C. Allowable units of measurement

`in`	inch	(1 in = 72.27 pt)
`cm`	centimetre	(2.54 cm = 1 in, 1 cm = 28.45 pt)
`mm`	millimetre	(10 mm = 1cm, 25.4 mm = 1in, 1 mm = 2.845 pt)
`pc`	pica	(1 pc = 12 pt, 6.023 pc = 1 in, 2.371 pc = 1 cm)
`cc`	cicero	(1 cc = 12 dd, 1 cc = 12.84 pt, 5.628 cc = 1 in, 2.216 cc = 1 cm)
`dd`	didôt point	(1157 dd = 1238 pt, 67.54 dd = 1 in, 26.59 dd = 1 cm)
`bp`	big point	(72 bp = 1 in, 28.35 bp = 1 cm)
`pt`	point	(1 pt = 0.01384 in, 1 pt = 0.03515 cm)
`sp`	scaled point	(65536 sp = 1 pt, 4736287 sp= 1 in, 1864690 sp = 1 cm)

D. Macros—page 199

`\def\nl{\hfil\break}`	`\nl` will now be interpreted as `\hfil\break`, ie. start a new line
`\def\({\left(}`	`\(` will now be interpreted as `\left(`
`\def\der#1{{d#1\over dx}}`	`\der y` will now be interpreted as `{dy\over dx}` and produce $\frac{dy}{dx}$ in maths mode
`\input macros`	Reads in the file `macros.tex` from the current directory or `\inputs` directory

Note: A definition nested inside braces, or within $ symbols, does not apply outside those braces or outside that mathematics.

E. Some Defaults of Plain TEX

```
\hsize = 16.51cm (6.5in)            \vsize = 22.61cm (8.9in)
\hoffset = 0pt                      \voffset = 0pt
\parindent = 20pt (7.0mm)           \parskip = 0pt plus 1pt
\baselineskip = 12pt (4.2mm)        \topskip = 10pt
\pageno = 1                         \tolerance = 200
```

(xiv) Features

`x_1^{-2}`	Produces x_1^{-2}
`{x+y\over 2a}`	Produces $\frac{x+y}{2a}$ —see page 139
`\sqrt{b-a}`	Produces $\sqrt{b-a}$
`\matrix\pmatrix\bordermatrix`	Produce arrays—see page 176
`\overbrace{x+y}`	Produces $\overbrace{x+y}$ —see page 176
`\underbrace{x+y}`	Produces $\underbrace{x+y}$ —see page 176
`\overline{x+y}`	Produces $\overline{x+y}$
`\underline{x+y}`	Produces $\underline{x+y}$
`\root n+1\of{a+b}`	Produces $\sqrt[n+1]{a+b}$
`{n\choose k}`	Produces $\binom{n}{k}$
`\bmod`	Inserts 'mod' as a binary operation (eg. `$m\bmod n$` produces $m \bmod n$)
`\pmod`	Inserts 'mod' in parentheses (eg. `$m\pmod n$` produces $m \pmod n$)
`\eqno`	Equation numbering on RHS—see page 187
`\leqno`	Equation numbering on LHS—see page 187
`\*`	Discretionary multiplication sign—see page 173
`\allowbreak`	Line break within text mathematics permitted here—see page 174

(x) Brackets, etc

`\{`	Produces {
`\}`	Produces }
`\langle`	Produces $\langle$
`\rangle`	Produces $\rangle$
`[\![`	Produces $[\![$
`(\!(`	Produces $(\!($
`\langle\!\langle`	Produces $\langle\!\langle$
`\lfloor`	Produces $\lfloor$
`\rfloor`	Produces $\rfloor$
`\lceil`	Produces $\lceil$
`\rceil`	Produces $\rceil$
`\left( ... \right)`	Produces (...) with '(' and ')' enlarged as appropriate
`\big \Big \bigg \Bigg`	Enlarge the slash or backslash following —see page 147
`\bigl ...`	Enlarge the left bracket following—see page 147
`\bigr ...`	Enlarge the right bracket following—see page 147
`\bigm ...`	Enlarge the | or || following—see page 147

(xi) Standard functions—page 162

Common mathematical functions like 'sin' are always set in roman type.
To ensure this in mathematics mode use the following control sequences:

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

Subscripts and superscripts will become limits when attached to `\det`, `\gcd`, `\inf`, `\lim`, `\liminf`, `\limsup`, `\max`, `\min`, `\Pr`, `\sup` in display style (eg. `$$\max_{1\le n\le m}\log_2P_n$$` produces $\max_{1\le n\le m}\log_2 P_n$ as a displayed equation)

(xii) Accents

See page 135—the possibilities are: $\hat{a}$ $\widehat{ab}$ $\check{a}$ $\tilde{a}$ $\widetilde{ab}$ $\acute{a}$ $\grave{a}$ $\dot{a}$ $\ddot{a}$ $\breve{a}$ $\bar{a}$ $\vec{a}$ (and others can be constructed)

(xiii) Local control for displayed mathematics

`\eqalign{...}`	Allows alignment of one or more equations over several lines—see page 190
`\eqalignno{...}`	Allows alignment together with RHS equation numbering—see page 192
`\leqalignno{...}`	Allows alignment together with LHS equation numbering—see page 192
`\displaylines{...}`	Display equations over several lines as you want but without alignment—see page 194
`\cases{...}`	Display an equation containing choices spanned by a brace—see page 175

Γ	\Gamma	Λ	\Lambda	Π	\Pi	Υ	\Upsilon	Ψ	\Psi
Δ	\Delta	Ξ	\Xi	Σ	\Sigma	Φ	\Phi	Ω	\Omega
Θ	\Theta								

(v) Relations

$\leq$	\le	$\vdash$	\vdash	$\ni$	\ni	$\sim$	\sim	$\propto$	\propto
$\ll$	\ll	$\geq$	\ge	$\dashv$	\dashv	$\simeq$	\simeq	$\models$	\models
$\subset$	\subset	$\gg$	\gg	$\mid$	\mid	$\asymp$	\asymp	$\doteq$	\doteq
$\subseteq$	\subseteq	$\supset$	\supset	$\parallel$	\parallel	$\approx$	\approx	$\perp$	\perp
$\in$	\in	$\supseteq$	\supseteq	$\equiv$	\equiv	$\cong$	\cong	$\neq$	\ne

plus others—see page 436

Many can be negated by prefixing with \not (eg. \not\le yields $\not\leq$)

(vi) Binary operations

$\pm$	\pm	$\cdot$	\cdot	$\star$	\star	$\bullet$	\bullet	$\cup$	\cup
$\mp$	\mp	$\times$	\times	$\diamond$	\diamond	$\div$	\div	$\vee$	\vee or \lor
$\setminus$	\setminus	$*$	\ast	$\circ$	\circ	$\cap$	\cap	$\wedge$	\wedge or \land

plus others—see page 436

(vii) Arrows

$\leftarrow$	\leftarrow or \gets	$\rightarrow$	\rightarrow or \to	$\leftrightarrow$	\leftrightarrow	$\uparrow$	\uparrow	$\updownarrow$	\updownarrow
$\Leftarrow$	\Leftarrow	$\Rightarrow$	\Rightarrow	$\Leftrightarrow$	\Leftrightarrow	$\Uparrow$	\Uparrow	$\Updownarrow$	\Updownarrow
$\longleftarrow$	\longleftarrow	$\longrightarrow$	\longrightarrow	$\longleftrightarrow$	\longleftrightarrow	$\downarrow$	\downarrow	$\mapsto$	\mapsto
$\Longleftarrow$	\Longleftarrow	$\Longrightarrow$	\Longrightarrow	$\Longleftrightarrow$	\Longleftrightarrow	$\Downarrow$	\Downarrow	$\longmapsto$	\longmapsto

plus others—see page 437

(viii) Operators

$\sum$	\sum	$\prod$	\prod	$\int$	\int	$\bigcap$	\bigcap	$\bigvee$	\bigvee
		$\coprod$	\coprod	$\oint$	\oint	$\bigcup$	\bigcup	$\bigwedge$	\bigwedge

plus others—see page 435

(ix) Miscellaneous symbols

$\aleph$	\aleph	ℓ	\ell	∞	\infty	$\surd$	\surd	$\backslash$	\backslash
$\hbar$	\hbar	$\Re$	\Re	$'$	' or \prime	$\|$	|	$\forall$	\forall
$\imath$	\imath	$\Im$	\Im	$\emptyset$	\emptyset	$\angle$	\angle	$\exists$	\exists
$\jmath$	\jmath	∂	\partial	∇	\nabla	$\triangle$	\triangle	$\neg$	\neg

plus others—see page 435

(i) Fonts:

`\mit`	Switch to computer modern maths italics (`cmmi10`)—the default font for most variable names
`\bmit`	Switch to computer modern bold maths italics (`cmmib10`)
`\rm`	Switch to computer modern roman—the default font for uppercase Greek letters
`\it`	Switch to computer modern italics (`cmti10`)
`\bf`	Switch to computer modern bold roman (`cmb10`)
`\cal`	For uppercase letters in $\mathcal{CALLIGRAPHIC}$ style (`cmsy10`)
`\displaystyle`	Force display style—see page 140
`\textstyle`	Force text style—see page 140
`\scriptstyle`	Force subscript/superscript size
`\scriptscriptstyle`	Force subsubscript/supersuperscript size

(ii) Horizontal spacing:

`\␣`	Insert a standard between-word space
`\quad`	Produces a 1.0 em space—this much
`\qquad`	Two 'quads'—this much
`\hskip2mm`	Produces a 2 mm horizontal space
`\,`	Produces a thinspace—this much (1/6 of a 'quad')
`\>`	Produces a medium space—this much (2/9 of a 'quad')
`\;`	Produces a thick space—this much (5/18 of a 'quad')
`\!`	Produces a negative thin space—thismuch ($-1/6$ of a 'quad')
`\mskip9mu`	Insert 9 mu of space ($18\,\mathrm{mu} = 1.0\,\mathrm{em} \approx 10\,\mathrm{pt}$)
`\mathsurround=1pt`	Insert an additional 1 pt of space before and after every formula

(iii) Vertical spacing

`\openup1\jot`	Insert an extra 1 jot ($= 3\,\mathrm{pt}$) of vertical space between displayed lines—see page 194
`\abovedisplayskip`	Controls the amount of space above displayed maths—see page 189
`\belowdisplayskip`	Controls the amount of space below displayed maths—see page 189

(iv) Greek letters—page 434

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

`\&`	Produces a & (`&` is used for alignment)
`\_`	Produces a _ (_ is used for subscripting)
`$\{$`	Produces a { (Mathematics mode is necessary) (`{` is used for grouping)
`$\}$`	Produces a } (Mathematics mode is necessary) (`}` is used for grouping)
`$\backslash$`	Produces a \ (Mathematics mode is necessary) (\ begins a control sequence)

(vii) Other (text) features:

`\underbar{important}`	Produces <u>important</u> (Note underlining is seldom, if ever, used in good type-setting)
`\footnote`	Insert a footnote—see page 116
`\topinsert...\endinsert`	Insert ...at top of first available page
`\midinsert...\endinsert`	Insert ...here or as soon as practicable
`\pageinsert...\endinsert`	Insert ...to fill all of the next page
`\llap`	Overwrite on the left—see page 82
`\rlap`	Overwrite on the right—see page 82
`\hyphenation`	Indicates allowable hyphenation—see page 28

(viii) Special symbols, etc:

`\TeX`	Produces TEX in the current font
`\dots`	Produces an ellipsis ...
`\dag`	Produces †
`\ddag`	Produces ‡
`\copyright`	Produces ©
`\S`	Produces §
`\P`	Produces ¶
`{\it\$}`	Produces *£*
`{\it\&}`	Produces *&*
`-`	Produces - (a hyphen), as in note-book
`--`	Produces – (an en-dash), as in pages 5–12
`---`	Produces — (an em-dash), ie. an ordinary dash used in punctuation
`$-$`	Produces − (a minus sign)
` `` `	Produces “
`''`	Produces ”
`\vrule`	See page 221
`\hrule`	See page 221

(ix) Accents and some foreign letters:

See page 52—the possibilities are: à é ô ü ȳ ñ ṗ qǐ š ǰ i͡u k̲ ç ḥ æ Œ å Å ø Ø

(iv) Vertical spacing:

`\smallskip`	Insert a little *extra* vertical space (about 3pt) between paragraphs. This much
`\medskip`	Two 'smallskips'. This much
`\bigskip`	Two 'medskips'. This much
`\vskip12mm`	Insert an extra vertical space of 12 mm between paragraphs

(v) Local control:

`\par`	Start a new paragraph (A double carriage return can also be used)
`\noindent`	Don't indent this new paragraph
`\centerline{Heading}`	Centre 'Heading' on a new line and starts a new paragraph
`\leftline{Heading}`	Put 'Heading' at left end of a new line and starts a new paragraph
`\rightline{Heading}`	Put 'Heading' at right end of a new line and starts a new paragraph
`\line{...}`	Spread ...to fill a whole line and start a new paragraph—see page 72
`\item{(a)}`	Start a 'paragraph' labelled '(a)' in which every line is indented—used for itemized lists
`\itemitem{(i)}`	Start a 'paragraph' labelled '(i)' in which every line is doubly-indented—used for itemized lists within lists
`\hfil\break`	Start a new line (but not a new paragraph)
`\vfil\eject`	Start a new page and a new paragraph
`\nobreak`	Inhibit line or page break
`\smallbreak`	Suitable place for a page break—insert a 'smallskip' if no break
`\medbreak`	Suitable place for a page break—insert a 'medskip' if no break
`\bigbreak`	Suitable place for a page break—insert a 'bigskip' if no break
`\goodbreak`	Start a new paragraph and encourage a page break here
`\filbreak`	See page 111
`\leftskip=-2mm`	Causes the left end of all the lines of a paragraph to be indented by −2 mm
`\rightskip=5pt`	Causes the right end of all the lines of a paragraph to be indented by 5 points
`\narrower`	Causes all lines of a paragraph to be indented at the left and right ends
`\obeylines`	Causes a carriage return to start a new line ("poetry mode")
`\raggedright`	Right margin justification turned off
`\parshape`	Controls the shape of a paragraph—see page 101
`\settabs`	Presets tab stops across page—see page 231
`\frenchspacing`	Make all between-word spaces the same regardless of punctuation
`\nonfrenchspacing`	Turn off frenchspacing (the default)
`\bye`	The usual way to end a TEX file (`\bye` ≡ `\vfill\eject\end`)

(vi) Printing reserved symbols:

`\#`	Produces a # (`#` is used in defining macros)
`\%`	Produces a % (`%` is the comment character)
`\$`	Produces a $ (`$` controls maths mode)

Some control sequences of Plain TEX

A. Text mode

(i) Document formatting:

`\hsize=4.5in`	Printed page width set at 4.5 inches
`\vsize=20cm`	Printed page length set at 20 cm
`\hoffset=25pt`	Printed page offset 25 points to the right
`\voffset=2pc`	Printed page offset 2 picas downwards
`\magnification=1200`	Whole document (all dimensions and fonts) magnified by the factor 1.2
	Note: Any dimension prefixed by `true` (eg. `\hsize=4.5truein`) is not affected by magnification
`\baselineskip=1pc`	Line spacing set at 1 pica
`\parskip=3pt`	Extra vertical space of 3 points inserted between paragraphs
`\parindent=1in`	Paragraph indentation set at 1 inch
`\pageno=4`	Pages will be numbered at bottom centre starting with '4'
`\nopagenumbers`	Refrain from inserting numbers at the bottom of each page
`\headline`	Control over space at top of each page—see page 252
`\footline`	Control over space at bottom of each page—see page 252
`\tolerance=2000`	Controls the allowable flexibility in word spacing—see page 29

(ii) Fonts:

`\rm`	Switch to computer modern roman at 10 point size (cmr10)—the default font
`\it`	*Switch to computer modern italic at 10 point size (cmti10)*
`\bf`	**Switch to computer modern bold at 10 point size (cmb10)**
`\sl`	*Switch to computer modern slant at 10 point size (cmsl10)*
`\tt`	`Switch to computer modern typewriter at 10 point size (cmtt10)`
`\font\ss=cmss10 at 11pt`	`\ss` will now cause a switch to 10 point computer modern sans serif magnified to 11 point size
	Note: Many other fonts, which need to be declared like `cmss10`, are available

(iii) Horizontal spacing:

`\␣`	Produces a single space (like between these words)
`~` (i.e. a tilde)	Produces a single space at which a line break cannot occur (a 'tie')
`\thinspace`	Produces a space of this much (Equivalent to `\,` in mathematics mode)
`\negthinspace`	Produces thismuch space (Equivalent to `\!` in mathematics mode)
`\enskip`	Produces a 0.5 em space—this much (1.0 em = 10 pt in `\rm` font)
`\quad`	Produces a 1.0 em space—this much
`\qquad`	Two 'quads'—this much
`\hskip2.2cm`	Produces a 2.2 cm horizontal space