

# Latex Certificate Course Instructions

Jacob Antony

March 21, 2021

## 1 Mathematics

L<sup>A</sup>T<sub>E</sub>X has a special mode for mathematics called **math mode**. L<sup>A</sup>T<sub>E</sub>X changes into or returns from math mode on each occurrence of dollar, \$ symbols.

1	Let <code>\$x\$</code> be an integer. <code>\\</code>	Let $x$ be an integer.
2	Let <code>x</code> be an integer.	Let $x$ be an integer.
3	<code>\end{document}</code>	

Figure 1: math mode

In figure 1 at line 1, L<sup>A</sup>T<sub>E</sub>X prints `Let`, enters into math mode, prints  $x$ , exits from math mode and prints `be an integer`. But at line 2, L<sup>A</sup>T<sub>E</sub>X prints everything in text mode. You might think that the difference in output isn't much. But, it is better to write variable names and numbers in math mode for readability of the document. And math mode supports complicated mathematical expressions as well.

### 1.0.1 Superscript and Subscript

In math mode, characters caret `^` and underscore `_` are used for writing superscripts and subscripts respectively. Exponents are also written using superscripts. For example,  $a^2 + b_3$  is written as `$ a ^ 2 + b _ 3 $`.

**Warning :** When the superscript/subscript is not a single character/digit, then L<sup>A</sup>T<sub>E</sub>X blocks should be used. For example, `$2^{10}$` and `$2^10$` gives  $2^{10}$  and  $2^{10}$  respectively.

Writing multilevel superscript/subscript without using blocks will throw an error as L<sup>A</sup>T<sub>E</sub>X can't predict the priority. When you are using multilevel superscript/subscript, then the superscript/subscript at next level should be in written in a subblock. For example, `$a_{b_{c_d}}$` and `{{{a_b}_c}_d}(a_{b_c})` gives  $a_{b_{c_d}}$  and  $a_{b_{c_d}}$  respectively. Clearly, the first looks better than the second.

## 2 Operators

Most of the symbols like  $+$ ,  $-$ ,  $=$  are readily available in math mode.  $\text{\LaTeX}$  allows you to write complicated symbols and expressions using commands. The following are a few commonly used symbols,

Symbol	Command	Symbol	Command	Symbol	Command
$\in$	<code>\in</code>	$\notin$	<code>\notin</code>	$\neq$	<code>\neq</code>
$\rightarrow$	<code>\rightarrow</code>	$\geq$	<code>\geq</code>	$\leq$	<code>\leq</code>
$\subset$	<code>\subset</code>	$\times$	<code>\times</code>	$\exists$	<code>\exists</code>
$\forall$	<code>\forall</code>	$\cap$	<code>\cap</code>	$\cup$	<code>\cup</code>

Table 1: Basic Symbols

### 2.1 Basic Expressions

When you are writing, your content might need some mathematical symbols occasionally. You will have to use dollars  $\$$  for each occurrence. But, for writing mathematical expressions you don't have to add dollars  $\$$  for each symbol. You can enter into math mode, write mathematical content and then return to text mode.

1	<code>\$ 2x_n^2 + 1 = y_n^2\$\\</code>	$2x_n^2 + 1 = y_n^2$
2	<code>\$ A \subset A \cup B\$\\</code>	$A \subset A \cup B$
3	<code>Let \$ f : X \rightarrow Y\$</code>	Let $f : X \rightarrow Y$

Figure 2: Basic Expressions

At first, you might find it hard to remember these commands. But, after practicing  $\text{\LaTeX}$  for a month, you will realise that you have to remember only a handful of commands.

## 3 Greek Letters

In mathematics, we often use greek alphabets.  $\text{\LaTeX}$  math mode has commands for each greek alphabet. For example, `\alpha` gives  $\alpha$ .

You might be wondering how to print  $\Gamma, \Delta, \Phi, \dots$ . The uppercase variants of greek alphabets are also available. And it is not hard to remember the commands.

## 4 Other Symbols

Other than greek letters there are many symbols used in mathematics for different operators which includes  $\nabla$  and  $\varphi$ .

Alphabet	Command	Alphabet	Command	Alphabet	Command
$\alpha$	<code>\alpha</code>	$\beta$	<code>\beta</code>	$\gamma$	<code>\gamma</code>
$\delta$	<code>\delta</code>	$\epsilon$	<code>\epsilon</code>	$\zeta$	<code>\zeta</code>
$\eta$	<code>\eta</code>	$\theta$	<code>\theta</code>	$\iota$	<code>\iota</code>
$\kappa$	<code>\kappa</code>	$\lambda$	<code>\lambda</code>	$\mu$	<code>\mu</code>
$\nu$	<code>\nu</code>	$\xi$	<code>\xi</code>	$\phi$	<code>\phi</code>
$\pi$	<code>\pi</code>	$\rho$	<code>\rho</code>	$\sigma$	<code>\sigma</code>
$\tau$	<code>\tau</code>	$\upsilon$	<code>\upsilon</code>	$\phi$	<code>\phi</code>
$\chi$	<code>\chi</code>	$\psi$	<code>\psi</code>	$\omega$	<code>\omega</code>

Table 2: Greek Alphabets

Alphabet	Command	Alphabet	Command	Alphabet	Command
$\Gamma$	<code>\Gamma</code>	$\Delta$	<code>\Delta</code>	$\Theta$	<code>\Theta</code>
$\Lambda$	<code>\Lambda</code>	$\Sigma$	<code>\Sigma</code>	$\Psi$	<code>\Psi</code>
$\Xi$	<code>\Xi</code>	$\Pi$	<code>\Pi</code>	$\Upsilon$	<code>\Upsilon</code>
$\emptyset$	<code>\emptyset</code>	$\Phi$	<code>\Phi</code>	$\Omega$	<code>\Omega</code>

Table 3: Greek Alphabets in Uppercase

## 5 Bringing it all together

The mathematical contents will look a bit different from text. However, the document remains beautiful. In  $\text{\LaTeX}$  documents the mathematical contents flows along with the text. This is not by accident.  $\text{\LaTeX}$  uses advanced algorithms to generate beautiful document.

<pre> 1  Let <math>x \in X</math>. 2  Then <math>\forall y \in Y</math>. 3  The function 4  <math>\psi : X \times Y \rightarrow X</math> 5  defined by <math>\psi(x,y) =</math> 6  <math>\int_0^{2\pi} x \, dy</math> 7  is well-defined.</pre>	<p>Let <math>x \in X</math>. Then <math>\forall y \in Y</math>. The function <math>\psi : X \times Y \rightarrow X</math> defined by <math>\psi(x,y) = \int_0^{2\pi} x \, dy</math> is well-defined.</p>
---	--

Figure 3: Writing mathematics

Symbol	Command	Symbol	Command	Symbol	Command
$\oplus$	<code>\oplus</code>	$\partial$	<code>\partial</code>	$\nabla$	<code>\nabla</code>
$\vee$	<code>\vee</code>	$\wedge$	<code>\wedge</code>	$*$	<code>\ast</code>
$\Re$	<code>\Re</code>	$\Im$	<code>\Im</code>	$\aleph$	<code>\aleph</code>
$\infty$	<code>\infty</code>	$\cdot$	<code>\cdot</code>	$\circ$	<code>\circ</code>
$\ddots$	<code>\ddots</code>	$\cdots$	<code>\cdots</code>	$\vdots$	<code>\vdots</code>
$\wp$	<code>\wp</code>	$\int$	<code>\int</code>	$\star$	<code>\star</code>

Table 4: Other Symbols