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`	\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

(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)

`\&`	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 qı̆ š ȷ̋ ı͡u k̲ ç ḥ æ Œ å Å ø Ø

(x) Additions for Hebrew typesetting:

`\sethebrew`	Enter hebrew mode
`\unsethebrew`	Go out of Hebrew mode
`\hebrewpar`	Starting one hebrew paragraph with indentation
`\hebrewlines`	Starting one hebrew paragraph without indentation
`\L{...string...}`	English string within a Hebrew environment
`\R{...סידרית...}`	Hebrew string within an English environment
`\הדגש{...}` or `\hadgesh{...}`	Making bold letters - Poor man's bold — see page 386
`\מקףגדול` or `\makafgadol`	Like the regular `--` producing – , which doesn't work in Hebrew
`\מקףענק` or `\makafanak`	Like the regular `---` producing — , which doesn't work in Hebrew
`\גרש` or `\geresh`	Like the regular ‘ , which doesn't work in Hebrew
`\פתחגרש` or `\opengeresh`	’
`\סגורגרש` or `\closegeresh`	‘
`\פתחציטוט` or `\openquote`	Like the regular ”, which doesn't work in Hebrew
`\סגורציטוט` or `\closequote`	Like the regular “, which doesn't work in Hebrew
`\פיסקה` or `\piska`	Like the regular `\item`, modified for Hebrew
`\פיסקהפיסקה` or `\piskapiska`	Like the regular `\itemitem`, modified for Hebrew
`\היום` or `\hebday`	Today's regular date in Hebrew
`\Hebrewtoday`	Hebrew date in Hebrew
`\Hebrewdate`	Converting a Georgian date to an Hebrew
`\קפיצהגדולה`	Like the regular `\bigskip`
`\קפיצהבינונית`	Like the regular `\medskip`
`\קפיצהקטנה`	Like the regular `\smallskip`
`\שורהימין`	Like the regular `\rightline`
`\שורהשמאל`	Like the regular `\leftline`
`\מרכז`	Like the regular `\centerline`
`\undertext{text טקסט}`	Produces <u>text טקסט</u>

B. Mathematics mode

(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 mu = 1.0 em ≈ 10 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 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`

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

(v) Relations

$\le$	`\le`	$\vdash$	`\vdash`	$\ni$	`\ni`	$\sim$	`\sim`	$\propto$	`\propto`
$\ll$	`\ll`	$\ge$	`\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`	$\ne$	`\ne`

plus others—see page 436

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

(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`	$\ast$	`\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

<table>
<tr><td>$\aleph$</td><td><code>\aleph</code></td><td>ℓ</td><td><code>\ell</code></td><td>∞</td><td><code>\infty</code></td><td>$\surd$</td><td><code>\surd</code></td><td>$\backslash$</td><td><code>\backslash</code></td></tr>
<tr><td>$\hbar$</td><td><code>\hbar</code></td><td>$\Re$</td><td><code>\Re</code></td><td>$\prime$</td><td><code>'</code> or <code>\prime</code></td><td>$\Vert$</td><td><code>\|</code></td><td>$\forall$</td><td><code>\forall</code></td></tr>
<tr><td>$\imath$</td><td><code>\imath</code></td><td>$\Im$</td><td><code>\Im</code></td><td>$\emptyset$</td><td><code>\emptyset</code></td><td>$\angle$</td><td><code>\angle</code></td><td>$\exists$</td><td><code>\exists</code></td></tr>
<tr><td>$\jmath$</td><td><code>\jmath</code></td><td>∂</td><td><code>\partial</code></td><td>∇</td><td><code>\nabla</code></td><td>$\triangle$</td><td><code>\triangle</code></td><td>$\neg$</td><td><code>\neg</code></td></tr>
</table>

plus others—see page 435

(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 $(\ldots)$ 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 $\vert$ or $\Vert$ 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 $\max\limits_{1\le n\le m}\log_2 P_n$ 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

(xiv) Features

`x_1^{-2}`	Produces x_1^{-2}
`{x+y\over 2a}`	Produces ${x+y\over 2a}$ —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

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`