LaTeX Article Template

Your Name
Your Company / University

The Other Dude
His Company / University

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Contents

Abstract

A short description about what the document or article is providing information about...

This is a first document which is an excerpt from `https://www.learnlatex.org`. The *SciSpace* at `https://typeset.io/` has good information about scientific articles.

For bibliographic citations, while you can include reference sources directly in your document, usually you will get that information from one or more external files. Such a file is a database of references, containing the information in a processing-friendly format. Using one or more reference databases lets you reuse information and avoid manual formatting.

The mathematics showcase is from Graham et al. [1995], whereas there is some chemistry in Thomas et al. [2008, p. 56].

Some parenthetical citations: [Graham et al., 1995] and then [Thomas et al., 2008, p. 56].

[See Graham et al., 1995, pp. 45- 48]

Together [Graham et al., 1995, Thomas et al., 2008]

1 Title of first Section

Text of material in the first section

The syntax for using Inline math using $F(x) = x^a$.

$$x^2 + y^2 = 2$$

1.1 Text alignment

The default text alignment is "Justification" for LaTeX and in addition to "justification", there are 3 other variants:

left-justified,

right-justified and

centered text

The latter three have their own environments in which they can be used or switches with which they can be activated.

If the **environments** are used, a new paragraph is started each time.

Using `begin{flushleft} end{flushleft}`

One line with text
A second line with text
...

Normal text

One line with text A second line with text ...

Using `begin{flushright} end{flushright}`

One line with text
A second line with text
...

1.2 Subsection of the first section

Something about *apples* and *oranges*.

Some more math equations...

$$f(x) = x^2 \tag{1}$$

$$g(x) = \frac{1}{x} \tag{2}$$

$$I(x) = \int_a^b x^2 \, dx \tag{3}$$

2 Second section

Some text with *emphasis and* nested *content.*

Some text in *italic and nested content.*

Text of material for the first subsection.

$$e^{i\pi} + 1 = 0 \tag{4}$$

In the subsection 1.2 is equation 4.

2.1 Using listings

Some ordered and unordered lists here

1. An entry
2. Another one
3. Wow! 3 entries

- An entry
- Another one
- Wow! 3 entries

If you want to change the numbers, it works in a similar way. To do this, the display symbol (label field) of the enumeration is changed. For example like "1 abc" as follows

a one

b two

c three

We can inslude a parentheses as well as shown here:

a) one

b) two

c) three

Using roman numerals is possible as well:

i one

ii two

iii three

2.2 Explicit formatting

Sometimes you want to make text bold, or italic, or monospaced, etc. There are two types of command for this:

ones for short pieces of text, and ones for 'running' material.

For short bits of text, we use `\textbf`, `\textit`, `\textrm`, `\textsf`, `\texttt` and `\textsc`.

Let's have some font fun:

i **bold**

ii *italic*

iii roman

iv sans serif

v `monospaced` and

vi SMALL CAPS

The default typesetting style can be amended by using the `\displaystyle` command:

$$a_0 + \cfrac{1}{a_1 + \cfrac{1}{a_2 + \cfrac{1}{a_3 + \cfrac{1}{a_4}}}}$$

Normal continued fraction by using the `\cfrac` from *amsmath.sty* within $ environment can be written as:

$$\cfrac{1}{1 + \cfrac{1}{1 + \cfrac{1}{1 + \cfrac{1}{1 + \cfrac{1}{1+x}}}}}$$

Here's another example which demonstrates the effect of `\textstyle`, `\scriptstyle` and `\scriptscriptstyle`:

$$z(x) = \sum_{i=0}^{n} \frac{a_i}{1+x}$$

$$z(x) = \sum_{i=0}^{n} \frac{a_i}{1+x}$$

$$z(x) = \sum_{i=0}^{n} \frac{a_i}{1+x}$$

$$z(x) = \sum_{i=0}^{n} \frac{a_i}{1+x}$$

2.3 LaTeX fractions without line or slash

With the command `\substack{numerator \ denominator}` you will be able to set a fraction without slash as shown here:

$\substack{a \\ b}$

It will also work within displaymath environment:

$$\substack{a \\ b}$$

2.4 Parenthesis around fraction

If you want to clamp fractions, you should use the `\left` and `\right` variants.

Without left and right: `$(\frac{a^{2}}{2})$`

$(\frac{a^2}{2})$

With left and right: `$\left( \frac{a^{2}}{2} \right)$`

$\left(\frac{a^2}{2} \right)$

2.5 Using cancel usepackage

The cancel.sty usepackage contains the following four commands for simplifying (reducing) of fractions.

Table 1: Using the cancel.sty

Command	**Example**	**Description**
α	β	γ
`$\cancel{24}$`	$\cancel{24}$	Stroke / Line from bottom left to top right
`$\bcancel{24}$`	$\bcancel{24}$	Stroke / Line from top left to bottom right
`$\xcancel{24}$`	$\xcancel{24}$	Two crossing strokes (combination of the first two commands)
`$\cancelto{23}{46}$`	$\cancelto{23}{46}$	Reducing to ...

A few examples to follow:

```
\frac{\cancel{24}}{\cancel{8}} = 3$\

\frac{\cancel{24}}{\bcancel{8}} = 3$\

\frac{\xcancel{24}}{\bcancel{8}} = 3$\

\frac{\cancelto{23}{46}}{\cancelto{4}{8}} = \frac{23}{4}$\
```

Output:

$\frac{\cancel{24}}{\cancel{8}} = 3$
$\frac{\cancel{24}}{\bcancel{8}} = 3$
$\frac{\xcancel{24}}{\bcancel{8}} = 3$
$\frac{\cancelto{23}{46}}{\cancelto{4}{8}} = \frac{23}{4}$

3 Third Section

This is a sample document with some dummy text[1]. This paragraph is quite long as we might want to see the effect of making the document have two columns.

Testing a figure.

[1] and a footnote can be inserted using footnote command

Figure 1: An example cute dog image

3.1 Subsection with Arrays

In a table body columns are separated using an ampersand & and a new row is started using

.

Animal	Food	Size
dog	meat	medium
horse	hay	large
frog	flies	small

3.2 Table with lot of text

If a table column contains a lot of text you will have issues to get that right with only l, c, and r. See what happens in the following example:

Animal	Description
dog	The dog is a member of the genus Canis, which forms part of the wolf-like canids, and is the most widely abundant terrestrial carnivore.
cat	The cat is a domestic species of small carnivorous mammal. It is the only domesticated species in the family Felidae and is often referred to as the domestic cat to distinguish it from the wild members of the family.

Adding of rules.

Animal	Food	Size
dog	meat	medium
horse	hay	large
frog	flies	small

More rules.

Animal	Food	Size
dog	meat	medium
horse	hay	large
frog	flies	small

subsectionMerging of cells

In LaTeX you can merge cells horizontally by using the multicolumn command. It has to be used as the first thing in a cell. multicolumn takes three arguments:

- The number of cells which should be merged
- The alignment of the merged cell
- The contents of the merged cell

The alignment can contain anything legal in a tabular's preamble, but only a single column type.

Animal	Food	Size
dog	meat	medium
horse	hay	large
frog	flies	small
fuath	unknown	

Group	Animal	Size
herbivore	horse	large
	deer	medium
	rabbit	small
carnivore	dog	medium
	cat	small
	lion	large
omnivore	crow	small
	bear	large
	pig	medium

3.3 Using color boxes and borders

The example shows how to use the `xcolor` package to change the color of LaTeX page elements.

- First item
- Second item

The background color of text can also be easily set. For instance, you can change use an orange background and then continue typing.

A colored background box may be created using `\colorbox{Color}{Text}` as shown here. For example the word "Colored Text" on a pink background Colored Text.

Another example, Gold color text on maroon background

Colored and framed equations can be specified using the `\fcolorbox` option as shown here:

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

Colored and framed listings are possible as well:

- listing
- key point 1
- key point 2

i. enumeration
ii. key point
iii. key point

4 All Mathematics

A sentence with inline mathematics: $y = mx + c$.

A second sentence with inline mathematics: $5^2 = 3^2 + 4^2$.

A second paragraph containing display math.

$$y = mx + c$$

See how the paragraph continues after the display.

Superscripts a^b and subscripts a_b.

Some mathematics: $y = 2 \sin \theta^2$.

A paragraph about a larger equation.

$$\int_{-\infty}^{+\infty} e^{-x^2}\,dx$$

4.1 AMSMath package

Mathematical notation is very rich, and this means that the tools built into the LaTeX kernel can't cover everything. The *amsmath* package extends the core support to cover a lot more ideas. The `amsmath User Guide` contains many more examples than we can show in this lesson.

Solve the following recurrence for $n, k \geq 0$:

$$\begin{aligned} Q_{n,0} &= 1 \quad Q_{0,k} = [k = 0]; \\ Q_{n,k} &= Q_{n-1,k} + Q_{n-1,k-1} + \binom{n}{k} \quad \text{for } n,\ k > 0. \end{aligned}$$

`\align*` environment makes the equations line up on the ampersands, the & symbols, just like a table. Notice how we've used `\quad` to insert a bit of space, and `\text` to put some normal text inside math mode. We've also used another math mode command, `\binom`, for a binomial.

Notice that here we used `align*`, and the equation didn't come out numbered. Most math environments number the equations by default, and the starred variant (with a *) disables the numbering.

The package also has several other convenient environments, for example for matrices.

$$\begin{matrix} a & b & c \\ d & e & f \end{matrix} \quad \begin{pmatrix} a & b & c \\ a & e & f \end{pmatrix} \quad \begin{bmatrix} a & b & c \\ a & e & f \end{bmatrix}$$

4.2 Fonts in Math mode

Unlike normal text, font changes in math mode often convey very specific meaning. They are therefore often written explicitly. There are a set of commands you need here:

- `\mathrm`: roman (upright)
- `\mathit`: italic spaced as 'text'
- `\mathbf`: bold face
- `\mathsf`: sas serif
- `\mathtt`: monospaced (typewriter)
- `\mathbb`: double-struck (blackboard bold) (provided by the amsfonts package)

Each of these takes Latin letters as an argument, so for example we might write a matrix as

"The matrix $\mathbf{M}$"

5 Paragraph spacing

One common style is to have no indents for paragraphs, but instead to have a 'blank line' between them. We can achieve that using the *parskip* package.

Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

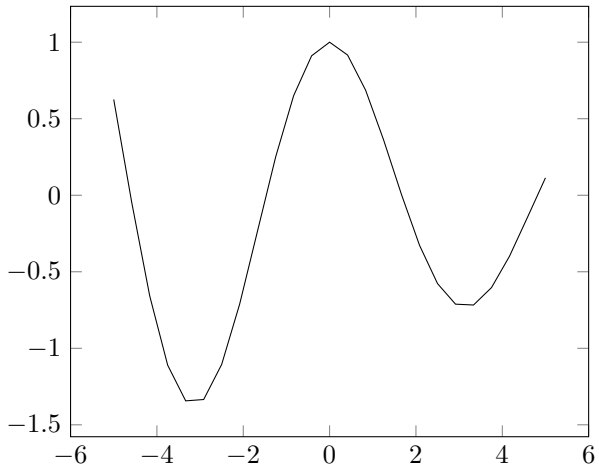
6 PGF Plotting

We are following a sample from `https://latexdraw.com/plot-a-function-and-data-in-latex/`. Additional details and documentation are available at `https://github.com/pgf-tikz/pgfplots`.

It is important to use the command `\pgfplotsset{compat = newest}` to specify to the compiler that we are working with the last version of the Pgfplots package.

6.1 The plotting of equations

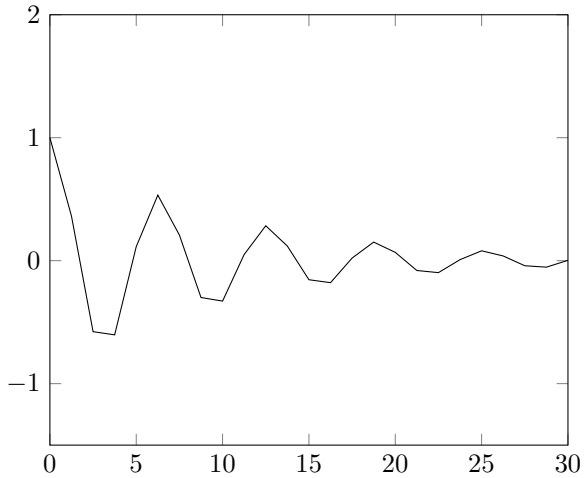
In order to start plot functions and data in TikZ we need to create the axis environment within the tikzpicture environment. All the pgfplots commands must be inside the axis environment.



Updating the picture with proper domain and range values as the same are auto determined in the earlier case. We have the below options for changing the plot limits:

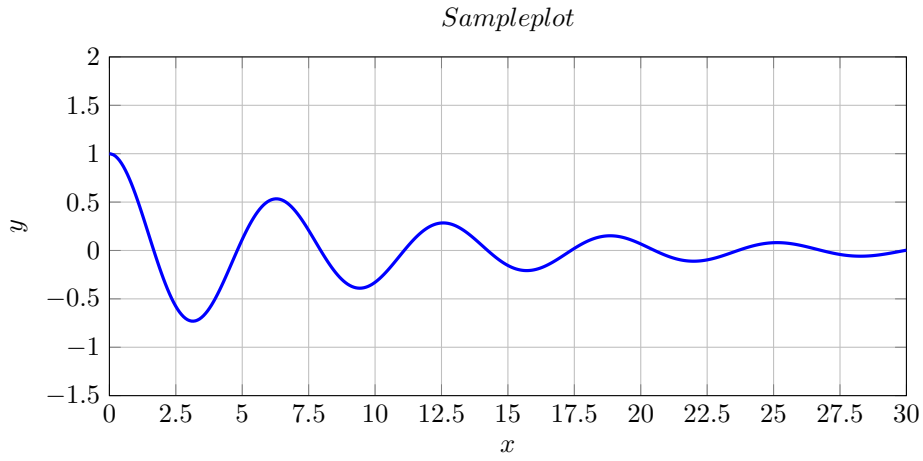
- *xmin*=<*value*>: Lower limit in the x-axis for the plot.
- *xmax*=<*value*>: Upper limit in the x-axis for the plot.
- *ymin*=<*value*>: Lower limit in the y-axis for the plot.
- *ymax*=<*value*>: Upper limit in the y-axis for the plot.

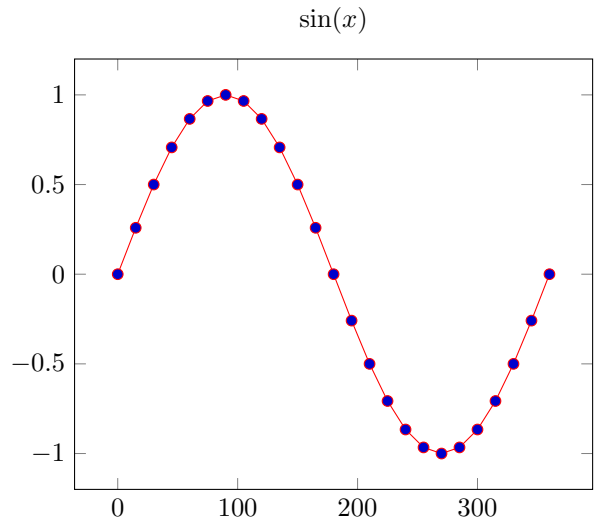
The domain of the function is independent of the limits of the axes, but usually it takes the same values to get a plot that fills the axis and it takes the format domain = a:b.



We can further customize the plot by setting the smoothness, thickness and

color etc., as shown below:





6.2 Adding captions and labelling

We can provide names or labels to the generated figures as demonstrated here

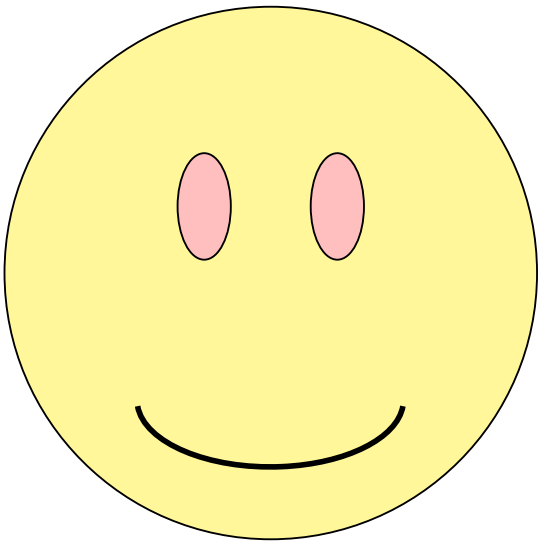


Figure 2: Set of balls

References

Ronald L. Graham, Donald E. Knuth, and Oren Patashnik. *Concrete Mathematics*. Addison-Wesley, 1995.

Christine M. Thomas, Tianbiao Liu, Michael B. Hall, and Marcetta Y. Darensbourg. Series of mixed valent Fe(II)Fe(I) complexes that model the H(OX) state of [FeFe]hydrogenase: Redox properties, density-functional theory investigation, and reactivity with extrinsic CO. *Inorg. Chem.*, 47(15):7009–7024, 2008. doi: 10.1021/ic800654a.