

MPS115/116 Presentation Lecture 4: Images and a Bit of Punctuation

Dr Simon Willerton

1: Images

Including images

LaTeX documents can include images.

There are two approaches.

- (i) Use software (e.g. a graphics programme) to create an image, then import it as an image file.
- (ii) Use a $\text{\LaTeX}$'s package to create the image directly with simple commands.

We will look at both of these methods.

1.1: Image files

Image formats

There are lots of ways to create an image, for example,

- ▶ graphics software,
- ▶ mathematical software,
- ▶ Python,
- ▶ a phone or a digital camera etc.

Images can be stored in different file-formats.

Different formats suit different purposes.

		photos	graphs/plots	screenshots	most other
JPEG	raster	✓	✗	✗	✗
PDF(*)	vector	✗	✓	✗	✓
PNG	raster	✗	(✓)	✓	(✓)

These are the three formats used with LaTeX.

(*) In HTML you use SVG instead of PDF.

Raster graphics files

In raster graphics files, the image is stored as coloured dots in a grid.

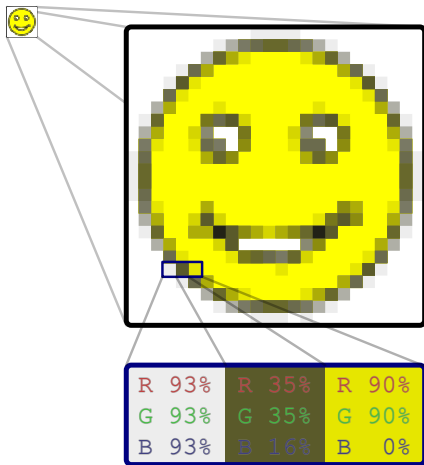


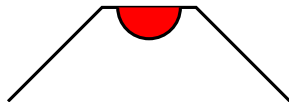
Image by Gringer from wikipedia

Vector graphics files

In vector graphics files, the image is stored as a sequence of commands describing the shape.

For example, the image on the right might be stored as follows.

```
newpath
0 0 moveto
30 30 lineto
60 30 lineto
90 0 lineto
stroke
newpath
45 30 10 180 0 arc
gsave
1 0 0 setrgbcolor fill
grestore
stroke
```



JPEG

Joint Photographic Experts Group (.jpg or .jpeg)

- ▶ Used for digital photographs.
- ▶ **Raster** format: stores the individual pixels (dots).
- ▶ Keeps file-sizes low by **lossy** compression of image data.
- ▶ Lossy: high compression but loss of fine detail.
- ▶ Excellent for photos, bad for mathematical images and fine detail.

High compression gives smaller filesize but lower image quality;
low compression makes images clearer but increases the filesize.



PNG

Portable Network Graphics (.png).

- ▶ **Raster** format: stores the individual pixels (dots).
- ▶ Keeps file-sizes low by **lossless** compression of image data.
- ▶ Lossless: much bigger file than JPEG but no loss of detail.
- ▶ Good for screenshots or other raster images.
- ▶ Use if not a photo and no PDF file is available.

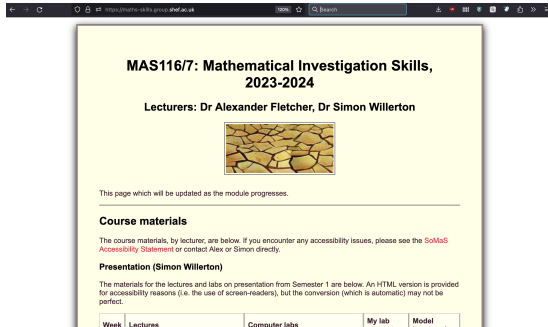


Image size and resolution

Raster images (JPEG or PNG files) will have a pixel size, e.g. “640 pixels by 1024 pixels”.

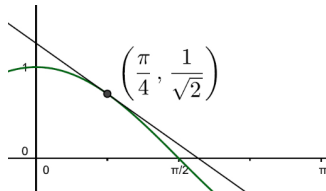
More pixels means more detail, but also a bigger file.

When you display an image it will also have a physical size, e.g. “5 cm by 10 cm” or “2 inches by 3 inches”.

The resolution of an image is the number of pixels (or dots) per unit of measurement, typically measured in dots per inch (dpi).

Higher resolution means better quality but a bigger file.

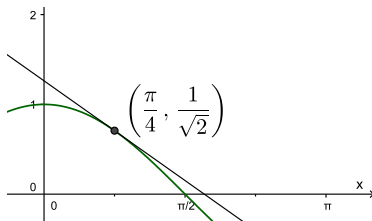
Standard high resolution for a printed image is 300 dpi.



PDF

Portable Document Format (.pdf)

- ▶ Is an image format as well as a document format.
- ▶ **Vector** format: stores 'shapes' not pixels.
- ▶ Stores things like 'circle of radius 2 cm with centre (0, 5)'.
- ▶ Lines and shapes are smoother and scalable.
- ▶ Good for mathematical images, bad for photos.



Use PDF images wherever possible for mathematical diagrams.

Image editing software

Good software to try for creating mathematical diagrams includes

- ▶ Geogebra (<http://www.geogebra.org/geometry>) and
- ▶ Google Draw.

Both are free and both export images as PDFs.

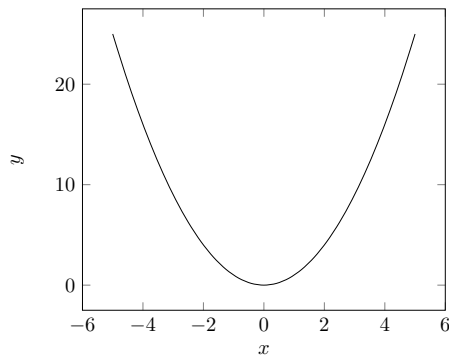
For editing images, software includes

- ▶ GIMP, free and good for editing JPG and PNG files; and
- ▶ Adobe Photoshop, available on the University Managed Desktop.

1.2: Using the PGFplots package

PGFplots

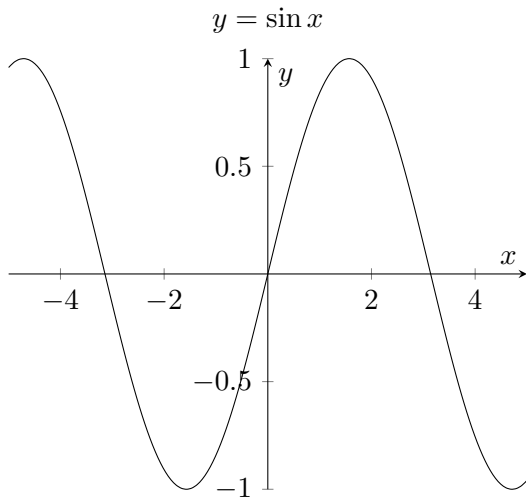
The pgfplots package is great for creating graphs quickly.



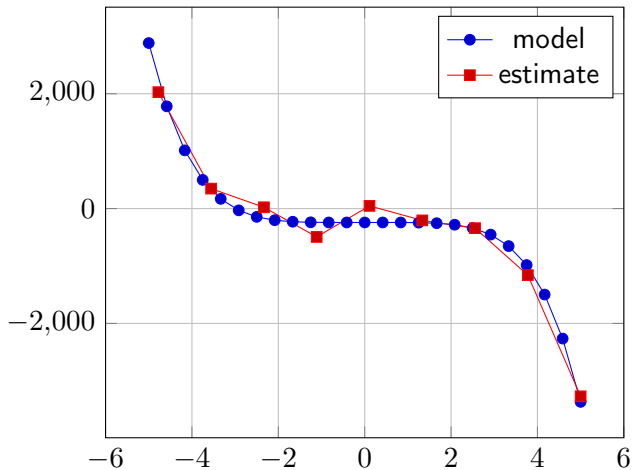
```
\begin{tikzpicture}
  \begin{axis}[
    xlabel=$x$,
    ylabel=$y$]
    \addplot[smooth]{x^2};
  \end{axis}
\end{tikzpicture}
```

It can also do more complicated things...

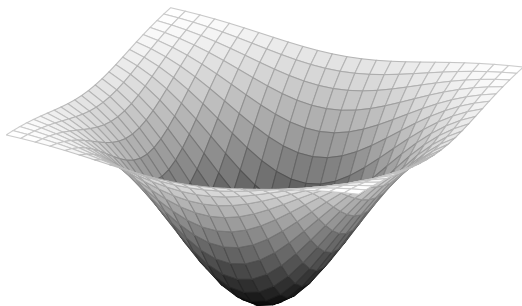
A second example



A third example



A fourth example



We'll look at how to use PGFplots more in Lab 4.

Lots of examples are available at

<http://pgfplots.sourceforge.net/gallery.html>.

2: Activity time

Activity.

The circulated document (also available on the course website) is in need of a serious proof-reading.

Find and correct as many problems as you can (some of which may be LaTeX errors).

3: Punctuation

Basic punctuation

Basic punctuation is easy: start sentences with capital letters and end them with full-stops. However, there are plenty of other punctuation marks that are often used (and misused).

It's not hard to use punctuation correctly once one learns the rules.

Commas (,)

Commas are used in lists. However, they have other uses. One of these is to separate clauses in sentences.

Often, where commas are used corresponds to where a pause is needed if read aloud.

Example.

- ▶ You will find plenty of examples, both good and bad, in these notes.

A common mistake is to overuse commas, inserting them in places where a pause in speech makes things sound odd. It's best to miss one out if in doubt.

Colons (:)

A colon is used to indicate that what follows explains or lists what precedes it.

A colon splits a sentence into two halves, the first half should make sense on its own.

Examples.

- ▶ The reason was clear: no-one was at home.

A common error is to put a hyphen afterwards, creating ':-'.
This is not correct punctuation. Avoid!

Colons (:)

A colon is used to indicate that what follows explains or lists what precedes it.

A colon splits a sentence into two halves, the first half should make sense on its own.

Examples.

- ▶ The reason was clear: no-one was at home.
- ▶ The shopping list had three items on it: eggs, bacon and bread.

A common error is to put a hyphen afterwards, creating ':-'.
This is not correct punctuation. Avoid!

Semicolons (;)

The main use of a semicolon is to join together two sentences where the latter is related to the former.

A semicolon is used to indicate a connection.

Examples.

- ▶ The weather took a turn for the worse; the sky became darker.
- ▶ I will look at the problem soon; it's on my to-do list.

Try not to overuse semicolons and only use them if you know how to.

Exclamation marks (!)

Exclamation marks are used for indicating surprise or for issuing instructions.

Examples.

- ▶ Stop! I want a word with you.
- ▶ I can't believe it!

Exclamation marks are not often used in formal writing.

F. Scott Fitzgerald wrote

Cut out all those exclamation marks. An exclamation mark is like laughing at your own jokes.

Apostrophes (')

Apostrophes are used to indicate missing letters or to indicate possession.

Examples.

- ▶ It's true that an apostrophe is needed here, as it indicates a shortening of 'it is'.
- ▶ This is Simon's lecture. Sam's lecture is on a different day.

A common error is to use an apostrophe in 'its' when used in a possessive way, as in 'The cat chased its tail'.

Apostrophes are also unnecessary in ours, yours, his, hers, theirs, and whose, and never needed for plurals.

Bad use of apostrophes tends to provoke strong reactions!

4: Later today...

About Computer Lab 4

In Computer Lab 4 we'll look at the commands needed to include graphics in a document.