

# L<sup>A</sup>T<sub>E</sub>X 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 L<sup>A</sup>T<sub>E</sub>X. Use `\( ... \)` instead.

### Displayed Math

Don't use `$$$` with L<sup>A</sup>T<sub>E</sub>X. Use `\[ ... \]` instead.

If you use  $\mathcal{A}$ , 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}{\underset{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:

$$\begin{array}{ll} aa < A & b \stackrel{!}{=} B \\ c =_{42} C & d = D \end{array}$$

### aligned

Allows for further mathstuff left/right, must be set in math mode.

Usage: `\begin{aligned} aa &= A & b &= B ... \end{aligned}`

Outcome:

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

### gather

Centered equations, one column. Must **not** be set in math mode!

Usage: `\begin{gather} aa = A \\ b = B \end{gather}`

Outcome:

$$\begin{array}{l} aa = A \\ b = B \end{array}$$

## 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:

$$A = 1 + 2 + 3 + 4 + 5$$

$$+ 6 + 7 + 8 + 9 + 10 + 11 + 12 + 13 + 14 + 15 \quad (5)$$

### 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:

$$\begin{array}{l} A = 5 + 9 + 3 \\ \quad = 14 + 3 \\ A = 17 \end{array}$$

## 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.

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

$$\text{Bmatrix} \quad \begin{Bmatrix} a & b \\ c & c \end{Bmatrix} \quad \text{vmatrix} \quad \begin{vmatrix} a & b \\ c & c \end{vmatrix} \quad \text{Vmatrix} \quad \left\| \begin{array}{l} a & b \\ c & c \end{array} \right\|$$

$$\text{pmatrix} \quad \begin{pmatrix} a & b \\ c & c \end{pmatrix} \quad \text{matrix} \quad \begin{array}{cc} a & b \\ c & c \end{array}$$

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

### (1) array

(2) Set flexible matrices. Allows for further mathstuff left/right, must be set in math mode.

Usage: `\begin{array}{lcl} 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:

$$\begin{array}{cc|c} a & b & c \\ d & e & f \end{array}$$

## Fractions

### (3) frac

(4) 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:

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

## Roots

Usage: `\( \sqrt[3]{8} \)` Outcome:  $\sqrt[3]{8}$

If the root looks like this  $\sqrt[3]{b}$ , use `\leftroot{n}` and `\uproot{n}` to correct positioning.

Usage: `\( \sqrt[\uproot{3}]{\leftroot{1} a_3} \)`

Outcome:  $\sqrt[3]{8}$

## Miscellaneous

### Numbering

Use `align*`, `gather*`, `multline*` to suppress numbering.

Use `\nonumber` to suppress numbering for current line in any math environment.

### Brackets

Use `\leftX` paired with `\rightY` with X and Y being `( ) [ ]`

`\langle` for  $\langle$  `\rangle` for  $\rangle$  `\lbrace` for  $\{$  `\rbrace` for  $\}$

`\lfloor` for  $\lfloor$  `\lceil` for  $\lceil$  `\vert` for  $|$  `\Vert` for  $\|$

or `.` to suppress one bracket. These brackets adapt in height to fit their inner object.

Usage: `\( \left( \frac{1}{2} \right) \)`

Outcome:  $(\frac{1}{2})$  as opposed to  $(\frac{1}{2})$

## Multi-line limits, Custom Operators & Sidesets

Usage: `\sum_{1 \leq i < p}` Outcome:  $\sum_{1 \leq i < p}$

Usage: `\operatorname{mysin}{x}` Outcome:  $\operatorname{mysin} x$

Usage: `\sideset{_{1}^{2}}{_{3}^{4}} \sum` Outcome:  ${}^2_1 \sum {}^4_3$

### cancel

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

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

## Sub-/Superscription

Use `_n` to subscript and `^n` to superscript n.

Usage: `\( a_{1_1}^{2_1} \)` Outcome:  $a_{1_1}^{2_1}$

## Symbols

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


# Ti**k**Z & PGF Cheat Sheet

## Package & Basic Usage



`\tikz` Create Drawings for use in (L<sup>A</sup>T<sub>E</sub>X, or ConT<sub>E</sub>Xt  
Use before `\begin{document}`. Usage: `\usepackage{package name}`  
Everything Ti**k**Z-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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sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.  
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urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus  
luctus mauris.

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wisi in dignissim interdum, justo lectus sagittis dui, et vehicula libero  
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augue. Cras ac magna. Cras nulla. Nulla egestas. Curabitur a leo.  
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consectetur.

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odio.

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quis dolor. Donec pellentesque, erat ac sagittis semper, nunc dui  
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vel, eleifend faucibus, vehicula eu, lacus.  
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fames ac turpis egestas. Donec odio elit, dictum in, hendrerit sit  
amet, egestas sed, leo. Praesent feugiat sapien aliquet odio. Integer  
vitae justo. Aliquam vestibulum fringilla lorem. Sed neque lectus,  
consectetur at, consectetur sed, eleifend ac, lectus. Nulla facilisi.  
Pellentesque eget lectus. Proin eu metus. Sed porttitor. In hac  
habitasse platea dictumst. Suspendisse eu lectus. Ut mi mi, lacinia  
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iaculis eu, malesuada ac, dui. Mauris nibh leo, facilisis non, adipiscing  
quis, ultrices a, dui.  
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nec commodo wisi enim eget quam. Quisque libero justo, consectetur  
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sollicitudin malesuada. Maecenas ultricies eros sit amet ante. Ut  
venenatis velit. Maecenas sed mi eget dui varius euismod. Phasellus  
aliquet volutpat odio. Vestibulum ante ipsum primis in faucibus orci  
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sem eleifend consectetur. Nullam elementum, urna vel imperdiet  
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Proin eu nunc eu urna hendrerit faucibus. Aliquam auctor, pede  
consequat laoreet varius, eros tellus scelerisque quam, pellentesque  
hendrerit ipsum dolor sed augue. Nulla nec lacus.  
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quis, commodo eu, libero. Fusce sagittis erat at erat tristique mollis.  
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dui. Aliquam sagittis. Nunc placerat. Pellentesque tristique sodales  
est. Maecenas imperdiet lacinia velit. Cras non urna. Morbi eros  
pede, suscipit ac, varius vel, egestas non, eros. Praesent malesuada,  
diam id pretium elementum, eros sem dictum tortor, vel consectetur  
odio sem sed wisi.