

# Markdown and LaTeX introduction

[Markdown](#) is a text-to-HTML conversion tool for web writers. Markdown allows you to write using an easy-to-read, easy-to-write plain text format, then convert it to structurally valid XHTML (or HTML). A Markdown document could contain chunks of embedded graphics, source codes and LaTeX formula. [LaTeX](#) is a high-quality typesetting system; it includes features designed for the production of technical and scientific documentation. A basic knowledge about Markdown and LaTeX could let to create HTML documents such as weblogs or reports very easily. This tutorial provides a quick reference to use Markdown and LaTeX.

## Markdown

The following provides a quick reference to the most commonly used Markdown syntax.

### Headers

H3

H4

H5

H6

```
# Markdown
The following provides a quick reference to the most commonly used Markdown syntax.

## Headers
### H3
#### H4
##### H5
##### H6
```

### Emphasis

*Italic* and **Bold**

```
*Italic* and **Bold**
```

~~Scratched Text~~

```
~~Scratched Text~~
```

superscript<sup>2</sup>

```
superscript^2^
```

Markdown doesn't support underline, but we can use HTML Text instead. Also, **we** can *render* almost any **HTML** code that we like such as superscript<sup>2</sup>.

```
Markdown doesn't support underline, but we can use <u>HTML Text</u> instead. Also, <b>we</b> can
<i>render</i> almost any <span style="color:red;">HTML</span> code that we &nbsp;<kbd>like</kbd>
&nbsp;<sup>2</sup>.
```

For manual line or page breaks, we can use following HTML and CSS codes:

- Line breaks:

```
<br />
```

- Print breaks:

```
<p style="page-break-after :a lways;"></p>
```

## Lists

- Item 1
- Item 2
  - Item 2a
  - Item 2b
    - Item 2b-1
    - Item 2b-2

```
- Item 1
- Item 2
  - Item 2a (2 tabs)
  - Item 2b
    - Item 2b-1 (4 tabs)
    - Item 2b-2
```

1. Item 1
2. Item 2
3. Item 3
  - Item 3a
  - Item 3b

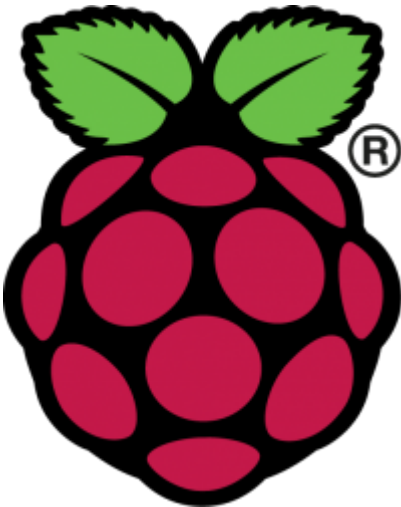
```
1. Item 1
2. Item 2
3. Item 3
  - Item 3a
  - Item 3b
```

## Links

[Github](#)

```
[Github](http://www.github.com/)
```

## Images



```
<p align="center">
![logo](https://www.raspberrypi.org/app/uploads/2018/03/RPi-Logo-Reg-SCREEN-199x250.png "Raspberry pi")
</p>
```

Note that here we used an HTML code to align center the image. Also, we can use HTML to add more styles, for example:

```
<p align="center">

</p>
```

Quotes

Imagination is more important than knowledge.

Albert Einstein

```
> Imagination is more important than knowledge.
>
> Albert Einstein
```

Hlines

Use three dashes --- to draw an horizontal line like:

```
---
```

Tables

1st Header	2nd Header	3rd Header
col 1 is	left-aligned	1
col 2 is	center-aligned	2
col 3 is	right-aligned	3

```
1st Header|2nd Header|3rd Header
---|:---:|---:
col 1 is|left-aligned|1
col 2 is|center-aligned|2
col 3 is|right-aligned|3
```

Note that we can use HTML styles to hide tables' overflow by putting them in a division like:

```
<div "margin-bottom: 1rem; overflow-x: auto;">
...
</div>
```

Also, we can use overflow-x: scroll to always scroll or overflow-x: hidden to hide them compeletely.

Code blocks

In Markdown, we can simply add plain code blocks to display (not evaluating) by inserting triple back quote i.e. `````. For example:

```
norm = function(x) {
  sqrt(x%*%x)
}
norm(1:4)
```

```
` ``r
norm <- function(x) {
  sqrt(x%*%x)
}
norm(1:4)
` ``
```

For inline plain codes use single back quote before and after the code, for example we defined `this codes here` in this way.

## YAML header

At the top of a Markdown document, we can insert the following meta data such that:

```
---
title: "Page Title"
subtitle: "Page sub-title"
author: "Author name"
description: "This is a test"
institute: "MU"
date: "20/02/2020"
abstract: "YAML "
keywords:
  - key1
  - key2
tags:
  - tag1
  - tag2
---
```

## Mathematical formula

We can use LaTeX to write mathematical equations in Markdown. To write inline LaTeX formula use a single `$` before and after the equation and use a double `$` to display equations.

# LaTeX

The following provides a quick reference of the most commonly used LaTeX syntax. You may find a more extensive references about mathematical formulas at [LaTeX Wikibooks](#).

## LaTeX equations

Inline equation: *equation*

```
Inline equation: $equation$
```

Display equation:

*equation*

```
Display equation: $$equation$$
```

## Operators

- $x + y$
- $x - y$
- $x \times y$
- $x \div y$
- $\frac{x}{y}$

- $\sqrt{x}$

- $x + y$
- $x - y$
- $x \times y$
- $x \div y$
- $\frac{x}{y}$
- $\sqrt{x}$

## Symbols

- $\pi \approx 3.14159$
- $\pm 0.2$
- $\frac{0}{1} \neq \infty$
- $0 < x < 1$
- $0 \leq x \leq 1$
- $x \geq 10$
- $\forall x \in (1,2)$
- $\exists x \notin [0,1]$
- $A \subset B$
- $A \subseteq B$
- $A \cup B$
- $A \cap B$
- $X \implies Y$
- $X \impliedby Y$
- $a \rightarrow b$
- $a \longrightarrow b$
- $a \Rightarrow b$
- $a \implies b$
- $a \propto b$

- $\pi \approx 3.14159$
- $\pm \, 0.2$
- $\frac{0}{1} \neq \infty$
- $0 < x < 1$
- $0 \leq x \leq 1$
- $x \geq 10$
- $\forall \, x \in (1,2)$
- $\exists \, x \notin [0,1]$
- $A \subset B$
- $A \subseteq B$
- $A \cup B$
- $A \cap B$
- $X \implies Y$
- $X \impliedby Y$
- $a \rightarrow b$
- $a \longrightarrow b$
- $a \Rightarrow b$
- $a \implies b$
- $a \propto b$

- $\bar{a}$
- $\tilde{a}$
- $\breve{a}$
- $\hat{a}$
- $a'$
- $a^\dagger$
- $a^*$
- $a^\star$

- $\mathcal{A}$
- $\mathfrak{a}$
- $\cdots$
- $\vdots$
- $\#$
- $\$$
- $\%$
- $\&$
- $\{ \}$
- $-$

- `$\bar a$`
- `$\tilde a$`
- `$\breve a$`
- `$\hat a$`
- `$a^ \prime$`
- `$a^ \dagger$`
- `$a^ \ast$`
- `$a^ \star$`
- `$\mathcal A$`
- `$\mathrm a$`
- `$\cdots$`
- `$\vdots$`
- `$\#$`
- `$\$$`
- `$\%$`
- `$\&$`
- `$\{ \}$`
- `$\_ $`

## Space

- Horizontal space: `\quad`
- Large horizontal space: `\qquad`
- Small space: `\,`
- Medium space: `\:`
- Large space: `\;`
- Negative space: `\!`

## Greek alphabets

Small Letter	Capital Letter	Alternative
$\alpha$ <code>\alpha</code>	$A$ <code>A</code>	
$\beta$ <code>\beta</code>	$B$ <code>B</code>	
$\gamma$ <code>\gamma</code>	$\Gamma$ <code>\Gamma</code>	
$\delta$ <code>\delta</code>	$\Delta$ <code>\Delta</code>	
$\epsilon$ <code>\epsilon</code>	$E$ <code>E</code>	$\varepsilon$ <code>\varepsilon</code>
$\zeta$ <code>\zeta</code>	$Z$ <code>Z</code>	
$\eta$ <code>\eta</code>	$H$ <code>H</code>	
$\theta$ <code>\theta</code>	$\Theta$ <code>\Theta</code>	$\vartheta$ <code>\vartheta</code>
$\iota$ <code>\iota</code>	$I$ <code>I</code>	

Small Letter	Capital Letter	Alternative
$\kappa$ \kappa	$K$ K	$\varkappa$ \varkappa
$\lambda$ \lambda	$\Lambda$ \Lambda	
$\mu$ \mu	$M$ M	
$\nu$ \nu	$N$ N	
$\xi$ \xi	$\Xi$ \Xi	
$o$ \omicron	$O$ O	
$\pi$ \pi	$\Pi$ \Pi	$\varpi$ \varpi
$\rho$ \rho	$P$ P	$\varrho$ \varrho
$\sigma$ \sigma	$\Sigma$ \Sigma	$\varsigma$ \varsigma
$\tau$ \tau	$T$ T	
$v$ \upsilon	$\Upsilon$ \Upsilon	
$\phi$ \phi	$\Phi$ \Phi	$\varphi$ \varphi
$\chi$ \chi	$X$ X	
$\psi$ \psi	$\Psi$ \Psi	
$\omega$ \omega	$\Omega$ \Omega	

## Equations

$$\mathbb{N} = \{a \in \mathbb{Z} : a > 0\}$$

```
$$\mathbb{N} = \{ a \in \mathbb{Z} : a > 0 \}$$
```

$$\forall x \in X \quad \exists y \leq \epsilon$$

```
$$\forall x \in X \quad \exists y \leq \epsilon$$
```

$$X \sim \textit{Normal}(\mu, \sigma^2)$$

```
$$\color{blue}{X \sim \textit{Normal}(\mu, \sigma^2)}$$
```

$$P\left(A=2 \left| \frac{A^2}{B} > 4 \right.\right)$$

```
$$P \left( A=2 \ , \ \middle| \ , \ \dfrac{A^2}{B}>4 \ \right)$$
```

$$f(x) = x^2 - x^{\frac{1}{\pi}}$$

```
$$f(x) = x^2 - x^{\frac{1}{\pi}}$$
```

$$f(X,n) = X_n + X_{n-1}$$

```
$$f(X,n) = X_n + X_{n-1}$$
```

$$f(x) = \sqrt[3]{2x} + \sqrt{x-2}$$

```
$$f(x) = \sqrt[3]{2x} + \sqrt{x-2}$$
```

$$e = \sum_{n=0}^{\infty} \frac{1}{n!}$$

```
$$\mathrm{e} = \sum_{n=0}^{\infty} \frac{1}{n!}$$
```

$$\prod_{i=1}^n x_i - 1$$

```
$$\prod_{i=1}^n x_i - 1$$
```

$$\lim_{x \rightarrow 0^+} \frac{1}{x} = \infty$$

```
$$\lim_{x \rightarrow 0^+} \frac{1}{x} = \infty$$
```

$$\int_a^b y \, dx$$

```
$$\int_a^b y \, \mathrm{d}x
```

$$\log_a b = 1$$

```
$$\log_a b = 1
```

$$\min(P) = \max_{i:S_i \in S} S_i$$

```
$$\max(S) = \max_{i:S_i \in S} S_i
```

$$\frac{n!}{k!(n-k)!} = \binom{n}{k}$$

```
$$\frac{n!}{k!(n-k)!} = \binom{n}{k}$$
```

$$\frac{b}{a+b} = 3, \text{ therefore we can set } a = 6$$

```
$$\text{\dfrac{b}{a+b}=3, \: therefore we can set \: a=6}$$
```

## Functions

$$f(x) = \begin{cases} 1/d_{ij} & \text{when } d_{ij} \leq 160 \\ 0 & \text{otherwise} \end{cases}$$



```
$$
f(x)=
\begin{cases}
1/d_{ij} & \text{when } d_{ij} \leq 160$\\
0 & \text{otherwise}
\end{cases}
$$
```

Matrices

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

```
$$
\begin{matrix}
1 & 2 & 3 \\
4 & 5 & 6 \\
7 & 8 & 9
\end{matrix}
$$
```

$$M = \begin{bmatrix} \frac{5}{6} & \frac{1}{6} & 0 \\ \frac{5}{6} & 0 & \frac{1}{6} \\ 0 & \frac{5}{6} & \frac{1}{6} \end{bmatrix}$$

```
$$
M =
\begin{bmatrix}
\frac{5}{6} & \frac{1}{6} & 0 \\
\frac{5}{6} & 0 & \frac{1}{6} \\
0 & \frac{5}{6} & \frac{1}{6}
\end{bmatrix}
$$
```

$$M = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

```
$$
M =
\begin{bmatrix}
1 & 0 \\
0 & 1
\end{bmatrix}
\begin{bmatrix}
1 & 0 \\
0 & 1
\end{bmatrix}
$$
```

$$M = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

```
$$
M =
\begin{pmatrix}
1 & 0 \\
0 & 1
\end{pmatrix}
\begin{pmatrix}
1 & 0 \\
0 & 1
\end{pmatrix}
$$
```

$$A_{m,n} = \begin{pmatrix} a_{1,1} & a_{1,2} & \cdots & a_{1,n} \\ a_{2,1} & a_{2,2} & \cdots & a_{2,n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m,1} & a_{m,2} & \cdots & a_{m,n} \end{pmatrix}$$

```
$$
A_{m,n} =
\begin{pmatrix}
a_{1,1} & a_{1,2} & \cdots & a_{1,n} \\
a_{2,1} & a_{2,2} & \cdots & a_{2,n} \\
\vdots & \vdots & \ddots & \vdots \\
a_{m,1} & a_{m,2} & \cdots & a_{m,n}
\end{pmatrix}
$$
```

Font sizes

*Hello!*  
*Hello!*  
*Hello!*  
*Hello!*  
*Hello!*  
*Hello!*  
*Hello!*  
*Hello!*

```
$\Huge Hello!$
$\huge Hello!$
$\LARGE Hello!$
$\Large Hello!$
$\large Hello!$
$\normalsize Hello!$
$\small Hello!$
$\scriptsize Hello!$
$\tiny Hello!$
```

Example:

Font size is small, eg.  $\sum x_i = 10$

```
$$\small \text{Font size is small, eg. }\sum{x_i = 10}$$$
```

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