

# Latex Document

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We can use the `\section`, `\subsection`, and the `\subsubsection` commands to add sections, subsections, and subsubsections respectively.

## 1 Section

Hello World!

### 1.1 Subsection

Structuring a document is easy!

#### 1.1.1 Subsubsection

More text.

**Paragraph** Some more text.

**Subparagraph** Even more text.

## 2 Commands

In Latex, commands begin with the `\` character. For example, inputting the `\copyright` command will return the following output: `©`.

## 3 Environments

We can use the `\begin{environment_name}g` and `\end{environment_name}g` commands to specify the start and end to an environment (in this case, the environment named `environment_name`). If an environment (which I will call a subenvironment) is initiated in another environment, that subenvironment needs to be terminated before terminating the environment.

Below is an example<sup>1</sup> that is valid:

```
\begin{environment1}g
  \begin{environment2}g
    \end{environment2}g
  \end{environment1}g
```

Below is an example that is not valid:

```
\begin{environment1}g
  \begin{environment2}g
\end{environment1}g
  \end{environment2}g
```

---

<sup>1</sup>Note that `environment1` and `environment2` are not actual environment names. They are just used to convey the point above.

## 4 Math equations

**Equations with number** To create a new math environment, we can use the equation or align environment.

$$f(x) = x^2 \tag{1}$$

**Equations without number** Adding a star to the end of the environment name will take out the equation number. To use this feature, we will have to include the amsmath package.

$$f(x) = x^3$$

**Use align for multiple equations** Using the align environments is the more preferred method when working with a math environment with multiple lines. In order to put an equation on a new line, we can use 2 backslashes: `\\` at the end of a line. Also, in the align environment, we can use the `&` symbol to align the equations. Notice that in the equations below, we have put the `&` symbol before the `=` sign. This will align all of the equations by the `=` sign.

$$1 + 2 = 3 \tag{2}$$

$$1 = 3 - 2 \tag{3}$$

**Superscripts and subscripts** We can use the `^` and `_` symbols to make superscripts and subscripts respectively. For example, the input `x_i` will result in  $x_i$ , and the input `x^2` will result in  $x^2$ . We can also have both the superscript and subscript on a character. Thus the input `x_i^2` results in  $x_i^2$ . If the subscript or superscript is more than 1 character long, then `f{g}` must be used. For example, if we want the following output:  $x_{ij}^{23}$ , then we would input: `x_{fij}^{f23g}`.

**Fractions, integrals, sums, and more** Below are some examples of common math operations and structures.

$$\begin{aligned} f(x) &= x^2 \\ g(x) &= \frac{1}{x} \\ F(x) &= \int_a^b \frac{1}{3} x^3 \\ h(x) &= \prod_{i=1}^n S_i \end{aligned}$$

**Combining commands** We can also combine commands:  $\frac{1}{\sqrt{x}}$ .

**Adding equations inline** We can use `$` before and after equation to put the equation inline. So we would write  $f(x) = x^2$ .

**Matrices** To create a matrix, we could use the matrix environment:

$$\begin{matrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{matrix} \tag{4}$$

Notice that using the matrix environment does not include any brackets. We could manually add brackets:

**Adding brackets to matrices**

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} \tag{5}$$

**Adding bigger brackets to matrices** In the case above, the brackets are too small. We could use `nleft[` for the left bracket, and `nright]` for the right bracket. Notice that we could also use `nleft(` (and `nright)`) to add big parentheses.

$$\begin{matrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{matrix} \quad (6)$$

$$\begin{matrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{matrix} \quad (7)$$

**Built in matrix commands** We could also use other built in matrix environments if we do not want to manually add the brackets. Use the `bmatrix` environment for a matrix with block brackets, and the `pmatrix` environment for a matrix with parentheses.

$$\begin{matrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{matrix} \quad (8)$$

$$\begin{matrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{matrix} \quad (9)$$

**Big parentheses for math equations** We can also big parentheses to equations to "beautify them." Here is an example using regular sized parentheses:

$$\left(\frac{1}{6}\right)7 \quad (10)$$

Now, using big parentheses, we get the following output:

$$\left.\frac{1}{6}\right. 7 \quad (11)$$

## 5 Math Symbols

We can also use commands to input mathematical (greek) symbols. Notice that these mathematical symbols need to be used in a mathematical environment like equation, align, or even `$$`.

Command	Output
<code>nalpha</code>	
<code>nbeta</code>	
<code>nlambda</code>	
<code>npsi</code>	
<code>nphi</code>	

## 6 Inserting Images

In order to be able to add images in a document, the `graphicx` packages need to be included. We can use the `nincludegraphics` command to include an image. The image in question needs to be in the same folder as the tex document.

Notice that we added the option of having the image be the width of the line. Specifically the `nlinewidth` returns the width of the line of the document. We could also set the width to a number of different widths. `2in` will make the width 2 inches, `2cm` will make the width 2 centimeters, and `2mm` will make the width 2 millimeters. If we have not included the width option, using the command above would have inserted the picture no



In this case, our image is too big, thus, not adding the width option will keep the image at its original size.

**The Figure Environment** Often times, we want to include an image in a figure environment. We can use the `\includegraphics` command in a figure environment.

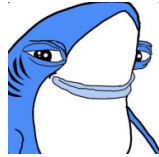


Figure 1: Here's a picture of a shark.

You'll notice that we have included the `\caption` and `\label` commands in the figure to add a caption and a label to the figure. These commands are not essential when creating a figure. Using the `\label` command makes it so we can refer back to that certain figure. We can use the `\ref` command to refer back to the figure. Example: figure 1 is a figure of a shark.

**Figure and Table Location** Another thing that you will notice with figures, is that they might not show up in the place where we would want them. We can include an option after creating the environment in order to put a figure or table where we want it. Here is a list of location options:

Option	Location
h	(here) same location
t	(top) top of page
b	(bottom) bottom of page
p	(page) on extra page
!	(override) will force the specified location

Table 1: Table of location options

**Adding multiple images on the same line** To add multiple images to same line, we can use the package `subcaption`. Then we could use the `subfigure` environment inside the figure environment. Below are some examples:



Figure 2: Nathan from Nathan for You.

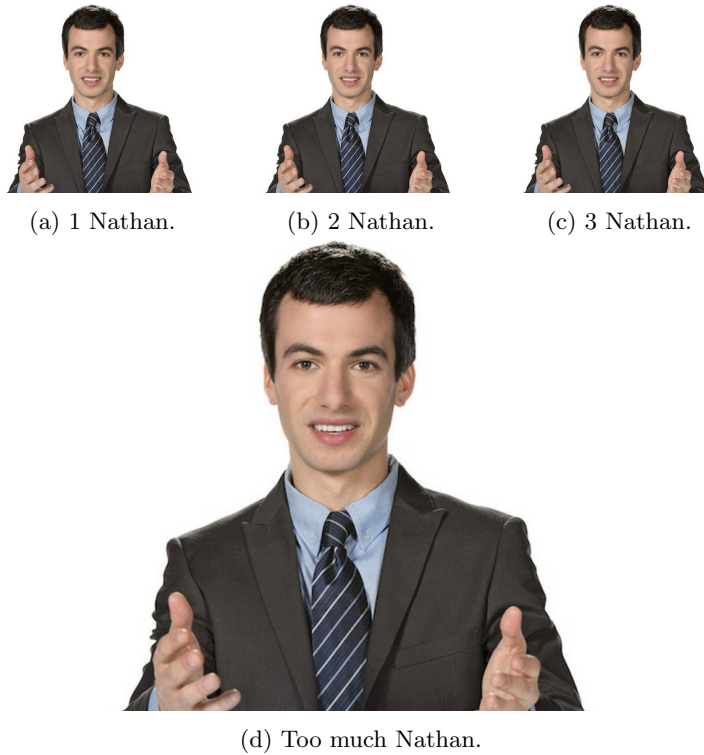


Figure 3: The same Nathan. Multiple times.

## 7 Using Bibtex

Now in order to cite a source, we can use the command `\cite{article_name}[1]`. The style of citation depends on how you define your bibliography style. I have defined the bibliography style at the end of this



tex document.

## 8 Footnotes

We can add footnotes by using the `\footnote{fg}` command<sup>2</sup>. We can also add a label to a footnote in order to refer to it later<sup>3</sup>. Referring to this label will give us: 3.

## 9 Tables

To create a table we will use the `table` environment. Notice that inside the table environment, we also have to create a `tabular` environment which contains all of the contents of the table itself. Using the `&` symbol moves us to the next column, and using `\\` moves us to the next row. Options can also be included when creating the `tabular` environment. The four letters which I have included in the example below (`lrcr`) tells latex to make three columns. The `l` tells latex to left justify that column, the `c` tells it to center justify that column, and the `r` tells latex to right justify that column. Notice in our example, the second and fourth rows are center-justified. Adding the `—` symbol before or after any of these characters will add a line to the left (if before) or right (if after) of that column.

Variable 1	Variable 2	Variable 3	Variable 4
1	2	6	7

Table 2: Caption

Again, we can use the same commands as we saw with figures. I have included the `\centering`, `\caption`, and `\label` commands to this table.

## 10 Lists

In order to make an unordered list, we have to use the `itemize` environment:

- chicken
- mayo
- rice

In order to make an ordered list, we have to use the `enumerate` environment:

1. Turn on computer
2. Login to Windows
3. Pull up start menu

You can also do lists inside of lists:

1. Turn on computer
  - (a) Wait for at least 2 minutes
  - (b) Get a cup of coffee
2. Login to Windows

If you wait for more than 5 minutes for Windows to load, call Microsoft support  
Check to make sure your caps lock is not toggled on

3. Pull up start menu

---

<sup>2</sup>Here is the footnote

<sup>3</sup>Here is another footnote

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## References

- [1] J. Doe, *The Book without Title*. Dummy Publisher, 2100.