LaTeX for the IB

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1 Introduction

1.1 The objective of this guide

Hello fellow reader, you're probably reading this guide wondering: "What's the difference between this guide and any other LaTeX guide?". Well for one, this guide isn't LaTeX documentation; it'll be a waste of time and effort to write documentation while there are a lot of good ones already. We really recommend using Overleaf's Documentation, which is our favorite resource for learning LaTeX. This guide is tailored to IB students who have an idea on what LaTeX is, and would like to use it for their Internal Assessments or their Extended Essay. This guide will mainly present the different tools generally used for writing your documents. It will also contain boilerplate for things that might be a bit annoying to write, as well as packages that are helpful for writing your documents and getting that 7 the ~~best~~ LaTeX way.

1.2 Documentation and IDEs

Before you go on, we assume that you already know basic LaTeX. If not, here's a list of good resources for learning:

- Overleaf's Documentation: Honestly, best documentation ever. You'll find it always useful and we will reference it a lot throughout this guide. We highly recommend you using this.

- Derek Banas' Youtube video: If you don't know Derek Banas, here's what you have to know. He's good at summarizing things, and this video covers a lot of LaTeX's documentation.

- CTAN: It's not really that suitable for beginners but it's the website you go to if you want to look up a package's official documentation. Useful later on if you want to look for something specific.

To write LaTeX documents, you're gonna need an IDE (Integrated Development Environment). Here's a link to a website that breaks down the most common used IDEs, from where you can choose one you like or suits you.

1.3 Contact us

This guide is an ongoing project, since the goal is to present everything an IB student would like to know before diving into writing their IAs/EE. So if you have something you would like to suggest / add to this guide or there are mistakes that you want to correct, don't hesitate to contribute over on our Github Repository or send a message to ImmortalPharaoh7#7811 on Discord.

2 Setting up and Structuring

2.1 Useful packages

Once you have your environment set up, you're gonna have to add packages and configure things in the preamble in order to respect the guidelines (things like double spacing and whatnot). Below is a example of what you generally will need in a preamble.

```
\documentclass[a4paper, 12pt]{article}

%Paragraph jumps and indentation
\setlength{\parskip}{1.6em}
\setlength{\parindent}{1.25cm}

%Border
\usepackage[left=1in, right=1in, top=1in, bottom=1in]{geometry}

%Double spacing
\usepackage{setspace}
\doublespacing

%Packages
\usepackage{amsmath}
\usepackage[dvipsnames]{xcolor}
\usepackage{mathtools}
\usepackage{amsfonts}
\usepackage{titlesec}

%Images
\usepackage{graphicx}
\graphicspath{ {./images/} }
\usepackage{wrapfig}
\usepackage{float}

%Tables
\usepackage{multirow}
\usepackage{array}
\usepackage{tabu}

\titleformat{\section}
{\normalfont\large\bfseries}{\thesection}{1em}{}
\titleformat{\subsection}
{\normalfont\large\bfseries}{\thesubsection}{1em}{}

%Equation numbering
\counterwithin{equation}{section}

\usepackage{hyperref}
```

```
\urlstyle{same}
```

Now a lot of those are quite straightforward and are just there to save time. This is the point of this guide, to save you some time. Packages related to tables and images will be talked about in later sections of this guide.

`\usepackage[dvipsnames]{xcolor}` allows you to color your text, which is generally useful for links since they aren't automatically colored. More details over on Overleaf's page.

`\usepackage{amsmath}` add maths symbols and environments like matrices, while `\usepackage{mathtools}` adds tools to make things like long fractions aesthetically pleasing. More details on mathtools are over on Overleaf's page.

`\usepackage{titlesec}` allows you to configure the space between sections and subsections. It's also used if you want to customize your sections or subsections. We've used it in the example above (starting from `\titleformat{\section}`) to reduce the space after sections. Since you have a hard 12 page limit in your G4 IAs, might as well remove any unnecessary space before reducing word count.

`\usepackage{hyperref}` allows you to add hyperlinks in your document, whether those are for navigating your documents or to link websites. We're using this right now to link you to Overleaf's documentation on hyperlinks.

That's not all! There are other useful packages for G4 subjects, which don't need to be in every preamble.

We recommend using `\usepackage{siunitx}` when it comes to writing a physics IA, since it provides a straightforward way to use SI and other units. Which can be pretty handy.

We recommend using `\usepackage[version=4]{mhchem}` for writing chemical reactions and formulas. However, we (and Overleaf) recommend using `\usepackage{chemfig}` for drawing molecules and other figures.

2.2   Structuring your documents

You can go on a couple of ways to structure your documents. This part is just to make your code more aesthetically pleasing for you to look at it, as well as being more organized. This part just covers coding conventions which are arbitrary to some extent.

- Single file projects: Generally for IAs you'd like to write it as a single file if you wanna keep it simple. Most of the times, there isn't really a reason to write multiple files unless you know what you're doing.

- Multiple files projects: You can also write your IA / EE in multiple files, a file per section. meaning that you will have a main file and is a bit more advanced when it comes to managing files and whatnot. However, this strategy is better for EEs or IAs where you have a lot of graphs and thus recompiling the whole file each time will be more time consuming. Looking at the code of this guide might help you get an idea of what those projects look like. Also you can check out Overleaf's guide on the matter for a lot more details which are targeted for very large LaTeX projects.

- Image folder: Generally you'd like to store your images in a folder in order to note clutter up your main folder. This is also why we have `\graphicspath{ {./images/} }` in the boilerplate example.

There are also other conventions when it comes to writing LaTeX code. Although it's convenient to write a paragraph per line, provided that your IDE has appropriate text wrapping, some people believe that manually breaking a line by pressing the enter key is useful, since it doesn't really affect the pdf generated, but it does help people who're looking at the github code, since they wouldn't have to scroll sideways 8 kilometers. Keeping in mind that the IA and EE code aren't generally going to be published, we're not going to recommend using a specific writing style; but we believe it's better to pick up the good practices early on just in case.

3 Writing your documents

In this section we will focus on the essential tables / graphs you'll need when writing an IA.

3.1 Tables

Overleaf's documentation on tables already provides almost everything you need to write a table. This website generates LaTeX tables if you would like some sort of GUI assistance when dealing with tables. But this guide is to offer boilerplate, so here's one for raw data tables (note: this boilerplate requires the inclusion of the packages mentioned in packages section):

```
\begin{table}[H]
\begin{tabu} to \textwidth {X[c]X[c]X[c]X[c]X[c]X[c]X[c]X[c]}
\hline
\multirow{2}{*}{\parbox{2cm}{IV}}&
\multicolumn{6}{c}{DV} \\
\cline{2-8}
& Trial 1 & Trial 2 & Trial 3 & Trial 4 & Trial 5 & Average & Uncert \\
\hline
value & value & value & value & value & value & value & value \\
 & & & & & & & \\
 & & & & & & & \\
 & & & & & & & \\
 & & & & & & & \\
\hline
\end{tabu}
\caption{Table caption}
\end{table}
```

Resulting table:

IV	DV						
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Average	Uncert
value	value	value	value	value	value	value	value

Table 1: Table caption

Just note that tables are highly customizable and we highly recommend that you read Overleaf's guide as it will allow you to better understand the code we've used.

3.2 Graphs

Now this part has been up for debate for a long time. There are 2 main approaches on how to implement graphs. You either can just take a screenshot from Excel or some other software, or you can use the pgfplots package. Screenshotting a graph is the fast way which doesn't require a lot of effort and we recommend doing this if you're short on time. The other approach takes more time and effort but it's more aesthetically pleasing. Anyways it's up to you to choose and it's normal if you want to just screenshot and save some time and effort. However, if you have some time on your hand, we recommend using pgfplots to make your graphs.

Here's the guide that Overleaf wrote about the package which we recommend that you read in order to get an idea on how to manipulate the code. The approach that we're taking is to use Excel in order to get the best fit line / equation, then we graph the points and just add the best fit its own plot. Now here's the boilerplate for a non-linear relation graph:

```
\begin{figure}[H]
\caption{Graph title}
\begin{center}
\begin{tikzpicture}
\begin{axis}[
    axis lines = left,
    xlabel = X label,
    ylabel = Y label,
    xmin=0, xmax=0.9,
    ymin=1.030, ymax=1.07,
    xtick={0, 0.2, 0.4, 0.6, 0.8},
    ytick={1.03, 1.04, 1.05, 1.06, 1.07},
    legend pos=north west,
]
\addplot [
    domain=0.05:0.8,
    samples=50,
    color=blue,
]
{0.0095*ln(x)+1.0667};

\addplot[
    only marks,
    color=blue,
    mark=*,
    error bars/.cd,
    y dir=both, y explicit,
    x dir=both, x explicit,
    ]
    coordinates {
    (0.05, 1.0384) +- (0.00204, 0.0015)
    (0.1, 1.0444) +- (0.00315 , 0.0015)
```
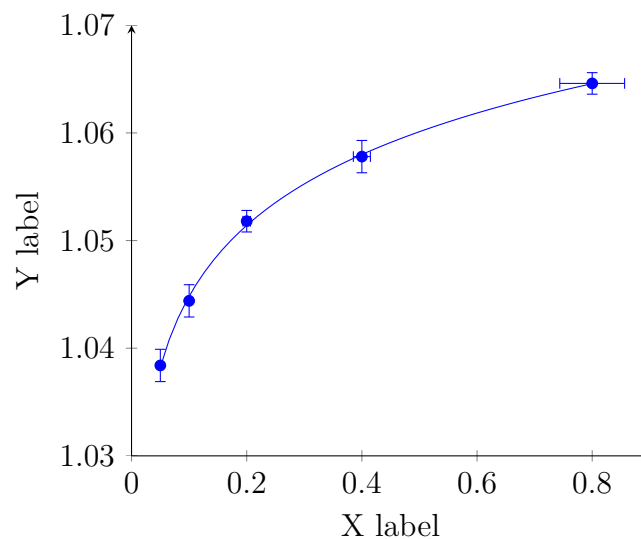
```
        (0.2, 1.0518) +- (0.00657, 0.001)
        (0.4, 1.0578) +- (0.0148, 0.0015)
        (0.8, 1.0646) +- (0.0563, 0.001)
        };
\end{axis}
\end{tikzpicture}
\end{center}
\end{figure}
```

Figure 1: Graph title

Now the linear graphs are a bit longer than that, since you have to add minimum and maximum slope along with their equations. We take the same idea as non linear graphs and apply it, but this time you don't really need to plot the linear function of the min and max slopes; you can just connect the 2 points that you use to get the equation. You're still going to need to add the equations of those in the legend section though. Here's the boilerplate:

```
\begin{figure}[H]
\caption{Graph title}
\begin{center}
\begin{tikzpicture}
\begin{axis}[
    axis lines = left,
    xlabel = X label,
    ylabel = Y label,
    xmin=0, xmax=3.5,
    ymin=1.030, ymax=1.07,
    xtick={0, 0.5, 1, 1.5, 2, 2.5, 3},
    ytick={1.03, 1.04, 1.05, 1.06, 1.07},
    legend pos=outer north east,
```

```
]

\addplot [
    color=red,
]
coordinates {
 (0.3039, 1.0661) (2.9446, 1.0369)
};
\addlegendentry{$y_{min}=-0.0111x+1.0695$}

\addplot [
    domain=0.2231:2.9957,
    samples=100,
    color=blue,
]
{-0.0095*x + 1.0667};
\addlegendentry{$y=-0.0095x+1.0667$}

\addplot [
    color=green,
]
coordinates {
(0.1424, 1.0631) (3.0468, 1.0399)
};
\addlegendentry{$y_{max}=-0.0080x+1.0642$}

\addplot[
    only marks,
    color=blue,
    mark=*,
    error bars/.cd,
    y dir=both, y explicit,
    x dir=both, x explicit,
    ]
    coordinates {
    (0.2231, 1.0646) +- (0.0807, 0.0015)
    (0.9163, 1.0578) +- (0.0472, 0.001)
    (1.6094, 1.0518) +- (0.0430, 0.001)
    (2.3026, 1.0444) +- (0.0417, 0.0015)
    (2.9957, 1.0384) +- (0.0511, 0.0015)
    };
\end{axis}
\end{tikzpicture}
\end{center}
\end{figure}
```
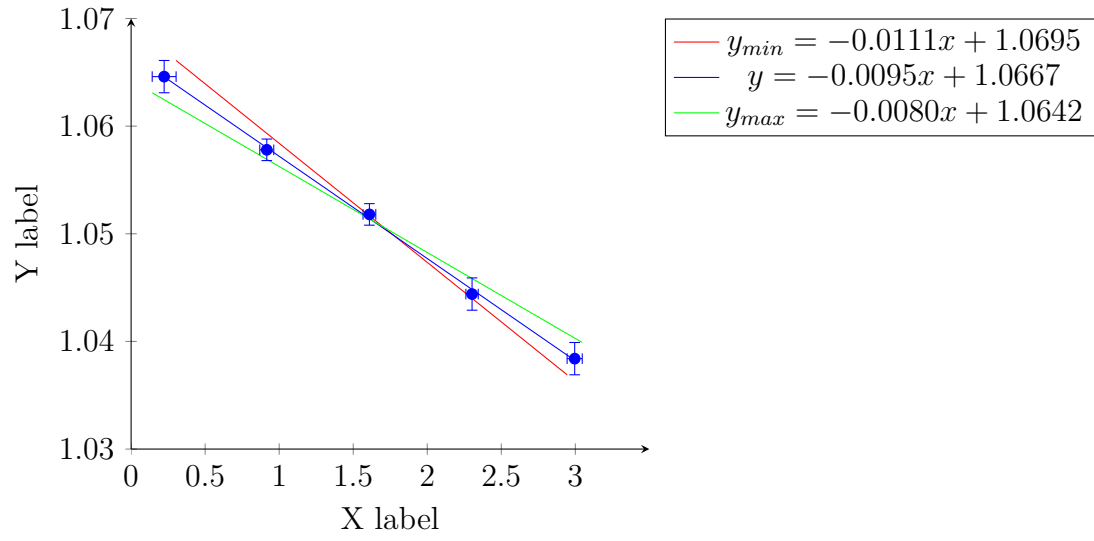
Figure 2: Graph title

3.3 BibLaTeX

4   Miscellaneous

4.1   French and Spanish support

Now if you're a part of the small amount of people who do IB in either French or Spanish, you can configure LaTeX in order to adapt to the language environment. There are things like transforming transforming the dot to commas when it comes to writing numbers, changing the table names and whatnot. For more details here's the Overleaf link for French and this is for Spanish.

This sums up what you need to put in the preamble but we've found out that (in French at least), some things aren't implemented. For example when it comes to writing numbers in math mode, the dot isn't turned into a comma. Yes you can commas in numbers, but there's this unnecessary space after the comma. By putting

```
\mathchardef\period=\mathcode`.
\DeclareMathSymbol{.}{\mathord}{letters}{"3B}
```

in the preamble, the dots in the math mode numbers would automatically turn into commas. Another solution is to put all your numbers in `\nombre{}`.

Tables' captions are also left as "Table" (instead of Tableau), you can also put that code in the preamble to fix this

```
\addto\captionsfrench{\def\tablename{Tableau}}
```

Last thing is you use `\og \fg{}` instead of quotes in order to use the French quotes.

4.2   Extended Essay Title Page

Here's the boilerplate code for the EE title page:

```
\begin{titlepage}
    \begin{center}

        EE group\\
        Subject

        \vspace*{4cm}

        \textbf{Title:}\\
        Insert title here
        \vspace{1cm}

        \textbf{RQ:}\\
        Insert RQ here
        \vspace{4cm}
```

```
        Word count:


        \vfill


        \vspace{0.1cm}


      Year session

    \end{center}
\end{titlepage}
```

We would like to note that this isn't the only way to write a title page, but it's one way and you can change it to your liking if you want to.