# ETEXTutorial 

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#### Abstract

If writing a paper, you can create an abstract here. For this document, the .pdf file provides the compiled document whereas the .tex file provides the source code. Follow through each document simultaneously to see how the .pdf file is generated. Or, just skip ahead to the parts that you need.


## 1 Introduction

This document goes through the basics of $\mathrm{EAT}_{\mathrm{E}} \mathrm{X}$, including some formatting tricks and typing math. Note that there are multiple ways to do certain things, so you may have seen other commands in the past that have the same output as shown here. This document is certainly not exhaustive in what it covers, but can serve as a starting point for creating a document using LATEX.

This document can also be used as a template for a document of your own by deleting the irrelevant text and sections.

Within this document, we will cover how to:

- format text (e.g. boldface, italics, underline, use color)
- create lists (this is one example!)
- make footnotes
- typeset equations
- display an equation within a sentence or on its own line, and
- create matrices

I'll cover some of the basics of formatting text here. In $\mathrm{ET}_{\mathrm{E}} \mathrm{X}$, commands are usually one word and are indicated by a backslash. For example, italics require the command $\backslash$ italics $\}$ with the italicized text in the brackets. Similarly, $\backslash$ textbf $\}$ creates boldface text and $\backslash$ underline $\}$ underlines text.

You can also put text in color. Cleverly, this uses the command color: $\{\backslash$ color\{color name here $\}$ text here $\}$. Notice the extra set of brackets surrounding the colored text.

Another useful command is $\backslash$ ref $\}$. This allows you to refer to a section (or equation, as we will see later) that has been labeled within the .tex document. The great thing about this is that you don't have the remember the number of each section (or equation) - ${ }^{\mathrm{E}} \mathrm{T}_{\mathrm{E}} \mathrm{X}$ tracks this for you. Wasn't Section 1 super informative?!

## 2 Lists, lists, and more lists

Creating lists is very useful and pretty straightforward to do in $\mathrm{IAT}_{\mathrm{E}} \mathrm{X}$. Lists can be itemized or enumerated and - like some other commands in $\mathrm{IAT}_{\mathrm{E}} \mathrm{X}$ - they begin with the command $\backslash$ begin $\}$ and end with $\backslash e n d\}$. A command is input into the brackets; for example, enumerated lists use the command "enumerate" whereas itemized lists use the command "itemize." For both types of
lists, each new point is identified by the command $\backslash$ item. Note that it is important to both begin and end the list, otherwise the document will not compile.

Here is one list:

1. Apple
2. Banana
3. Orange

I can also create this as an itemized list:

- Apple
- Banana
- Orange $^{1}$

Notice that I created a footnote using the $\backslash$ footnote command.
Just for the fun of it, I'm going to force the next section to start on a new page using the $\backslash$ newpage command.

[^0]
## 3 Let the math begin!

Now that we have the basics down for typing text, let's learn how to type math. When typing equations or using math symbols, you need to specify that the given text should be written in "mathmode."

There are two forms of mathmode, the first of which is inline mode. Inline mathmode places the math directly in a sentence. For example, I might want to refer to the Greek letter $\kappa$. In the .tex document, you would type $\$ \backslash$ kappa $\$$. In the .tex document, the dollar sign indicates the beginning and end of mathmode, and \kappa specifies the letter I want displayed. Similarly, $\$ \backslash$ phi\$ produces $\phi$, and so on.

The second form of mathmode is display mode, which places the math on its own line and begins with a double dollar sign $\$ \$$ and ends with another double dollar sign $\$ \$$.

A lot of $\mathrm{ET}_{\mathrm{E}} X$ commands within mathmode are intuitive. For example, a carrot is used to create exponents/superscripts, underscore is used to create subscripts, $\backslash$ sum is used to create sums, $\backslash$ int is used to create integrals, and so on. Below are some examples and you can use the .tex file to see the exact formatting.

1. Polynomials

$$
f(x)=a_{n} x^{n}+a_{n-1} x^{n-1}+\ldots+a_{1} x+a_{0}
$$

2. Fractions

$$
\frac{\cos \left(4 x^{2}-2\right)}{5 \pi}
$$

3. Inequalities

$$
f(x) \leq g(x) \leq h(x)
$$

4. Sums

$$
\sum_{i=1}^{\infty}\left(\frac{1}{i}\right)^{k}
$$

5. Limits

$$
\lim _{x \rightarrow-\infty} e^{x^{2}}
$$

Each of the above examples uses mathmode, but notice that the equations are not numbered. Now, we are going to introduce a way of entering math that allows you to label and number equations. This is known as equation mode, and begins with \begin\{equation\} and ends with } $\backslash$ end \{equation\}. Similar to labeling sections of a document, equations can also be labeled within equation mode.

To demonstrate the usage of equation mode, we're going to create a matrix, which is somewhat of a different beast in $\mathrm{ETEX}_{\mathrm{E}}$. To create a matrix, you need to create an "array." This requires an
input that specifies the alignment and number of columns. For example, to start an array with 4 columns, the first of which is aligned to the left, the second is the the right, and the third and fourth are centered, you would begin with the command $\backslash$ begin\{array $\}\{\operatorname{lrcc}\}$. When typing the array, the \& command indicates a new element and $\backslash \backslash$ forces a new row. Here is an example (again, refer to the .tex document for the details):

$$
x=\left[\begin{array}{llll}
a_{11} & a_{12} & a_{13} & a_{14}  \tag{1}\\
a_{21} & a_{22} & a_{23} & a_{24}
\end{array}\right]
$$

I have labeled this matrix so that I can refer to it later. For example, the matrix $x$ provided in Equation 1 etc etc.

Finally, if we want to nicely align a set of equations then we can create an array of equations. This requires a command to begin and end the array of equations. In other words, the array starts with the command $\backslash$ begin\{eqnarray $\}$ and ends with $\backslash$ begin $\{$ eqnarray $\}$. Similar to creating a matrix, the command $\backslash \backslash$ forces a new row. Also, you usually want to align the equals signs of each equation. To do this, you type $\&=\&$ for each equation:

$$
\begin{align*}
x^{\prime} & =x y+2 x  \tag{2}\\
y^{\prime} & =y^{2} \tag{3}
\end{align*}
$$

If you take a look at the .tex code, you'll notice that I labeled the equations so that I can easily refer to Equations 2 and 3.


[^0]:    ${ }^{1}$ Oranges are my favorite of the three listed fruits

