Latex Class

- Environments

- Mathematical structures

Environment

- \begin{*environment*}   *text*   \end{*environment*}

Where *environment* is the name of the environment. Environments can be nested within each other as long as the correct nesting order is maintained.

\begin{aaa}...\begin{bbb}...\end{bbb}...\end{aaa}

```
\begin{enumerate}
\item You can mix the list environments to your taste:
        \begin{itemize}
            \item But it might start to look silly.
            \item[-] With a dash.
        \end{itemize}
\item Therefore remember:
        \begin{description}
            \item[Stupid] things will not
                become smart because they are  in a list.
            \item Smart things, though, can be
                    presented beautifully in a list.
        \end{description}
\end{enumerate}
```

Example –output

1. You can mix the list environments to your taste:

   - But it might start to look silly.

   - With a dash.

2. Therefore remember:

   Stupid things will not become smart because they are in a list.

   Smart things, though, can be presented beautifully in a list.

Flushleft

- The environments `flushleft` and `flushright` generate paragraphs that are either left- or right-aligned. The `center` environment generates centred text. If you do not issue \\ to specify line breaks, LaTeX will automatically determine line breaks.

```
\begin{flushleft}
This text is\\ left-aligned.
\LaTeX{} is not trying to make
each line the same length.
\end{flushleft}
```

This text is
left-aligned. LaTeX is not trying to
make each line the same length.

Flushright

```
\begin{flushright}
This text is right-\\aligned.
\LaTeX{} is not trying to make
each line the same length.
\end{flushright}
```

> This text is right-aligned. LaTeX is not trying to make each line the same length.

Centre–

```
\begin{center}
At the centre\\of the earth
\end{center}
```

> At the centre
> of the earth

Quote

```
A typographical rule of thumb
for the line length is:
    \begin{quote}
    On average, no line should
    be longer than 66 characters.
    \end{quote}
This is why \LaTeX{} pages have
such large borders by default and
also why multicolumn print is
used in newspapers.
```

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> On average, no line should be longer than 66 characters.

This is why LaTeX pages have such large borders by default and also why multicolumn print is used in newspapers.

Verbatim

```
\begin{verbatim}
10 PRINT "HELLO WORLD ";
20 GOTO 10
\end{verbatim}
```

```
10 PRINT "HELLO WORLD ";
20 GOTO 10
```

Verse

```
I know only one English poem by
heart. It is about Humpty Dumpty.
\begin{flushleft}
\begin{verse}
Humpty Dumpty sat on a wall:\\
Humpty Dumpty had a great fall.\\
All the King's horses and all
the King's men\\
Couldn't put Humpty together
again.
\end{verse}
\end{flushleft}
```

I know only one English poem by heart. It is about Humpty Dumpty.

> Humpty Dumpty sat on a
>   wall:
> Humpty Dumpty had a
>   great fall.
> All the King's horses and
>   all the King's men
> Couldn't put Humpty
>   together again.

Tabular Environment

```
\begin{tabular}[b]{|r|l|}
\hline
7C0&hexadecimal\\
 3700 & octal\\
\cline{2-2} 1 & binary\\
\hline \hline
1984 & decimal \\
\hline
\end{tabular}
```

7C0	hexadecimal
3700	octal
1	binary
1984	decimal

Mathematics

```
Add $a$ squared and $b$ squared
to get $c$ squared. Or, using
a more mathematical approach:
$c^{2}=a^{2}+b^{2}$
```

Add a squared and b squared to get c squared. Or, using a more mathematical approach: $c^2 = a^2 + b^2$

```
Add $a$ squared and $b$ squared
to get $c$ squared. Or, using
a more mathematical approach:
\begin{displaymath}
c^{2}=a^{2}+b^{2}
\end{displaymath}
or you can type less with:
\[a+b=c\]
```

Add a squared and b squared to get c squared. Or, using a more mathematical approach:

$$c^2 = a^2 + b^2$$

or you can type less with:

$$a + b = c$$

Mathematics

```
\begin{equation} \label{eq:eps}
\epsilon > 0
\end{equation}
From (\ref{eq:eps}), we gather
\ldots{}From \eqref{eq:eps} we
do the same.
```

$$\epsilon > 0 \qquad\qquad (1)$$

From (1), we gather ...From (1) we do the same.

```
$\lim_{n \to \infty}
\sum_{k=1}^n \frac{1}{k^2}
= \frac{\pi^2}{6}$
```

$$\lim_{n\to\infty} \sum_{k=1}^n \frac{1}{k^2} = \frac{\pi^2}{6}$$

```
\begin{displaymath}
\lim_{n \to \infty}
\sum_{k=1}^n \frac{1}{k^2}
= \frac{\pi^2}{6}
\end{displaymath}
```

$$\lim_{n \to \infty} \sum_{k=1}^{n} \frac{1}{k^2} = \frac{\pi^2}{6}$$

Math Mode

There are differences between *math mode* and *text mode*. For example, in *math mode*:

1. Most spaces and line breaks do not have any significance, as all spaces are either derived logically from the mathematical expressions, or have to be specified with special commands such as `\,`, `\quad` or `\qquad`.

2. Empty lines are not allowed. Only one paragraph per formula.

3. Each letter is considered to be the name of a variable and will be typeset as such. If you want to typeset normal text within a formula (normal upright font and normal spacing) then you can enter the text using the

Mathematics $\mathbb{R}$

Mathematicians can be very fussy about which symbols are used: it would be conventional here to use 'blackboard bold', which is obtained using `\mathbb` from the package `amsfonts` or `amssymb`. The last example becomes

```
\begin{displaymath}
x^{2} \geq 0\qquad
\textrm{for all }x\in\mathbb{R}
\end{displaymath}
```

$$x^2 \geq 0 \qquad \text{for all } x \in \mathbb{R}$$

Mathematics

```
\begin{equation}
a^x+y \neq a^{x+y}
\end{equation}
```

$$a^x + y \neq a^{x+y} \tag{2}$$

```
\begin{displaymath}
1 + \left( \frac{1}{ 1-x^{2} }
    \right) ^3
\end{displaymath}
```

$$1 + \left(\frac{1}{1 - x^2} \right)^3$$

```
\newcommand{\ud}{\mathrm{d}}
\begin{displaymath}
\int\!\!\!\int_{D} g(x,y)
  \, \ud x\, \ud y
\end{displaymath}
instead of
\begin{displaymath}
\int\int_{D} g(x,y)\ud x \ud y
\end{displaymath}
```

$$\iint_D g(x,y)\,\mathrm{d}x\,\mathrm{d}y$$

instead of

$$\int\int_D g(x,y)\mathrm{d}x\mathrm{d}y$$

```
\begin{displaymath}
y = \left\{ \begin{array}{ll}
 a & \textrm{if $d>c$}\\
 b+x & \textrm{in the morning}\\
 l & \textrm{all day long}
   \end{array} \right.
\end{displaymath}
```

$$y = \left\{ \begin{array}{ll} a & \text{if } d > c \\ b+x & \text{in the morning} \\ l & \text{all day long} \end{array} \right.$$

```
{\setlength\arraycolsep{2pt}
\begin{eqnarray}
\sin x & = & x -\frac{x^{3}}{3!}
     +\frac{x^{5}}{5!}-{}
                    \nonumber\\
 & & {}-\frac{x^{7}}{7!}+{}\cdots
\end{eqnarray}}
```

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} -$$
$$-\frac{x^7}{7!} + \cdots \qquad (3)$$

```
\begin{eqnarray}
\lefteqn{ \cos x = 1
     -\frac{x^{2}}{2!} +{} }
                    \nonumber\\
 & & {}+\frac{x^{4}}{4!}
     -\frac{x^{6}}{6!}+{}\cdots
\end{eqnarray}
```

$$\cos x = 1 - \frac{x^2}{2!} +$$
$$+\frac{x^4}{4!} - \frac{x^6}{6!} + \cdots \qquad (4)$$

Mathematics **Bold**

```
\begin{displaymath}
\mu, M \qquad \mathbf{M} \qquad
\mbox{\boldmath $\mu, M$}
\end{displaymath}
```

$$\mu, M \qquad \mathrm{M} \qquad \mu, M$$

Notice that the comma is bold too, which may not be what is required.

The package `amsbsy` (included by `amsmath`) as well as the `bm` from the tools bundle make this much easier as they include a `\boldsymbol` command.

```
\begin{displaymath}
\mu, M \qquad
\boldsymbol{\mu}, \boldsymbol{M}
\end{displaymath}
```

$$\mu, M \qquad \mu, M$$

Phantoms

We can't see phantoms, but they still occupy some space in many people's minds. LaTeX is no different. We can use this for some interesting spacing tricks.

When vertically aligning text using ^ and _ LaTeX is sometimes just a little bit too helpful. Using the `\phantom` command you can reserve space for characters that do not show up in the final output. The easiest way to understand this is to look at the following examples.

```
\begin{displaymath}
{}^{12}_{\phantom{1}6}\textrm{C}
\qquad \textrm{versus} \qquad
{}^{12}_{6}\textrm{C}
\end{displaymath}
```

$$ {}^{12}_{6}\textrm{C} \qquad \textrm{versus} \qquad {}^{12}_{6}\textrm{C} $$

```
\begin{displaymath}
\Gamma_{ij}^{\phantom{ij}k}
\qquad \textrm{versus} \qquad
\Gamma_{ij}^{k}
\end{displaymath}
```

$$\Gamma_{ij}{}^{k} \qquad \textrm{versus} \qquad \Gamma_{ij}^{k}$$

Fonts

```
\begin{equation}
2^{\textrm{nd}} \quad
2^{\mathrm{nd}}
\end{equation}
```

$$2^{\mathrm{nd}} \quad 2^{\mathrm{nd}} \tag{5}$$

Sometimes you still need to tell LaTeX the correct font size. In math mode, this is set with the following four commands:

\displaystyle (123), \textstyle (123), \scriptstyle (123) and \scriptscriptstyle (123).

Changing styles also affects the way limits are displayed.

```
\begin{displaymath}
\mathop{\mathrm{corr}}(X,Y)=
 \frac{\displaystyle
   \sum_{i=1}^n(x_i-\overline x)
   (y_i-\overline y)}
  {\displaystyle\biggl[
 \sum_{i=1}^n(x_i-\overline x)^2
\sum_{i=1}^n(y_i-\overline y)^2
\biggr]^{1/2}}
\end{displaymath}
```

$$\mathrm{corr}(X,Y) = \frac{\displaystyle\sum_{i=1}^{n}(x_i - \overline{x})(y_i - \overline{y})}{\left[\displaystyle\sum_{i=1}^{n}(x_i - \overline{x})^2 \sum_{i=1}^{n}(y_i - \overline{y})^2\right]^{1/2}}$$

Theorems, Lemmas and such

```
\newtheorem{name}[counter]{text}[section]
```

The *name* argument is a short keyword used to identify the "theorem." With the *text* argument you define the actual name of the "theorem," which will be printed in the final document.

The arguments in square brackets are optional. They are both used to specify the numbering used on the "theorem." Use the *counter* argument to specify the *name* of a previously declared "theorem." The new "theorem" will then be numbered in the same sequence. The *section* argument allows you to specify the sectional unit within which the "theorem" should get its numbers.

After executing the **\newtheorem** command in the preamble of your document, you can use the following command within the

document.

$$\backslash \textbf{begin}\{name\}[text]$$

This is my interesting theorem

$$\backslash \textbf{end}\{name\}$$

```
% definitions for the document
% preamble
\newtheorem{law}{Law}
\newtheorem{jury}[law]{Jury}
%in the document
\begin{law} \label{law:box}
Don't hide in the witness box
\end{law}
\begin{jury}[The Twelve]
It could be you! So beware and
see law~\ref{law:box}\end{jury}
\begin{law}No, No, No\end{law}
```

Law 1 *Don't hide in the witness box*

Jury 2 (The Twelve) *It could be you! So beware and see law 1*

Law 3 *No, No, No*

\flushleft

\newtheorem{mur}{Murphy}[section]

\begin{mur}

If there are two or more

ways to do something, and

one of those ways can result

in a catastrophe, then

someone will do it.\end{mur}

Murphy 0.1 *If there are two or more ways to do something, and one of those ways can result in a catastrophe, then someone will do it.*