LaTeX Math Cheat Sheet

Packages

`amsmath` Use math macros
`amssymb` Use more math symbols
`cancel` Cross out text
Use before `\begin{document}`. Usage: `\usepackage{`*package name*`}`

Math Mode

Inline Math

Don't use `$ … $` with LaTeX. Use `\( … \)` instead.

Displayed Math

Don't use `$$ … $$` with LaTeX. Use `\[ … \]` instead.
If you use $\mathcal{AMS}$math, don't use `\[ … \]` either, use `\begin{displaymath} … \end{displaymath}` (unnumbered) and `\begin{equation} … \end{equation}` (numbered).

Plain Text in Math Mode

Use `\text{…}` or `\textnormal{…}` or `\mathrm{…}` for inline text.
Note the different outcomes.
Examples: *mathmode*, text, normaltext, mathrm
Use `\intertext{…}` for a complete line, only in displayed mode.

Sets of Equations

`&=` Typeset and aligns equations on =. Works with any relation.
Use `\mathrel{…}` or `\stackrel{`*top*`}{`*bot*`}` for custom relations
`&` Add another column `\\` Add another line

align

Note that align must **not** be set in math mode!
Usage: `\begin{align} aa &< A & b &\stackrel{!}{=} B \\ c &\mathrel{=_{42}} C & d &= D \end{align}` Outcome:

$$aa < A \qquad b \stackrel{!}{=} B \tag{1}$$
$$c =_{42} C \qquad d = D \tag{2}$$

aligned

Allows for further mathstuff left/right, must be set in math mode.
Usage: `\begin{aligned} aa &= A & b &= B … \end{aligned}`
Outcome:

$$\begin{aligned} aa &= A & b &= B \\ c &= C & d &= D \end{aligned}$$

gather

Centered equations, one column. Must **not** be set in math mode!
Usage: `\begin{gather} aa = A \\ b = B \end{gather}`
Outcome:

$$aa = A \tag{3}$$
$$b = B \tag{4}$$

Long Terms/Equations

multline

Set long terms with multiple lines. Must **not** be set in math mode!
Usage: `\begin{multline} A = 1 + … + 5 \\+ 6 + 7 + … + 14 + 15 \end{multline}`
Outcome:

$$A = 1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 + 11 + 12 + 13 + 14 + 15 \tag{5}$$

split

Set long equations with multiple lines. Must be set in math mode.
Usage:
`\begin{split} A &= 5+9+3 \\ &= 14+3 \\ A &= 17 \end{split}`
Outcome:

$$\begin{aligned} A &= 5 + 9 + 3 \\ &= 14 + 3 \\ A &= 17 \end{aligned}$$

Cases

Set if-then-else cases. Must be set in math mode.
Usage: `\begin{cases} 1 & \text{if A=...} \\ 2 & \text{if B=...} \end{cases}`
Outcome:

$$\begin{cases} 1 & \text{if A=...} \\ 2 & \text{if B=...} \end{cases}$$

Matrices

matrix

Set simple matrices. Must be set in math mode.

`\( \begin{bmatrix} a & b \\ c & d \end{bmatrix} \)` $\begin{bmatrix} a & b \\ c & c \end{bmatrix}$

`Bmatrix` $\begin{Bmatrix} a & b \\ c & c \end{Bmatrix}$ `vmatrix` $\begin{vmatrix} a & b \\ c & c \end{vmatrix}$ `Vmatrix` $\begin{Vmatrix} a & b \\ c & c \end{Vmatrix}$

`pmatrix` $\begin{pmatrix} a & b \\ c & c \end{pmatrix}$ `matrix` $\begin{matrix} a & b \\ c & c \end{matrix}$

A `smallmatrix` for inline use only is available as well. $\left(\begin{smallmatrix} a & b \\ c & d \end{smallmatrix}\right)$

array

Set flexible matrices. Allows for further mathstuff left/right, must be set in math mode.
Usage: `\begin{array}{lc|r} a & b & c \\ \hline d & e & f \end{array}`
`l` for left aligned, `c` for centered, `r` for right aligned column. `|` for optional vertical line. `\hline` adds a horizontal line.
Outcome:

$$\begin{array}{lc|r} a & b & c \\ \hline d & e & f \end{array}$$

Fractions

frac

Usage: `\( \frac{1}{2} \)`
Outcome: $\frac{1}{2}$

cfrac

Set continued fractions, must be set in math mode.
Usage: `\cfrac{1}{1 + \cfrac{2}{33} }`
Outcome:

$$\cfrac{1}{1 + \cfrac{2}{33}}$$

Roots

Usage: `\( \sqrt[3]{8} \)` Outcome: $\sqrt[3]{8}$
If the root looks like this ${}^{a}\!\sqrt[3]{b}$, use `\leftroot{n}` and `\uproot{n}` to correct positioning.
Usage: `\( \sqrt[\uproot{3}\leftroot{1} a_3]{8} \)`
Outcome: ${}^{a_3}\!\sqrt[3]{8}$

Miscellaneous

Numbering

Use `align*`, `gather*`, `multline*` to supress numbering.
Use `\nonumber` to supress numbering for current line in any math environment.

Brackets

Use `\leftX` paired with `\rightY` with X and Y being `( ) [ ]`
`\langle` for ⟨ `\rangle` for ⟩ `\lbrace` for { `\rbrace` for }
`\lfloor` for ⌊ `\lceil` for ⌈ `\vert` for | `\Vert` for ‖
or `.` to supress one bracket. These brackets adapt in height to fit their inner object.
Usage: `\( \left( \frac{1}{2} \right) \)`
Outcome: $\left(\frac{1}{2}\right)$ as opposed to $(\frac{1}{2})$

Multi-line limits, Custom Operators & Sidesets

Usage: `\sum_{ \substack{1<i<p \\ 1<j<q} }` Outcome: $\sum_{\substack{1<i<p\\1<j<q}}$
Usage: `\operatorname{myop}{x} \mathbin{;} 5` Outcome: $\operatorname{myop} x \mathbin{;} 5$
Usage: `\sideset{_{1}^{2}}{_{3}^{4}}\sum` Outcome: $\sideset{_{1}^{2}}{_{3}^{4}}\sum$

cancel

Usage: `\cancel{22}` Outcome: $\cancel{22}$

`\cancel` $\cancel{\frac{(x+2)(x-1)}{(x-1)(x+1)}}$ `\bcancel` $\bcancel{\frac{(x+2)(x-1)}{(x-1)(x+1)}}$ `\xcancel` $\xcancel{\frac{(x+2)(x-1)}{(x-1)(x+1)}}$

Sub-/Superscription

Use `_{n}` to subscript and `^{n}` to superscript `n`.
Usage: `\( a_{1_{1}}^{2} \)` Outcome: $a_{1_1}^{2}$

Symbols

$\sum_{i=1}^{n}$	`\sum_{i=1}^{n}`	$\prod_{i=1}^{n}$	`\prod_{i=1}^{n}`
$\rightarrow$	`\rightarrow`	$\leftarrow$	`\leftarrow`
$\Rightarrow$	`\Rightarrow`	$\Leftarrow$	`\Leftarrow`
$\uparrow$	`\uparrow`	$\downarrow$	`\downarrow`
$\uparrow$	`\uparrow`	$\downarrow$	`\downarrow`
$\xrightarrow[3]{44}$	`\xrightarrow[3]{44}`	$\xleftarrow[3]{44}$	`\xleftarrow[3]{44}`
π	`\pi`	$\aleph$	`\aleph`
$\overrightarrow{abc}$	`\overrightarrow{abc}`	$\overleftarrow{abc}$	`\overleftarrow{abc}`
$\widehat{abc}$	`\widehat{abc}`	$\widetilde{abc}$	`\widetilde{abc}`
$\overbrace{abc}$	`\overbrace{abc}`	$\underbrace{abc}$	`\underbrace{abc}`
$*$	`\ast`	$\cdot$	`\cdot`
$\times$	`\times`	$\div$	`\div`
$\leq \nleq$	`\leq \nleq`	$\geq \ngeq$	`\geq \ngeq`
$\not< \not>$	`\nless \ngtr`	$\neq$	`\neq`
$\pm$	`\pm`	$\sim$	`\sim`
$\in$	`\in`	$\notin$	`\notin`
$\forall$	`\forall`	$\exists$	`\exists`
$\sin(x)$	`\sin(x)`	$\cos(x)$	`\cos(x)`
$\log n$	`\log n`	$\ln n$	`\ln n`

TikZ & PGF Cheat Sheet

Package & Basic Usage

`tikz` Create Drawings for use in (LA)TEX, or ConTEXt
Use before `\begin{document}`. Usage: `\usepackage{`*package name*`}`
Everything TikZ-related must be preceded by a `\tikz` command or placed inside `\begin{tikzpicture}` … `\end{tikzpicture}`.

Geometric figures, grid panes, axes

Rectangle

```
\tikz \draw (0,0) rectangle (0.2,0.2);
```
`\draw` draws the given figure starting from the first coordinate, ending with the second coordinate, the standard unit is cm. Don't forget the semicolon!

Circle/Ellipses

```
\tikz \draw (1mm,1mm) circle [radius=0.1cm];
```
`[radius=0.15cm]` is an optional parameter, the default radius is 0pt. The coordinate determines the center of the circle.

```
\tikz \draw (3mm,3mm) circle
[x radius=0.3cm, y radius=0.15cm];
```
Use two radii for ellipses.

Line

```
\tikz \draw (0,0) -- (1,0.2) -- (1.5,0.1);
```
Lines are drawn coordinates connected by `--`.

Dot

```
\tikz \filldraw (0,0) circle [radius=2pt];
```
Use `filldraw` for any filled figure.

Triangles/Polygons

```
\tikz \draw (0,0) -- (0.5,0.2) -- (1,0.1) -- cycle;
\tikz \draw (0,0)--(.4,0.2)--(.8,0.1)--(.4,0)--cycle;
```
Add `cycle` after connected lines to generate a polygon.

Arcs

```
\tikz \draw (0,0) arc
[start angle=0, end angle=120, radius=4mm];
\tikz \draw (0,0) arc [start angle=0
, end angle=120, x radius=8mm, y radius=4mm];
```

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