Figures, Graphics, and TikZ

Lecture 5

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Outline

Last time

- We learned about how LaTeX handles external packages
- We found ways of integrating various packages into our documents
- We also learned about some neat packages for niche uses such as chemical formulae and programming language typesetting

This time

- We will learn about how LaTeX uses figures and tables
- We will also get started with some simple applications of graphics integration
- Finally, we will take a peek at the massive graphics-generation package, `tikz`

The `figure` environment

- The `figure` environment is a built-in environment that allows you to place blocks designated for tables, graphs, images, etc.
- It also keeps track of the number of figures in your document as well as their order.

The `figure` environment

```
\begin{figure}[X]
Figure contents...
\end{figure}
```

- The `X` designates the location on the page of the figure. Possible values for `X` are

The `figure` environment

`h`	Place the figure *here*
`t`	Position at the *top* of the page
`b`	Position at the *bottom* of the page
`p`	Put on a specific *page* by itself
`!`	Override internal rules and place exactly as specified

- Use `!` in tandem with the previous four commands

Figures of tables

- One great use of figures is for including tables
- LaTeX includes a `tabular` environment by default
- However, without an encapsulating figure environment, the tables generate inline or immediately following text

The `tabular` environment

```
\begin{tabular}{| c | c | c || c |}\hline
What & is & love & baby \\ \hline
baby & don't & hurt & me \\ \hline
don't & hurt & me & no more \\ \hline
\end{tabular}
```

The `tabular` environment

- The line

  `{| c | c | c || c |}`

  tells LaTeX to produce a row of four columns, with centered text, and vertical separator bars
- Apart from `c`, there are also choices of `l` and `r`
- The & tells LaTeXto move to the next entry, \\moves to the next line, and `\hline` produces a horizontal separator bar
- The code on the previous slide generates a table that looks like this:

What	is	love	baby
baby	don't	hurt	me
don't	hurt	me	no more

Graphics file integration

- Using the `graphicx` package, we can include easy integration of `png` and `pdf` graphics.
- Here is an example:

Graphics integration

```
\begin{figure}[h]
 \includegraphics[scale=0.6]{/home/alethiometryst/
                Documents/mathematica-10-spikey.png}
  \caption{The \textit{Mathematica} spikey logo}
\end{figure}
```

- The `\includegraphics` command allows you to give an input file to be included in the document
- The `scale` parameter is one such way of fitting your image to the document, but others exist!

Graphics integration

- The code from the previous slide generates the figure:

Figure 1 : The *Mathematica* spikey logo

Graphics integration

- `graphicx` and the `figure` environment make including scientific plots easy!
- Here's an example:

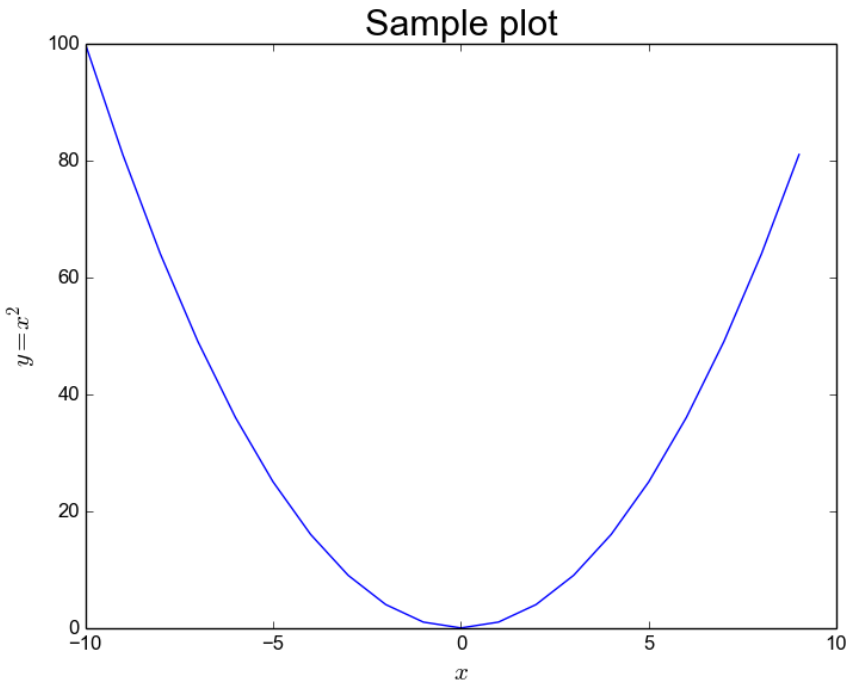

Figure 2 : The beauty of `matplotlib.pyplot`

A brief introduction to TikZ

- Graphics integration and plotting is nice and simple, but sometimes you want to build the image or plot yourself
- Luckily, there is a (massive) package called `tikz` which offers a robust drawing construction environment that compiles and renders inside of your LaTeX document
- To fully understand all of the capabilities of `tikz` takes a large amount of time, so we will only go over the basics
- We can get started by adding `\usepackage{tikz}` to our preamble

A simple tikz drawing

- The tikz package can be accessed via the tikzpicture environment
- Here, we will make a smiley face

A TikZ smiley face

```
\begin{figure}[h]
\begin{tikzpicture}
\filldraw[fill=yellow] (0,0) circle (2cm);
\filldraw[fill=black] (0.8,0.8) circle (0.3cm);
\filldraw[fill=black] (-0.8, 0.8) circle (0.3cm);
\draw (-1.3,-0.2) arc (180:360:1.3cm);
\end{tikzpicture}
\caption{A creepy \texttt{TikZ} smiley face!}
\end{figure}
```

A simple tikz drawing

- The drawing on the previous page produces a tikz picture like:

Figure 3 : A creepy TikZ smiley face!

More cool things with TikZ

- Learning how to use `tikz` is like learning another programming language altogether
- So, we won't cover it in depth
- If you're interested in learning more, check out the TikZ Manual
- Also, the website TexExample has a boatload of interesting constructions that people have made
- We've picked a few of our favorites.

An advanced TikZ drawing

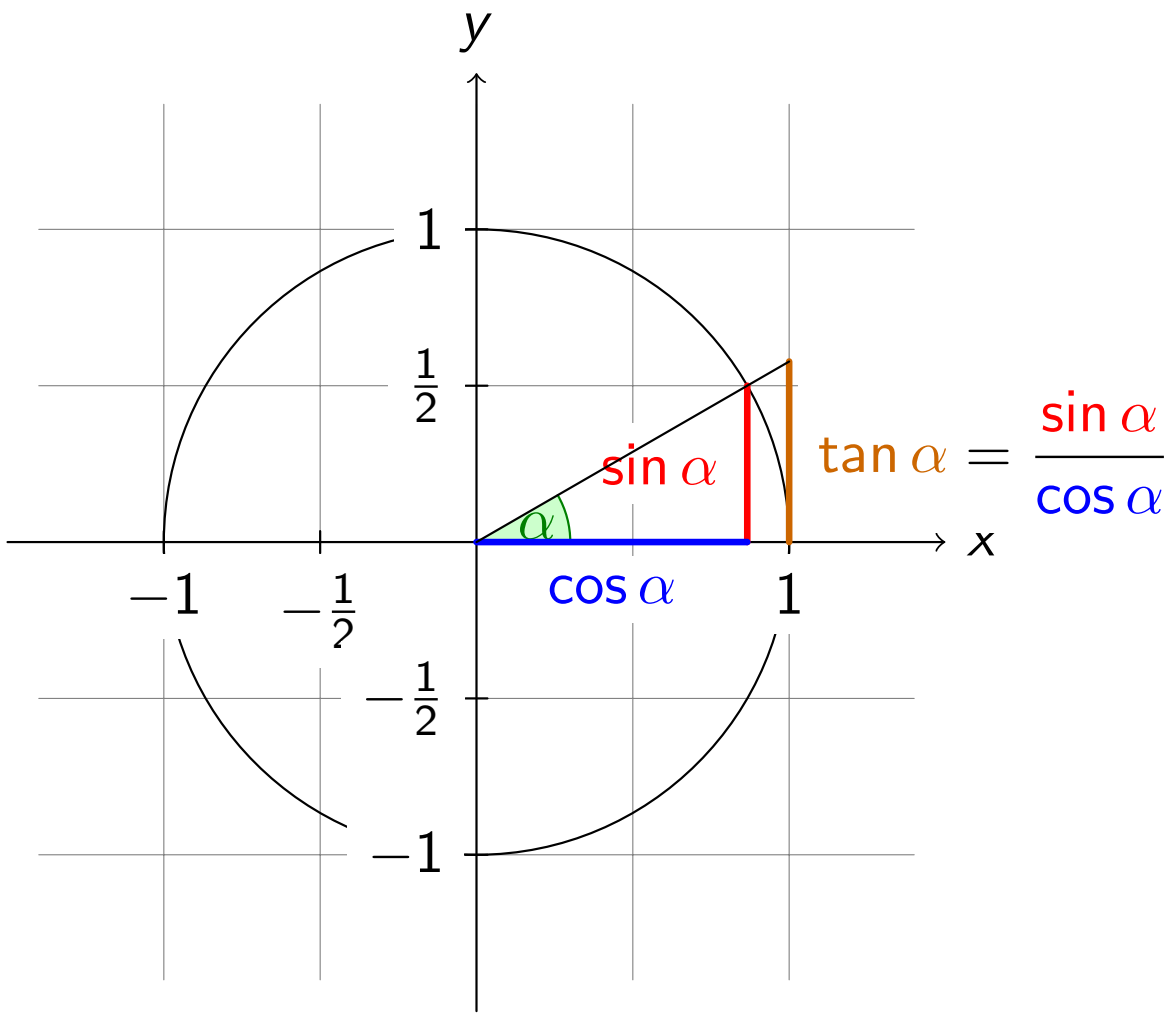

Figure 4 : Motivation for trigonometric functions

An advanced TikZ drawing

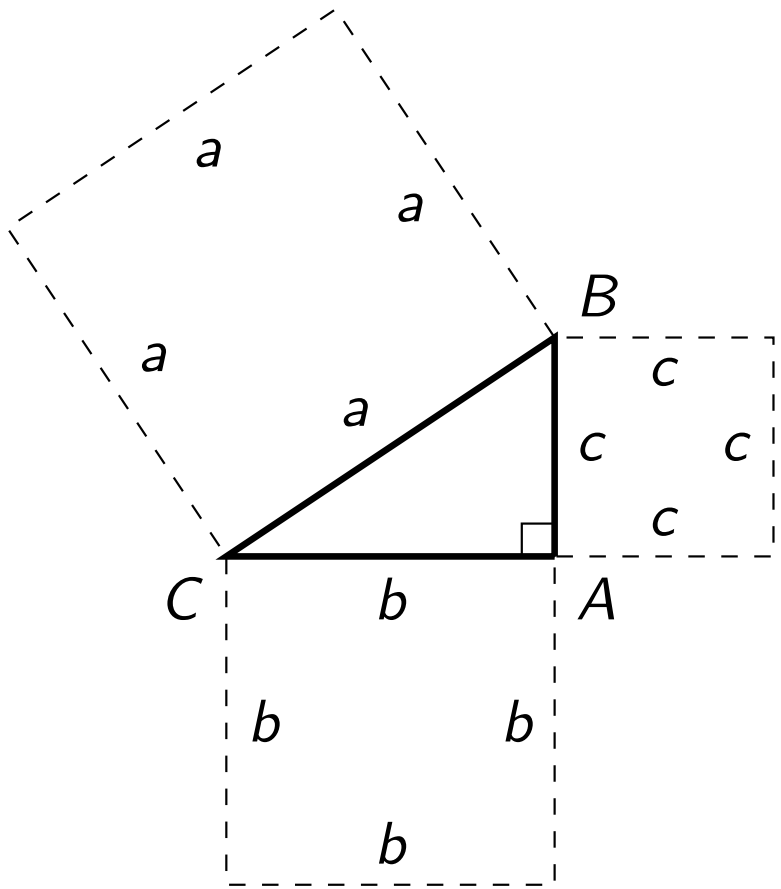

Figure 5 : The Pythagorean Theorem

An advanced TikZ drawing

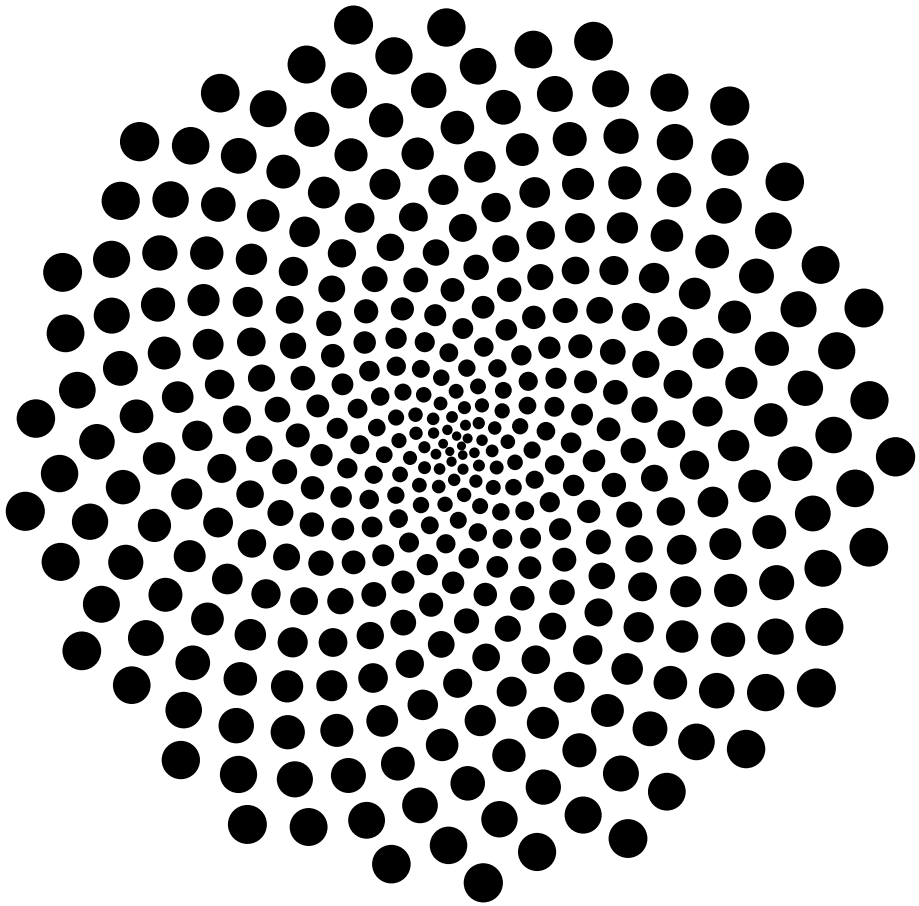

Figure 6 : A spiral pattern