LaTeX Cheat Sheet For Math Students

Rule One Any mathematics at all, even a single character, goes in a mathematical setting. To get "the value of x is 7" write '`the value of $x$ is $7$`'.

Template Your document should contain at least this.

```
\documentclass[a4paper]{article}
\usepackage{amsmath, amssymb, amsthm}
\usepackage[utf8]{inputenc}

\begin{document}
  --document body here--
\end{document}
```

Common Constructs

x^2 `x^2`	$\sqrt{2}, \sqrt[n]{3}$	`\sqrt{2}, \sqrt[n]{3}`
$x_{i,j}$ `x_{i,j}`	$\frac{2}{3}, 2/3$	`\frac{2}{3}, 2/3`

Calligraphic Letters Use as `$\mathcal{A}$`.

$$\mathcal{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$$

Calligraphic Letters (II) Use as `$\mathbb{A}$`.

$$\mathbb{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$$

Calligraphic Letters (III) Use as `$\mathfrak{A}$`.

$$\mathfrak{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$$

Greek

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`

Sets and Logic

$\cup$	`\cup`	$\mathbb{R}$	`\mathbb{R}`	$\forall$	`\forall`
$\cap$	`\cap`	$\mathbb{Z}$	`\mathbb{Z}`	$\exists$	`\exists`
$\subset$	`\subset`	$\mathbb{Q}$	`\mathbb{Q}`	$\neg$	`\neg`
$\subseteq$	`\subseteq`	$\mathbb{N}$	`\mathbb{N}`	$\vee$	`\vee`
$\supset$	`\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`
$\not\in$	`\not\in`	$\equiv$	`\equiv`	$\rightarrow$	`\rightarrow`

You can negate as operator, like $\not\subset$, by using `\not\subset`. For the set complement, get A^c use `A^{\mathsf{c}}` and to get get $A^\complement$ use `A^{\complement}`, or to get $\bar A$ use `\bar{A}`.

Decorations

f'	`f'`	$\dot{a}$	`\dot{a}`	$\tilde{x}$	`\tilde{x}`
f''	`f''`	$\ddot{a}$	`\ddot{a}`	$\bar{x}$	`\bar{x}`
Σ^*	`\Sigma^{*}`	$\hat{x}$	`\hat{x}`	$\vec{x}$	`\vec{x}`

To decorate mathematical i or j use `\imath` or `\jmath`, as in `\vec{\imath}`. You can use boldface for vectors by using: `\boldsymbol{x}`.

$\overline{x+y}$	`\overline{x+y}`	$\widehat{x+y}$	`\widehat{x+y}`
$\overbrace{x+y}$	`\overbrace{x+y}`	$\underbrace{x+y}$	`\underbrace{x+y}`

Comment on an expression can be written as follows

$$\underbrace{x+y}_{|A|} \quad \texttt{\underbrace\{x+y\}\_\{|A|\}}$$
$$\overbrace{x+y}^{|A|} \quad \texttt{\overbrace\{x+y\}\^\{|A|\}}$$

Dots

$\ldots$	`\ldots`	$\cdots$	`\cdots`
$\ddots$	`\ddots`	$\vdots$	`\vdots`

Use low dots in a list $0, 1, 2, \ldots$, entered as `0,1,2,\ldots`.

Use centered dots in a sum or product $1 + \cdots + 100$, entered as `1+\cdots+100`.

Using all dots while writing in matrix

$$\begin{bmatrix} a & b & \cdots & c \\ \vdots & \vdots & \ddots & \vdots \\ d & e & \cdots & f \end{bmatrix}$$

```
$\begin{bmatrix}
a & b & \cdots & c\\
\vdots & \vdots & \ddots & \vdots \\
d & e & \cdots & f
\end{bmatrix}$
```

Roman Names Enter `\tan(x)`, with a backslash, instead of `tan(x)`. These get the same treatment.

sin	`\sin`	sinh	`\sinh`	arcsin	`\arcsin`
cos	`\cos`	cosh	`\cosh`	arccos	`\arccos`
tan	`\tan`	tanh	`\tanh`	arctan	`\arctan`
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`

Spacing in Mathematics Inside math mode `x  y` gives you xy. To give space inside math mode we need some operator likes `\, \: \: \quad \qquad \!`

$x\,y$	`x \, y`	$x \quad y$	`x \quad y`
$x\:y$	`x \: y`	$x \qquad y$	`x \qquad y`
$x\;y$	`x \; y`	$x\!y$	`x \! y`

The left column spaces are in ratio $3 : 4 : 5$. The last in the right column is a negative space, opposite to `\,`. Get arbitrary space as in `\hspace{0.5cm}`.

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Other Symbols

$<$	`<`	$\angle$	`\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`

Enter `a|b` for the divides relation $a|b$. Use `\mid` to denote such that, for example for $\{a \in S \mid a = 0$ or a is odd$\}$ use `\{a\in S\mid\text{$a=0$ or $a$ is odd}\}`

Variable-sized operators

$$\textstyle\sum_{j=0}^3 j^2 \quad \texttt{\\sum\_\{j=0\}^3 j^2}$$

$$\textstyle\int_{x=0}^3 x^2\,dx \quad \texttt{\\int\_\{x=0\}^3 x^2\\,dx}$$

$$\sum_{j=0}^3 j^2 \quad \texttt{\\displaystyle\\sum\_\{j=0\}^3 j^2}$$

$$\int_{x=0}^3 x^2\,dx \quad \texttt{\\displaystyle\\int\_\{x=0\}^3 x^2\\,dx}$$

Following are some mathematical operators.

$\int$	`\int`	$\iiint$	`\iiint`	$\cup$	`\cup`
$\iint$	`\iint`	$\oint$	`\oint`	$\cap$	`\cap`
$\amalg$	`\amalg`	$\vee$	`\vee`	$\wedge$	`\wedge`
$\oplus$	`\oplus`	$\ominus$	`\ominus`	$\otimes$	`\otimes`
$\prod$	`\prod`	$\cong$	`\cong`	$\sqcup$	`\sqcup`

You can use each operator given in above in big size.

$\bigvee$	`\bigvee`	$\bigwedge$	`\bigwedge`	$\bigcup$	`\bigcup`
$\bigoplus$	`\bigoplus`	$\bigotimes$	`\bigotimes`	$\bigcap$	`\bigcap`

Arrows

$\rightarrow$	`\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`

The right arrows in the first column have matching left arrows, such as `\leftarrow` for $\leftarrow$, `\uparrow` for $\uparrow$ and `\downarrow` for $\downarrow$ also `\curvearrowleft` for $\curvearrowleft$ etc.

Fences

$(\ )$	`()`	$\langle\ \rangle$	`\langle\rangle`	$\|\ \|$	`||`
$[\ ]$	`[]`	$\lfloor\ \rfloor$	`\lfloor\rfloor`	$\|\|\ \|\|$	`|\ |`
$\{\ \}$	`\{\}`	$\lceil\ \rceil$	`\lceil\rceil`	$\ulcorner\ \urcorner$	`\ulcorner\urcorner`

They will grow appropriately with the enclosed formula using `\left` and `\right`. For example,

$$\left\langle i,2^{2^i}\right\rangle \quad \texttt{\\left\\langle i,2^\{2^i\}\\right\\rangle}$$

Every `\left` must match a `\right` and they must end on the same line in the output. For a one-sided fence put a period `\left.` or `\right.` on the other side.

$$\frac{df}{dx}\bigg|_{x_0} \quad \texttt{\\left.\\frac\{df\}\{dx\}\\right|\_\{x\_0\}}$$

Fix the size with `\big`, `\Big`, `\bigg`, or `\Bigg`.

$$\Big[\sum_{k=0}^n e^{k^2}\Big] \quad \texttt{\\Big[\\sum\_\{k=0\}^n e^\{k^2\}\\Big]}$$

Arrays, Matrices
Make an array of mathematical text as you make a table of plain text.

$$\begin{array}{rcl} 0 &\leftrightarrow &0 \\ 1 &\leftrightarrow &1 \\ 2 &\leftrightarrow &4 \\ \vdots & &\vdots \end{array}$$

```
\begin{array}{rcl}
    0 &\leftrightarrow &0 \\
    1 &\leftrightarrow &1 \\
    2 &\leftrightarrow &4 \\
    \vdots &           &\vdots
\end{array}
```

Definition by cases is an array with two columns.

$$f_n = \begin{cases} a & \text{if } n=0 \\ r \cdot f_{n-1} & \text{else} \end{cases}$$

```
f_n=
\begin{cases}
    a         &\text{if $n=0$} \\
    r\cdot f_{n-1} &\text{else}
\end{cases}
```

A matrix is another array variant. With this abbreviation you need not specify that columns are centered.

$$\begin{pmatrix} a & b & \cdots & c\\ \vdots & \vdots & \ddots & \vdots \\ d & e & \cdots & f \end{pmatrix}$$

```
\begin{pmatrix}
a & b & \cdots & c\\
\vdots & \vdots & \ddots & \vdots \\
d & e & \cdots & f
\end{pmatrix}
```

For the determinant use `|A|` inline and `vmatrix` in display.

$$\begin{vmatrix} a & b & \cdots & c\\ \vdots & \vdots & \ddots & \vdots \\ d & e & \cdots & f \end{vmatrix}$$

```
\begin{vmatrix}
a & b & \cdots & c\\
\vdots & \vdots & \ddots & \vdots \\
d & e & \cdots & f
\end{vmatrix}
```

Also you can use `matrix` and `bmatrix` instead of `pmatrix` or `vmatrix` to get matrix without boundary fences and with square boundary fences, respectively.

For More See also the Comprehensive LaTeX Symbols List at `mirror.ctan.org/info/symbols/comprehensive` and ShareLaTeX `sharelatex.com/learn/Attribute_Value_Matrices`.

Displayed equations
Put equations on a separate line with the `equation*` environment. When you will put `equation*`

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

```
\begin{equation*}
e^{\pi i} + 1 = 0
\end{equation*}
```

You can break into multiple lines.

$$\sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \cdots$$

```
\begin{multline*}
  \sin (x)=x-\frac{x^3}{3!} \\
         +\frac{x^5}{5!}-\cdots
\end{multline*}
```

Align using the `eqnarray*` environment (`&` operator use to specify alignment and you can use atmost two alignment option in each line)

$$
\begin{array}{rcl}
z_0 &=& d = 0 \\
z_{n+1} &=& z_n^2 + c
\end{array}
$$

```
\begin{eqnarray*}
z_0 &=& d = 0 \\
z_{n+1} &=& z_n^2+c
\end{eqnarray*}
```

(you can have an empty left or right side of the alignment).

Align using the `align*` environment (`&` operator use to specify alignment and you can use as many as you want alignment option in each line)

$$
\begin{array}{lll}
x = y & w = z & a = b + c \\
2x = -y & 3w = \frac{1}{2}z & a = b \\
-4 + 5x = 2 + y & w + 2 = -1 + w & ab = cb
\end{array}
$$

```
\begin{align*}
x&=y          &   w &=z        &    a&=b+c\\
2x&=-y        &   3w&=\frac{1}{2}z  &    a&=b\\
-4 + 5x&=2+y  &   w+2&=-1+w     &    ab&=cb
\end{align*}
```

For each environment, get a numbered version by omitting the asterisk, as with `align` in place of `align*`.

Calculus examples
The last three here are display style.

$$f \colon \mathbb{R} \to \mathbb{R}$$ `f\colon\mathbb{R}\to\mathbb{R}`

$$9.8 \text{ m/s}^2$$ `9.8~\text{m}/\text{s}^2`

$$\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$$ `\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}`

$$\int x^2\, dx = x^3/3 + C$$ `\int x^2\,dx=x^3/3+C`

$$\nabla = \boldsymbol{i}\frac{d}{dx} + \boldsymbol{j}\frac{d}{dy}$$ `\nabla=\boldsymbol{i}\frac{d}{dx}+\cdots!`

Discrete Mathematics Examples
There are several operator we used:

$a \equiv b \pmod{m}$ `a\equiv b\pmod m` $m \bmod n$ `m\bmod n`

$a \equiv b \mod m$ `a\equiv b\mod m` $a \equiv b \pod{m}$ `a\equiv b\pod m`

$\binom{n}{k}$ `\binom{n}{k}` $\dbinom{n}{k}$ `\dbinom{n}{k}`

$\tbinom{n}{k}$ `\tbinom{n}{k}` ${}_nP_r$ `{}_nP_r`

Font face
The font can also be changed for a specific element in the document.

Command	Declaration	Effect
`\textrm{`*text*`}`	`{\rmfamily `*text*`}`	Roman family
`\textsf{`*text*`}`	`{\sffamily `*text*`}`	Sans serif family
`\texttt{`*text*`}`	`{\ttfamily `*text*`}`	Typewriter family
`\textmd{`*text*`}`	`{\mdseries `*text*`}`	Medium series
`\textbf{`*text*`}`	`{\bfseries `*text*`}`	**Bold series**
`\textup{`*text*`}`	`{\upshape `*text*`}`	Upright shape
`\textit{`*text*`}`	`{\itshape `*text*`}`	*Italic shape*
`\textsl{`*text*`}`	`{\slshape `*text*`}`	*Slanted shape*
`\textsc{`*text*`}`	`{\scshape `*text*`}`	SMALL CAPS SHAPE
`\emph{`*text*`}`	`{\em `*text*`}`	*Emphasized*
`\textnormal{`*text*`}`	`{\normalfont `*text*`}`	Document font
`\underline{`*text*`}`		Underline

The declarations command should be used in the form `{\rmfamily text}`, or without braces to affect the entire document.

Font size
To specify font size use following commands, for example to get "This Document Created by Rakesh" use `{\tiny This} {\scriptsize Document} {\small Created} {\large by} {\Large Rakesh}`.

`\tiny`	tiny	`\Large`	Large
`\scriptsize`	scriptsize	`\LARGE`	LARGE
`\footnotesize`	footnotesize	`\huge`	huge
`\small`	small	`\Huge`	Huge
`\normalsize`	normalsize		
`\large`	large		

These are declarations and should be used in the form `{\small ...}`, or without braces to affect the entire document.

Tabular environments
`\=` Set tab stop.   `\>` Go to tab stop.

Tab stops can be set on "invisible" lines with `\kill` at the end of the line. Normally `\\` is used to separate lines.

`tabular` environment

```
\begin{array}[pos]{cols}
  \begin{tabular}[pos]{cols}
  \begin{tabular*}{width}[pos]{cols}
```

`tabular` column specification

`l`	Left-justified column.
`c`	Centered column.
`r`	Right-justified column.
`p{`*width*`}`	Same as `\parbox[t]{`*width*`}`.
`|`	Inserts a vertical line between columns.

`tabular` elements

`\hline`	Horizontal line between rows.
`\cline{`*x-y*`}`	Horizontal line across columns x through y.
`\multicolumn{`*n*`}{`*cols*`}{`*text*`}`	A cell that spans n columns, with *cols* column specification.

A Tabular Example

To get below table

Col1	Col2	Col2	col4
1	6	87837	am
12	7	78	Rakesh is
3	55	778	Math is beautiful
5	88	788	Department

use following code.

```
\begin{tabular}{||l c r c||}
\hline
Col1 & Col2 & Col2 & Col3 \\ [0.5ex]
\hline\hline
1 & 6 & 87837 & 787 \\
\hline
12 & 7 & 78 & 5415 \\
\hline
3 & 55 & 778 & 7507 \\
\hline
224 & 545 & 18744 & 7560 \\
\hline
5 & 88 & 788 & 6344 \\ [1ex]
\hline
\end{tabular}
```

To use \multicolumn{*n*}{*cols*}{*text*} and \multirow{*n*}{*cols*}{*text*} you have to use package \usepackage{multicol} and \usepackage{multirow}, respectively.

col1	col2	col3
Multiple row	cell2	cell3
	cell5	cell6
	cell8	cell9

```
\begin{tabular}{ |c|c|c|c| }
\hline
col1 & col2 & col3 \\
\hline
\multirow{3}{4em}{Multiple row} & cell2 & cell3 \\
& cell5 & cell6 \\
& cell8 & cell9 \\
\hline
\end{tabular}
```

Document Styling

Lists

\begin{enumerate}	Numbered list.
\begin{itemize}	Bulleted list.
\begin{description}	Description list.
\item *text*	Add an item.
\item[*x*] *text*	Use *x* instead of normal bullet or number. Required for descriptions.

References

`marker` have to be an unique name with respect to different marking position.

\label{*marker*}	Set a marker for cross-reference, often of the form \label{sec:item}.
\ref{*marker*}	Give section/body number of marker.
\pageref{*marker*}	Give page number of marker.
\footnote{*text*}	Print footnote at bottom of page.

Floating Bodies

\begin{table}[*place*]	Add numbered table.
\begin{figure}[*place*]	Add numbered figure.
\begin{equation}[*place*]	Add numbered equation.
\caption{*text*}	Caption for the body.

The *place* is a list valid placements for the body. t=top, h=here, b=bottom, p=separate page, !=place even if ugly. Captions and label markers should be within the environment.

Justification The declarations command should be used in the form {\centering text}, or without braces to affect the entire document.

Environment	*Declaration*
\begin{center}	\centering
\begin{flushleft}	\raggedright
\begin{flushright}	\raggedleft

Sample LaTeX document The following simple code will generate a nice document.

```
\documentclass[11pt]{article}
\usepackage{fullpage}
\title{My Title Goes Here}
\author{My Name}
\begin{document}
\maketitle

\section{section}
\subsection*{subsection without number}
text \textbf{bold text} text. Some math: $2+2=5$
\subsection{subsection}
text \emph{emphasized text} text.
discovered the structure of Mathematics.

A table:
\begin{table}[!th]
\begin{tabular}{|l|c|r|}
\hline
first  &  row  &  data \\
second & row  &  data \\
\hline
\end{tabular}
\caption{This is the caption}
\label{ex:table}
\end{table}

The table is numbered \ref{ex:table}.
\end{document}
```

For more See also the following site for any help:

LaTeX Symbols	mirror.ctan.org/info/symbols/comprehensive
DeTeXify	detexify.kirelabs.org/classify.html
TeXStack Exchange	tex.stackexchange.com
ShareLaTeX	sharelatex.com/learn
Wiki Book	en.wikibooks.org/wiki/LaTeX

August 30, 2017