LaTeX Lab 1: this is where the title goes

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1 Introduction to lab 1

We now have a LaTeX 2_ε document with a title, an author and date. We also have our first section with this paragraph.

And a new paragraph — **created with a blank line!**

2 This is the title for the next section

The text for the section goes here. This paragraph is being deliberately filled up with too many words just to show that LaTeX can handle all line breaking and inter-word spacing on its own. The human's job is to look after the content. LaTeX will look after the appearance.

As above, we start a new paragraph by leaving a blank line in your source file.

Notice that this subsection has been given the name of `sec:next`. We did this with the `\label{}` command.

2.1 Here's a subsection

A subsection is one level lower down than a section. It is the first subsection of section 2, and precedes subsection 2.2.

Note that we refer to sections using the `\ref{}` command. This means that the numbering in the final document is automatically taken care of by LaTeX and will update automatically if a new section is inserted.

2.2 Here's another subsection

This subsection is again one level lower down than a section. It is the second subsection of section 2, and precedes subsection 2.1.

2.2.1 We can make sub-subsections too

This is sub-subsection of subsection 2.2. Whether you want to work at this level of nesting is often a matter of personal style and taste. It may also depend very strongly on what you want to achieve with your document.

3 Starting with maths

Some famous trigonometric identities relating $\sin\theta$, $\cos\theta$ and $\tan\theta$ are,

$$\sin^2\theta + \cos^2\theta = 1, \qquad \tan^2\theta + 1 = \sec^2\theta \quad \text{and} \quad 1 + \cot^2\theta = \csc^2\theta.$$

The first identity in (1) below

$$\sin^2\theta + \cos^2\theta = 1, \qquad \tan^2\theta + 1 = \sec^2\theta \quad \text{and} \quad 1 + \cot^2\theta = \csc^2\theta. \tag{1}$$

follows by taking $A = \theta$ and $B = \theta$ in the addition formula

$$\cos(A - B) = \cos(A)\cos(B) + \sin(A)\sin(B) \tag{2}$$

Other versions of (2) lead to other identities.

4 Remarks

You should appreciate that very similar advice applies to the creation of mathematical documents as for any other. Accordingly you should feel free to use any learning resource materials that you find helpful, as well as, for example, Dr Greenhow's study skills guide at

`http://people.brunel.ac.uk/~mastmmg/ssguide/sshome.htm`

to inform your report writing. Also, although aimed at LaTeX 2_ε users, the book [1] contains a lot of helpful tips on how to write mathematical text. The original LaTeX book, [2], was written by Leslie Lamport. (Also see [3].)

5 Lab session 1

For the first lab session you should create a document called *Maths degrees: the good, the bad and the ugly*. In Section 1 describe the reasons that led you to study maths.

You can just add material to this document if you wish.

Before we start the lab though, be aware that you may find two *WinEdt* programs on the lab machines. This is because our department labs have a local installation, but there is also a university-wide installation for use on all computers. So, here is the advice, if you have a *WinEdt* shortcut on your desktop use that. It's quicker. If you go to the programs menu and start the global version and run it then you'll find that it will take about 10 minutes before anything happens. This is because it needs to generate all the font information that LaTeX needs. This is a one-time only thing and once it is done you'll be able to use *WinEdt* on all campus computers (e.g. in the library).

Now, back to the lab. In Section 2 create three subsections called *The good*, *The bad* and *The ugly*.

In the first one create a list of all the good things about studying maths to degree level. In the second put all the bad things. In the third put all the things that you regard as necessary and important (i.e. not bad things), but that you can't possibly bring yourself to regard as good.

You should use the `itemize` environment for the good, the `enumerate` environment for the bad, and the `description` environment for the ugly — giving a bit more detail on each item to explain your reasoning.

For example... The good things about studying maths are:

- Doing lots of maths.
- Getting lots of coursework.
- Sitting lots of exams.
- ... Can you see how to create a bulleted list?

The bad things about studying maths are:

1. Not doing enough maths in the evenings and weekends.
2. Not getting enough coursework.
3. Too few exams.
4. ... Can you see how to create a numbered list?

The ugly aspects of a maths degree are:

Short lectures. It would be much better if we could start maths at 7:30am and continue learning it until 9pm, seven days a week.

Thin textbooks. Each book should be at least one thousand pages long.

OK? ... Can you see how to create a descriptive list?

You can even put lists inside of lists...

Calculus: One easy and one hard thing:

1. Differentiation
2. Integration

Algebra: One good thing and one excellent thing!

- Complex numbers
- Gauss-Jordan elimination

In a new section choose your favourite piece of maths and type it up carefully and precisely. If you are looking for some inspiration you could look at the trig identities at `http://www.purplemath.com/modules/idents.htm`.

Or you could type up some Taylor or Maclaurin expansions from your ma2730 lectures.

For example...

The *Taylor polynomial* of degree n about $x = a$ is given by:

$$T_n^a f(x) = \sum_{m=0}^{n} x^m \frac{f^{(n)}(a)}{n!}. \tag{3}$$

If $a = 0$ in (3) then it is called the Maclaurin polynomial and we write $T_n f$. As an example,

$$T_n e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots + \frac{x^n}{n!}. \tag{4}$$

You should make sure you practice using the `\label` and `\eqref` commands to reference your work.

Over to you: Type up the Maclaurin series for $\sin(x)$, $\cos(x)$, $(1 \pm x)^{-1}$, $\ln(1 \pm x)$. Three last things. You get subscripts like this: `x_{i}`, superscripts like this: `x^{m+1}` and fractions like this:

```
x_i,    x^{n},  \frac{x+5}{x^2+3x-8}
```

These give x_i, x^n and

$$\frac{x+5}{x^2+3x-8}$$

Happy typing!

References

[1] Nicholas J. Higham. *Handbook of writing for the mathematical sciences*. SIAM, 1998.

[2] Leslie Lamport. *LaTeX Users Guide & Reference Manual*. Addison-Wesley Publishing Company, 1986.

[3] Helmut Kopka and Patrick W. Daly. *A Guide to LaTeX 2ε. Document preparation for beginners and advanced users*. Addison Wesley, 1995", second edition.