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1 % This is the plain TeX format that's described in The TeXbook.
2 % N.B.: A version number is defined at the very end of this file;
3 %     please change that number whenever the file is modified!
4 % And don't modify the file unless you change its name:
5 %     Everybody's "plain.tex" file should be the same, worldwide.
6
7 % Unlimited copying and redistribution of this file are permitted as long
8 % as this file is not modified. Modifications are permitted, but only if
9 % the resulting file is not named plain.tex.
10
11 \catcode'\{=1 % left brace is begin-group character
12 \catcode'\}=2 % right brace is end-group character
13 \catcode'\$=3 % dollar sign is math shift
14 \catcode'\&=4 % ampersand is alignment tab
15 \catcode'\#=6 % hash mark is macro parameter character
16 \catcode'\^=7 \catcode'\^^K=7 % circumflex and uparrow are for superscripts
17 \catcode'\_ =8 \catcode'\^^A=8 % underline and downarrow are for subscripts
18 \catcode'\^^I=10 % ascii tab is a blank space
19 \chardef\active=13 \catcode'\~=\active % tilde is active
20 \catcode'\^^L=\active \outer\def^^L{\par} % ascii form-feed is "\outer\par"
21
22 \message{Preloading the plain format: codes,}
23
24 % We had to define the \catcodes right away, before the message line,
25 % since \message uses the { and } characters.
26 % When INITEX (the TeX initializer) starts up,
27 % it has defined the following \catcode values:
28 % \catcode'\^^@=9 % ascii null is ignored
29 % \catcode'\^^M=5 % ascii return is end-line
30 % \catcode'\ =0 % backslash is TeX escape character
31 % \catcode'\%=14 % percent sign is comment character
32 % \catcode'\ =10 % ascii space is blank space
33 % \catcode'\^^?=15 % ascii delete is invalid
34 % \catcode'\A=11 ... \catcode'\Z=11 % uppercase letters
35 % \catcode'\a=11 ... \catcode'\z=11 % lowercase letters
36 % all others are type 12 (other)
37
38 % Here is a list of the characters that have been specially catcoded:
39 \def\dospecials{\do\ \do\\\do{\do}\do\$do\&%
40 \do\#\do\^do\^^Kdo\_do\^^Ado%\do\~}
41 % (not counting ascii null, tab, linefeed, formfeed, return, delete)
42 % Each symbol in the list is preceded by \do, which can be defined
43 % if you want to do something to every item in the list.
44
45 % We make @ signs act like letters, temporarily, to avoid conflict
46 % between user names and internal control sequences of plain format.
47 \catcode'@=11
48
49 % INITEX sets up \mathcode x=x, for x=0..255, except that
50 % \mathcode x=x+"7100, for x = 'A to 'Z and 'a to 'z;
51 % \mathcode x=x+"7000, for x = '0 to '9.
52 % The following changes define internal codes as recommended
53 % in Appendix C of The TeXbook:
54 \mathcode'\^^@="2201 % \cdot
55 \mathcode'\^^A="3223 % \downarrow
56 \mathcode'\^^B="010B % \alpha
57 \mathcode'\^^C="010C % \beta
58 \mathcode'\^^D="225E % \land
59 \mathcode'\^^E="023A % \lnot
60 \mathcode'\^^F="3232 % \in
61 \mathcode'\^^G="0119 % \pi

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62 \mathcode'\^^H="0115 % \lambda
63 \mathcode'\^^I="010D % \gamma
64 \mathcode'\^^J="010E % \delta
65 \mathcode'\^^K="3222 % \uparrow
66 \mathcode'\^^L="2206 % \pm
67 \mathcode'\^^M="2208 % \oplus
68 \mathcode'\^^N="0231 % \infty
69 \mathcode'\^^O="0140 % \partial
70 \mathcode'\^^P="321A % \subset
71 \mathcode'\^^Q="321B % \supset
72 \mathcode'\^^R="225C % \cap
73 \mathcode'\^^S="225B % \cup
74 \mathcode'\^^T="0238 % \forall
75 \mathcode'\^^U="0239 % \exists
76 \mathcode'\^^V="220A % \otimes
77 \mathcode'\^^W="3224 % \leftrightarrow
78 \mathcode'\^^X="3220 % \leftarrow
79 \mathcode'\^^Y="3221 % \rightarrow
80 \mathcode'\^^Z="8000 % \ne
81 \mathcode'\^^[="2205 % \diamond
82 \mathcode'\^^\="3214 % \le
83 \mathcode'\^^]="3215 % \ge
84 \mathcode'\^^^="3211 % \equiv
85 \mathcode'\^^_="225F % \lor
86 \mathcode'\ =="8000 % \space
87 \mathcode'\!="5021
88 \mathcode'\prime="8000 % \prime
89 \mathcode'\(="4028
90 \mathcode'\)="5029
91 \mathcode'\*="2203 % \ast
92 \mathcode'\+="202B
93 \mathcode'\,="613B
94 \mathcode'\-="2200
95 \mathcode'\.="013A
96 \mathcode'\="/="013D
97 \mathcode'\:="303A
98 \mathcode'\;="603B
99 \mathcode'\<="313C
100 \mathcode'\=="303D
101 \mathcode'\>="313E
102 \mathcode'\?="503F
103 \mathcode'\["405B
104 \mathcode'\\="026E % \backslash
105 \mathcode'\]="505D
106 \mathcode'\_="8000 % \_
107 \mathcode'\{"4266
108 \mathcode'\|"026A
109 \mathcode'\}"5267
110 \mathcode'\^^?="1273 % \smallint
111
112 % INITEX sets \uccode'x='X and \uccode'X='X for all letters x,
113 % and \lccode'x='x, \lccode'X='x; all other values are zero.
114 % No changes to those tables are needed in plain TeX format.
115
116 % INITEX sets \sfcode x=1000 for all x, except that \sfcode'X=999
117 % for uppercase letters. The following changes are needed:
118 \sfcode'\=0 \sfcode'\'=0 \sfcode'\]=0
119 % The \nonfrenchspacing macro will make further changes to \sfcode values.
120
121 % Finally, INITEX sets all \delcode values to -1, except \delcode'.=0
122 \delcode'\(="028300

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123 \delcode'\)="029301
124 \delcode'\[="05B302
125 \delcode'\]="05D303
126 \delcode'\<="26830A
127 \delcode'\>="26930B
128 \delcode'\/"02F30E
129 \delcode'\|"26A30C
130 \delcode'\\"26E30F
131 % N.B. { and } should NOT get delcodes; otherwise parameter grouping fails!
132
133 % To make the plain macros more efficient in time and space,
134 % several constant values are declared here as control sequences.
135 % If they were changed, anything could happen; so they are private symbols.
136 \chardef\@ne=1
137 \chardef\tw@=2
138 \chardef\thr@@=3
139 \chardef\sixt@@n=16
140 \chardef\@cclv=255
141 \mathchardef\@cclvi=256
142 \mathchardef\@m=1000
143 \mathchardef\@M=10000
144 \mathchardef\@MM=20000
145
146 % Allocation of registers
147
148 % Here are macros for the automatic allocation of \count, \box, \dimen,
149 % \skip, \muskip, and \toks registers, as well as \read and \write
150 % stream numbers, \fam codes, \language codes, and \insert numbers.
151
152 \message{registers,}
153
154 % When a register is used only temporarily, it need not be allocated;
155 % grouping can be used, making the value previously in the register return
156 % after the close of the group. The main use of these macros is for
157 % registers that are defined by one macro and used by others, possibly at
158 % different nesting levels. All such registers should be defined through
159 % these macros; otherwise conflicts may occur, especially when two or more
160 % macro packages are being used at once.
161
162 % The following counters are reserved:
163 %   0 to 9  page numbering
164 %   10     count allocation
165 %   11     dimen allocation
166 %   12     skip allocation
167 %   13     muskip allocation
168 %   14     box allocation
169 %   15     toks allocation
170 %   16     read file allocation
171 %   17     write file allocation
172 %   18     math family allocation
173 %   19     language allocation
174 %   20     insert allocation
175 %   21     the most recently allocated number
176 %   22     constant -1
177 % New counters are allocated starting with 23, 24, etc. Other registers are
178 % allocated starting with 10. This leaves 0 through 9 for the user to play
179 % with safely, except that counts 0 to 9 are considered to be the page and
180 % subpage numbers (since they are displayed during output). In this scheme,
181 % \count 10 always contains the number of the highest-numbered counter that
182 % has been allocated, \count 14 the highest-numbered box, etc.
183 % Inserts are given numbers 254, 253, etc., since they require a \count,

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184 % \dimen, \skip, and \box all with the same number; \count 20 contains the
185 % lowest-numbered insert that has been allocated. Of course, \box255 is
186 % reserved for \output; \count255, \dimen255, and \skip255 can be used freely.
187
188 % It is recommended that macro designers always use
189 % \global assignments with respect to registers numbered 1, 3, 5, 7, 9, and
190 % always non-\global assignments with respect to registers 0, 2, 4, 6, 8, 255.
191 % This will prevent ‘‘save stack buildup’’ that might otherwise occur.
192
193 \count10=22 % allocates \count registers 23, 24, ...
194 \count11=9 % allocates \dimen registers 10, 11, ...
195 \count12=9 % allocates \skip registers 10, 11, ...
196 \count13=9 % allocates \muskip registers 10, 11, ...
197 \count14=9 % allocates \box registers 10, 11, ...
198 \count15=9 % allocates \toks registers 10, 11, ...
199 \count16=-1 % allocates input streams 0, 1, ...
200 \count17=-1 % allocates output streams 0, 1, ...
201 \count18=3 % allocates math families 4, 5, ...
202 \count19=0 % allocates \language codes 1, 2, ...
203 \count20=255 % allocates insertions 254, 253, ...
204 \countdef\insc@unt=20 % the insertion counter
205 \countdef\allocationnumber=21 % the most recent allocation
206 \countdef\m@ne=22 \m@ne=-1 % a handy constant
207 \def\wlog{\immediate\write\m@ne} % write on log file (only)
208
209 % Here are abbreviations for the names of scratch registers
210 % that don’t need to be allocated.
211
212 \countdef\count@=255
213 \dimendef\dimen@=0
214 \dimendef\dimen@i=1 % global only
215 \dimendef\dimen@ii=2
216 \skipdef\skip@=0
217 \toksdef\toks@=0
218
219 % Now, we define \newcount, \newbox, etc. so that you can say \newcount\foo
220 % and \foo will be defined (with \countdef) to be the next counter.
221 % To find out which counter \foo is, you can look at \allocationnumber.
222 % Since there’s no \boxdef command, \chardef is used to define a \newbox,
223 % \newinsert, \newfam, and so on.
224
225 \outer\def\newcount{\alloc@0\count\countdef\insc@unt}
226 \outer\def\newdimen{\alloc@1\dimen\dimendef\insc@unt}
227 \outer\def\newskip{\alloc@2\skip\skipdef\insc@unt}
228 \outer\def\newmuskip{\alloc@3\muskip\muskipdef\@cclvi}
229 \outer\def\newbox{\alloc@4\box\chardef\insc@unt}
230 \let\newtoks=\relax % we do this to allow plain.tex to be read in twice
231 \outer\def\newhelp#1#2{\newtoks#1#1\expandafter{\csname#2\endcsname}}
232 \outer\def\newtoks{\alloc@5\toks\toksdef\@cclvi}
233 \outer\def\newread{\alloc@6\read\chardef\sixt@n}
234 \outer\def\newwrite{\alloc@7\write\chardef\sixt@n}
235 \outer\def\newfam{\alloc@8\fam\chardef\sixt@n}
236 \outer\def\newlanguage{\alloc@9\language\chardef\@cclvi}
237 \def\alloc@#1#2#3#4#5{\global\advance\count1#1by\@ne
238 \ch@ck#1#4#2% make sure there’s still room
239 \allocationnumber=\count1#1%
240 \global#3#5=\allocationnumber
241 \wlog{\string#5=\string#2\the\allocationnumber}}
242 \outer\def\newinsert#1{\global\advance\insc@unt by\m@ne
243 \ch@ck0\insc@unt\count
244 \ch@ck1\insc@unt\dimen

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245 \ch@ck2\insc@unt\skip
246 \ch@ck4\insc@unt\box
247 \allocationnumber=\insc@unt
248 \global\chardef#1=\allocationnumber
249 \wlog{\string#1=\string\insert\the\allocationnumber}}
250 \def\ch@ck#1#2#3{\ifnum\count1#1<#2%
251 \else\errmessage{No room for a new #3}\fi}
252
253 % Here are some examples of allocation.
254 \newdimen\maxdimen\maxdimen=16383.99999pt % the largest legal <dimen>
255 \newskip\hideskip \hideskip=-1000pt plus 1fill % negative but can grow
256 \newskip\centering \centering=0pt plus 1000pt minus 1000pt
257 \newdimen\p@ \p@=1pt % this saves macro space and time
258 \newdimen\z@ \z@=0pt % can be used both for 0pt and 0
259 \newskip\z@skip \z@skip=0pt plus0pt minus0pt
260 \newbox\voidb@x % permanently void box register
261
262 % And here's a different sort of allocation:
263 % For example, \newif\iffoo creates \footrue, \foofalse to go with \iffoo.
264 \outer\def\newif#1{\count@\escapechar\escapechar@m@ne
265 \expandafter\expandafter\expandafter
266 \def\@if#1{true}{\let#1=\iftrue}%
267 \expandafter\expandafter\expandafter
268 \def\@if#1{false}{\let#1=\iffalse}%
269 \@if#1{false}\escapechar\count@} % the condition starts out false
270 \def\@if#1#2{\csname\expandafter\if@\string#1#2\endcsname}
271 {\uccode'1='i \uccode'2='f \uppercase{\gdef\if@12{}}}} % 'if' is required
272
273 % Assign initial values to TeX's parameters
274
275 \message{parameters,}
276
277 % All of TeX's numeric parameters are listed here,
278 % but the code is commented out if no special value needs to be set.
279 % INITEX makes all parameters zero except where noted.
280
281 \pretolerance=100
282 \tolerance=200 % INITEX sets this to 10000
283 \hbadness=1000
284 \vbadness=1000
285 \linepenalty=10
286 \hyphenpenalty=50
287 \exhyphenpenalty=50
288 \binoppenalty=700
289 \relpenalty=500
290 \clubpenalty=150
291 \widowpenalty=150
292 \displaywidowpenalty=50
293 \brokenpenalty=100
294 \predisplaypenalty=10000
295 % \postdisplaypenalty=0
296 % \interlinepenalty=0
297 % \floatingpenalty=0, set during \insert
298 % \outputpenalty=0, set before TeX enters \output
299 \doublehyphendemerits=10000
300 \finalhyphendemerits=5000
301 \adjdemerits=10000
302 % \looseness=0, cleared by TeX after each paragraph
303 % \pausing=0
304 % \holdinginserts=0
305 % \tracingonline=0

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306 % \tracingmacros=0
307 % \tracingstats=0
308 % \tracingparagraphs=0
309 % \tracingpages=0
310 % \tracingoutput=0
311 \tracinglostchars=1
312 % \tracingcommands=0
313 % \tracingrestores=0
314 % \language=0
315 \uchyph=1
316 % \lefthyphenmin=2 \righthyphenmin=3 set below
317 % \globaldefs=0
318 % \maxdeadcycles=25 % INITEX does this
319 % \hangafter=1 % INITEX does this, also TeX after each paragraph
320 % \fam=0
321 % \mag=1000 % INITEX does this
322 % \escapechar='\ % INITEX does this
323 \defaultshyphenchar='\-
324 \defaultskewchar=-1
325 % \endlinechar='\^M % INITEX does this
326 \newlinechar=-1
327 \delimiterfactor=901
328 % \time=now % TeX does this at beginning of job
329 % \day=now % TeX does this at beginning of job
330 % \month=now % TeX does this at beginning of job
331 % \year=now % TeX does this at beginning of job
332 \showboxbreadth=5
333 \showboxdepth=3
334 \errorcontextlines=5
335
336 \hfuzz=0.1pt
337 \vfuzz=0.1pt
338 \overfullrule=5pt
339 \hsize=6.5in
340 \vsize=8.9in
341 \maxdepth=4pt
342 \splitmaxdepth=\maxdimen
343 \boxmaxdepth=\maxdimen
344 % \lineskiplimit=0pt, changed by \normalbaselines
345 \delimitershortfall=5pt
346 \nulldelimiterspace=1.2pt
347 \scriptspace=0.5pt
348 % \mathsurround=0pt
349 % \predisplaysize=0pt, set before TeX enters $$
350 % \displaywidth=0pt, set before TeX enters $$
351 % \displayindent=0pt, set before TeX enters $$
352 \parindent=20pt
353 % \hangindent=0pt, zeroed by TeX after each paragraph
354 % \hoffset=0pt
355 % \voffset=0pt
356
357 % \baselineskip=0pt, changed by \normalbaselines
358 % \lineskip=0pt, changed by \normalbaselines
359 \parskip=0pt plus 1pt
360 \abovedisplayskip=12pt plus 3pt minus 9pt
361 \abovedisplayskip=0pt plus 3pt
362 \belowdisplayskip=12pt plus 3pt minus 9pt
363 \belowdisplayskip=7pt plus 3pt minus 4pt
364 % \leftskip=0pt
365 % \rightskip=0pt
366 \topskip=10pt

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367 \splittopskip=10pt
368 % \tabskip=0pt
369 % \spaceskip=0pt
370 % \xspaceskip=0pt
371 \parfillskip=0pt plus 1fil
372
373 \thinmuskip=3mu
374 \medmuskip=4mu plus 2mu minus 4mu
375 \thickmuskip=5mu plus 5mu
376
377 % We also define special registers that function like parameters:
378 \newskip\smallskipamount \smallskipamount=3pt plus 1pt minus 1pt
379 \newskip\medskipamount \medskipamount=6pt plus 2pt minus 2pt
380 \newskip\bigskipamount \bigskipamount=12pt plus 4pt minus 4pt
381 \newskip\normalbaselineskip \normalbaselineskip=12pt
382 \newskip\normallineskip \normallineskip=1pt
383 \newdimen\normallineskiplimit \normallineskiplimit=0pt
384 \newdimen\jot \jot=3pt
385 \newcount\interdisplaylinepenalty \interdisplaylinepenalty=100
386 \newcount\interfootnotelinepenalty \interfootnotelinepenalty=100
387
388 % Definitions for preloaded fonts
389
390 \def\magstephalf{1095 }
391 \def\magstep#1{\ifcase#1 \@m\or 1200\or 1440\or 1728\or 2074\or 2488\fi\relax}
392
393 % Fonts assigned to \preloaded are not part of "plain TeX",
394 % but they are preloaded so that other format packages can use them.
395 % For example, if another set of macros says "\font\ninerm=cmr9",
396 % TeX will not have to reload the font metric information for cmr9.
397
398 \message{fonts,}
399
400 \font\tenrm=cmr10 % roman text
401 \font\preloaded=cmr9
402 \font\preloaded=cmr8
403 \font\sevenrm=cmr7
404 \font\preloaded=cmr6
405 \font\fiverm=cmr5
406
407 \font\teni=cmmi10 % math italic
408 \font\preloaded=cmmi9
409 \font\preloaded=cmmi8
410 \font\seveni=cmmi7
411 \font\preloaded=cmmi6
412 \font\fivei=cmmi5
413
414 \font\tensy=cmsy10 % math symbols
415 \font\preloaded=cmsy9
416 \font\preloaded=cmsy8
417 \font\sevensy=cmsy7
418 \font\preloaded=cmsy6
419 \font\fivesy=cmsy5
420
421 \font\tenex=cmex10 % math extension
422
423 \font\preloaded=cmss10 % sans serif
424 \font\preloaded=cmssq8
425
426 \font\preloaded=cmssi10 % sans serif italic
427 \font\preloaded=cmssqi8

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428
429 \font\tenbf=cmbx10 % boldface extended
430 \font\preloaded=cmbx9
431 \font\preloaded=cmbx8
432 \font\sevenbf=cmbx7
433 \font\preloaded=cmbx6
434 \font\fivebf=cmbx5
435
436 \font\tentt=cmtt10 % typewriter
437 \font\preloaded=cmtt9
438 \font\preloaded=cmtt8
439
440 \font\preloaded=cmsl10 % slanted typewriter
441
442 \font\tensl=cmsl10 % slanted roman
443 \font\preloaded=cmsl9
444 \font\preloaded=cmsl8
445
446 \font\tenit=cmti10 % text italic
447 \font\preloaded=cmti9
448 \font\preloaded=cmti8
449 \font\preloaded=cmti7
450
451 \message{more fonts,}
452 \font\preloaded=cmu10 % unslanted text italic
453
454 \font\preloaded=cmmib10 % bold math italic
455 \font\preloaded=cmsy10 % bold math symbols
456
457 \font\preloaded=cmcsc10 % caps and small caps
458
459 \font\preloaded=cmsb10 % sans serif bold extended
460
461 \font\preloaded=cmdunh10 % Dunhill style
462
463 \font\preloaded=cmr7 scaled \magstep4 % for titles
464 \font\preloaded=cmtt10 scaled \magstep2
465 \font\preloaded=cmsb10 scaled \magstep2
466
467 \font\preloaded=manfnt % METAFONT logo and dragon curve and special symbols
468
469 % Additional \preloaded fonts can be specified here.
470 % (And those that were \preloaded above can be eliminated.)
471
472 \let\preloaded=\undefined % preloaded fonts must be declared anew later.
473
474 \skewchar\teni='177 \skewchar\seveni='177 \skewchar\fivei='177
475 \skewchar\tensy='60 \skewchar\sevensy='60 \skewchar\fivesy='60
476
477 \textfont0=\tenrm \scriptfont0=\sevenrm \scriptscriptfont0=\fiverm
478 \def\rm{\fam\z@\tenrm}
479 \textfont1=\teni \scriptfont1=\seveni \scriptscriptfont1=\fivei
480 \def\mit{\fam@ne} \def\oldstyle{\fam@ne\teni}
481 \textfont2=\tensy \scriptfont2=\sevensy \scriptscriptfont2=\fivesy
482 \def\cal{\fam\tw@}
483 \textfont3=\tenex \scriptfont3=\tenex \scriptscriptfont3=\tenex
484 \newfam\itfam \def\it{\fam\itfam\teni} % \it is family 4
485 \textfont\itfam=\teni
486 \newfam\slfam \def\sl{\fam\slfam\tensl} % \sl is family 5
487 \textfont\slfam=\tensl
488 \newfam\bffam \def\bffam{\fam\bffam\tenbf} % \bf is family 6

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489 \textfont\bffam=\tenbf \scriptfont\bffam=\sevenbf
490 \scriptscriptfont\bffam=\fivebf
491 \newfam\ttfam \def\tt{\fam\ttfam\tentt} % \tt is family 7
492 \textfont\ttfam=\tentt
493
494 % Macros for setting ordinary text
495 \message{macros,}
496
497 \def\frenchspacing{\sfcode'\.\@m \sfcode'\?\@m \sfcode'\!\@m
498 \sfcode'\:\@m \sfcode'\;\@m \sfcode'\,\@m}
499 \def\nonfrenchspacing{\sfcode'\.3000\sfcode'\?3000\sfcode'\!3000%
500 \sfcode'\:2000\sfcode'\;1500\sfcode'\,1250 }
501
502 \def\normalbaselines{\lineskip\normallineskip
503 \baselineskip\normalbaselineskip \lineskiplimit\normallineskiplimit}
504
505 \def^^M{\ } % control <return> = control <space>
506 \def^^I{\ } % same for <tab>
507
508 \def\lq{'} \def\rq{'}
509 \def\lbrack{[} \def\rbrack{]}
510
511 \let\endgraf=\par \let\endline=\cr
512
513 \def\space{ }
514 \def\empty{}
515 \def\null{\hbox{}}
516
517 \let\bgroup={ \let\egroup=}
518
519 % In \obeylines, we say '\let^^M=\par' instead of '\def^^M{\par}'
520 % since this allows, for example, '\let\par=\cr \obeylines \halign{...'
521 {\catcode^^M=\active % these lines must end with %
522 \gdef\obeylines{\catcode^^M\active \let^^M\par}%
523 \global\let^^M\par} % this is in case ^^M appears in a \write
524 \def\obeyspaces{\catcode\ \active}
525 {\obeyspaces\global\let =\space}
526
527 \def\loop#1\repeat{\def\body{#1}\iterate}
528 \def\iterate{\body \let\next\iterate \else\let\next\relax\fi \next}
529 \let\repeat=\fi % this makes \loop...\if...\repeat skippable
530
531 \def\thinspace{\kern .16667em }
532 \def\negthinspace{\kern-.16667em }
533 \def\enspace{\kern.5em }
534
535 \def\enskip{\hskip.5em\relax}
536 \def\quad{\hskip1em\relax}
537 \def\qqquad{\hskip2em\relax}
538
539 \def\smallskip{\vskip\smallskipamount}
540 \def\medskip{\vskip\medskipamount}
541 \def\bigskip{\vskip\bigskipamount}
542
543 \def\nointerlineskip{\prevdepth-1000\p@}
544 \def\offinterlineskip{\baselineskip-1000\p@
545 \lineskip\z@ \lineskiplimit\maxdimen}
546
547 \def\topglue{\nointerlineskip\vglue-\topskip\vglue} % for top of page
548 \def\vglue{\afterassignment\vgl@skip@=}
549 \def\vgl@{\par \dimen@\prevdepth \hrule height\z@

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550 \nobreak\vskip\skip@ \prevdepth\dimen@}
551 \def\hg glue{\afterassignment\hg l@\skip@=}
552 \def\hg l@{\leavevmode \count@\spacefactor \vrule width\z@
553 \nobreak\hskip\skip@ \spacefactor\count@}
554
555 \def~{\penalty\@M \ } % tie
556 \def\slash{/\penalty\exhyphenpenalty} % a '/' that acts like a '-'
557
558 \def\break{\penalty-\@M}
559 \def\nobreak{\penalty \@M}
560 \def\allowbreak{\penalty \z@}
561
562 \def\filbreak{\par\vfil\penalty-200\vfilneg}
563 \def\goodbreak{\par\penalty-500 }
564 \def\eject{\par\break}
565 \def\supereject{\par\penalty-\@MM}
566
567 \def\removelastskip{\ifdim\lastskip=\z@\else\vskip-\lastskip\fi}
568 \def\smallbreak{\par\ifdim\lastskip<\smallskipamount
569 \removelastskip\penalty-50\smallskip\fi}
570 \def\medbreak{\par\ifdim\lastskip<\medskipamount
571 \removelastskip\penalty-100\medskip\fi}
572 \def\bigbreak{\par\ifdim\lastskip<\bigskipamount
573 \removelastskip\penalty-200\bigskip\fi}
574
575 \def\line{\hbox to\hsize}
576 \def\leftline#1{\line{#1\hss}}
577 \def\rightline#1{\line{\hss#1}}
578 \def\centerline#1{\line{\hss#1\hss}}
579
580 \def\rlap#1{\hbox to\z@{#1\hss}}
581 \def\llap#1{\hbox to\z@{\hss#1}}
582
583 \def\m@th{\mathsurround\z@}
584 \def\underbar#1{\setbox\z@\hbox{#1}\dp\z@\z@
585 \m@th \underline{\box\z@}$}
586
587 \newbox\strutbox
588 \setbox\strutbox=\hbox{\vrule height8.5pt depth3.5pt width\z@}
589 \def\strut{\relax\ifmmode\copy\strutbox\else\unhcopy\strutbox\fi}
590
591 \def\hidewidth{\hskip\hideskip} % for alignment entries that can stick out
592 \def\ialign{\everycr{} \tabskip\z@skip\halign} % initialized \halign
593 \newcount\mscount
594 \def\multispan#1{\omit \mscount#1\relax
595 \loop\ifnum\mscount>\@ne \sp@n\repeat}
596 \def\sp@n{\span\omit\advance\mscount\m@ne}
597
598 \newif\ifus@ \newif\if@cr
599 \newbox\tabs \newbox\tabsyet \newbox\tabsdone
600
601 \def\cleartabs{\global\setbox\tabsyet\null \setbox\tabs\null}
602 \def\settabs{\setbox\tabs\null \futurelet\next\sett@b}
603 \let+=\relax % in case this file is being read in twice
604 \def\sett@b{\ifx\next+\def\nxt{\afterassignment\s@tt@b\let\nxt}%
605 \else\let\nxt\s@tcols\fi \let\next\relax \nxt}
606 \def\s@tt@b{\let\nxt\relax \us@false\m@ketabbox}
607 \def\tabalign{\us@true\m@ketabbox} % non-\outer version of \+
608 \outer\def+{\tabalign}
609 \def\s@tcols#1\columns{\count@#1\dimen@\hsize
610 \loop\ifnum\count@>\z@ \@another \repeat}

```

```

611 \def\@nother{\dimen@ii\dimen@ \divide\dimen@ii\count@
612 \setbox\tabs\hbox{\hbox to\dimen@ii{\unhbox\tabs}}%
613 \advance\dimen@-\dimen@ii \advance\count@\m@ne}
614
615 \def\m@ketabbox{\begingroup
616 \global\setbox\tabsyet\copy\tabs
617 \global\setbox\tabsdone\null
618 \def\cr{\@crtrue\crr\egroup\egroup
619 \ifus@\unvbox\z@\lastbox\fi\endgroup
620 \setbox\tabs\hbox{\unhbox\tabsyet\unhbox\tabsdone}}%
621 \setbox\z@\vbox\bgroup\@crfalse
622 \ialign\bgroup&\t@bbox##\t@bb@x\crr}
623
624 \def\t@bbox{\setbox\z@\hbox\bgroup}
625 \def\t@bb@x{\if\cr\egroup % now \box\z@ holds the column
626 \else\hss\egroup \global\setbox\tabsyet\hbox{\unhbox\tabsyet
627 \global\setbox\@ne\lastbox}% now \box\@ne holds its size
628 \ifvoid\@ne\global\setbox\@ne\hbox to\wd\z@{}}%
629 \else\setbox\z@\hbox to\wd\@ne{\unhbox\z@}\fi
630 \global\setbox\tabsdone\hbox{\box\@ne\unhbox\tabsdone}\fi
631 \box\z@}
632
633 \def\hang{\hangindent\parindent}
634 \def\textindent#1{\indent\llap{#1\enspace}\ignorespaces}
635 \def\item{\par\hang\textindent}
636 \def\itemitem{\par\indent \hangindent2\parindent \textindent}
637 \def\narrower{\advance\leftskip\parindent
638 \advance\rightskip\parindent}
639
640 \outer\def\beginsection#1\par{\vskip\z@ plus.3\vsize\penalty-250
641 \vskip\z@ plus-.3\vsize\bigskip\vskip\parskip
642 \message{#1}\leftline{\bf#1}\nobreak\smallskip\noindent}
643 \outer\def\proclaim #1. #2\par{\medbreak
644 \noindent{\bf#1.\enspace}{\sl#2\par}}%
645 \ifdim\lastskip<\medskipamount \removelastskip\penalty55\medskip\fi}
646
647 \def\raggedright{\rightskip\z@ plus2em \spaceskip.3333em \xspaceskip.5em\relax}
648 \def\tttraggedright{\tt\rightskip\z@ plus2em\relax} % for use with \tt only
649
650 \chardef\%= '\%
651 \chardef\&= '\&
652 \chardef\#= '\#
653 \chardef\$= '\$
654 \chardef\ss="19
655 \chardef\ae="1A
656 \chardef\oe="1B
657 \chardef\o="1C
658 \chardef\AE="1D
659 \chardef\OE="1E
660 \chardef\O="1F
661 \chardef\i="10 \chardef\j="11 % dotless letters
662 \def\aa{\accent23a}
663 \def\l{\char32l}
664 \def\L{\leavevmode\setbox0\hbox{L}\hbox to\wd0{\hss\char32L}}
665
666 \def\leavevmode{\unhbox\voidb@x} % begins a paragraph, if necessary
667 \def\_ {\leavevmode \kern.06em \vbox{\hrule width.3em}}
668 \def\AA{\leavevmode\setbox0\hbox{!}\dimen@\ht0\advance\dimen@-1ex%
669 \rlap{\raise.67\dimen@\hbox{\char'27}}A}
670
671 \def\mathhexbox#1#2#3{\leavevmode

```

```

672 \hbox{$\m@th \mathchar"#1#2#3$}
673 \def\dag{\mathhexbox279}
674 \def\ddag{\mathhexbox27A}
675 \def\S{\mathhexbox278}
676 \def\P{\mathhexbox27B}
677 \def\Orb{\mathhexbox20D}
678
679 \def\oalign#1{\leavevmode\vtop{\baselineskip\z@skip \lineskip.25ex%
680 \ialign{##\crrc#1\crrc}} \def\o@lign{\lineskiplimit\z@ \oalign}
681 \def\oalign{\lineskiplimit-\maxdimen \oalign} % chars over each other
682 {\catcode'p=12 \catcode't=12 \gdef\#1pt{#1} \let\getf@ctor=\
683 \def\sh@ft#1{\dimen@#1\kern\expandafter\getf@ctor\the\fontdimen1\font
684 \dimen@} % kern by #1 times the current slant
685 \def\d#1{\o@lign{\relax#1\crrc\hidewidth\sh@ft{-1ex}.\hidewidth}}
686 \def\b#1{\o@lign{\relax#1\crrc\hidewidth\sh@ft{-3ex}%
687 \vbox to.2ex{\hbox{\char22}\vss}\hidewidth}}
688 \def\c#1{\setbox\z@\hbox{#1}\ifdim\ht\z@=1ex\accent24 #1%
689 \else\oalign{\unhbox\z@\crrc\hidewidth\char24\hidewidth}\fi}
690 \def\copyright{\oalign{\hfil\raise.07ex\hbox{c}\hfil\crrc\Orb}}
691
692 \def\dots{\relax\ifmmode\ldots\else$\m@th\ldots$, \fi}
693 \def\TeX{T\kern-.1667em\lower.5ex\hbox{E}\kern-.125emX}
694
695 \def\'#1{\accent18 #1}
696 \def\'#1{\accent19 #1}
697 \def\#1{\accent20 #1} \let\^_=\v
698 \def\#1{\accent21 #1} \let\^S=\u
699 \def=#1{\accent22 #1}
700 \def\^#1{\accent94 #1} \let\^D=\^
701 \def\.#1{\accent95 #1}
702 \def\H#1{\accent"7D #1}
703 \def\~#1{\accent"7E #1}
704 \def\"#1{\accent"7F #1}
705 \def\t#1{\edef\next{\the\font}\the\textfont1\accent"7F\next#1}
706
707 \def\hrulefill{\leaders\hrule\hfill}
708 \def\dotfill{\cleaders\hbox{$\m@th \mkern1.5mu.\mkern1.5mu$}\hfill}
709 \def\rightarrowfill{\$ \m@th\smash-\mkern-7mu%
710 \cleaders\hbox{\$ \mkern-2mu\smash-\mkern-2mu$}\hfill
711 \mkern-7mu\mathord\rightarrow$}
712 \def\leftarrowfill{\$ \m@th\mathord\leftarrow\mkern-7mu%
713 \cleaders\hbox{\$ \mkern-2mu\smash-\mkern-2mu$}\hfill
714 \mkern-7mu\smash-$}
715 \mathchardef\braced="37A \mathchardef\bracerd="37B
716 \mathchardef\bracelu="37C \mathchardef\braceru="37D
717 \def\downbracefill{\$ \m@th \setbox\z@\hbox{\$ \braced$}%
718 \braced\leaders\vrule height\ht\z@ depth\z@\hfill\braceru
719 \bracelu\leaders\vrule height\ht\z@ depth\z@\hfill\bracerd$}
720 \def\upbracefill{\$ \m@th \setbox\z@\hbox{\$ \braced$}%
721 \bracelu\leaders\vrule height\ht\z@ depth\z@\hfill\bracerd
722 \braced\leaders\vrule height\ht\z@ depth\z@\hfill\braceru$}
723
724 \outer\def\bye{\par\vfill\supereject\end}
725
726 % Macros for math setting
727 \message{math definitions,}
728
729 \let\sp=\^ \let\sb=_
730 \def\,\{\mskip\thinmuskip}
731 \def\>\{\mskip\medmuskip}
732 \def\;\{\mskip\thickmuskip}

```

```

733 \def\!{\mskip-\thinmuskip}
734 \def\*{\discretionary{\thinspace\the\textfont2\char2\!}{}}
735 {\catcode'\='active \gdef'\bgroup\prim@s}
736 \def\prim@s{\prime\futurelet\next\pr@m@s}
737 \def\pr@m@s{\ifx'\next\let\nxt\pr@@@s \else\ifx'\next\let\nxt\pr@@@t
738 \else\let\nxt\egroup\fi\fi \next}
739 \def\pr@@@s#1{\prim@s} \def\pr@@@t#1#2{#2\egroup}
740 {\catcode'\^Z=\active \gdef^^Z{\not=} } % ^^Z is like \ne in math
741
742 {\catcode'\_=\active \global\let\_=\_} % _ in math is either subscript or \_
743
744 \mathchardef\alpha="010B
745 \mathchardef\beta="010C
746 \mathchardef\gamma="010D
747 \mathchardef\delta="010E
748 \mathchardef\epsilon="010F
749 \mathchardef\zeta="0110
750 \mathchardef\eta="0111
751 \mathchardef\theta="0112
752 \mathchardef\iota="0113
753 \mathchardef\kappa="0114
754 \mathchardef\lambda="0115
755 \mathchardef\mu="0116
756 \mathchardef\nu="0117
757 \mathchardef\xi="0118
758 \mathchardef\pi="0119
759 \mathchardef\rho="011A
760 \mathchardef\sigma="011B
761 \mathchardef\tau="011C
762 \mathchardef\upsilon="011D
763 \mathchardef\phi="011E
764 \mathchardef\chi="011F
765 \mathchardef\psi="0120
766 \mathchardef\omega="0121
767 \mathchardef\varepsilon="0122
768 \mathchardef\vartheta="0123
769 \mathchardef\varpi="0124
770 \mathchardef\varrho="0125
771 \mathchardef\varsigma="0126
772 \mathchardef\varphi="0127
773 \mathchardef\Gamma="7000
774 \mathchardef\Delta="7001
775 \mathchardef\Theta="7002
776 \mathchardef\Lambda="7003
777 \mathchardef\Xi="7004
778 \mathchardef\Pi="7005
779 \mathchardef\Sigma="7006
780 \mathchardef\Upsilon="7007
781 \mathchardef\Phi="7008
782 \mathchardef\Psi="7009
783 \mathchardef\Omega="700A
784
785 \mathchardef\aleph="0240
786 \def\hbar{{\mathchar'26\mkern-9muh}}
787 \mathchardef\imath="017B
788 \mathchardef\jmath="017C
789 \mathchardef\ell="0160
790 \mathchardef\wp="017D
791 \mathchardef\Re="023C
792 \mathchardef\Im="023D
793 \mathchardef\partial="0140

```

```

794 \mathchardef\infty="0231
795 \mathchardef\prime="0230
796 \mathchardef\emptyset="023B
797 \mathchardef\nabla="0272
798 \def\surd{\mathchar"1270}
799 \mathchardef\top="023E
800 \mathchardef\bot="023F
801 \def\angle{\vbox{\ialign{\m@th\scriptstyle##$\cr
802   \not\mathrel{\mkern14mu}\cr
803   \noalign{\nointerlineskip}
804   \mkern2.5mu\leaders\hrule height.34pt\hfill\mkern2.5mu\cr}}}
805 \mathchardef\triangle="0234
806 \mathchardef\forall="0238
807 \mathchardef\exists="0239
808 \mathchardef\neg="023A \let\not=\neg
809 \mathchardef\flat="015B
810 \mathchardef\natural="015C
811 \mathchardef\sharp="015D
812 \mathchardef\clubsuit="027C
813 \mathchardef\diamondsuit="027D
814 \mathchardef\heartsuit="027E
815 \mathchardef\spadesuit="027F
816
817 \mathchardef\coprod="1360
818 \mathchardef\bigvee="1357
819 \mathchardef\bigwedge="1356
820 \mathchardef\biguplus="1355
821 \mathchardef\bigcap="1354
822 \mathchardef\bigcup="1353
823 \mathchardef\intop="1352 \def\int{\intop\nolimits}
824 \mathchardef\prod="1351
825 \mathchardef\sum="1350
826 \mathchardef\bigotimes="134E
827 \mathchardef\bigoplus="134C
828 \mathchardef\bigodot="134A
829 \mathchardef\ointop="1348 \def\oint{\ointop\nolimits}
830 \mathchardef\bigsqcup="1346
831 \mathchardef\smallint="1273
832
833 \mathchardef\triangleleft="212F
834 \mathchardef\triangleright="212E
835 \mathchardef\bigtriangleup="2234
836 \mathchardef\bigtriangledown="2235
837 \mathchardef\wedge="225E \let\land=\wedge
838 \mathchardef\vee="225F \let\lor=\vee
839 \mathchardef\cap="225C
840 \mathchardef\cup="225B
841 \mathchardef\ddagger="227A
842 \mathchardef\dagger="2279
843 \mathchardef\sqcap="2275
844 \mathchardef\sqcup="2274
845 \mathchardef\uplus="225D
846 \mathchardef\amalg="2271
847 \mathchardef\diamond="2205
848 \mathchardef\bullet="220F
849 \mathchardef\wr="226F
850 \mathchardef\div="2204
851 \mathchardef\odot="220C
852 \mathchardef\oslash="220B
853 \mathchardef\otimes="220A
854 \mathchardef\ominus="2209

```

```

855 \mathchardef\oplus="2208
856 \mathchardef\mp="2207
857 \mathchardef\pm="2206
858 \mathchardef\circ="220E
859 \mathchardef\bigcirc="220D
860 \mathchardef\setminus="226E % for set difference A\setminus B
861 \mathchardef\cdot="2201
862 \mathchardef\ast="2203
863 \mathchardef\times="2202
864 \mathchardef\star="213F
865
866 \mathchardef\propto="322F
867 \mathchardef\sqsubseteq="3276
868 \mathchardef\sqsupseteq="3277
869 \mathchardef\parallel="326B
870 \mathchardef\mid="326A
871 \mathchardef\dashv="3261
872 \mathchardef\vdash="3260
873 \mathchardef\nearrow="3225
874 \mathchardef\searrow="3226
875 \mathchardef\nwarrow="322D
876 \mathchardef\swarrow="322E
877 \mathchardef\leftrightharrow="322C
878 \mathchardef\Leftarrow="3228
879 \mathchardef\Rightarrow="3229
880 \def\not{ \let\ne=\neq
881 \mathchardef\leq="3214 \let\le=\leq
882 \mathchardef\geq="3215 \let\ge=\geq
883 \mathchardef\succ="321F
884 \mathchardef\prec="321E
885 \mathchardef\approx="3219
886 \mathchardef\succeq="3217
887 \mathchardef\preceq="3216
888 \mathchardef\supset="321B
889 \mathchardef\subset="321A
890 \mathchardef\supseteq="3213
891 \mathchardef\subseteq="3212
892 \mathchardef\in="3232
893 \mathchardef\ni="3233 \let\owns=\ni
894 \mathchardef\gg="321D
895 \mathchardef\ll="321C
896 \mathchardef\not="3236
897 \mathchardef\leftrightharrow="3224
898 \mathchardef\leftarrow="3220 \let\gets=\leftarrow
899 \mathchardef\rightarrow="3221 \let\to=\rightarrow
900 \mathchardef\mapstochar="3237 \def\mapsto{\mapstochar\rightarrow}
901 \mathchardef\sim="3218
902 \mathchardef\simseq="3227
903 \mathchardef\perp="323F
904 \mathchardef\equiv="3211
905 \mathchardef\asymp="3210
906 \mathchardef\smile="315E
907 \mathchardef\frown="315F
908 \mathchardef\leftharpoonup="3128
909 \mathchardef\leftharpoondown="3129
910 \mathchardef\rightharpoonup="312A
911 \mathchardef\rightharpoondown="312B
912
913 \def\joinrel{\mathrel{\mkern-3mu}}
914 \def\relbar{\mathrel{\smash-}} % \smash, because - has the same height as +
915 \def\Relbar{\mathrel=}

```

```

916 \mathchardef\lhook="312C \def\hookrightarrow{\lhook\joinrel\rightarrow}
917 \mathchardef\rhook="312D \def\hookleftarrow{\leftarrow\joinrel\rhook}
918 \def\bowtie{\mathrel\triangleright\joinrel\mathrel\triangleleft}
919 \def\models{\mathrel|\joinrel=}
920 \def\Longrightarrow{\Relbar\joinrel\rightarrow}
921 \def\longrightarrow{\relbar\joinrel\rightarrow}
922 \def\longleftarrow{\leftarrow\joinrel\relbar}
923 \def\Longleftarrow{\Leftarrow\joinrel\Relbar}
924 \def\longmapsto{\mapstochar\longrightarrow}
925 \def\longlefttrightarrow{\leftarrow\joinrel\rightarrow}
926 \def\Longlefttrightarrow{\Leftarrow\joinrel\rightarrow}
927 \def\iff{\;\Longlefttrightarrow\;}
928
929 \mathchardef\ldotp="613A % ldot as a punctuation mark
930 \mathchardef\cdotp="6201 % cdot as a punctuation mark
931 \mathchardef\colone="603A % colon as a punctuation mark
932 \def\ldots{\mathinner{\ldotp\ldotp\ldotp}}
933 \def\cdots{\mathinner{\cdotp\cdotp\cdotp}}
934 \def\vdots{\vbox{\baselineskip4\p@ \lineskiplimit\z@
935 \kern6\p@\hbox{.}\hbox{.}\hbox{.}}}
936 \def\ddots{\mathinner{\mkern1mu\raise7\p@\vbox{\kern7\p@\hbox{.}}\mkern2mu
937 \raise4\p@\hbox{.}\mkern2mu\raise\p@\hbox{.}\mkern1mu}}
938
939 \def\acute{\mathaccent"7013 }
940 \def\grave{\mathaccent"7012 }
941 \def\ddot{\mathaccent"707F }
942 \def\tilde{\mathaccent"707E }
943 \def\bar{\mathaccent"7016 }
944 \def\breve{\mathaccent"7015 }
945 \def\check{\mathaccent"7014 }
946 \def\hat{\mathaccent"705E }
947 \def\vec{\mathaccent"017E }
948 \def\dot{\mathaccent"705F }
949 \def\widetilde{\mathaccent"0365 }
950 \def\widehat{\mathaccent"0362 }
951 \def\overrightarrow#1{\vbox{\m@th\ialign{##\crrc
952 \rightarrowfill\crrc\noalign{\kern-\p@\nointerlineskip}
953 $\hfil\displaystyle{#1}\hfil$\crrc}}}
954 \def\overleftarrow#1{\vbox{\m@th\ialign{##\crrc
955 \leftarrowfill\crrc\noalign{\kern-\p@\nointerlineskip}
956 $\hfil\displaystyle{#1}\hfil$\crrc}}}
957 \def\overbrace#1{\mathop{\vbox{\m@th\ialign{##\crrc\noalign{\kern3\p@}
958 \downbracefill\crrc\noalign{\kern3\p@\nointerlineskip}
959 $\hfil\displaystyle{#1}\hfil$\crrc}}}\limits}
960 \def\underbrace#1{\mathop{\vtop{\m@th\ialign{##\crrc
961 $\hfil\displaystyle{#1}\hfil$\crrc\noalign{\kern3\p@\nointerlineskip}
962 \upbracefill\crrc\noalign{\kern3\p@}}}\limits}
963 \def\skew#1#2#3{\muskip\z@#1mu\divide\muskip\z@\tw@ \mkern\muskip\z@
964 #2{\mkern-\muskip\z@#3}\mkern\muskip\z@}\mkern-\muskip\z@}{}
965
966 \def\lmoustache{\delimiter"437A340 } % top from (, bottom from )
967 \def\rmoustache{\delimiter"537B341 } % top from ), bottom from (
968 \def\lgroup{\delimiter"462833A } % extensible ( with sharper tips
969 \def\rgroup{\delimiter"562933B } % extensible ) with sharper tips
970 \def\arrowvert{\delimiter"26A33C } % arrow without arrowheads
971 \def\Arrowvert{\delimiter"26B33D } % double arrow without arrowheads
972 \def\bracevert{\delimiter"77C33E } % the vertical bar that extends braces
973 \def\Vert{\delimiter"26B30D } \let|\=\Vert
974 \def\vert{\delimiter"26A30C }
975 \def\uparrow{\delimiter"3222378 }
976 \def\downarrow{\delimiter"3223379 }

```

```

977 \def\updownarrow{\delimiter"326C33F }
978 \def\Uparrow{\delimiter"322A37E }
979 \def\Downarrow{\delimiter"322B37F }
980 \def\Updownarrow{\delimiter"326D377 }
981 \def\backslash{\delimiter"26E30F } % for double coset G\backslash H
982 \def\rangle{\delimiter"526930B }
983 \def\langle{\delimiter"426830A }
984 \def\rbrace{\delimiter"5267309 } \let\}=\rbrace
985 \def\lbrace{\delimiter"4266308 } \let\{=\lbrace
986 \def\rceil{\delimiter"5265307 }
987 \def\lceil{\delimiter"4264306 }
988 \def\rfloor{\delimiter"5263305 }
989 \def\lfloor{\delimiter"4262304 }
990
991 \def\bigl{\mathopen\big}
992 \def\bigm{\mathrel\big}
993 \def\bigr{\mathclose\big}
994 \def\Bigl{\mathopen\Big}
995 \def\Bigm{\mathrel\Big}
996 \def\Bigr{\mathclose\Big}
997 \def\biggl{\mathopen\bigg}
998 \def\biggm{\mathrel\bigg}
999 \def\biggr{\mathclose\bigg}
1000 \def\Biggl{\mathopen\Bigg}
1001 \def\Biggm{\mathrel\Bigg}
1002 \def\Biggr{\mathclose\Bigg}
1003 \def\big#1{\{\hbox{\$left#1\ vbox to8.5\p@{\}right.\n@space$}}
1004 \def\Big#1{\{\hbox{\$left#1\ vbox to11.5\p@{\}right.\n@space$}}
1005 \def\bigg#1{\{\hbox{\$left#1\ vbox to14.5\p@{\}right.\n@space$}}
1006 \def\Bigg#1{\{\hbox{\$left#1\ vbox to17.5\p@{\}right.\n@space$}}
1007 \def\n@space{\nulldelimiterspace\z@ \m@th}
1008
1009 \def\choose{\atopwithdelims()}
1010 \def\brack{\atopwithdelims[]}
1011 \def\brace{\atopwithdelims\{\}}
1012
1013 \def\sqrt{\radical"270370 }
1014
1015 \def\mathpalette#1#2{\mathchoice{#1\displaystyle{#2}}%
1016   {#1\textstyle{#2}}{#1\scriptstyle{#2}}{#1\scriptscriptstyle{#2}}
1017 \newbox\rootbox
1018 \def\root#1\of{\setbox\rootbox
1019   \hbox{\$m@th\scriptscriptstyle{#1}\$}\mathpalette\r@t}
1020 \def\r@t#1#2{\setbox\z@\hbox{\$m@th#1\sqrt{#2}\$}\dimen@ht\z@
1021   \advance\dimen@-\dp\z@
1022   \mkern5mu\raise.6\dimen@\copy\rootbox \mkern-10mu\box\z@}
1023 \newif\ifv@ \newif\ifh@
1024 \def\vphantom{\v@true\h@false\ph@nt}
1025 \def\hphantom{\v@false\h@true\ph@nt}
1026 \def\phantom{\v@true\h@true\ph@nt}
1027 \def\ph@nt{\ifmmode\def\next{\mathpalette\mathph@nt}%
1028   \else\let\next\makeph@nt\fi\next}
1029 \def\makeph@nt#1{\setbox\z@\hbox{#1}\finph@nt}
1030 \def\mathph@nt#1#2{\setbox\z@\hbox{\$m@th#1{#2}\$}\finph@nt}
1031 \def\finph@nt{\setbox\zw@null
1032   \ifv@ \ht\zw@\ht\z@ \dp\zw@\dp\z@\fi
1033   \ifh@ \wd\zw@\wd\z@\fi \box\zw@}
1034 \def\mathstrut{\vphantom{}}
1035 \def\smash{\relax % \relax, in case this comes first in \halign
1036   \ifmmode\def\next{\mathpalette\mathsm@sh}\else\let\next\makesm@sh
1037   \fi\next}

```



```

1099 \setbox0=\hbox{\tenex B} \p@renwd=\wd0 % width of the big left (
1100 \def\bordermatrix#1{\begingroup \m@th
1101 \setboxz@\vbox{\def\crrc\cr\crrc\noalign{\kern2\p@\global\let\cr\endline}}%
1102 \ialign{###\hfil\kern2\p@\kern\p@renwd&\thinspace\hfil###\hfil
1103 &&\quad\hfil###\hfil\crrc
1104 \omit\strut\hfil\crrc\noalign{\kern-\baselineskip}%
1105 #1\crrc\omit\strut\cr}}%
1106 \setbox\tw@\vbox{\unvcopyz@\global\setbox\@ne\lastbox}%
1107 \setbox\tw@\hbox{\unhbox\@ne\unskip\global\setbox\@ne\lastbox}%
1108 \setbox\tw@\hbox{\kern\wd\@ne\kern-\p@renwd\left(\kern-\wd\@ne
1109 \global\setbox\@ne\vbox{\box\@ne\kern2\p@}%
1110 \vcenter{\kern-\ht\@ne\unvboxz@\kern-\baselineskip}\, \right)$}%
1111 \null\; \vbox{\kern\ht\@ne\box\tw@}\endgroup}
1112
1113 \def\openup{\afterassignment\@penup\dimen@=}
1114 \def\@penup{\advance\lineskip\dimen@
1115 \advance\baselineskip\dimen@
1116 \advance\lineskiplimit\dimen@}
1117 \def\equalign#1{\null\, \vcenter{\openup\jot\m@th
1118 \ialign{\strut\hfil$\displaystyle{##}$&\displaystyle{{}##}$\hfil
1119 \crrc#1\crrc}}\,}
1120 \newif\ifdt@p
1121 \def\disply{\global\dt@ptrue\openup\jot\m@th
1122 \everycr{\noalign{\ifdt@p \global\dt@pfalse \ifdim\prevdepth>-1000\p@
1123 \vskip-\lineskiplimit \vskip\normallineskiplimit \fi
1124 \else \penalty\interdisplaylinepenalty \fi}}}
1125 \def\@lign{\tabskipz@skip\everycr{}} % restore inside \disply
1126 \def\displaylines#1{\disply \tabskipz@skip
1127 \halign{\hbox to\displaywidth{\@lign\hfil\displaystyle##\hfil}\crrc
1128 #1\crrc}}
1129 \def\equaligno#1{\disply \tabskip\centering
1130 \halign to\displaywidth{\hfil$\@lign\displaystyle{##}$\tabskipz@skip
1131 & $\@lign\displaystyle{{}##}$\hfil\displaystyle{\centering
1132 & \llap{\@lign##}$\tabskipz@skip\crrc
1133 #1\crrc}}
1134 \def\lequaligno#1{\disply \tabskip\centering
1135 \halign to\displaywidth{\hfil$\@lign\displaystyle{##}$\tabskipz@skip
1136 & $\@lign\displaystyle{{}##}$\hfil\displaystyle{\centering
1137 & \kern-\displaywidth\rlap{\@lign##}$\tabskip\displaywidth\crrc
1138 #1\crrc}}
1139
1140 % Definitions related to output
1141
1142 \message{output routines,}
1143
1144 \countdef\pageno=0 \pageno=1 % first page is number 1
1145 \newtoks\headline \headline={\hfil} % headline is normally blank
1146 \newtoks\footline \footline={\hss\tenrm\folio\hss}
1147 % footline is normally a centered page number in font \tenrm
1148 \newif\ifr@ggedbottom
1149 \def\raggedbottom{\topskip 10\p@ plus60\p@ \r@ggedbottomtrue}
1150 \def\normalbottom{\topskip 10\p@ \r@ggedbottomfalse} % undoes \raggedbottom
1151 \def\folio{\ifnum\pageno<z@ \romannumeral-\pageno \else\number\pageno \fi}
1152 \def\nopagenumbers{\footline{\hfil}} % blank out the footline
1153 \def\advancepageno{\ifnum\pageno<z@ \global\advance\pageno\m@ne
1154 \else\global\advance\pageno\@ne \fi} % increase |pageno|
1155
1156 \newinsert\footins
1157 \def\footnote#1{\let\@sf\empty % parameter #2 (the text) is read later
1158 \ifhmode\edef\@sf{\spacefactor\the\spacefactor}\fi
1159 #1\@sf\vfootnote{#1}}

```

```

1160 \def\vfootnote#1{\insert\footins\bgroup
1161 \interlinepenalty\interfootnotelinepenalty
1162 \splittopskip\ht\strutbox % top baseline for broken footnotes
1163 \splitmaxdepth\dp\strutbox \floatingpenalty\@MM
1164 \leftskip\z@skip \rightskip\z@skip \spaceskip\z@skip \xspaceskip\z@skip
1165 \textindent{#1}\footstrut\futurelet\next\fo@t}
1166 \def\fo@t{\ifcat\bgroup\noexpand\next \let\next\fo@t}
1167 \else\let\next\fo@t\fi \next}
1168 \def\fo@t{\bgroup\aftergroup\@foot\let\next}
1169 \def\fo@t#1{#1\@foot}
1170 \def\@foot{\strut\egroup}
1171 \def\footstrut{\vbox to\splittopskip{}}
1172 \skip\footins=\bigskipamount % space added when footnote is present
1173 \count\footins=1000 % footnote magnification factor (1 to 1)
1174 \dimen\footins=8in % maximum footnotes per page
1175
1176 \newinsert\topins
1177 \newif\ifp@ge \newif\if@mid
1178 \def\topinsert{\@midfalse\p@gefalse\@ins}
1179 \def\midinsert{\@midtrue\@ins}
1180 \def\pageinsert{\@midfalse\p@getrue\@ins}
1181 \skip\topins=\z@skip % no space added when a topinsert is present
1182 \count\topins=1000 % magnification factor (1 to 1)
1183 \dimen\topins=\maxdimen % no limit per page
1184 \def\@ins{\par\begingroup\setbox\z@\vbox\bgroup} % start a \vbox
1185 \def\endinsert{\egroup % finish the \vbox
1186 \if@mid \dimen@ht\z@ \advance\dimen@dp\z@ \advance\dimen@12\p@
1187 \advance\dimen@pagetotal \advance\dimen@-\pageshrink
1188 \ifdim\dimen@>\pagegoal\@midfalse\p@gefalse\fi\fi
1189 \if@mid \bigskip\box\z@\bigbreak
1190 \else\insert\topins{\penalty100 % floating insertion
1191 \splittopskip\z@skip
1192 \splitmaxdepth\maxdimen \floatingpenalty\z@
1193 \ifp@ge \dimen@dp\z@
1194 \vbox to\vsize{\unvbox\z@\kern-\dimen@}% depth is zero
1195 \else \box\z@\nobreak\bigskip\fi}\fi\endgroup}
1196
1197 \output{\plainoutput}
1198 \def\plainoutput{\shipout\vbox{\makeheadline\pagebody\makefootline}}%
1199 \advancepageno
1200 \ifnum\outputpenalty>-\@MM \else\dosupereject\fi}
1201 \def\pagebody{\vbox to\vsize{\boxmaxdepth\maxdepth \pagecontents}}
1202 \def\makeheadline{\vbox to\z@{\vskip-22.5\p@
1203 \line{\vbox to8.5\p@{\the\headline}\vss}\nointerlineskip}
1204 \def\makefootline{\baselineskip24\p@\lineskiplimit\z@\line{\the\footline}}
1205 \def\dosupereject{\ifnum\insertpenalties>\z@ % something is being held over
1206 \line{\kern-\topskip\nobreak\vfill\supereject}\fi}
1207
1208 \def\pagecontents{\ifvoid\topins\else\unvbox\topins\fi
1209 \dimen@=\dp\@cclv \unvbox\@cclv % open up \box255
1210 \ifvoid\footins\else % footnote info is present
1211 \vskip\skip\footins
1212 \footnoterule
1213 \unvbox\footins\fi
1214 \ifr@ggedbottom \kern-\dimen@ \vfil \fi}
1215 \def\footnoterule{\kern-3\p@
1216 \hrule width 2truein \kern 2.6\p@} % the \hrule is .4pt high
1217
1218 % Hyphenation, miscellaneous macros, and initial values for standard layout
1219 \message{hyphenation}
1220

```

```

1221 \lefthyphenmin=2 \righthyphenmin=3 % disallow x- or -xx breaks
1222 \input hyphen
1223
1224 \def\magnification{\afterassignment\m@g\count@}
1225 \def\m@g{\mag\count@}
1226 \hsize6.5truein\vsize8.9truein\dimen\footins8truein}
1227
1228 \def\loggingall{\tracingcommands\tw@\tracingstats\tw@
1229 \tracingpages\@ne\tracingoutput\@ne\tracinglostchars\@ne
1230 \tracingmacros\tw@\tracingparagraphs\@ne\tracingrestores\@ne
1231 \showboxbreadth\maxdimen\showboxdepth\maxdimen}
1232 \def\tracingall{\tracingonline\@ne\loggingall}
1233
1234 \def\showhyphens#1{\setbox0\vbox{\parfillskip\z@skip\hsize\maxdimen\tenrm
1235 \pretolerance\m@ne\tolerance\m@ne\hbadness0\showboxdepth0\ #1}}
1236
1237 \normalbaselines\rm % select roman font
1238 \nonfrenchspacing % punctuation affects the spacing
1239 \catcode'@=12 % at signs are no longer letters
1240
1241 \def\fmtname{plain}\def\fmtversion{3.141592653} % identifies the current format

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