Basic LaTeX

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Contents

Before Start

You need some preparations before starting to use LaTeX.

1. Install MiKTeX or MacTeX

For Windows users, you are suggested to install MiKTeX. For MacOS users, you are suggested to install MacTeX.

2. Install Texmaker

Texmaker is a good Tex editor for beginners.

2.1 Setup Texmaker

Packages List

Common packages

1. fontenc: do not import for XeLaTeX!
2. inputenc: do not import for XeLaTeX!
3. babel
4. setspace
5. fancyhdr
6. textcomp: import before "gensymb" to prevent warning in latex but *do not import for XeLaTeX*
7. graphicx
8. xcolor
9. adjmulticol
10. wrapfig
11. subcaption
12. array

Maths packages

1. gensymb
2. amsmath
3. amssymb
4. amsfonts

Packages for XeLaTeX

1. fontspec
2. xeCJK
3. Do not import "textcomp"

XeLaTeX

XeLaTeX is different from LaTeX and pdfLaTeX since it directly read UTF-8. So, it is important to remember to set the compiler encoding into UTF-8.
It is convenient to use "xecjk" package to output Chinese in XeLaTeX. It is suggested to use XeLaTeX as main tool if you need to output Chinese

1 Basic Document Structure

\documentclass{article}
preamble
\begin{document}
content
\end{document}

2 How to make a title page

You can make a title page by using environment: "\begin{titlepage}", or you can just use"\maketitle", while it will leave the page number at the footage. If you use 'titlepage' environment, you will be able to adjust the page style.

3 Basic Skills

3.1 Basic Commands

1. spacing: ( ): quad(\quad), ( ): 3/18 quad(\,), ( ): 4/18 quad(\:), ( ): 5/18 quad(\;), (): -3/18 quad(\!)
2. "\renewcommand" and "\setlength"
3. "\renewcommand{\baselinestretch}{1.5}": set the spacing between lines to 1.5
4. \parindent 0ex: set paragraph indentation to 0ex
5. \parskip 5mm: change the spacing between paragraphs to 5mm
6. \vfill: fill the space by vertical spacing
7. \line(a,b){'length'}: a line with ratio {a(horizontal) : b(vertical)}
8. \cline{i-j}: partial horizontal line beginning in column i and ending in column j
9. \tableofcontents: create table of contents
10. \counter{page}: count page from current page
11. "\newpage" and "\clearpage": "newpage" just end the current column while "clearpage" start a new page
12. Some symbol can only display in math mode, e.g. '|' , '<' , '>' ...

3.2 Margin, Spacing and Placement

4 Units

Common units:

pt	mm	cm	in	ex	em	textwidth
1pt	2.84pt	28.4pt	72.27pt	height of 'x'	width of 'M'	483.69687pt

Uncommon units:

bp	pc	dd	cc	nd	nc	sp
1.00375pt	12pt	1.070pt	12.84pt	1.067	12.80	0.000015pt

5 Basic document formatting

5.1 Font size

Parameter	tiny	scriptsize	footnotesize	small	normalsize	large	Large	LARGE	huge	Huge
Sample	A	A	A	A	A	A	A	A	A	A
Size	5pt	7pt	8pt	9pt	10pt	12pt	14.4	17.28	20.74	24.88

5.2 Alignment

Flush left:
\begin{flushleft}
xxx
\end{flushleft}

Centre:
\begin{center}
xxx
\end{center}

Flush right:
\begin{flushright}
xxx
\end{flushright}

6 Table

6.1 Basic Table Structure

You can use "tabular" environment to build a table. The first line of the environment has the form:

"\begin[pos]{table spec}"

The "table spec" argument tells LaTeX the alignment to be used in each column and the vertical lines to insert. By default, if the text in a column is too wide for the page, LaTeX won't automatically wrap it. Using p{'width'} you can define a special type of column which will wrap-around the text as in a normal paragraph.

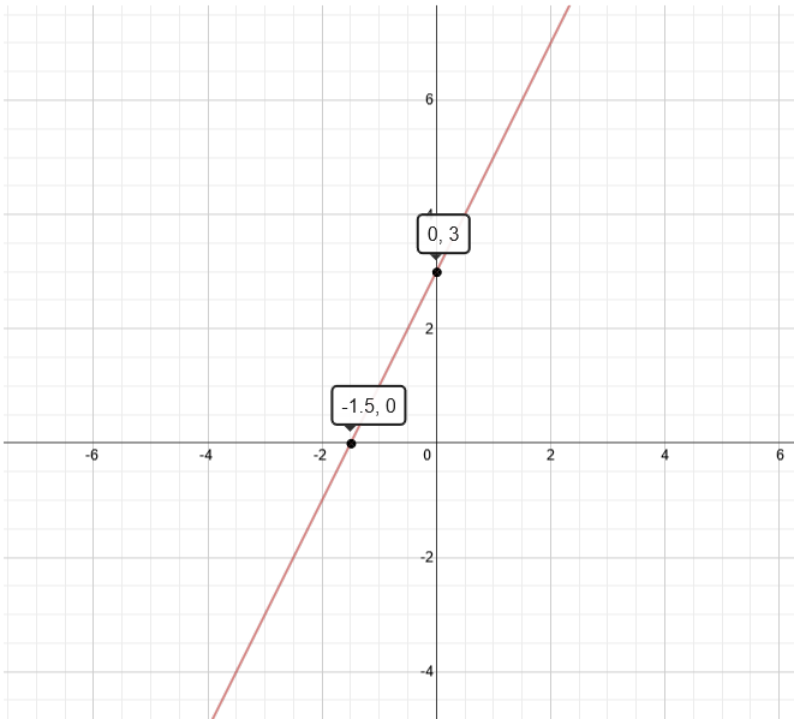
l	left-justified column
c	centered column
r	right-justified column
p{'width'}	paragraph column with text vertically aligned at the top
m{'width'}	paragraph column with text vertically aligned in the middle (requires array package)
b{'width'}	paragraph column with text vertically aligned at the bottom (requires array package)
|	vertical line
||	double vertical line

6.2 Table Formatting

There are some command in LaTeX to format your table. Instead of using "p{'width'}", you can just add "\parbox[t/c/b]{width}" after & sign.
The command "\renewcommand{\arraystretch}{'length'}" is defined to set the space between rows.
An alternative way to adjust the rule spacing is to add "\noalign{\smallskip}" before or after the "\hline" and "\cline{i-j}" commands

7 Graphics

It is possible to insert graphics inside LaTeX. However, this function is provided by external packages, you have to install the related packages if you want yo insert pictures. One of the packages is called ***graphicx***.
If you want to insert a picture using ***graphicx***, the command is "\includegraphics[scale=•]{name.format}".
Note that the pictures must be in the same file as the tex document, the file name must not include spacing, and the acceptable format of picture are *.jpg, .png, .gif, .pdf* only.



sample figure

8 Packages

There are necessary to use packages while building a document. Packages can change or adjust the outline or looking of the document. Packages have to be downloaded from the MikTeX Console and install before applying to LaTeX. Packages can be imported by "\usepackage" at the preamble, which is the blank area between "documentclass" and "\begin{document}".

9 Colour

You are able to change the colour of text using ***colorx*** package. Just simply using command "\color{color}". For Example, this is blue text.

10 Multi-Sources

The format of using multi-sources rather than putting in one .tex file are as below. The sources should be in the same location.

```
\documentclass{book}
\includeonly{chap1, appen1}
\begin{document}
\include{chap1}
\include{chap2}
\include{chap3}
\include{appen1}
\include{appen2}
\end{document}
```

11 Sections

Command: ‘\parameter’{‘Title’}

Parameter	Priority
part (in book and report)	Level -1
part (in article)	Level 0
chapter (only in book and report)	Level 0
section	Level 1
subsection	Level 2
subsubsection	Level 3
paragraph	Level 4
subparagraph	Level 5

12 Mathematics

It is suggested to use“ \frac” instead of “\over” in LxTeX.
Useful command: “\setlength{\mathindent}{0mm}” to set math mode indentation.

12.1 Basic Maths symbols

1. text: This is text in math mode instead of using mathrm
2. math font: D, D, D
3. textstyle and displaystyle: $\frac{1}{2}$ and $\dfrac{1}{2}$, $\binom{n}{r}$ and $\dbinom{n}{r}$
4. approach to: “\approx”: $\approx$
5. limit: “\lim_{a \to b}”
6. integral: “\int”: $\int_a^b$
7. limits: “\limits”: place argument at top or bottom, e.g $\int\limits_a^b$
8. vectors: “\vec”: $\vec{v}$
9. summation: “\sum”: $e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!}$
10. degree(°): by ‘***gensymb***’ package: “\degree”

12.2 Equation array

An equation array aims to group a set of equations. The format is as follows:
\begin{eqnarray}
equation 1
equation 2
⋮
equation n
\end{eqnarray}
Sample output:

$$\begin{aligned} y &= mx + c \quad (1) \\ x^2 + y^2 &= 1 \quad (2) \end{aligned}$$

12.3 Matrix withoit amsmath

You can make a matrix by array environment in mathematics environment. The following is the format:
$ \left(\begin{array}{clr} *{clr} is the same as tabular
a_{11} & a_{12} & a_{13}
b_{21} & b_{22} & b_{23}
c_{31} & c_{32} & c_{33}
\end{array} \right) $
Output: $\left(\begin{array}{clr} a_{11} & a_{12} & a_{13} \\ b_{21} & b_{22} & b_{23} \\ c_{31} & c_{32} & c_{33} \end{array} \right)$

12.4 Matrix with amsmath

You can use ***masmath*** package to easily build a matrix in matrix environment. There are "matrix", "pmatrix", "bmatrix", "vmatrix", "Vmatrix" and "smallmatrix" you can use. Below shows the sample outputs respectively. Note that "smallmatrix" is usually used to display matrix in a sentence.

$$\begin{matrix} a & b \\ c & d \end{matrix} \quad \begin{pmatrix} a & b \\ c & d \end{pmatrix} \quad \begin{bmatrix} a & b \\ c & d \end{bmatrix} \quad \begin{vmatrix} a & b \\ c & d \end{vmatrix} \quad \begin{Vmatrix} a & b \\ c & d \end{Vmatrix} \quad \left(\begin{smallmatrix} a & b \\ c & d \end{smallmatrix}\right)$$

The matrices as show above are limited to 10 columns. If you want to use more than 10 columns, just adjust "MaxMatrixCols" to desired value, for example 15: "\setcounterMaxMatrixCols{15}"

12.5 Alignment

Environment enclosed by: \begin{align} …\end{align}.
The environment is automatically in math mode.
Using & to be the indicator.
Example format:

The resultant force:
$$\begin{aligned} \overrightarrow{F_R} &= \overrightarrow{F_1} + \overrightarrow{F_2} \\ &= \{-4\vec{i} + 2\vec{j} - 3\vec{k}\} + \{3\vec{i} - 4\vec{j} - 2\vec{k}\} \\ &= \underline{\underline{\{-\vec{i} - 2\vec{j} - 5\vec{k}\}}} \text{ kN} \end{aligned}$$

The distance of OA: $\overrightarrow{r_{OA}} = \{3\vec{i} - 0.12\vec{j} + 0.2\vec{k}\}$ m

The distance of OB: $\overrightarrow{r_{OB}} = \{3\vec{i} + 0.12\vec{j} + 0.2\vec{k}\}$ m

Moment at point O:
$$\begin{aligned} \overrightarrow{M_O} &= \sum (\vec{r} \times \vec{F}) \\ &= \{3\vec{i} - 0.12\vec{j} + 0.2\vec{k}\} \times \{-4\vec{i} + 2\vec{j} - 3\vec{k}\} + \{3\vec{i} + 0.12\vec{j} + 0.2\vec{k}\} \times \{3\vec{i} - 4\vec{j} - 2\vec{k}\} \\ &= \underline{\underline{\{-0.2\vec{i} - 3.2\vec{j} - 6.84\vec{k}\}}} \text{ kNm} \end{aligned}$$