

# 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  $\mathcal{A}$   $\mathcal{S}$   $\mathcal{M}$   $\mathcal{A}$ , don't `\[ ... \]` either, use `\begin{displaymath} ... \end{displaymath}` or `\begin{equation*} ... \end{equation*}` (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 depending on your font choice. `\text{...}` is usually the best choice. Examples: *math* *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.  $\begin{smallmatrix} a & b \\ c & d \end{smallmatrix}$

### array

- (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

### frac

- (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 `equation*`, `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 ( ) [ ]

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

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

or  $\cdot$  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 < i < p}` Outcome:  $\sum_{1 < i < p}$

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

Usage: `\sideset_{1}^{2}{3}^{4}\sum` Outcome:  $\sum_{1}^{2}{}^{3}{}^{4}$

### 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: `\( a_{11}^{22} \)` Outcome:  $a_{11}^{22}$

## 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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