

LaTeX Part 2

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1 Mathematical Equations

1.1 Inline Math mode

Either write your **mathematical formula** between `$..$` or between `\(..\)` as in: $f(x) = x^2 + 1$ or $f(x) = \sum_{i=1}^N x_i$ This is the second line, use of setspace package to adjust line spacing.

1.2 Display Math mode

When you want to show your formula or equation on a separate line centered.

1.2.1 Use equation or equation* environment

Write your formula in a display math mode with equations being numbered automatically.

$$f(x) = \sum_{i=1}^N x_i \tag{1}$$

1.2.2 Unnumbered display math equation

Use `\[..\]` :

$$f(x, k) = \sum_{i=1}^N \frac{x_i}{k_i}$$

1.3 Mathematical symbols and special characters

Each of the mathematical symbols and special characters used in mathematical formulas has each own command like `\sum`, `\int`, `\infty`, `\rightarrow`, `\sqrt`, `\bigotimes`, `\alpha`, `\beta`, `\gamma`, `\delta`, `\Delta`, `\pi`, `\chi`, `\omega`, `\theta`,

$\backslash\Theta$, $\backslash\approx$

$$\sum, \int, \infty, \Rightarrow, \sqrt{}, \bigotimes, \alpha, \beta, \gamma, \delta, \Delta, \pi, \chi, \omega, \theta, \Theta, \approx \dots$$

1.4 Arrays

Matrices, determinants and set of equations can be displayed using the array environment as in equations (2), (3) and (4).

$$\begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix} \times \begin{pmatrix} 2 & 0 \\ 1 & 3 \end{pmatrix} = \begin{bmatrix} 4 & 6 \\ 1 & 3 \end{bmatrix} \quad (2)$$

$$\begin{vmatrix} 1 & 2 & 3 \\ 0 & 1 & 0 \\ 1 & 1 & 1 \end{vmatrix} = -2 \quad (3)$$

$$\left\{ \begin{array}{l} f(x) = x^2 + 1 \\ f(x) = \sqrt{x} \\ f(x) = \frac{1}{e^{-x}} \end{array} \right\} \quad (4)$$

1.5 Spacing

By default, all spaces are ignored within mathematical formula as within text. In some cases it is needed to adjust spacing for some formulas to be more readable as in the below example. \backslash , for thin space, $\backslash:$ for medium space, $\backslash!$ for negative thin space and $\backslash;$ for thick space.

$$\int \int z dx dy$$

$$\iint z \, dx dy$$

$$\int_{i=0}^{\infty} \int_{i=0}^{\infty} z \, dx dy$$

1.6 Formatting

To change the format of any part of the mathematical formula, you can use the following commands `\mathbf`, `\mathit`, `\mathcal`, `\mathtt`, `\mathsf`, `\mathrm` in L^AT_EXmath mode.

$$\mathbf{Y} = \mathcal{F} * \mathbf{X} \quad \text{where } \mathbf{X} = \dots \text{ and } \mathcal{F} \text{ is the } \dots$$

Use `\boldmath` to make all the formula bold $\mathbf{X} \Leftarrow \mathbf{Y}$ or even within formula.

Changing size of scripts can be done using `\textstyle`: $e^{y(i)} = e^{x(i)}$. Other styles include `\displaystyle`, `\scriptstyle` and `\scriptscriptstyle`.

1.7 Multi-line equations

- Using `split` environment

$$\begin{aligned} A &= \frac{\pi r^2}{2} \\ &= \frac{1}{2} \pi r^2 \end{aligned} \tag{5}$$

- Using `align/align*` environment in `amsmath` package

$$f(x) = x^2 \quad (6)$$

$$g(x) = \frac{1}{x} \sqrt{x^3 + 2x^2 + 5} \quad (7)$$

$$F(x) = \int_b^a \frac{1}{3} x^3 \quad (8)$$

$$\begin{array}{lll} x = y & w = z & a = b + c \\ 2x = -y & 3w = \frac{1}{2}z & a = b \\ -4 + 5x = 2 + y & w + 2 = -1 + w & ab = cb \end{array}$$

1.8 Exercise

$$F(x, y) = 0 \quad \text{and} \quad \begin{vmatrix} F_{xx} & F_{xy} & F_x \\ F_{yx} & F_{yy} & F_y \\ F_x & F_y & 0 \end{vmatrix} = 0 \quad (9)$$

Table 1: Gaussian distribution

Written as	$f(x)$	$\mathbb{E}[X]$	mode	$\text{Var}[X]$
$X \sim \mathcal{N}(\mu, \sigma^2)$	$\frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{1}{2\sigma^2}(x-\mu)^2}$	μ	μ	σ^2

2 Revisiting Figures

It is usually preferable to adding all images in a folder at the same directory of your tex file, you can inform latex about this directory using `\graphicspath{{images/}}` for example to use the name of your image file directly with the `\includegraphics` command.

Now we present how to add multiple images using the subfigure environment and subcaption package as in Figure 1. Notice that the fourth cat and the fifth cat in Figure (2d) and (2e) cannot fit beside each other, each is 0.5 of line width but there should be a spacing between images. (Look in the tex code)

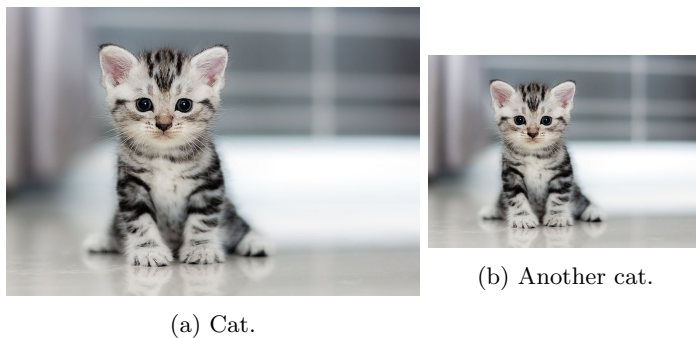


Figure 1: Adding two images.

3 Revisiting Tables

3.1 Adjusting tables for decimal values alignment

Table 2 shows how the decimal points are not aligned and it appears according to left-aligned/centered/right-aligned options provided to tabular environment `l—r—c`. To do the alignment for better comparison between numbers, you have to use package `\usepackage{siunitx}`, and replace `l` or `r` or `c` with `"S"`.

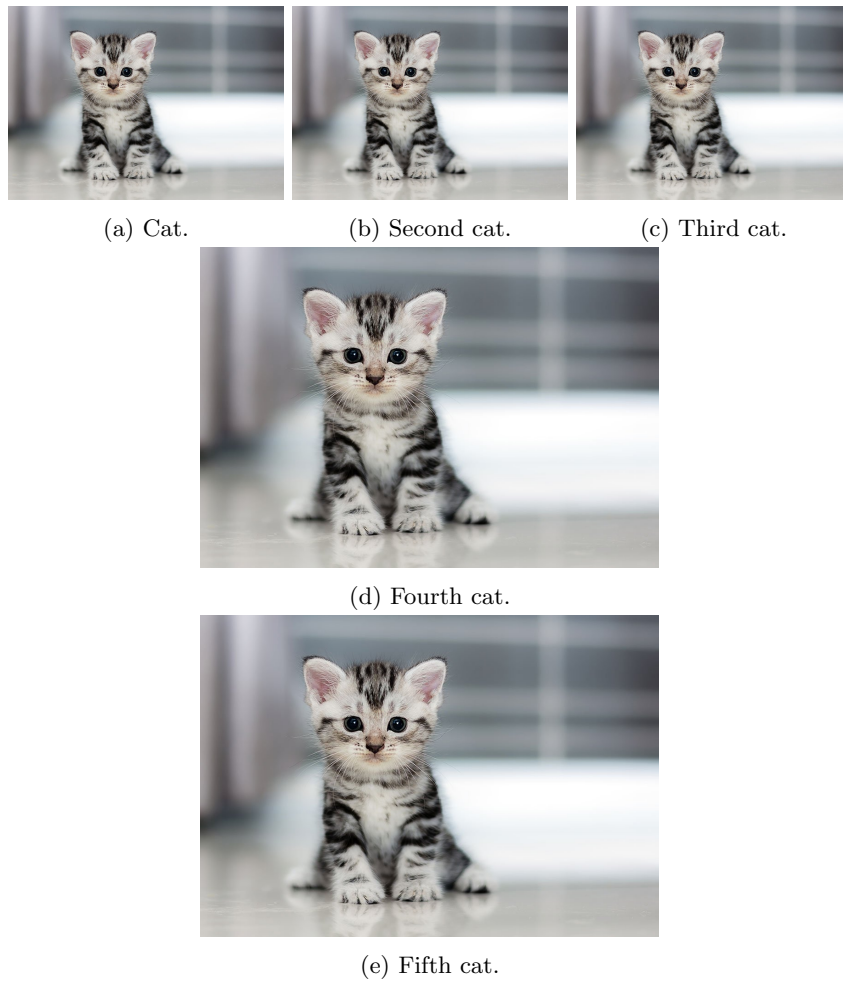


Figure 2: Many cats.

For cells that span multiple rows or columns, we have to use multirow package `\multirow` in the preamble and use `\multirow`, `\multicolumn` as in Table 4.

Table 2: Decimal points table without alignment

x	y1	y2
x1	0.9862	30.1117
x2	100.54	3.48
x3	1000.37897	0.0378

Table 3: Decimal points table with alignment

x	y1	y2
x1	0.99	30.11
x2	100.54	3.48
x3	1000.38	0.04

Table 4: Multirow and multi-column table.

Value 1	Value 2	Value 3
1	69	a
	1.39	b
2		f
3		a
		b
4	2300.11	c
5	25.11	d

3.2 Multipages tables

For a table to span multiple pages we have to use package Longtable `\longtable` and then use `longtable` environment instead of the `table` and `tabular` environments. This makes the table header to be repeated at every page and not cropped and the caption will show only at the start of the table.

Table 5: Multipage table.

Value 1	Value 2	Value 3
1	1110.10	a
2	10.10	b
3	23.11	c
1	1110.10	a
2	10.10	b
3	23.11	c

Value 1	Value 2
1	1110.10	a
2	10.10	b
3	23.11	c
1	1110.10	a
2	10.10	b
3	23.11	c
1	1110.10	a
2	10.10	b
3	23.11	c
1	1110.10	a
2	10.10	b
3	23.11	c
1	1110.10	a
2	10.10	b
3	23.11	c
1	1110.10	a
2	10.10	b
3	23.11	c
1	1110.10	a
2	10.10	b
3	23.11	c
1	1110.10	a
2	10.10	b

Value 1	Value 2
3	23.11	c
1	1110.10	a
2	10.10	b
3	23.11	c
1	1110.10	a
2	10.10	b
3	23.11	c

3.3 Landscape tables

To let wide tables appear in a landscape view, you can use `\usepackage{rotating}` and use the `sideways table` environment instead of the `table` environment

3.4 Tables from Comma Separated Value Files (.csv)

Writing tables in LaTeX by hand is a very time-consuming and error-prone task and usually you already have your results in a spreadsheet. Here we discuss how to read the cells values from the csv instead of writing or copying it. First export your spreadsheet to a .csv format.

4 Bibliography and referencing

You can cite any reference using the command `\cite{citationKEY}` [1] , [2] and [3].

Thank you.

Hope it was easy for you getting started with L^AT_EX.

References

- [1] K. Ng, *Subword-based approaches for spoken document retrieval*. PhD thesis, Massachusetts Institute of Technology. Dept. of Electrical Engineering and Computer Science, USA, 2000.
- [2] S. Russel and P. Norvig, *Artificial Intelligence: A Modern Approach*. Publisher, 2008.
- [3] M. Ma, “Spoken keyword rescoring and document retrieval for low-resource languages,” in *Proceedings of the 16th Annual Conference of the International Speech Communication Association*, 2015.
- [4] B. Patel and B. Meshram, “Content based video retrieval systems,” *International Journal of UbiComp (IJU)*, vol. 3, no. 2, 2012.

Table 6: Landscape table.

Value 1	Value 2	Value 3
1	1110.10	a
2	10.10	b
3	23.11	c

Table 7: Autogenerated table from .csv file.

PassengerId	Pclass	Age	SibSp	Parch
892	3	34.5	0	0
893	3	47	1	0
894	2	62	0	0
895	3	27	0	0
896	3	22	1	1
897	3	14	0	0
898	3	30	0	0
899	2	26	1	1
900	3	18	0	0
901	3	21	2	0
902	3		0	0
903	1	46	0	0
904	1	23	1	0
905	2	63	1	0
906	1	47	1	0
907	2	24	1	0
908	2	35	0	0
909	3	21	0	0
910	3	27	1	0
911	3	45	0	0
912	1	55	1	0
913	3	9	0	1
914	1		0	0
915	1	21	0	1
916	1	48	1	3
917	3	50	1	0
918	1	22	0	1
919	3	22.5	0	0
920	1	41	0	0
921	3		2	0
922	2	50	1	0
923	2	24	2	0
924	3	33	1	2
925	3		1	2
926	1	30	1	0
927	3	18.5	0	0
928	3		0	0
929	3	21	0	0
930	3	25	0	0
931	3		0	0
932	3	39	0	1