21, 176, 178
\sup (sup math op.), *174*, *465*
superscripts, **17**, 19, 27, **163–164**, 166, 179
in HTML, **441**
in math
font size of, **195**, *513*
with horizontal braces, 181
as limits, **19**, 27, **166**, 173, 176, 177, 304
as multiline limits, **178–179**, 515
in text, *473*
support, technical, *see* technical support
\suppressfloats (float com.), 252
suppressing
creation of auxiliary files, 428, 482
placement of floats, 252
hyperlinks in PDF files, 452
italic corrections, 97–98
ligatures, 26, **83**, 312
loading of AMS packages, 304
numbering, 206
of equations, 35, 36, 161, 197, 206, 207, 209, 212, 224
of proclamations, 139, 142, 329, 330
of structural units, 48, 245, 412
Overfull \hbox warnings, 102
q.e.d. symbol, 143
\supset (⊃ binary rel.), *457*
\Supset (⋑ binary rel.) Ⓐ, *458*
\supseteq (⊇ binary rel.), *457*
\supseteqq (⫆ binary rel.) Ⓐ, *458*
\supsetneq (⊋ neg. binary rel.) Ⓐ, *459*
\supsetneqq (⫌ neg. binary rel.) Ⓐ, *459*
\surd (√ math sym.), *463*
Sutor, Robert, 439
svsing2e (pack.), 495
svsing6 (doc. class), 495
example of, 495–506
svsing6.cls (sample document class file), 495
Swanson, Ellen, 211, 519
\swapnumbers (theorem-style com.), 142
\swarrow (↙ math arrow), *461*
symbol fonts, math, 192–193
Greek, 192
\symbol (symbol com.), **82**, 269
symbolic references, showing in margins, **249**, 270
symbolic referencing, *see also* cross-referencing, 33, **247–249**
symbols
as footnote indicators, 92
math, 68, 509, *455–469*
bold, **193–195**, 270
building new, 187–190
classification of, 183–184, 190
declaring types of, 190
negated, 189
shorthand commands for, 312
side-setting, 189
spacing of, 182–187
stacking, 188–189
stretchable, 180–182
in text, 316
types of, 183–184
text, 81, 82, 84, 85, 279, *469–473*
systems
of equations, 218–219
TEX, *see* TEX systems

\t tie text accent (͡), *84*, *470*
T1 (Cork) font encoding, 87, 491, *473*
Tab key, 5, 69
\tabalign (obs. TEX com.), *509*
tabbing (disp. text env.), **127–129**, 508, 517, 518
table (counter), *345*
table (float env.), 146, **250**, 251
optional arguments of, **252**, 427
placement of, 426, 427
table* (double-column float env.), 250
\tablename (redef. name), *324*
and hyperref package, *453*

\tableofcontents (front matter com.), **413**, 483
tables, 127, **146–153**, 231, **250**, 251, 270, 477, 508, 517, 518
  captions in, 146, **250**, 416
    fragile commands in, 79
  commands for, 147, 149–151, 250, 416
  cross-referencing of, 147
  designing, 152–153
  double-column, 250
  forcing typesetting of, 107
  hyphenation, 479
  typeset inline, 146
  intersection of lines in, 152, **270**
  lists of, *see under* lists
  multiline entries in, 150
  multipage, 270
  numbering of, 250
  placement of, **252**, 426, 427
  style of, 152–153
tables of contents, 244, **413–415**, 452
  adding a line to, 413–414
  adding vertical spacing to, 414
  auxiliary file (toc), 413, 482
  commands, 414
  depth, 349
  fragile commands in, 79, 414–415
  typesetting, 414
\tabs (obs. TEX com.), *509*
tabs, setting, 127
\tabsdone (obs. TEX com.), *509*
\tabset (obs. TEX com.), *509*
tabular (table env.), 127, **146–153**, 231, 250, 270, 477, 508, 517, 518
  arguments of, 147
    optional, 148
  breaking lines in, 147
  horizontal lines in, 147, 149
  intercolumn space in, 148
  \parbox in, 115
  rules for, 147–148
  vertical lines in, 147
  width of columns in, 148
tabularx (pack.), 270
\tag Ⓐ, 34, 161, **197**, 198, 206, 207, 209, 212, 223, 224
  in subsidiary math environments, 223
\tag* Ⓐ, 198
tags
  names for equations, 34, 161, **197–199**, 206, 207, 209, 212, 223, 224
    top-or-bottom placement of, 302
  in HTML, 441
  in MathML, 443–444
\TagsAsMath (obs. AMS-TEX com.), *512*
\TagsAsText (obs. AMS-TEX com.), *512*
\TagsOnLeft (obs. AMS-TEX com.), *512*
\TagsOnRight (obs. AMS-TEX com.), *512*
\tan (tan math op.), *174*, *465*
\tanh (tanh math op.), *174*, *465*
\tau (τ Greek char.), *456*
\tbinom (inline-style binomial com.), 164
tbtags
  AMS document class option, **302**, 304, *512*
  amsmath package option Ⓐ, 304
TCI Soft, Inc., 435
techexplorer (IBM LATEX plug-in for Web browsers), 448
technical reports, in BIBTEX database files, 380–381
technical support
  provided by commercial TEX system vendors, 435
  provided by the AMS, 437
  on the World Wide Web, 437
TECHREPORT (bibl. entry type), 371, **380–381**
template.bib (sample bibl. file), 370, 383, 392
templates, 47, 239
  article.tpl, 46–47, 49, 253
  article2.tpl, 46–47
  bibilographical, 253
  customizing
    for AMS document classes, 297–301
    for LATEX document classes, 46–47
  ggamsart.tpl Ⓐ, 301
  ggart.tpl, 47
  ggart2.tpl, 47
  myams.tpl Ⓐ, 298–301
  personalized, 508, 511, 514
    for AMS document classes, 297–301
    making read-only, 301
\teni (obs. TEX com.), *509*
terminating
  fields in BIBTEX database entries, 391
  commands, 10, 12, **74**, **75**, 85, **86**, 271, 313
  environments, **73**, 77, 511
  files, 338, 360, **417**
  paragraphs, 7, 53, **70**, 71, 105, 145
  sentences, **70–73**, *474*
testart.tex (sample article) Ⓐ, 25
teTEX (UNIX TEX system), 436
TEX, xxxi, 57, 58
  choosing a TEX system, xxx
  commands, 325, 327, 360, 508
    to avoid using, 18, 164, 424, 509, *509*
    for fonts, 508
    in LATEX, 508–509
    obsolete, 18, 164, 508, *509*

displayed math delimiters (**$$**), 508
distribution, 479
extensibility of, 57
files, portability of, 5
history of, 475–479
inner workings of, 479–483
inputs directory, 435, 450, 487–489, 492
and the Internet, 433–454
omissions in discussion of, 518
output routines, 508
Plain, 479
converting to LATEX, 508–509
platform independence of, xxxi, 317
programming, 519
resources on the World Wide Web, 437–438
source files, *see under* source files
structure of, 58, **479–480**, *57*
typesetting with, 58, *59*
using, **58**, *59*
TEX systems, 57
commercial, 435–436
freeware, 436
integrated, 58, **435**
layers of, 58, **479–480**
for Macintosh, xxix, 58, **435, 436**
nonintegrated, 436
for PCs, 58, **435, 436**
shareware, 436
technical support provided with, 435
for UNIX, xxviii, 58, **436**, 450
TEX'n ANSI font encoding (LY1), 489
TEX by Topic: A TEXnician's Reference (Eijkhout), 519
TEX for the Beginner (Snow), 519
TEX for the Impatient (Abrahams, et al.), 519
TEX Starting from $\boxed{1}$ (Doob), 114, 479
TEX user groups, *see also* TUG, **436–437**, 491
international, 437
\TeX (TEX logo com.), 84
TeX4ht (conversion program), 442
TEXbook, The (Knuth), xxx, 475, 479, 508, 519
TEXLive (TUG CD-ROM), 436
TEXSpell (PC spelling checker), 63
text
\\ in, 104
accents, 75, *84*, *470*
blocks, width of, 349
boxes, *see* text boxes
editors, xxvii, xxviii, xxx, 51, 58, 69, 89, 93, 435
framing, 101
in math mode, 12, **22**, 26, 28, 60, 87, 104, 112, 113, 159, **167–168**, 192, **219–220**, 233, 305
specifying fonts for, 168
using math symbols in, 316
mode, 3, **156**
\newline in, 104
plain, xxxi, 5
scaling, 251
spacing in, 108–112
style commands, *see* text style commands
symbols, *see* text symbols
in tables
multicolumn, 149–151
multiline, 150
typing, **4–11**, 67–93
user-defined commands for, 313
white space in, 108–112
text boxes, 101, 112–119
alignment of contents in, 113, 116
behave as single characters, 112
commands for
\framebox, 114
\makebox, 112, **113**, 114, 116, 118
\mbox, 12, 22, 26, 28, 87, 104, **112**, 113, **159**, **167**, 168, 192
measuring, *see* measurements
\parbox, 101, 112, **115, 116**, 150, 351, *513*
\raisebox, 119
\rule, 117, 118, 151
\text Ⓐ, **22**, 28, 60, 104, 112, **113**, **159**, 168, 192, 233, 305
environments for
minipage, 101, 112, 116, 330, 331
framed, 114
multiline, 112
paragraph, 115–116
single line, 112–114
vertical alignment of, 115, 116
text environments, 120–154
for alignment, **4**, 73, 112, 146, **153**, 220, 352, 360, 508
for bibliographies, *see* **thebibliography**
blank lines in, 145–146
for boxes, *see under* text boxes
for comments, *see* **comment**
displayed, *see* displayed text environments
for figures, *see* figures
for indexes, *see* **theindex**
for lists, *see* list text environments
for proofs, *see* **proof** Ⓐ
rules for, 145–146
and stretchable vertical space, 352
for styles, *see under* text style
for tables, *see* tables

text style commands
  avoiding direct use of, 423
  \emph, 4, 10, 73, **95**, *95*, *470*
  \textbf, 10, **98**, 168, 305, 315, 337, *95*, *470*
  \textit, **95**, *95*, *470*
  \textmd, **98**, *95*, *470*
  \textnormal, **94**, *95*, *470*
  \textrm, 94, 305, *95*, *470*
  \textsc, **95**, 96, *95*, *470*
  \textsf, *95*, *470*
  \textsl, **95**, *95*, *470*
  \texttt, 10, *95*, *470*
  \textup, 41, **95**, *95*, *470*
text style environments
  bfseries, 153
  emshape, 153
  itshape, 153
  rmfamily, 153
  scshape, 153
  sffamily, 153
  slshape, 153
  ttfamily, 153
  upshape, 153
text symbols, 82, **84**, *469–473*
  commands for, 81, 82, 84, 85, 279, 470, 472, 473
  typing, 79–85
\text (box com.) Ⓐ, **22**, 28, 60, 104, 112, **113**, 168, 192, 233, 305
  spacing rules in, 159
\textasciicircum (^ circumflex), *85*, *472*
\textasciitilde (~ tilde), *473*
\textasteriskcentered (* asterisk), **82**, *85*, *472*
\textbackslash (\ backslash), **81–82**, *85*, *472*
\textbar (| vertical bar), **82**, *85*, *472*
\textbf (font weight com.), 10, **98**, 168, 305, 315, 337, *95*, *470*
\textbullet (• bullet), *85*, *472*
\textcircled (ⓐ), **84**, *85*, *472*
\textcompwordmark (lig.-suppr. com.), 83
\textemdash (— em dash), *85*, *472*
\textendash (– en dash), *85*, *472*
textenv.tpl (sample file), 121
\textexclamdown (¡ exclamation mark), *85*, *472*
\textgreater (> greater than), *85*, *472*
\textit (font shape com.), **95**, *95*, *470*
\textless (< less than), *85*, *472*
\textmd (font weight com.), **98**, *95*, *470*
\textnormal (font shape com.), **94**, *95*, *470*
\textperiodcentered (· midpoint), *85*, *472*
\textquestiondown (¿ question mark), *85*, *472*
\textquotedbl (Eur. quot. mark), *473*
\textquotedblleft (“ left double quote), *85*, *472*
\textquotedblright (” right double quote), *85*, *472*
\textquoteleft (‘ left single quote), *473*
\textquoteright (’)
  European quot. mark, *473*
  text symbol, *473*
\textregistered (® registered trademark), *85*, *472*
\textrm (font shape com.), 94, 305, *95*, *470*
\textsc (font shape com.), **95**, 96, *95*, *470*
\textsf (font shape com.), *95*, *470*
\textsinglbase (Eur. quot. mark), *473*
\textsl (font shape com.), **95**, *95*, *470*
\textstyle (math font size com.), **195**, *513*
\textsuperscript, *473*
\texttrademark (™ trademark), *473*
\texttt (font shape com.), 10, *95*, *470*
\textup (font shape com.), 41, **95**, *95*, *470*
TEXTURES (Macintosh TEX system), xxix, **435**, 450
  font encoding (LM1), 489
\textvisiblespace (␣ visible space), *473*
\textwidth (length com.), 261, 349
tfm (TEX font metric file), **480**, 487
\tfrac ($\frac{x}{y}$) Ⓐ, 162
\th (thorn Eur. char.), *473*
\TH (Thorn Eur. char.), *473*
Thames and Hudson Manual of Typography, The (McLean), 519
\thanks (top-matter com.), 48, 93
  AMS variant, 280, 281, 300
\the (value expansion com.), **85–86**, 117, **347**
thebibliography (bibliography env.), 42–43, 50, 72, **253–258**, 352, 383, 388
  argument of, 255–256
  in bbl files, 388
\thechapter (the value of counter chapter), 347
\thefootnote (the value of counter footnote), 92
theindex (index env.), **258**, 352, **393**, 404
  commands in, 258, 393
theorem (proclamation env.), 39, 49, 54, 55
  body of, 49
  logical design of, 55
  visual design of, 55
theorem (pack.), 143, 270
theorem-like structures, *see* proclamations
\theoremstyle (procl. com.) Ⓐ, 139–142
\theoremstyle* (procl. com.) Ⓐ, 139–142
\theparentequation (the value of counter parentequation), 347

\therefore (∴ binary rel.) Ⓐ, *458*
\thesection (the value of counter section), 347
theses, in BibTeX database files, 379–380
\thesubsection (the value of counter subsection), 347
\theta (θ Greek char.), *456*
\Theta (Θ Greek char.), *456*
\thickapprox (≈ binary rel.) Ⓐ, *458*
\thickfrac (obs. AMS-TEX com.), *513*
\thickfracwithdelims (obs. AMS-TEX com.), *513*
\thicksim (∼ binary rel.) Ⓐ, *458*
\thickspace (spacing com.) Ⓐ, *185*, *468*, *474*
\thinspace (spacing com.), 19, 26, 72, 80, 183, **185**, *185*, *468*, *474*
third-party document classes, *see under* document classes
\thispagestyle (set page style), 259
thorn (Eur. char.), *473*
Thorup, Kresten K., 348, 351
tie (~ spacing com.), 7, 33, 69, 71, 72, 80, **81**, 104, *474*
  in AMS documents, 81
  in BibTeX databases, 374
  with cross-references, 33, **72**, 248
tie (͡ text accent), *84*, *470*
tilde (~)
  text accent, *84*, *470*
  text symbol, *473*
\tilde ($\tilde{x}$ math accent), 19, *180*, *467*
\Tilde ($\tilde{x}$ obs. math accent), 512
time commands
  \day, 85
  \month, 85
  \time, 85
  \today, **10**, 48, 75–76, 86, 277, 491
  \year, 85
\time (time com.), 85
times (pack.), 487, 488
\times (× math op.), 16, **162**, *460*
Times, in LaTeX documents, 487–489
times.sty (PSNFSS distr. file), 487
\tiny (font size com.), **98**, 514, *275*, *471*
\Tiny (font size com.), 514
title (BibTeX database field), 371, *379*
title pages, 39
  of books, 413
  commands for, 39, **413**
  document class options for, 266, 303, 412
  environments for, 413
  footnotes on, 93
\title (top-matter com.), 40, 47, 48, 112, 413
  AMS variant, 301
  optional arguments of, 275, 282, 301
titlepage (doc. class opt.), 266, 412
  AMS variant, 303
titlepage (front-matter env.), 413
titles
  of articles, **48**, **275**, 301
  in bibliographies, rules for typing, 373–374
  in running heads, 276, 301
  of structural commands, 244, 508
    fragile commands in, 79
Tittel, Ed, 442
\to (→ math arrow), *461*
toc (tables of contents files), 413, 482
  commands in, 414
tocdepth (counter), 349
\today (time com.), **10**, 48, 75–76, 86, 277, 491
tokens, 480
tools (LaTeX distr. dir.), 249, **268**
  packages in, 269–271
tools, for HTML authoring, 442
tools.ins (LaTeX distr. file), 271
top matter, **39–40**, 241, *38*
  of AMS documents, 275–285
    AMS information, 279–281
    author information, 277–279
    errors with, 284–285
    examples, 281–284
    with multiple authors, 281
  for article document class, 47–48
  article information, 39–40, 47–48
    of AMS documents, 275–277
  commands, 39, 40, 47, 48, 86, 93, 112, 261, 275–281, 300, 301, 413, 454, 514
    blank lines in, 275
    examples of, 281–284
  customizing templates, 47, 298
  is document-class specific, 242
  editing, 47–48
  with multiple authors, 48
\top (⊤ math sym.), *463*
top-or-bottom, placement of tags, 302
\topins (obs. TEX com.), *509*
\topinsert (obs. TEX com.), *509*
topmat.tpl (sample file) Ⓐ, 281–284
\TopOrBottomTagsOnSplits (obs. AMS-TEX com.), *512*
tops, of text boxes, 351
\topsep (length com.), **352**, 354, *353*
\topsmash (obs. AMS-TEX com.), *513*
\topspace (obs. AMS-TEX com.), *513*
\totalheight (length com.), 114, 116
trademark text symbols (™ ®), *85*, *472*, *473*

translation, of line-ending characters, 69
`\translator` (top-matter com.) Ⓐ, 276
`\triangle` (△ math sym.), *463*
`\triangledown` (▽ math sym.) Ⓐ, *463*
`\triangleleft` (◁ math op.), *460*
`\trianglelefteq` (⊴ binary rel.) Ⓐ, *458*
`\triangleq` (≜ binary rel.) Ⓐ, *458*
`\triangleright` (▷ math op.), *460*
`\trianglerighteq` (⊵ binary rel.) Ⓐ, *458*
Trigram Systems, 63
`trivlist` (text list env.), 360
`\tsize` (obs. $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX com.), *513*
`\tt` (obs. LATEX 2.09 font com.), 100
`ttfamily` (font shape env.), 153
`\ttfamily` (font shape com. dec.), *95*, *470*
TUG (TEX Users Group), 436–437
  Web resources, 438
TUGboat, 437, 519
two-letter font commands, *see under* font commands
`twocolumn` (doc. class opt.), 107, 241, **265**
  AMS variant, 303
`\twocolumn` (double-column com.), 107
`\twoheadleftarrow` (↞ math arrow) Ⓐ, *462*
`\twoheadrightarrow` (↠ math arrow) Ⓐ, *462*
`twoside` (doc. class opt.), 107, **265**, **412**
  AMS variant, 303
`type` (BIBTEX database field), 371, 380
`typelcm` (pack.), 487
Typefaces for Desktop Publishing (Black), 519
types
  of commands, 78–79
  of math symbols, **183–184**, 194
    declaring, 190
typeset
  example articles
    `intrart.tex`, 43–45
    `sampart.tex` Ⓐ, 286–288
  material, including in illustrations, 436
typesetting, 480–481
  indexes, 402–405
  with LATEX, 58, *59*
  tables of contents, 414
  with TEX, 58, *59*
typewriter-style
  document font family, **94**, 487
  font shape, 10, **153**, 436, 478, **484**, **486**, *95*, *470*
    in math, **191**, *191*, *468*
  fonts, 93
typing
  bibliographic entries, 372–383
    accents in, 374
    names in, 372–373
    titles in, 373–374
  books, 409–429
  exercises, 142–143
  footnotes, 92–93
  math, 11–38, 155–201
  poetry, 130–131
  programs, 127–129, 131–133
  quotations, 129–130
  text, 4–11, 67–93
    symbols, 79–85
typographical
  conventions, xxxvii–xxxviii
  errors, 50
  rules for
    abbreviations and acronyms, 96
    initials, 72
    placement of punctuation, 96

`\u` breve text accent (˘), *84*, *470*
UK TUG (United Kingdom TEX User Group), 437
  Frequently Asked Questions (FAQ), 437
`\ulcorner` (⌜ math delim.) Ⓐ, *169*, *464*
umlaut (¨ text accent), 5, 492, *84*, *470*
unbreakable
  hyphens, 88
  spaces (~ tie), 7, 33, 69, 71, 72, 80, **81**, 104, *474*
    in AMS documents, 81
    in BIBTEX databases, 374
    with cross-references, 33, **72**, 248
`\underbrace` (math sym.), 181
  with a subscript, 181
underdot (. text accent), *84*, *470*
`\underleftarrow` ($\underleftarrow{x}$ math arrow) Ⓐ, 182
`\underleftrightarrow` ($\underleftrightarrow{x}$ math arrow) Ⓐ, 182
`\underline` ($\underline{x}$ math line sym.), 181
`\underrightarrow` ($\underrightarrow{x}$ math arrow) Ⓐ, 182
underscore (_), *81*
  text accent, *84*, *470*
  text symbol, *85*, *472*
    in electronic mail addresses, 279
`\underset` (symbol-building com.) Ⓐ, 28, **188**
units
  absolute, *see under* absolute
  dimensional, *see under* dimensional units
  logical, *see under* logical
  math, *see* mu
  relative, *see under* relative
UNIX, xxxi, 5, 317, 362, 434, 436, 476
  FTP clients, 434
  line-ending characters, 420
  spelling checkers, 63
  TEX systems for, xxviii, 58, **436**, 450

\unlhd (⊴ math op.), *460*
unmarked footnotes Ⓐ, 279, 280
unnumbered
  environments, 209
  equations, 35, 36, 161, 197, 206, 207, 209, 212, 224
  math environments, 206
  proclamations, 139, 142, 329, 330
  structural units, 48, 245, 412
unpacked (LaTeX distr. dir.), **268**, 435
UNPUBLISHED (bibl. entry type), 371, **381–382**
\unrhd (⊵ math op.), *460*
\uparrow (↑)
  math arrow, *461*
  math delimiter, *169*, *464*
\Uparrow (⇑)
  math arrow, *461*
  math delimiter, *169*, *464*
updates
  to AMSFonts and packages, 61
  to LaTeX, 61
  to *Math into LaTeX*, xxxvii
\updownarrow (↕)
  math arrow, *461*
  math delimiter, *169*, *464*
\Updownarrow (⇕)
  math delimiter, *169*, *464*
\Updownarrow(⇕)
  math arrow, *461*
\upharpoonleft (↿ math arrow) Ⓐ, *462*
\upharpoonright (↾ math arrow) Ⓐ, *462*
\uplus (⊎ math op.), *460*
uppercase counter styles
  letters (\Alph), *347*
  roman numerals (\Roman), *347*
upref (pack.) Ⓐ, 305
upright (font shape), 41, **95**, **153**, 358, *95*, *470*
\uproot (root-adjustment com.), 167
upshape (font shape env.), 153
\upshape (font shape com. dec.), **95**, 358, *95*, *470*
\upsilon (υ Greek char.), *456*
\Upsilon (Υ Greek char.), *456*
\upuparrows (⇈ math arrow) Ⓐ, *462*
\urcorner (⌝ math delim.) Ⓐ, *169*, *464*
URL (Uniform Resource Locator), *see also* hyperlinks, 442
\URL (bibl. com.) Ⓐ, 50
\urladdr (top-matter com.) Ⓐ, **279**, 281, 300, 454
\usecounter (list counter com.), 356
\usepackage (preamble com.), 16, 39, 75, 105, 241, 298, 313, 333
  can load multiple packages, 241
user groups, **436–437**, 491
  international, 437
User's Guide for the amsmath *Package (version 2.0)*, 171, 204
user-defined commands, 63, **312–327**, 422
  arguments of, 318–321
  command declarations in, 95
    scope of, **314–315**, 329
  with \def, 326
  defining, 92, 105, 143, 152, 257, 258, 312, 313, 320–323, 347, 511
    in preamble, 242
  delimited, 325–327
  for environments, 313
  for indexing, 318–319, 398
  invoking, 313
  optional arguments of, 321
  for pathnames, 317
  rules, 313
  short arguments, 320–321
  as shorthand, 312–321
  spaces in, 314
  for subformulas, 319–320
  for text, 313
  as tokens, 480
user-defined environments, **328–333**, 422
  defining, 328, 331, **332**
  for custom lists, 358–359
  optional arguments of, 331–332
  short arguments, 332

\v caron text accent (ˇ), *84*, *470*
Valiente Feruglio, Gabriel, 234
\value (value of counter), 348
values, of counters, 92, 347
  printing, **85–86**, 117, **347**
van Oostrum, Piet, 261
\varDelta (Δ Greek char.) Ⓐ, *456*
\varepsilon (ε Greek char.), *456*
\varGamma (Γ Greek char.) Ⓐ, *456*
\varinjlim ($\varinjlim$ math op.) Ⓐ, *174*, *465*
varioref (pack.), 249, 270
\varkappa (ϰ Greek char.), *456*
\varLambda (Λ Greek char.) Ⓐ, *456*
\varliminf ($\varliminf$ math op.) Ⓐ, *174*, *465*
\varlimsup ($\varlimsup$ math op.) Ⓐ, *174*, *465*
\varnothing (∅ math sym.) Ⓐ, *463*
\varOmega (Ω Greek char.) Ⓐ, *456*
\varphi (φ Greek char.), *456*
\varPhi (Φ Greek char.) Ⓐ, *456*
\varpi (ϖ Greek char.), *456*
\varPi (Π Greek char.) Ⓐ, *456*
\varprojlim ($\varprojlim$ math op.) Ⓐ, *174*, *465*

\varpropto (∝ binary rel.) Ⓐ, *458*
\varPsi (Ψ Greek char.) Ⓐ, *456*
\varrho (ϱ Greek char.), *456*
\varsigma (ς Greek char.), *456*
\varSigma (Σ Greek char.) Ⓐ, *456*
\varsubsetneq (⊊ neg. binary rel.) Ⓐ, *459*
\varsubsetneqq (⫋ neg. binary rel.) Ⓐ, *459*
\varsupsetneq (⊋ neg. binary rel.) Ⓐ, *459*
\varsupsetneqq (⫌ neg. binary rel.) Ⓐ, *459*
\vartheta (ϑ Greek char.), *456*
\varTheta (Θ Greek char.) Ⓐ, *456*
\vartriangle (△ math op.) Ⓐ, *460*
\vartriangleleft (◁ binary rel.) Ⓐ, *458*
\vartriangleright (▷ binary rel.) Ⓐ, *458*
\varUpsilon (Υ Greek char.) Ⓐ, *456*
\varXi (Ξ Greek char.) Ⓐ, *456*
\vdash (⊢ binary rel.), *457*
\vDash (⊨ binary rel.) Ⓐ, *458*
\Vdash (⊩ binary rel.) Ⓐ, *458*
\vdots (vertical ellipsis) Ⓐ, 228
\vec ($\vec{x}$ math accent), 19, 324, *180*, *467*
\Vec ($\vec{x}$ obs. math accent), 512
\vee (∨ math op.), *460*
\veebar (⊻ math op.) Ⓐ, *460*
\verb (inline verbatim com.), 133–134
  in AMS aligned math environments, 134
  in argument of other commands, 134
  delimiters with, 133–134
  spaces in, 134
\verb* (inline verbatim com.), 134
verbatim (disp. text env.), **131–133**, 269, 270, *477*
  blank lines in, 145
  characters following, 132
  spaces in, 132
verbatim (pack.), 91, 92, 133, 270, 334
verse (disp. text env.), **130–131**, 352, 356
  breaking lines in, 131
versions
  of $\mathcal{A}\mathcal{M}\mathcal{S}$ packages and AMSFonts, 61
  of LaTeX packages, 61–62
\vert (| math delim.), *169*, *464*
\Vert (‖ math delim.), *169*, *464*
vertical
  alignment, of text boxes, 115, 116
  bar (| text sym.), *85*, *472*
  ellipses, 228
  glue, 481
  lines
    in CD environments Ⓐ, 233
    in tabular environments, 147
  math arrows, 233
vertical spacing
  adding after \\, 10, 32, **103**, 146
  adding to table of contents, 414
  adjusting, 196
    with \arraystretch, 151
  adjusting the setspace package, 105
  adjusting with struts, 151
  commands
    to avoid using, 424
    \bigskip, 110
    \enlargethispage, 107, **426**, 429
    \mathstrut, 196
    \medskip, **110**, 325
    \smallskip, 110
    \smash Ⓐ, 119, **196**, 197, *513*
    \vphantom, 196
    \vspace, 110, 414
    \vspace*, 111
  in indexes, 258, 393
  between marginal notes, 349
  in math mode, 119, **196–197**, 513
  between paragraphs, 349
  preventing removal of, 111
  stretchable, 352
  in text, 10, 107, **110–111**, 196, 325, 414, 426, 429
  using the setspace package, 105
\vfootnote (obs. TeX com.), *509*
viewers, DVI, 58, 435, 481
viewing typeset documents, xxviii, xxix, 481
virtex (TeX program), 479
virtual fonts, 487
visible spaces (␣), 69, *473*
  and \verb* command, 134
visual
  design, 55–56, 259–261
    determined by Web browsers, 440
  guide, to multiline math formulas, **204**, *205*
  markup, 56
vmatrix (subsid. math env.) Ⓐ, 20, 21, 29, **228**
Vmatrix (subsid. math env.) Ⓐ, 29, **228**
volume (BibTeX database field), 371
von, in bibliographic entries, 373
\vphantom (spacing com.), 196
\vspace
  obsolete $\mathcal{A}\mathcal{M}\mathcal{S}$-TeX command, *513*
  spacing command, 110, 414
\vspace* (spacing com.), 111
\Vvdash (⊪ binary rel.) Ⓐ, *458*

warning messages, *see also* error messages
  \end occurred inside a group at level *x*, *77*
  \end occurred when *xxx* on line *yy* was incomplete, 417

`Abstract should precede \maketitle in AMS documentclasses` Ⓐ, 243, 274
with BibTeX, 390–392
in `blg` file, 388
`Characters dropped after '\end{verbatim}'`, 133
`File 'xxxx.xxx' already exists on the system. Not generating it from this source`, 421
`Foreign command \atopwithdelims` Ⓐ, 18, 164
generated by overlapping braces, 77
about hyphenation, 102
`Label(s) may have changed`, 248
line numbers in, 8
lines are too wide, 7–9, 101–102
`No auxiliary output files`, 482
`Overfull \hbox`, 8, **101–102**, 481
suppressing, 102
recorded in `log` file, **58**, 101
regarding font substitution, 99
`Rerun to get cross-references right`, 248
`Underfull \vbox has occurred while \output is active`, 481
`Warning--missing field in label`, 390–392
when using the `filecontents` environment, 421
when using `\NeedsTeXFormat`, 61
`Writing file 'xxxx.xxx'`, 421
Web Publishing with Acrobat (Merz), 454
WebEQ (Java equation generator for Web browsers), 443
WebTeX (markup language), 443
`\wedge` ($\wedge$ math op.), *460*
weight, of fonts, *see under* font environments, font commands *and* font command declarations
white space
adjusting, 425
in arguments of commands, 90
and binary operations and relations, 159
in command definitions, 314
in command names, 74
commands, avoiding direct use of, 423
in delimited commands, 326–327
for distinguishing braces, 24
determined by document classes, 108
horizontal, 19, 22, 73, 74, 108, 109, 128, 158, 184, 185, 187, 217, 218, 271, 315, 316, 351, 468, 474
in math mode, 31, 227, 229, 513
in text mode, 7, 12, **70–73**, **108–109**, **111–112**, 118, 137, 359
between marginal notes, 349
in math, 12, 158–160, 182–187, 196–197
adjusting, 196
within an `\mbox` command, 26
between paragraphs, 349
in source files, 159
suppressing, 330
in `tabular` environments, 147
terminating commands with, 74, 158
in text, 7, 70–72, 76, **108–112**, 330, 373, 474
in `\verb` commands, 134
in `verbatim` environments, 132
vertical
adding to table of contents, 414
in math mode, 119, 196, 197, 513
in text mode, 10, 107, **110–111**, 196, 325, 414, 426, 429
Whole Internet: The Next Generation (Conner & Krol), 519
`\widehat` ($\widehat{x}$ math accent), 30, **179**, *180*, *467*
`\widetilde` ($\widetilde{x}$ math accent), *180*, *467*
width
of columns in `tabular` environments, 148
of fonts, *see* font width
of text blocks, 349
of text boxes, 113, *351*
`\width` (length com.), 116
Windows, *see also* PCs, *see under* Microsoft
word processors, xxvii, xxx
words, are separated by spaces, 70
`work` (dir.), **4**, 6, 8, 9, 11, 14, 46, 47, 51, 298, 385
creating, 4
World Wide Web, 434
addresses, 442
in top matter (`\urladdr` comm.) Ⓐ, 279, 281, 300
browsers, **434**, 441
determine document appearance, 440, 442
displaying DVI files in, 448
plug-ins for, 446, 448
support for MathML, 444
viewing PDF files in, 445, 446, 450
file formats, 440–450
hyperlinks, 442
in PDF documents, 453–454
LaTeX and TeX resources on, 434, 437–438
putting LaTeX documents on, 438–454
World Wide Web Consortium, 443

\wp ($\wp$ math sym.), *463*
\wr ($\wr$ math op.), *460*
wrapping
    of comments, 90
    of lines by text editors, 89

X Window System, xxviii
xalignat (obs. AMS math align. env.), 514
xca (exercise env.) Ⓐ, 142
xcb (exercise env.) Ⓐ, 142
xdvi (X Window DVI viewer), xxviii
\xi (ξ Greek char.), *456*
\Xi (Ξ Greek char.), *456*
\xleftarrow (math arrow) Ⓐ, **182**, 514
xr (pack.), 249, 271
\xrightarrow (math arrow) Ⓐ, **182**, 514
\xspace (spacing com.), 315–316
xspace (pack.), 271, **315–316**, 327
xxalignat (obs. AMS math align. env.), 514

Y&Y, 63, 436, 450, 478, 485, 488, 489
    version of AMS fonts, 487
year (BibTeX database field), 371
\year (time com.), 85

zero, specifying in arguments, 118
\zeta (ζ Greek char.), *456*