

# MAS115 Presentation Lab 1

In this lab we will use online software called *Overleaf* to create basic mathematical documents.

To start in Overleaf, go to <http://www.overleaf.com>. If you haven't already signed up for an account, do so now. Otherwise, log in.

Once you have entered Overleaf, click on 'New Project' and create a project titled 'MAS115 Week 1'.

Delete any text that appears in the left-hand *source* pane, and type or copy and paste the text 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 green 'recompile' button above the right-hand pane. A mathematical PDF document should appear on the right!

*If the document doesn't seem to have appeared properly, look for red-crosses next to the code you entered, check your typing carefully, and try again. If you still have problems, ask for help.*

*Tip: Pressing CTRL+Enter is a keyboard shortcut for the recompile button. Thanks to Sam Bromley for that one!*

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  $\sim$  symbol for a space?

Here, you've created your first  $\text{\LaTeX}$  file (pronounced 'lay-tek').  $\text{\LaTeX}$  is a *mark-up language* used for creating good quality mathematical documents. Every  $\text{\LaTeX}$  file starts with a `\documentclass{...}` command. The main output text is put between `\begin{document}` and `\end{document}` commands. Maths must go inside  $\text{\$}$ -signs if it's *inline*, or between  $\text{\$\$}$ -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 ' $\dots = [\sin(x)]_0^\pi = \dots$ ').
6. Change the first paragraph so it reads

*Let  $f(x) = \frac{e^x}{1-x}$ . Then*

$$f'(x) = \dots,$$

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 ' $f'(x) = \dots$ '.

7. Change the second paragraph so it reads  
*'Because the derivative of  $\sin(x)$  is  $\cos(x)$ , it follows that*

$$\int_0^\pi \cos(x) dx = \dots'$$

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 made it this far without problems, 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 a homework question, a student handed in the following.

$$\begin{aligned}e^x \cos x &\rightsquigarrow e^x - \sin x + e^x \cos x \text{ (chain rule)} \\e^x (\cos x - \sin x) \\&= 0 \\ \cos x = \sin x &= \tan x = 1\end{aligned}$$

$$\pi/4$$

Your job is to try and work out what question was asked, then write a much better solution using  $\text{\LaTeX}$ , correcting errors and improving the solution above as much as possible.

Your document should have two sections, 'Question' (where you state your guess at the 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.
- Download your PDF file from Overleaf, and upload it in Blackboard (Presentation Homework 1) before next week's lab class. You do not need to upload the  $\text{\LaTeX}$  source code, just the output PDF document.

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