towards
data science

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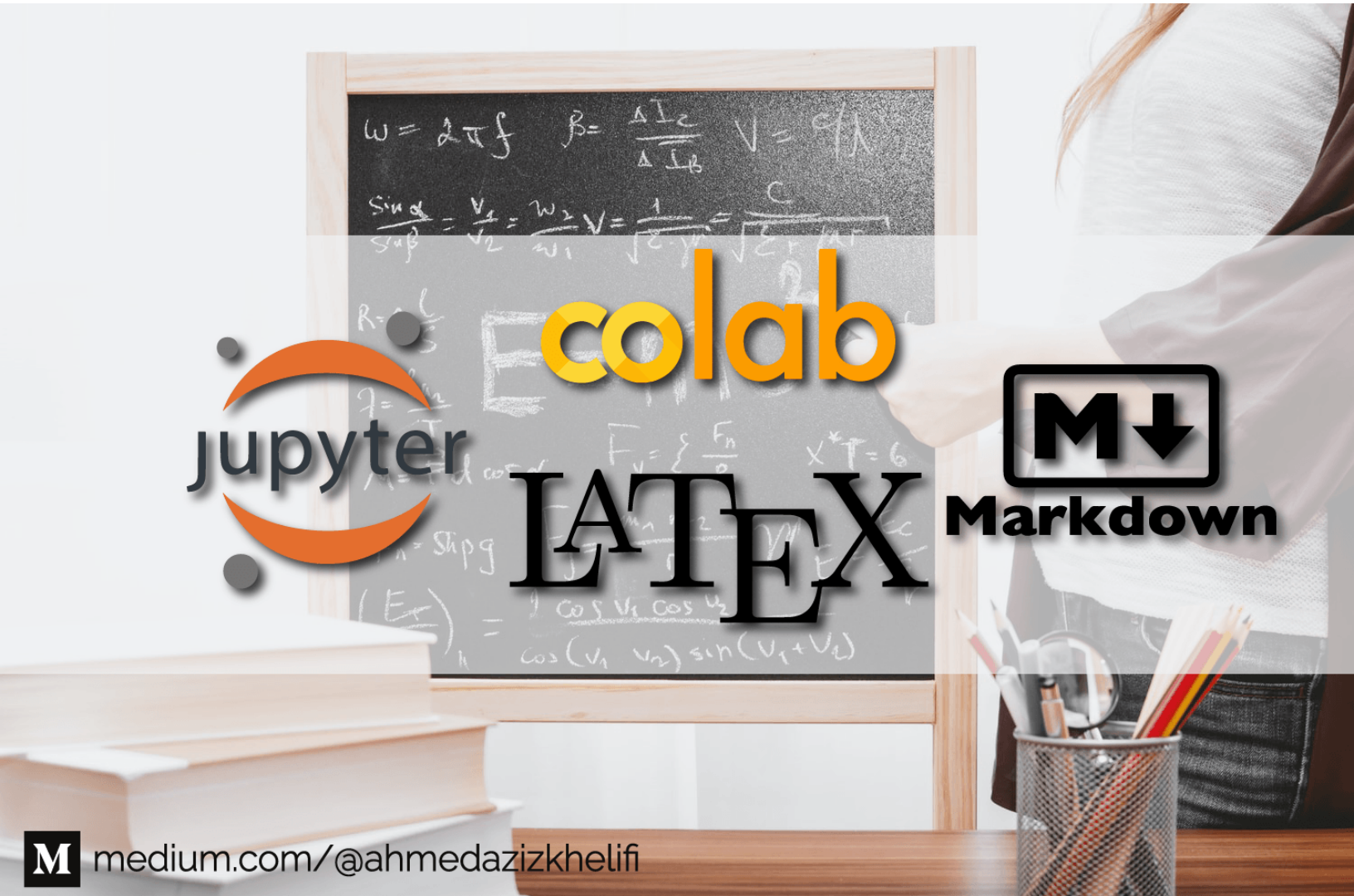
Learn How to Write Markdown & LaTeX in The Jupyter Notebook

Not only Jupyter. Google Colab, R Markdown, and much more.

Khelifi Ahmed Aziz Apr 4, 2020 · 6 min read ★



Interactive notebooks are experiencing a rise in popularity. *Why?*
Simply because it's a great teaching environment, powerful, shareable, and provides the ability to perform data visualization in the same environment. *Which interactive notebooks should I use?* I recommend:

- **The Jupyter Notebook** is an open-source web application that allows you to create and share documents that contain live code, equations, visualizations, and narrative text.
- **Colaboratory** is a free Jupyter notebook environment that requires no setup and runs entirely in the cloud.

Both of them support

1. **Markdown** which is a markup language that is a superset of HTML.
2. **Latex** to render mathematical and scientific writing.

Markdown

It's a very simple language that allows you to write HTML in a shortened way. It can be used on some websites like Stack Overflow or to write documentations (essentially on GitHub).

> Markdown file extension is .md

When you write in Markdown, you use shortened notations which are replaced by the corresponding HTML tags. Each time, I will tell you the HTML equivalent of the Markdown notation to show you how Markdown made our life easier than ever.

Even web developers, now, use Markdown then convert it to HTML using some websites.

• Headings

You make titles using hashtags `#`. A single hashtag gives you a title (h1), two hashtags give you a subtitle (h2) and so on as shown below:

```
# Heading 1
## Heading 2
### Heading 3
```

HTML equivalent:

```html
<h1>Heading 1</h1>
<h2>Heading 2</h2>
<h3>Heading 3</h3>
<h4>Heading 4</h4>
<h5>Heading 5</h5>
<h6>Heading 6</h6>
```

heading.html hosted with ♡ by GitHub view raw

Heading 1

Heading 2

Heading 3

Heading 4

Heading 5

Heading 6

headings.md hosted with ♡ by GitHub view raw

Output Result : Colab Notebook

• Paragraphs

Paragraphs are represented by the `<p>` tag in HTML. In Markdown, they're separated by one or more blank lines. Like HTML, whitespace is ignored. So if you add 10 blank lines, you're still only going to have one paragraph.

```
This is a paragraph of text.

This is another paragraph of text.
```

```
<p>This is a paragraph of text.</p>
<p>This is another paragraph of text.</p>
```

paragraph.html hosted with ♡ by GitHub view raw

This is a paragraph of text.

This is another paragraph of text.

paragraph.md hosted with ♡ by GitHub view raw

Output Result: Colab Notebook

• Line breaks

Just end a line with two or more spaces , then type return. Or leave an empty line.

```
This is a text.     <!-- spaces -->
This is another text.
```

HTML equivalent:

Output Result: Colab Notebook

• Mark emphasis

You can add emphasis by making text bold or italic.

```
Emphasis, aka italics, with *asterisks* or _underscores_.

Strong emphasis, aka bold, with **asterisks** or __underscores__.

Combined emphasis with **asterisks and _underscores_**.

Strikethrough uses two tildes ~ . ~~Scratch this.~~
```

HTML equivalent:

Output Result: Colab Notebook

```
1. Item 1
2. Item 2 ( we can type 1. and the markdown will automatically
numerate them)
* First Item
  * Nested item 1
  * Nested item 2
    1. Keep going
    1. Yes

* Second Item
- First Item
- Second Item
```

HTML equivalent:

```
<ol>
<li>Item 1</li>
<li>Item 2 ( we can type 1. and the markdown will automatically numerate them) </li>
<li><p>First Item</p>
<ul>
<li>Nested item 1</li>
<li>Nested item 2<ol>
<li>Keep going</li>
<li>Yes</li>
</ol>
</li>
</ul>
</li>
<li><p>Second Item</p>
</li>
<li>First Item</li>
<li>Second Item</li>
</ol>
```

list.html hosted with ♡ by GitHub view raw

1. Item 1
2. Item 2 (we can type 1. and the markdown will automatically numerate them)

- First Item
  - Nested item 1
  - Nested item 2

- Second Item

- First Item
- Second Item

list.md hosted with ♡ by GitHub view raw

Output Result: Colab Notebook

• Links and Images

To create a link, you must place the text of the link in square brackets followed by the URL in parentheses. Images are almost inserted in the same way as links, add an exclamation mark (`!`), followed by alt text in brackets, and the path or URL to the image asset in parentheses.

```
<!-- [Text](link) -->
[Link Text](https://medium.com/@ahmedazizkhelifi "Optional Title")

<!-- ![Alt Text](image path "title") -->
![Alt Text](https://miro.medium.com/max/80/0*PRNVc7bjff0Jj1pm.png
"Optional Title")

<!-- Linking Image -->
<!-- [![Alt Text](image path "title")](link) -->[![Alt Text]
(https://miro.medium.com/max/80/0*PRNVc7bjff0Jj1pm.png "Optional
Title")](https://medium.com/@ahmedazizkhelifi)
```

HTML equivalent:

```
<!-- [Text](link) -->
<p><a href="https://medium.com/@ahmedazizkhelifi" title="Optional Title">Link Text</a></p>
<!-- ![Alt Text](image path "title") -->
<p><img src="https://miro.medium.com/max/80/0*PRNVc7bjff0Jj1pm.png" alt="Alt Text" title="Optiona
<!-- [![Alt Text](image path "title")](link) -->
<p><a href="https://medium.com/@ahmedazizkhelifi"><img src="https://miro.medium.com/max/80/0*PRNV
```

LinkImage.html hosted with ♡ by GitHub view raw

Link Text

LinkImage.md hosted with ♡ by GitHub view raw

Output Result: Colab Notebook

• Horizontal Rule

To create a horizontal rule, use three or more asterisks (`***`), dashes (`---`), or underscores (`___`) on a line by themselves.

```
Reading articles on Medium is awesome.
---
Sure !!
```

HTML equivalent:

```
<p>Reading articles on Medium is awesome.</p>
<hr>
<p>Sure !!</p>
```

hr.html hosted with ♡ by GitHub view raw

Reading articles on Medium is awesome.

Sure !!

hr.md hosted with ♡ by GitHub view raw

Output Result: Colab Notebook

• Table

It's so freaking easy. And you can use this website to generate them.
Use `\` before the dollar signs `$` , on your Notebook, otherwise, you'll enter the math display mode (check it out on the LaTeX side).

```
| 02 | is       |  \$12 |
| 03 | AWESOME  | \$999 |
```

HTML Equivalent:

```
<table>
<thead>
<tr>
<th>Id</th>
<th>Label</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Markdown</td>
<td>$1600</td>
</tr>
<tr>
<td>02</td>
<td>is</td>
<td>$12</td>
</tr>
<tr>
<td>03</td>
<td>AWESOME</td>
<td>$999</td>
</tr>
</tbody>
</table>
```

table.html hosted with ♡ by GitHub view raw

Id	Label	Price
01	Markdown	$1600
02	is	$12
03	AWESOME	$999

table.md hosted with ♡ by GitHub view raw

• Code and Syntax Highlighting

```
```python
def staySafe(Coronavirus)
  if not home:
    return home
```
```

HTML Equivalent:

```
<pre><code class="lang-python"><span class="hljs-function"><span class="hljs-keyword">def</span>
    <span class="hljs-keyword">if</span> <span class="hljs-keyword">not</span> <span class="hljs-
        <span class="hljs-keyword">return</span> home
</code></pre>
```

code.html hosted with ♡ by GitHub view raw

```
def staySafe(Coronavirus):
        if not home:
                return home
```

code.md hosted with ♡ by GitHub view raw

Output Result: Colab Notebook

• Blockquotes

Blockquotes work like replies to e-mails: you must precede the quoted lines with a `>`.

```
> This is a blockquote.
>
> This is part of the same blockquote.

Quote break

> This is a new blockquote.
```

HTML Equivalent:

```
<blockquote>
```

```
</blockquote>
<p>Quote break</p>
<blockquote>
<p>This is a new blockquote.</p>
</blockquote>
```

blockquote.html hosted with ♡ by GitHub view raw

> This is a blockquote.
>
> This is part of the same blockquote.

Quote break

> This is a new blockquote.

blockquote.md hosted with ♡ by GitHub view raw

Output Result: Colab Notebook

LaTeX

> Have you ever asked yourself, how they write complex maths and physics equations using computer? Well, it's all about LaTeX.

The Jupyter Notebook uses MathJax to render LaTeX inside HTML / Markdown. Just put your LaTeX math inside `$ $`. Or enter in *display* math mode by writing between `$$ $$`.

```
To insert a mathematical formula we use the dollar symbol $, as follows:

Euler's identity: $ e^{i \pi} + 1 = 0 $

To isolate and center the formulas and enter in math display mode, we use 2 dollars symbol:
$$
...
$$


Euler's identity: $$ e^{i \pi} + 1 = 0 $$

```

introLatex.tex hosted with ♡ by GitHub view raw

To insert a mathematical formula we use the dollar symbol $, as follows:

Euler's identity: $e^{i\pi} + 1 = 0$

To isolate and center the formulas and enter in math display mode, we use 2 dollars symbol:

...

Euler's identity:

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

Output Result: Colab Notebook

Important Notes:

1. To add **little spacing** in math mode use `\,`
2. To add **a new line** when in math mode use `\\`
3. To display **fraction** use `\frac{arg 1}{arg 2}`
4. For **power** (superscripts text) use `^{}`
5. For **indices** (subscripts) use `_{}`
6. For **roots** use `\sqrt[n]{arg}`
   The `[n]` is optional.

```
$$
\frac{arg 1}{arg 2} \\
x^2\\
e^{i\pi}\\
A_i\\
B_{ij}\\
\sqrt[n]{arg}
$$
```

Note1.tex hosted with ♡ by GitHub view raw

$$\frac{arg1}{arg2}$$
$$x^2$$
$$e^{i\pi}$$

$$\sqrt[n]{arg}$$

Output Example: Colab Notebook

LaTeX file extension is .tex

• Greek Letters

To write greek letters, type `\` and the letter name:

```
Given : $\pi = 3.14$ , $\alpha = \frac{3\pi}{4}\, rad$
$$
\omega = 2\pi f \\
f = \frac{c}{\lambda}\\
\lambda_0=\theta^2+\delta\\
\Delta\lambda = \frac{1}{\lambda^2}
$$
```

greek.tex hosted with ♡ by GitHub view raw

$$\text{Given : } \pi = 3.14\,,\, \alpha = \frac{3\pi}{4}\, rad$$

$$\omega = 2\pi f$$

$$f = \frac{c}{\lambda}$$

$$\lambda_0 = \theta^2 + \delta$$

$$\Delta\lambda = \frac{1}{\lambda^2}$$

Output Result: Colab Notebook

Important Note:

To write **Capital Greek Letter**, type the first case after the backslash `\` as an uppercase, for example:

```
\delta >>> δ
\Delta >>> Δ

\omega >>> ω
\Omega >>> Ω
```

Ω	\Omega	ω	\omega

Output Example: Colab Notebook

As shown in this figure:

α	\alpha	ξ, Ξ	\xi, \Xi
β	\beta	o	o
γ, Γ	\gamma, \Gamma	π, Π	\pi, \Pi
δ, Δ	\delta, \Delta	ϖ	\varpi
ϵ	\epsilon	ρ	\rho
ε	\varepsilon	ϱ	\varrho
ζ	\zeta	σ, Σ	\sigma, \Sigma
η	\eta	ς	\varsigma
$\theta \Theta$	\theta, \Theta	τ	\tau
ϑ	\vartheta	υ, Υ	\upsilon, \Upsilon
ι	\iota	ϕ, Φ	\phi, \Phi
κ	\kappa	φ	\varphi
$\lambda \Lambda$	\lambda, \Lambda	χ	\chi
μ	\mu	ψ, Ψ	\psi, \Psi
ν	\nu	ω, Ω	\omega, \Omega

Full Greek Letter List. Source

- **Roman Names:**

```
$$
\sin(-\alpha)=-\sin(\alpha)\\
\arccos(x)=\arcsin(u)\\
\log_n(n)=1\\
\tan(x) = \frac{\sin(x)}{\cos(x)}
$$
```

roman.tex hosted with ♡ by GitHub view raw

$$\sin(-\alpha) = -\sin(\alpha)$$
$$\arccos(x) = \arcsin(u)$$
$$\log_n(n) = 1$$
$$\tan(x) = \frac{\sin(x)}{\cos(x)}$$

Output Result: Colab Notebook

sec	\sec	coth	\coth	min	\min
csc	\csc	det	\det	max	\max
cot	\cot	dim	\dim	inf	\inf
exp	\exp	ker	\ker	sup	\sup
log	\log	deg	\deg	lim inf	\liminf
ln	\ln	arg	\arg	lim sup	\limsup
lg	\lg	gcd	\gcd	lim	\lim

Source

- **Other Symbols**

```
#Other Symbols
## Angles:
Left angle : $\langle$

Right angle : $\rangle$

Angle between two vectors u and v       : $\langle \vec{u},\vec{v}\rangle$

$$ \vec{AB} \, \cdot \, \vec{CD} =0  \Rightarrow  \vec{AB} \, \perp\, \vec{CD}$$

##Sets and logic
$$\mathbb{N} \subset \mathbb{Z} \subset \mathbb{D} \subset \mathbb{Q} \subset \mathbb{R} \subset
```

other.tex hosted with ♡ by GitHub view raw

Angles:

Left angle : $\langle$

Right angle : $\rangle$

Angle between two vectors u and v : $\langle \vec{u}, \vec{v} \rangle$

$$\vec{AB} \cdot \vec{CD} = 0 \Rightarrow \vec{AB} \perp \vec{CD}$$

Sets and logic

$$\mathbb{N} \subset \mathbb{Z} \subset \mathbb{D} \subset \mathbb{Q} \subset \mathbb{R} \subset \mathbb{C}$$

Output Result: Colab Notebook

∪	\cup	ℝ	\mathbb{R}	∀	\forall

$\supset$	\supset	$\mathbb{C}$	\mathbb{C}	$\wedge$	\wedge
$\supseteq$	\supseteq	$\varnothing$	\varnothing	$\vdash$	\vdash
$\in$	\in	$\emptyset$	\emptyset	$\models$	\models
$\ni$	\ni	$\aleph$	\aleph	$\Rightarrow$	\Rightarrow
$\notin$	\notin	$\setminus$	\setminus	$\nRightarrow$	\nRightarrow
$\notin$	\not\in	$\equiv$	\equiv		

Sets and Logic: Source

$\rightarrow$	\rightarrow, \to	$\mapsto$	\mapsto
$\nrightarrow$	\nrightarrow	$\longmapsto$	\longmapsto
$\longrightarrow$	\longrightarrow	$\leftarrow$	\leftarrow
$\Rightarrow$	\Rightarrow	$\leftrightarrow$	\leftrightarrow
$\nRightarrow$	\nRightarrow	$\downarrow$	\downarrow
$\Longrightarrow$	\Longrightarrow	$\uparrow$	\uparrow
$\leadsto$	\leadsto	$\updownarrow$	\updownarrow

Arrows: Source

$<$	<	$\angle$	\angle	$\cdot$	\cdot
$\leq$	\leq	$\measuredangle$	\measuredangle	$\pm$	\pm
$>$	>	ℓ	\ell	$\mp$	\mp
$\geq$	\geq	$\parallel$	\parallel	$\times$	\times
$\neq$	\neq	45°	45^{\circ}	$\div$	\div
$\ll$	\ll	$\cong$	\cong	$*$	\ast
$\gg$	\gg	$\ncong$	\ncong	$\mid$	\mid
$\approx$	\approx	$\sim$	\sim	$\nmid$	\nmid
$\asymp$	\asymp	$\simeq$	\simeq	$n!$	n!
$\equiv$	\equiv	$\nsim$	\nsim	∂	\partial
$\prec$	\prec	$\oplus$	\oplus	∇	\nabla
$\preceq$	\preceq	$\ominus$	\ominus	$\hbar$	\hbar
$\succ$	\succ	$\odot$	\odot	$\circ$	\circ
$\succeq$	\succeq	$\otimes$	\otimes	$\star$	\star
$\propto$	\propto	$\oslash$	\oslash	$\surd$	\surd
$\doteq$	\doteq	$\upharpoonright$	\upharpoonright	$\checkmark$	\checkmark

Other Symbols: Source

- **Vertical curly braces:**

To define a left vertical curly brace we use the attribute

```
\left\{
```

```
\right\}
```

```
$$
sign(x) = \left\{
    \begin{array}\\
        1 & \mbox{if } \ x \in \mathbf{N}^* \\
        0 & \mbox{if } \ x = 0 \\
        -1 & \mbox{else.}
    \end{array}
\right.
$$

\\

$$
 \left.
    \begin{array} \\
        \alpha^2 = \sqrt5 \\
        \alpha \geq 0
    \end{array}
\right \}=\alpha = 5
$$
```

Vbraces.tex hosted with ♡ by GitHub view raw

$$sign(x) = \begin{cases} 1 & \text{if } x \in \mathbf{N}^* \\ 0 & \text{if } x = 0 \\ -1 & \text{else.} \end{cases}$$

$$\left.\begin{array}{l} \alpha^2 = \sqrt{5} \\ \alpha \geq 0 \end{array}\right\} \alpha = 5$$

Output Result: Colab Notebook

• Horizontal curly braces

For horizontal curly braces, we use :

```
$$
\underbrace{\ln \left( \frac{5}{6} \right)}_{\simeq -0.1823}
< \overbrace{\exp (2)}^{\simeq 7.3890}
$$
```

Hbraces.tex hosted with ♡ by GitHub view raw

$$\underbrace{\ln\left(\frac{5}{6}\right)}_{\simeq -0.1823} < \overbrace{\exp(2)}^{\simeq 7.3890}$$

Output Result: Colab Notebook

• Derivative

```
First order derivative : $$f'(x)$$
K-th order derivative  : $$f^{(k)}(x)$$
Partial firt order deivative    : $$\frac{\partial f}{\partial x}$$
Partial k-th order derivative   : $$\frac{\partial^{k} f}{\partial x^k}$$
```

Derivative.tex hosted with ♡ by GitHub view raw

First order derivative :

$$f'(x)$$

K-th order derivative :

$$f^{(k)}(x)$$

Partial firt order derivative :

$$\frac{\partial f}{\partial x}$$

Partial k-th order derivative :

$$\frac{\partial^k f}{\partial x^k}$$

Output Result: Colab Notebook

• Limit

```
#limit
```

```
Limit at $\alpha$ : $$\lim_{x \to \alpha} f(x)$$

Max : $$\max_{x \in [a,b]}f(x)$$
Min : $$\min_{x \in [\alpha,\beta]}f(x)$$
Sup : $$\sup_{x \in \mathbb{R}}f(x)$$
Inf : $$\inf_{x > s}f(x)$$
```

limit.tex hosted with ♡ by GitHub view raw

Limit at plus infinity :

$$\lim_{x \to +\infty} f(x)$$

Limit at minus infinity :

$$\lim_{x \to -\infty} f(x)$$

Limit at α :

$$\lim_{x \to \alpha} f(x)$$

Max :

$$\max_{x \in [a,b]} f(x)$$

Min :

$$\min_{x \in [\alpha,\beta]} f(x)$$

Sup :

$$\sup_{x \in \mathbb{R}} f(x)$$

Inf :

$$\inf_{x > s} f(x)$$

Output Result: Colab Notebook

• Sum

```
Sum from 0 to +inf:

$$\sum_{j=0}^{+\infty} A_{j}$$

Double sum:
$$\sum^k_{i=1}\sum^{l+1}_{j=1}\,A_i A_j$$


Taylor expansion of $e^x$:
$$ e^x  = \sum_{k=0}^{n}\, \frac{x^k}{k!} + o(x^n) $$
```

sum.tex hosted with ♡ by GitHub view raw

Sum from 0 to +inf:

$$\sum_{j=0}^{+\infty} A_j$$

Double sum:

$$\sum^k_{i=1}\sum^{l+1}_{j=1}\,A_i A_j$$

Taylor expansion of e^x:

$$e^x = \sum_{k=0}^{n} \frac{x^k}{k!} + o(x^n)$$

Output Result: Colab Notebook

• Product

```
Product:
$$\prod_{j=1}^k A_{\alpha_j}$$
Double product:
$$\prod^k_{i=1}\prod^l_{j=1}\,A_i A_j$$
```

product.tex hosted with ♡ by GitHub view raw

Product:

$$\prod_{j=1}^{k} A_{\alpha_j}$$

Double product:

$$\prod_{i=1}^{k}\prod_{j=1}^{l} A_i A_j$$

Output Result: Colab Notebook

• Integral

```
Simple integral:
$$\int_{a}^b f(x)dx$$

Double integral:
$$\int_{a}^b\int_{c}^d f(x,y)\,dxdy$$

Triple integral:
$$\iiint$$

Quadruple integral:
$$\iiiint$$

Multiple integral :
$$\idotsint$$
```

Simple integral:

$$\int_a^b f(x)dx$$

Double integral:

$$\int_a^b \int_c^d f(x,y)dxdy$$

Triple integral:

$$\iiint$$

Quadruple integral:

$$\iiiint$$

Multiple integral :

$$\int \cdots \int$$

Contour integral:

$$\oint$$

Output Result: Colab Notebook

• Matrix

```
Plain:

\begin{matrix}
1 & 2 & 3\\
a & b & c
\end{matrix}

Round brackets:
\begin{pmatrix}
1 & 2 & 3\\
a & b & c
\end{pmatrix}

Curly brackets:
\begin{Bmatrix}
1 & 2 & 3\\
```

```
Pipes:
\begin{vmatrix}
1 & 2 & 3\\
a & b & c
\end{vmatrix}

Double pipes
\begin{Vmatrix}
1 & 2 & 3\\
a & b & c
\end{Vmatrix}
```

matrix.tex hosted with ♡ by GitHub view raw

Plain:

$$\begin{matrix} 1 & 2 & 3 \\ a & b & c \end{matrix}$$

Round brackets:

$$\begin{pmatrix} 1 & 2 & 3 \\ a & b & c \end{pmatrix}$$

Curly brackets:

$$\begin{Bmatrix} 1 & 2 & 3 \\ a & b & c \end{Bmatrix}$$

Pipes:

$$\begin{vmatrix} 1 & 2 & 3 \\ a & b & c \end{vmatrix}$$

Double pipes

$$\begin{Vmatrix} 1 & 2 & 3 \\ a & b & c \end{Vmatrix}$$

Output Result: Colab Notebook

Resources:

- https://www.datasciencecentral.com/profiles/blogs/all-about-using-jupyter-notebooks-and-google-colab
- https://oeis.org/wiki/List_of_LaTeX_mathematical_symbols
- https://jupyter.org/

- http://tug.ctan.org/info/undergradmath/
- https://openclassrooms.com/en/courses/1304236-redigez-en-markdown

. . .

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Khelifi Ahmed Aziz

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