MAS115 PRESENTATION LAB 1

In this lab we will use a software bundle called `MiKTeX` (pronounced 'mik-tek') to create some basic mathematical documents.

Log on, then check to see if MiKTeX is installed on the computer by typing 'texworks' into the search box on the Start Menu. If it's not there, you need to install MiKTeX 2.9 from the Software Center on the desktop.

> *The Software Center may take a minute or two to work properly. If it's not responding, wait, then press F5.*

Once MiKTeX is installed, start TeXWorks.

In the Intro Week computer session, you may have created a file which you saved in 'My Documents' on your `U:` drive in a folder called 'Intro Week'. If you can find this file, open it. If not, retype it as below.

```
\documentclass{article}
\begin{document}

Hello! Here's $f(x)=\frac{e^x}{1-x}$ inline,
and bigger on a new line: $$f(x)=\frac{e^x}{1-x}.$$

Here's an integral:
$$\int \cos x~dx=\sin x + c.$$

\end{document}
```

Click on the big green arrow, but make sure it says `pdfLaTeX` and not `pdfTeX` by the side. If you're asked to save your file, make a folder on your `U:` drive called 'MAS115 LaTeX' and use the filename 'week1.tex'.

A PDF document should appear!

> *If the green arrow has turned into a red cross and no PDF has appeared after a little wait, click on the red cross, check your typing carefully and try again. If you still have problems, ask for help.*

By comparing the *source code* (the text you typed) with the output, do some experimenting to answer the following questions, pressing the green arrow each time to see the result.

(1) What is the point of the `$`-signs in the source code? Does it work without them? What happens if you type `f(x)` without `$`-signs?
(2) What about is the purpose of double-dollars, `$$`? (Try turning single-dollars into double-dollars or vice-versa.)
(3) What has the `\frac` command done?
(4) What happens if you swap the `~` symbol for a space?

Here, you've created your first LaTeX file (pronounced 'lay-tek'). LaTeX is a *mark-up language* used for creating good quality mathematical documents. Every LaTeX file starts with a `\documentclass{...}` command. The main output text is put between `\begin{document}` and `\end{document}` commands. Maths must go inside $-signs if it's *inline*, or between $$-signs if it needs to be displayed large on its own line (called *displaymath*).

Let's do some more experimenting.

(5) What happens if you change the `\int` command into `\int_0^\pi`? Finish off the calculation in your document (including something like '... $= [\sin x]_0^\pi = \ldots$').

(6) Change the first paragraph so it reads
'Let $f(x) = \frac{e^x}{1-x}$. Then
$$f'(x) = \ldots',$$
completing the line by calculating the derivative of f by hand and typing it in. Show the steps in your workings by including them as part of the line beginning '$f'(x) = \ldots$'.

(7) Change the second paragraph so it reads
'Because the derivative of $\sin x$ is $\cos x$, it follows that
$$\int_0^\pi \cos x \ dx = \ldots'$$
where the last line is finished as in question 5.

(8) Did you remember to use $-signs and backslashes with the $\sin x$ and $\cos x$ in the previous question, as in `$\cos x$`?

We will now give the document some structure. Between `\begin{document}` and the first paragraph, put the line `\section{Differentiation}`. Before the second paragraph, put the line `\section{Integration}`. Your PDF output should now have sections.

Let's make things look even better with a title.

(9) Above the `\begin{document}` command, put the command `\title{Calculus examples}`, then process the file. Any change? See below if not.

(10) The `\title{}` command works differently to the `\section` one. Type `\maketitle` after `\begin{document}`. Now process the file. This time it should work.

(11) Add `\author{(your name)}` just under `\title{Calculus examples}`, and process the file again.

(12) See what happens if you put `\date{September 1684}` just after the `\author{...}` command. What about using `\date{}` instead?

This document is pretty much finished. If you've got this far, add a new section called 'Formulas' and try to typeset the main three differentiation rules (product, quotient and chain) along with the formula for integration by parts.

Homework

In response to the question

> 'Let $y = e^x \cos x$. Show that the stationary points on the curve occur precisely where $\tan x = 1$.'

a student handed in the following.

> $\frac{dy}{dx} \rightsquigarrow e^x - \sin x + e^x \cos x \text{ (chain rule)} = e^x(\cos x - \sin x) = 0.$
> $\cos x = \sin x$
> $\tan x = 1.$

Your job is to write a much better solution using LaTeX, correcting any errors and improving it as much as possible. Your document should have two sections, 'Question' and 'Solution'. Your solution doesn't need to be long, but should include significantly more words than the badly written one above.

- Remember to use full sentences, with full stops.
- You should present the solution more like the second re-write in the Week 1 lecture than the first.
- Include a title 'MAS115: Presentation Homework 1' and your name as the author.
- Remember to use commands like $\sin$ and $\cos$ in your solution.
- Print out your document and hand it in at next week's computer lab.

(This homework counts towards the 10% homework component of your module score, as do all the weekly presentation homeworks.)