

MPS115/MPS116 PRESENTATION LAB 2

If at any point you need to look back at last week's sheet, you can find it on the MPS115/116 'website'.

1. A NEW DOCUMENT

Open TeXworks. Start a new document with the following.

```
\documentclass[11pt, a4paper]{amsart}
```

Add the commands `\begin{document}` and `\end{document}`. Insert appropriate commands, as last week, to ensure that it has a suitable title and author. Save your document as `lab_2.tex`.

Create a section called 'Research in Mathematics and Statistics'. Find the School of Mathematical and Physical Sciences website, click on the Research menu item. Find the page of the Pure Mathematics research cluster. In your document create a subsection by typing

```
\subsection{Pure Mathematics}
```

then copy and paste the short paragraph describing the cluster into your document. Create the PDF and check that everything is working.

Problems? Check the last few lines of the log file which appears at the bottom of TeXworks to see if there are clues as to what's gone wrong.

Change the beginning of the paragraph so that it starts

```
The \emph{Pure Mathematics} cluster...
```

Process your document and see what has changed. Here `\emph` means *emphasize*.

Now start a new subsection called 'Applied Mathematics and Theoretical Physics'. Find the page of the Applied Mathematics and Theoretical Physics research cluster then copy and paste the main paragraph (the one below the picture). Process your document and make sure it works. Use the `\emph` command to emphasize the name of the cluster in the first sentence. Edit the second sentence so it looks as follows, where you fill in the dots.

```
We have particular expertise in
\begin{itemize}
  \item Gravitation and Cosmology,
  \item Plasma Dynamics,
  \item ...
\end{itemize}
```

Here, you've created an *itemize environment*. Environments always start with a `\begin` command and end with an `\end` command. We'll see more of them in future weeks. Change the `itemize` environment to `enumerate` instead, and look at the difference.

In the two subsections you've created you can see two ways to present the list of subareas. Which do you prefer? There's no right answer, sometimes it makes sense to create a list with the `itemize` or `enumerate` environment, sometimes not.

Think about the following.

- (1) Edit the first line to `\documentclass[12pt, a4paper]{amsart}` and compile the LaTeX. What changed?
- (2) The `amsart` document class will only allow a restricted range of font-sizes in the output PDF. Change the `12pt` command in the document class to `10pt` and process the document again. Can you find any other values that will work?

Here you've used the unit of measurement `pt` which stands for *point size*. The usual size to work with is `11pt`, so revert to that in your document.

2. ADDING WEBPAGE LINKS

We should reference where we took this information. We will learn how to do references properly later, but the following approach will work for now. First add `\usepackage{hyperref}` before `\begin{document}` this will allow us to create proper website links in the document using the `\url` command as below.

Packages add extra functionality into LaTeX documents, and we'll see them more in future weeks.

At the beginning of the section, before the first subsection, add the text "The following information was taken almost word-for-word from the websites in the References section."

Create a subsection called 'References' at the end of the document. Create an itemized list with two items. Each item should be of the form

`\item \url{https://sheffield.ac.uk/mps/...}`

where one gives the web address of the pure mathematics page and the other the applied mathematics page.

Process your document and click on the links that have been created in the References section.

3. TYPESETTING PRACTICE

Now for something more fun. Try to typeset the following in a section called 'Typesetting practice' at the end of your document. To find some symbols you'll need to use search the web (e.g. search for 'latex summation symbol'). Put your answers in an `enumerate` environment.

Make sure your output looks *exactly* as it does here.

- (1) $x^2 + y^2$; x_i ; $x_i^2 - y_i^2$; x_{i_m} ; x_i^m ; x^{2p} .
[Hint: the line begins `$x^2+y^2$`; `$x_i$`; and LaTeX uses curly brackets `{}` to bracket terms together.]

- (2) $\frac{1}{y}$; $\frac{x^2}{x+y}$;

$$\frac{\frac{1}{x} + \frac{1}{y}}{\frac{1}{x+y}}.$$

[Hint: the first one is `$\frac{1}{y}$`.]

- (3) $\sqrt{x+y} + 7$; $\sqrt[3]{7}$; $\sqrt[n]{1 + \sqrt{1+x}}$.
[Hint: use `\sqrt{}` and `\sqrt[3]{}`.]

- (4)

$$\int_0^\infty e^{-x^2} dx = \frac{\sqrt{\pi}}{2}; \quad \sum_{i=1}^n i = \frac{1}{2}n(n+1).$$

$$(5) \sin^2 x + \cos^2 x = 1;$$

$$\Gamma(x) \equiv \lim_{x \rightarrow 0} \prod_{v=0}^{n-1} \frac{n! n^{x-1}}{x+v}.$$

$$(6) \left(2^{2^{2^2}} - 1\right)^2; \left\{\alpha + (\sqrt{\beta} + \gamma^2)^2\right\}.$$

[Hint: for the correct sized brackets use `\left(...\right)`, and for a curly bracket use `\{.`]

$$(7) \sum_{i=1}^n i^2 = \frac{1}{6}n(n+1)(2n+1) \text{ for } n = 1, 2, 3, \dots$$

[Hint: try using `\ldots`.]

If you get stuck with any of these, you can look at my attempt at the lab sheet. This will go on the course webpage after the end of the lab.

If you finish all of the above, have a look at the excellent *Short Introduction to LaTeX* found at

<https://tug.ctan.org/info/lshort/english/lshort.pdf>

(or search the web). Another very useful resource is the LaTeX Wikibook, which lives at

<http://en.wikibooks.org/wiki/LaTeX>

HOMEWORK

Create a document with the title ‘MPS115/116: Homework 2’ and your name as author, using the `amsart` document class, 11pt font and A4 paper options. Remember that the homework must be your own work. If you require help then do make use of the Discussion Forum and Office Hours.

1. Getting to know your academic tutor. Look for your academic tutor at the School website, or find their homepage. Find out which areas of mathematics and statistics they are interested in. Find at least two sources of information on the web which explain their research area, and use them to write a brief summary in your own words of what it is you think they do in a new subsection called something like “Aisha Smith’s Research Interests”.

You only need to write a paragraph or two. Don’t copy and paste text from their website or Wikipedia, but use multiple sources to write a summary in your words as best you can. Reference the sources you used to write your summary. We will cover referencing more fully in a future lab.

2. Another bad solution. In response to a question, a student wrote the following in an exam.

$$m = \text{gradient} = \frac{3-1}{2-8} = -\frac{2}{6} = -\frac{1}{3}$$

L in form $y = mx + c$

use coordinates from A thus

$$L \text{ is } y = mx + c$$

$$L \text{ is } 1 = -\frac{1}{3}8 + c$$

$$\frac{y-x}{m} = c$$

$$c = \frac{1-8}{-1/3} \iff c = 21$$

thus the equation of L is $y = -\frac{x}{3} + 21$

Your job is to try and work out what question was asked, then write a much better solution using LaTeX, correcting errors and improving the solution above as much as possible. Create a new section called ‘Solution Rewrite’, with two subsections, ‘Question’ and ‘Solution’. Your solution will probably be short, but should include more words than the badly written one above. Take into account points discussed in the lectures, including the following.

- Use full sentences, with full stops and capital letters.
- Write in paragraphs and don’t overdo the displayed mathematics.

Print out your PDF and LaTeX files and hand them in at the start of next week’s computer lab.

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