EBESS and MESS Presents: Learn to LaTeX

Presented by Joshua Tambunan

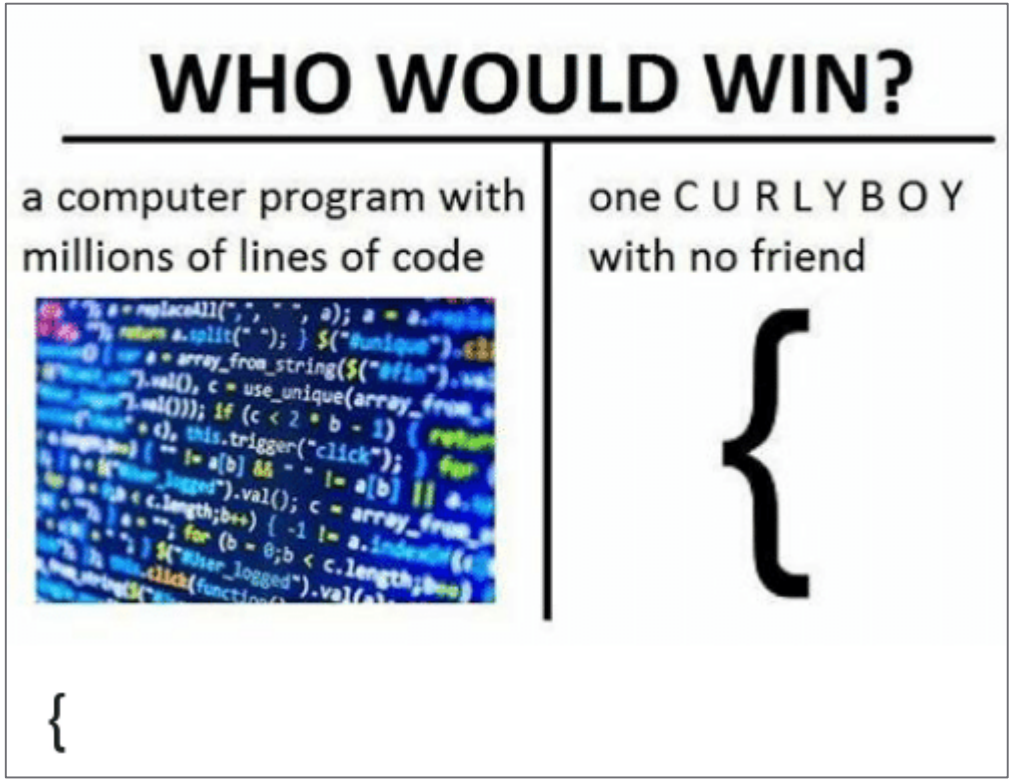
13 February 2018

Structure of the Night

- Basics of LaTeX
- Motivation
- What?
- Why?

Structure of the Night

- Starting a document
- Commenting
- Curly bois
- **Bold,** *italics* & <u>underline</u>
- Basic Maths



Structure of the Night

- Document structure
- Tables
- Lists
- Bibliography & citation

Structure of the Night

- Packages and libraries
- Some meaty maths
- Some useful packages
- Practical interactions
- Challenge


PIZZA FILLS THE
VOID IN MY LIFE
OFFiCiALLYGENIUS.COM

What is LaTeX

- Lay-tek or lah-tek
- WYSIWYM

What it is

- Document preparation
- Typesetting
- Professional finish
- Free software license –
  - latex-project.org/lppl.txt

3 Mathematical Equations

Simple equations, like x^y or $x_n = \sqrt{a+b}$ can be typeset right in the text line by enclosing them in a pair of single dollar sign symbols. Don't forget that if you want a real dollar sign in your text, like $2000, you have to use the \$ command.

A more complicated equation should be typeset in *displayed math* mode, like this:

$$z\left(1 + \sqrt{\omega_{i+1} + \zeta - \frac{x+1}{\Theta+1}y + 1}\right)$$

The "equation" environment displays your equations, and aut
utively within your document, like this:

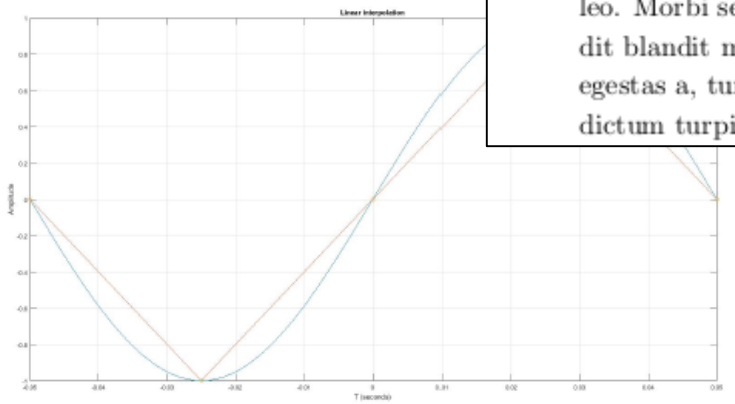
$$\left[\quad N \quad \right]$$

5. Sampling and Windowing

In sampling theory, in order to accurately characterise the behaviou
be true: the sampling frequency f_s must be more than $2f_{max}$, where
the signal being sampled (Nyquist theorem). In practice, there is stil
wave even after using a sampling rate which satisfies the Nyquist c
oversampling (upsampling the original sampler) and windowing is u

Linear interpolation is sampling at a certain rate, obtaining p
and connecting those points with straight lines from one to the othe

With a 10Hz sinusoid signal, sampling at 50Hz and reconstructin
interpolation produces the following:



Given that there was no phase shift in the sampler relative to the original signal, the above could be reconstructed. Even without a phase shift, significant distortion can be seen: the sine wave is reconstructed as a triangle wave.

A Minimal Working Example

by Fran

February 24, 2013

Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

Figure 1: Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante.

What it isn't

- Coding-free
- Learning curve-free
- A fast, lazy method

FAQ

- Coding skills
- Time
- Why

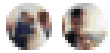
Motivation

- Common Applications
  - Assignments
  - Project reports
  - Thesis
  - Grocery list
  - Facebook

15:01

$x^n + y^n = z^n$

It works!



Emie

Ok what's the equation about

I am being a dumb dumb right now and can't figure it out

Pythagoras, fam.

Basic Syntax

```
\documentclass[12pt]{article}
\usepackage[utf8]{inputenc}

\title{My First LaTeX Document}
\author{Joshua Tambunan}
\date{February 2017}
```

Let's Get Started!

- Laptop/Desktop
- Download an IDE:
  - TeXworks
  - TeXstudio
  - TeXlipse (plugin for Eclipse IDE)
- OR use an online editor:
  - ShareLatex

Document Structure

- Preamble
- Main body

Preamble

```
\documentclass[12pt]{article}
\usepackage[utf8]{inputenc}

\title{My First LaTeX Document}
\author{Joshua Tambunan}
\date{February 2017}
```

Main Body

```
\begin{document}

\maketitle

We have now added a title, author and date to our
first \LaTeX{} document!

\end{document}
```

Comments

```
\begin{document}

\maketitle

We have now added a title, author and date to our
first \LaTeX{} document!

% This line here is a comment. It will not be
printed in the document.

\end{document}
```

Bold, italics and underlining

```
Some of the \textbf{greatest}
discoveries in
\underline{science} were made by
\textit{accident}.
```

Emphasis I

```
Some of the greatest
\emph{discoveries} in
science were made by
accident.
```

Emphasis II

```
\textit{Some of the
greatest
\emph{discoveries} in
science were made by
accident. }
```

Emphasis III

```
\textbf{Some of the
greatest
\emph{discoveries} in
science were made by
accident. }
```

```
\usepackage{graphicx}
```

Images I

```
\documentclass{article}
\usepackage{graphicx}
\graphicspath{ {images/} }

\begin{document} I’ve heard of this really good
EBESS networking event.

\includegraphics{employ.png}   There's a picture
of a really employable student!
\end{document}
```

Images II

```
\begin{figure}[h] \centering
    \includegraphics[width=0.25\textwidth]{mesh.png}
    \caption{a nice plot}
    \label{fig:mesh1}
\end{figure}

As you can see in the figure \ref{fig:mesh1}, the
function grows near 0. Also, in the page
\pageref{fig:mesh1} is the same example.
```

Mathematics (and curlyboys)

- Inline
- Display
  - Numbered
  - Unnumbered

Maths - Inline

```
Was ENGG1300 that subject that had $V = IR$? I can’t remember. I was always hungover from EBESS parties. I know that \(F = ma\). Is that the same thing?
```

Maths - Display

```
The only equation that made sense to
me in fluids is $$P=\rho gh$$ Ok,
that's a lie. I understood the
potential equation:
\begin{equation}
    \frac{\delta \phi}{\delta x} = -u
\end{equation}
```

Maths - Display Summary

```
We can write
$\Omega = \sum_{k=1}^n \omega_k$
In text, or we can write
\begin{equation}
    \Omega = \sum_{k=1}^n \omega_k
\end{equation}
to display it.
```

Formatting

- Abstracts
- Paragraphs and newlines
- Chapters and sections
- Tables

Abstracts

```
\begin{document}

\begin{abstract}
This is the abstract of my thesis. A
compulsory thesis means I have the right
to be an elitist to all the other
engineering majors.
\end{abstract}

\end{document}
```

Paragraphs and newlines

```
\begin{document}
This is my first paragraph.
This is still my first paragraph.

My second paragraph.\\
My third paragraph.
\newpage

My fourth paragraph on a new page.
\end{document}
```

Chapters and Sections I

```
\chapter{First Chapter}

\section{Introduction}
This is the first section.  Lorem ipsum dolor
sit amet, consectetuer adipiscing elit. Etiam
lobortisfacilisis sem. Nullam nec mi et neque
pharetra sollicitudin. Praesent imperdietmi
nec ante. Donec ullamcorper, felis non
sodales...
```

Chapters and Sections II

```
\section{Second Section}   Lorem ipsum dolor
sit amet, consectetuer adipiscing elit. Etiam
lobortis facilisissem. Nullam nec mi et neque
pharetra sollicitudin. Praesent imperdiet mi
necante...

\subsection{First Subsection} Praesent
imperdietmi nec ante. Donec ullamcorper, felis
non sodales...
```

Chapters and Sections III

```
\section*{Unnumbered Section} Lorem ipsum
dolor sit amet, consectetuer adipiscing elit.
Etiam lobortis facilisissem.
```

Chapters and section depth

-1	`\part{part}`
0	`\chapter{chapter}`
1	`\section{section}`
2	`\subsection{subsection}`
3	`\subsubsection{subsubsection}`
4	`\paragraph{paragraph}`
5	`\subparagraph{subparagraph}`

Note that **\part** and **\chapter** are only available in *report* and *book* classes

Types of Documents

`article`	For articles in scientific journals, presentations, short reports, program documentation, invitations, ...
`IEEEtran`	For articles with the IEEE Transactions format.
`proc`	A class for proceedings based on the article class.
`report`	For longer reports containing several chapters, small books, thesis, ...
`book`	For real books.
`slides`	For slides. The class uses big sans serif letters.
`memoir`	For changing sensibly the output of the document. It is based on the `book` class, but you can create any kind of document with it [1]
`letter`	For writing letters.
`beamer`	For writing presentations (see LaTeX/Presentations).

Document Class options

`10pt, 11pt, 12pt`	Sets the size of the main font in the document. If no option is specified, 10pt is assumed.
`a4paper, letterpaper,...`	Defines the paper size. The default size is `letterpaper`; However, many European distributions of TeX now come pre-set for A4, not Letter, and this is also true of all distributions of pdfLaTeX. Besides that, `a5paper`, `b5paper`, `executivepaper`, and `legalpaper` can be specified.
`fleqn`	Typesets displayed formulas left-aligned instead of centered.
`leqno`	Places the numbering of formulas on the left hand side instead of the right.
`titlepage, notitlepage`	Specifies whether a new page should be started after the document title or not. The article class does not start a new page by default, while report and book do.
`twocolumn`	Instructs LaTeX to typeset the document in two columns instead of one.
`twoside, oneside`	Specifies whether double or single sided output should be generated. The classes `article` and `report` are single sided and the `book` class is double sided by default. Note that this option concerns the style of the document only. The option `twoside` does not tell the printer you use that it should actually make a two-sided printout.
`landscape`	Changes the layout of the document to print in landscape mode.
`openright, openany`	Makes chapters begin either only on right hand pages or on the next page available. This does not work with the `article` class, as it does not know about chapters. The `report` class by default starts chapters on the next page available and the `book` class starts them on right hand pages.
`draft`	makes LaTeX indicate hyphenation and justification problems with a small square in the right-hand margin of the problem line so they can be located quickly by a human. It also suppresses the inclusion of images and shows only a frame where they would normally occur.

Creating Tables I

```
\begin{center}
\begin{tabular}{ c c c }
    cell1 & cell2 & cell3 \\
    cell4 & cell5 & cell6 \\
    cell7 & cell8 & cell9
\end{tabular}
\end{center}
```

Creating Tables II

```
\begin{center}
\begin{tabular}{ |c|c|c| }
    \hline
    cell1 & cell2 & cell3 \\
    cell4 & cell5 & cell6 \\
    cell7 & cell8 & cell9
    \hline
\end{tabular}
\end{center}
```

Creating Tables III

```
\caption{Table to test
captions and labels}
\label{table:data}
```

Lists - unordered

```
Things to do on my CSSE2310 assignment:
\begin{itemize}
    \item write code
    \item debug code
    \item cry because I didn't properly learn
    gdb and valgrind \& stackoverflow isn't
    helping
\end{itemize}
```

Lists - ordered

```
Expectations of me showing off Latex skills:
\begin{enumerate}
    \item Friends: “Much wow!” :surprised:
    \item Grills: “You’re awesome!”:awed:
\end{enumerate}
```

Table of Contents (for LaTeX)

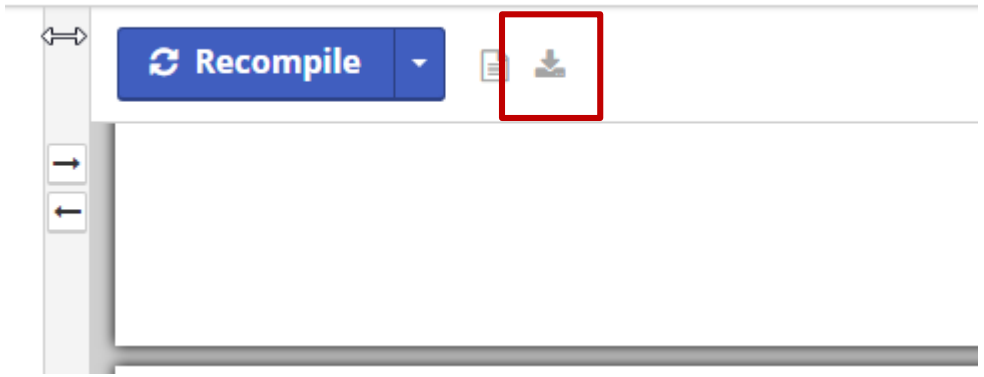
```
\maketitle

\tableofcontents

\section{Introduction}
```

PDA, PDEs and PDFs

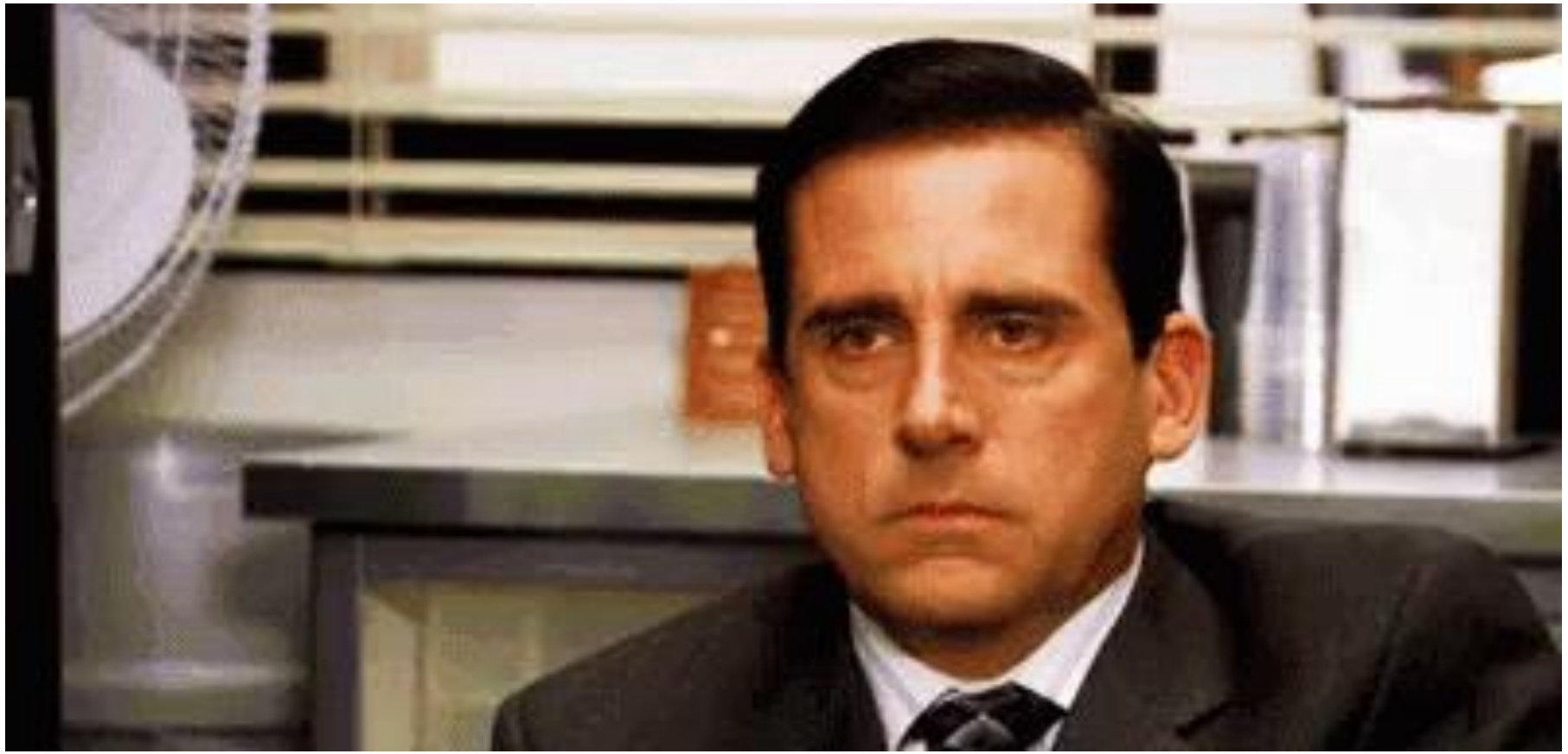
- Exporting result




RANGER
CENTURION

Advanced

- amsmath, mathtools, amsthm, amssymb – math symbols & tools packages
- biblatex – bibliography package
- babel – languages package



Maths packages I

```
\begin{align*}
    W = \frac{1}{\sqrt{N}}
    \begin{bmatrix}
        1   &       1       &       1       &       1       &   ...     &   1\\
        1   &   \omega     &   \omega^2    &   \omega^3    &   ...     &   \omega^{N-1}\\
        1   &   \omega^2    &   \omega^4    &   \omega^6    &   ...     &   \omega^{2(N-1)}\\
        1   &   \omega^3    &   \omega^6    &   \omega^9    &   ...     &   \omega^{3(N-1)}\\
        \vdots  &   \vdots  &   \vdots  & \vdots  & \ddots  &   \vdots\\
        1   &   \omega^{N-1}    &   \omega^{2(N-1)}    &   \omega^{3(N-1)}    &   ...     &   \omega^{(N-1)^2}\\
    \end{bmatrix}
\end{align*}
```

Maths packages II

$$W = \frac{1}{\sqrt{N}} \begin{bmatrix} 1 & 1 & 1 & 1 & \dots & 1 \\ 1 & \omega & \omega^2 & \omega^3 & \dots & \omega^{N-1} \\ 1 & \omega^2 & \omega^4 & \omega^6 & \dots & \omega^{2(N-1)} \\ 1 & \omega^3 & \omega^6 & \omega^9 & \dots & \omega^{3(N-1)} \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ 1 & \omega^{N-1} & \omega^{2(N-1)} & \omega^{3(N-1)} & \dots & \omega^{(N-1)^2} \end{bmatrix}$$

Maths packages III

```
\begin{document}
\begin{lemma}
When I pull out my \LaTeX{} skills, I can woo anyone because I have game.
\end{lemma}

\begin{proof}
\begin{align*}
    9x-7i &> 3(3x-7u)\\
    9x-7i &> 9x - 21u\\
    -7i &> -21u\\
    i \quad &<3 \quad u
\end{align*}
$\therefore$ \text{ I have game.}
\end{proof}


\end{document}
```

Maths packages IV

Lemma 0.1. *When I pull out my LaTeX skills, I can woo anyone because I have game.*

Proof.

$$\begin{aligned} 9x - 7i &> 3(3x - 7u) \\ 9x - 7i &> 9x - 21u \\ -7i &> -21u \\ i &< 3 \quad u \end{aligned}$$

$\therefore$ I have game. $\square$

babel I

```
\documentclass[french]{article}
\usepackage[utf8]{inputenc}
\usepackage[T1]{fontenc}
\usepackage{babel}
\begin{document}

\tableofcontents

\end{document}
```

babel II

```
\begin{abstract}
Ceci est un bref résumé du contenu du document
écrit en français.
\end{abstract}
```

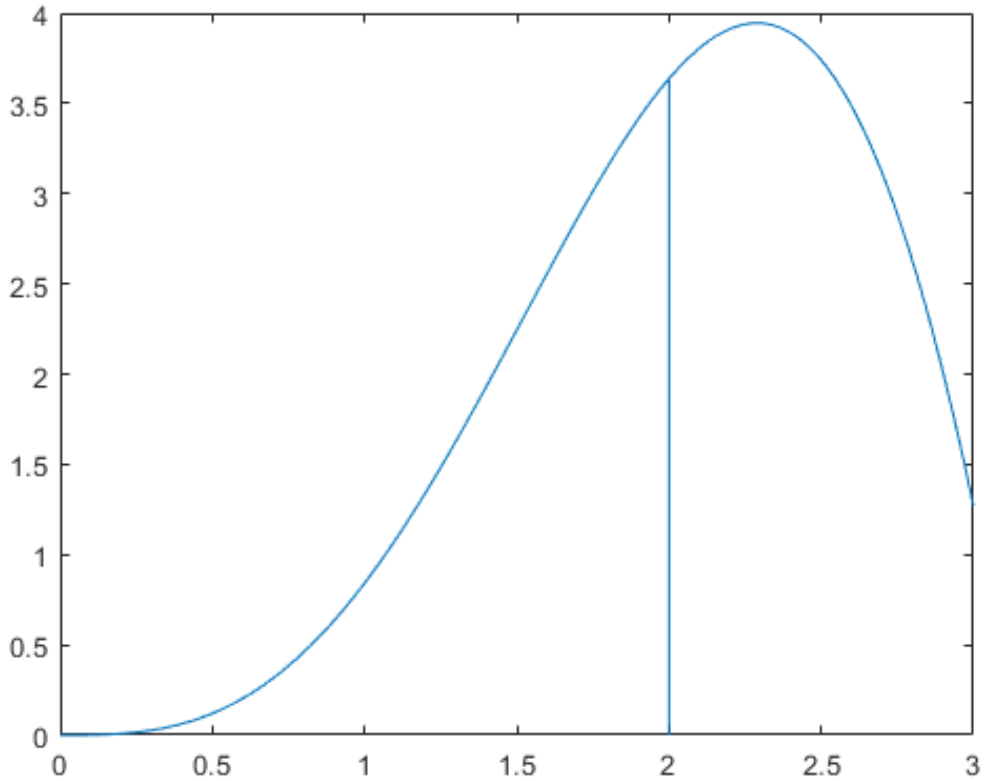
biblatex

```
\documentclass{abstract}
\usepackage[style=numeric-comp]{biblatex}
\printbibliography{<database>} % or
% \addbibresource{<database>.<extension>}
\begin{document}
\cite {<some-ref>}
\printbibliography
\end{document}
```

Matlab & LaTeX I

```
x = linspace(0,3);
y = x.^2.*sin(x);
plot(x,y)
line([2,2],[0,2^2*sin(2)])
```

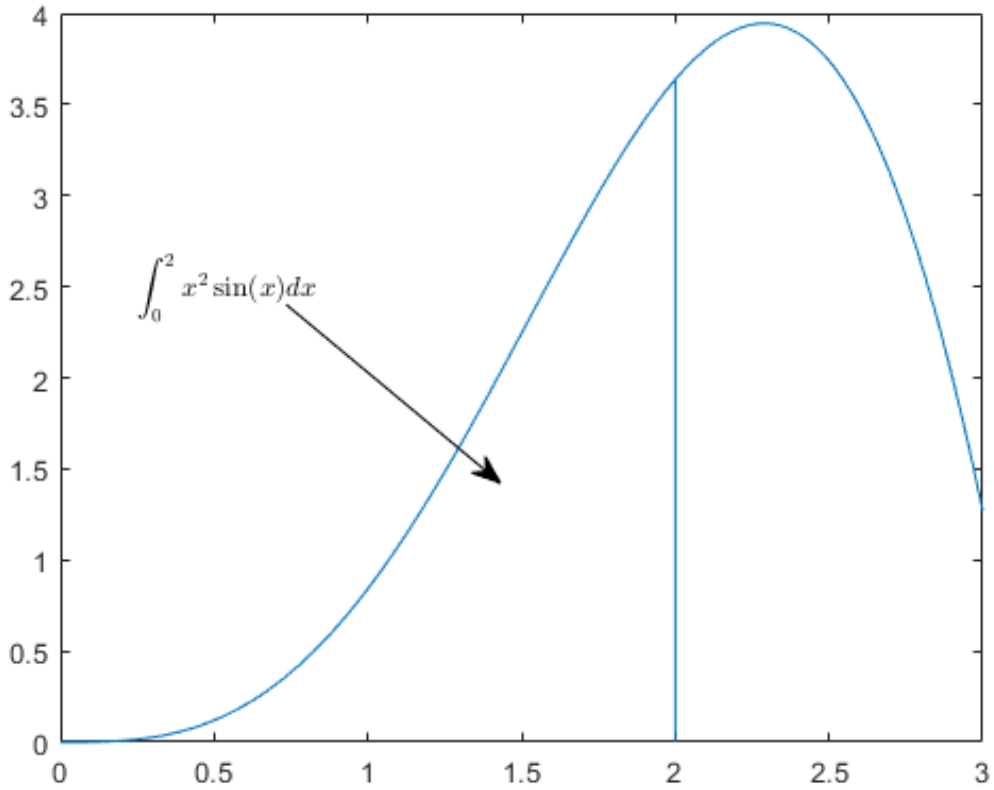
Matlab & LaTeX II



Matlab & LaTeX III

```
str = '$$ \int_{0}^{2} x^2\sin(x) dx $$';
text(0.25,2.5,str,'Interpreter','latex')
annotation('arrow','X',[0.32,0.5],'Y',[0.6,0.4])
```

Matlab & LaTeX IV



Matlab & LaTeX V

Editor - C:\Users\Josh\Downloads\html\foobar.tex

foobar.m | foobar.tex

```
1
2  % This LaTeX was auto-generated from MATLAB code.
3  % To make changes, update the MATLAB code and republish this document.
4
5  \documentclass{article}
6  \usepackage{graphicx}
7  \usepackage{color}
8
9  \sloppy
10 \definecolor{lightgray}{gray}{0.5}
11 \setlength{\parindent}{0pt}
12
13 \begin{document}
14
15
16     \begin{verbatim}
17 x = linspace(0,3);
18 y = x.^2.*sin(x);
19 plot(x,y)
20 line([2,2],[0,2^2*sin(2)])
21
22 str = '$$ \int_{0}^{2} x^2\sin(x) dx $$';
23 text(0.25,2.5,str,'Interpreter','latex')
```

Intro | Syntax | Format | Advanced | Pizza

Challenge

- Create a Thesis template:
  - http://www.itee.uq.edu.au/thesis/submission-information (for ITEE students)
  - http://www.mechmining.uq.edu.au/mech-mining-thesis-submission (for SoMME students)

- Create a report template

LaTeX Memes

badness10000/

References

- https://www.sharelatex.com/learn/Learn_LaTeX_in_30_minutes
- https://www.latex-project.org/about/
- https://tobi.oetiker.ch/lshort/lshort.pdf
- http://www.math.harvard.edu/texman/
- https://www.overleaf.com/latex/learn/free-online-introduction-to-latex-part-1#.Wp5PV-huaUk

Quicksheets

- Maths cheat sheet:
  - https://reu.dimacs.rutgers.edu/Symbols.pdf
- General cheat sheet
  - https://people.cs.umass.edu/~freedman/resources/Freedman_LaTeXCheatSheet.pdf