Delimiters :

Large delimiters (parentheses, square brackets, curly brackets, etc.) are produced with \left and \right commands. For example, the expression

$$\left(\frac{a+b}{x+y}\right)^{1/3}$$

is produced with the input

```
\[ \left( \frac{a+b}{x+y} \right)^{1/3} \]
```

NOTE: Delimiters must occur in left-right pairs, but if you want only one delimiter, then pair it with \right. For example, to typeset a piece-wise defined function, a left brace \left\{ would be paired with a \right.

((	))	↑ \uparrow
[[	]]	↓ \downarrow
{ \{	} \}	↕ \updownarrow
⌊ \lfloor	⌋ \rfloor	⇑ \Uparrow
⌈ \lceil	⌉ \rceil	⇓ \Downarrow
⟨ \langle	⟩ \rangle	⇕ \Updownarrow
/ /	\ \backslash	
| |	‖ \\|	

Table 3.10: Delimiters.

that they delimit. To make a delimiter the right size, type a \left or \right command before it.

Big delimiters are most often used with arrays.

$$\left(\left| \begin{array}{cc} x_{11} & x_{12} \\ x_{21} & x_{22} \end{array} \right| \begin{array}{c} y \\ z \end{array} \right)$$

```
...\[ \left( \begin{array}{c}
       \left| \begin{array}{cc}
                ... \end{array}
       \right| \\
       y \\ z
     \end{array}  \right) \]
```

The \left and \right commands must come in matching pairs, but the matching delimiters need not be the same.

$$\vec{x} + \vec{y} + \vec{z} = \left(\begin{array}{c} a \\ b \end{array} \right[$$

```
\[  ... = \left( \begin{array}{c}
            a \\ b
          \end{array}  \right[ \]
```

Some formulas require a big left delimiter with no matching right one, or vice versa. The \left and \right commands must match, but you can make an invisible delimiter by typing a "." after the \left or \right command.

$$x = \left\{ \begin{array}{ll} y & \text{if } y > 0 \\ z + y & \text{otherwise} \end{array} \right.$$

```
\[ x = \left\{ \begin{array}{ll}
         y   & \mbox{if $y>0$} \\
         z+y & \mbox{otherwise}
       \end{array}
\right. \]
```

Multi-line expressions:

Multi-line expressions are created in the \eqnarray* (or eqnarray) environment. Within the environment, each line may consist of three parts: two expressions and a relational symbol (e.g. = or ≤). The parts are separated by & symbols. As with array, each line (except the last) ends with a \\ command. For example

$$e^x = \frac{x^0}{0!} + \frac{x^1}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots\cdots$$

$$e^{-1} = \frac{(-1)^0}{0!} + \frac{(-1)^1}{1!} + \frac{(-1)^2}{2!} + \frac{(-1)^3}{3!} + \cdots\cdots$$

$$= \frac{1}{0!} - \frac{1}{1!} + \frac{1}{2!} - \frac{1}{3!} + \cdots\cdots$$

use the following commands.

Input ⇒

```
\begin{eqnarray*}
e^x & = & \frac{x^0}{0!}+\frac{x^1}{1!}
  +\frac{x^2}{2!}+\frac{x^3}{3!}+\cdots\\
e^{-1} & = & \frac{{(-1)}^0}{0!}+\frac{{(-1)}^1}{1!}
  +\frac{{(-1)}^2}{2!}+\frac{{(-1)}^3}{3!}+\cdots\\
& = & \frac{1}{0!}-\frac{1}{1!}+\frac{1}{2!}
  -\frac{1}{3!}+\cdots
\end{eqnarray*}
```

Note. The * in the eqnarray* environment causes the equations produced to be u
bered. If you want numbered equations, use eqnarray instead of eqnarray*.

The middle column can be anything, not just a '='.

$$x = 17y \tag{2}$$
$$y > a+b+c+d+e+f+g+h+i+j+ k+l+m+n+o+p \tag{3}$$

```
...\begin{eqnarray}
    x & = & 17y \\
    y & > & a + ... + j +  \nonumber  \\
      &   & k + l + m + n + o + p
  \end{eqnarray}
```

Section 4.2 describes how to let LaTeX handle references to equations so you don't have to remember equation numbers.

The eqnarray* environment is the same as eqnarray except it does not generate equation numbers.

$$x \ll y_1 + \cdots + y_n \leq z$$

```
\begin{eqnarray*}
  x  & \ll  & y_{1} + \cdots + y_{n} \\
     & \leq & z
\end{eqnarray*}
```

A + or - that begins a formula (or certain subformulas) is assumed to be a unary operator, so typing `$-x$` produces $-x$ and typing `$\sum -x_{i}$` produces $\sum -x_i$, with no space between the "−" and the "x". If the formula is part of a larger one that is being split across lines, TeX must be told that the + or − is a binary operator. This is done by starting the formula with an invisible first term, produced by an \mbox command with a null argument.

$$y = a+b+c+d+e+f+g+h+i+j +k+l+m+n+o+p$$

```
\begin{eqnarray*}
y & = & a + b + c + ...  + h + i + j \\
  &   & \mbox{} + k + ...
\end{eqnarray*}
```

A formula can often be split across lines using a \lefteqn command in an eqnarray or eqnarray* environment, as indicated by the following example:

$$w+x+y+z = a+b+c+d+e+f+g+h+i+j+ k+l+m+n+o+p$$

```
\begin{eqnarray*}
\lefteqn{w+x+y+z = }  \\
  & &  a + ... + j +  \\
  & &  k + ... + o + p
\end{eqnarray*}
```

The \lefteqn command works by making TeX think that the formula it produces has zero width, so the left-most column of the eqnarray or eqnarray* environment is made suitably narrow. The indentation of the following lines can be increased by adding space (with the commands of Section 6.4.2) between the \lefteqn command and the \\.

OVER AND UNDERLINE

- The \overline command puts a horizontal line above its argument. e.g. $\overline{x^2+1}$ produced by $\overline{x^2+1}$

- The \underline command puts a horizontal line below its argument. e.g. $\underline{x^2+1}$ is produced by \underline{x^2+1}

NOTE: The \underline command never used in displaymath mode.

- Horizontal braces are put above or below an expression with the \overbrace and \underbrace commands. e.g.

$\overbrace{a+\underbrace{b+c}+d}$ is produced by the following code

```
\overbrace{a+\underbrace{b+c}+d}
```

NOTE: In a displayed formula, a subscript or superscript puts a label on the brace. e.g.

$$\underbrace{a+\overbrace{b+\cdots+y}^{24}+z}_{26}$$ is generated by

```
\[\underbrace{a+\overbrace{b+\cdots+y}^{24}+z}_{26}\]
```