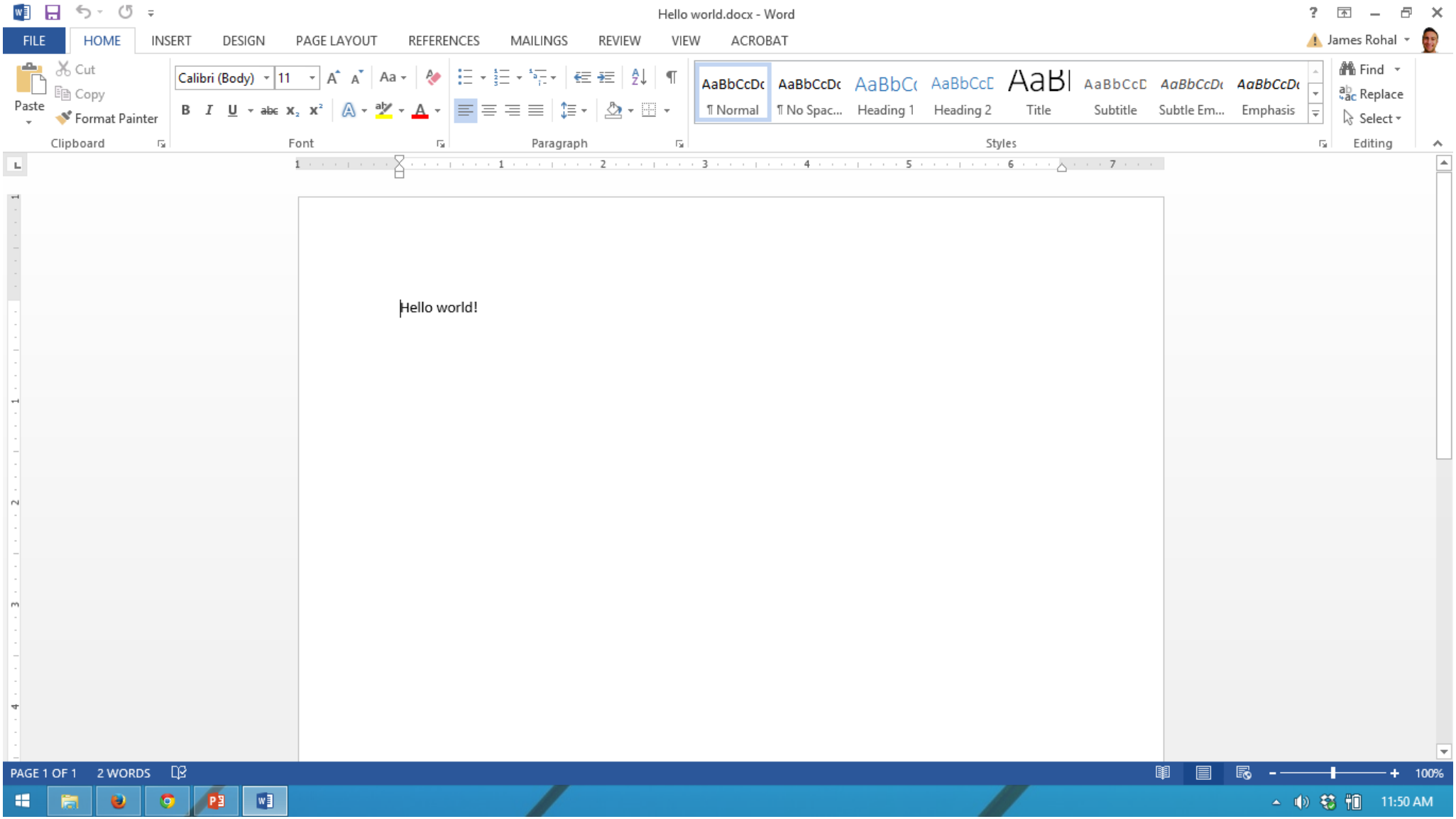
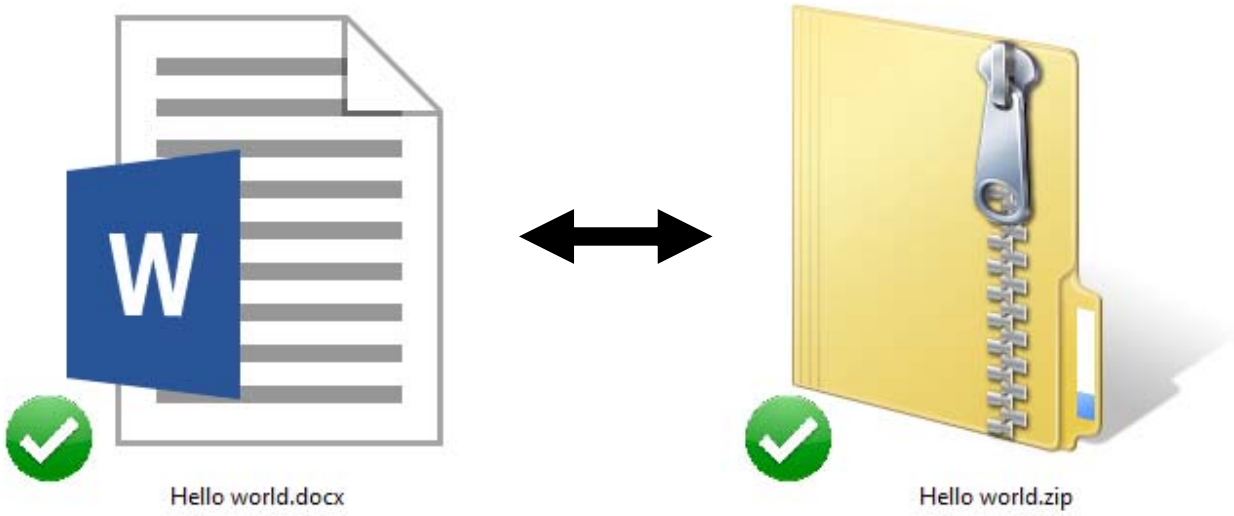
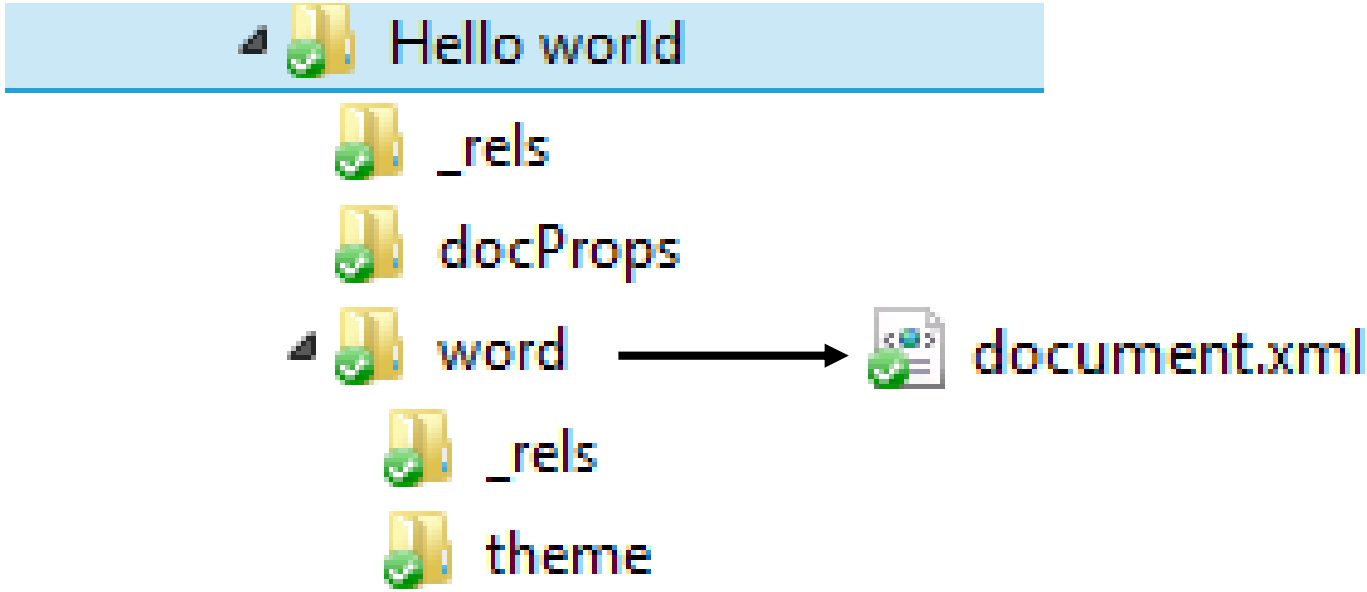
Introduction to LaTeX

Structure of a “Document”



Structure of a “Document”





Structure of a “Document”

document.xml

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<w:document xmlns:wpc="http://schemas.microsoft.com/office/word/2010/wordprocessingCanvas" xmlns:mc="http://schemas
  <w:body>
    <w:p w:rsidR="00781A5D" w:rsidRDefault="0061420B">
      <w:r><w:t>Hello world!</w:t></w:r>
      <w:bookmarkStart w:id="0" w:name="_GoBack"/><w:bookmarkEnd w:id="0"/>
    </w:p>
    <w:sectPr w:rsidR="00781A5D">
      <w:pgSz w:w="12240" w:h="15840"/>
      <w:pgMar w:top="1440" w:right="1440" w:bottom="1440" w:left="1440" w:header="720" w:footer="720" w:gutter="0
      <w:cols w:space="720"/>
      <w:docGrid w:linePitch="360"/>
    </w:sectPr>
  </w:body>
</w:document>
```

Structure of a “Document”

Hello world.tex - TeXworks

File Edit Search Format Typeset Scripts Window Help

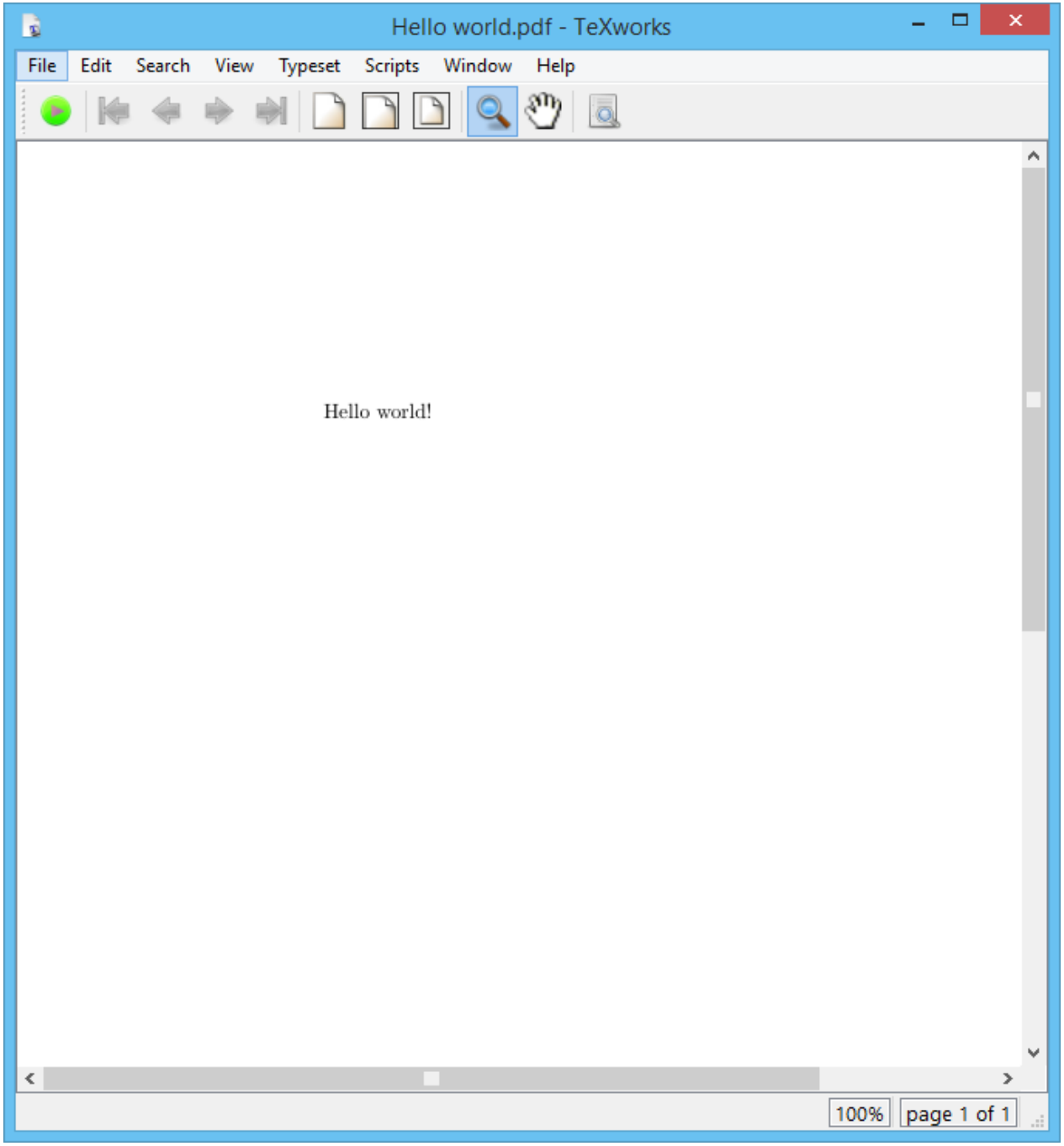
pdfLaTeX+MakeIndex+BibTeX

```
\documentclass{article}

\begin{document}
Hello world!
\end{document}
```

CRLF UTF-8 Line 5 of 5; col 14

Structure of a “Document”



Structure of a "Document"

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<w:document xmlns:wpc="http://schemas.microsoft.com/office/word/2010/wordprocessingCanvas" xmlns:mc="http://schemas
  <w:body>
    <w:p w:rsidR="00781A5D" w:rsidRDefault="0061420B">
      <w:r><w:t>Hello world!</w:t></w:r>
      <w:bookmarkStart w:id="0" w:name="_GoBack"/><w:bookmarkEnd w:id="0"/>
    </w:p>
    <w:sectPr w:rsidR="00781A5D">
      <w:pgSz w:w="12240" w:h="15840"/>
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      <w:cols w:space="720"/>
      <w:docGrid w:linePitch="360"/>
    </w:sectPr>
  </w:body>
</w:document>
```

Highlight "Hello world!" and press **BOLD** Button in Word

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<w:document xmlns:wpc="http://schemas.microsoft.com/office/word/2010/wordprocessingCanvas" xmlns:mc="http://schema
  <w:body>
    <w:p w:rsidR="00781A5D" w:rsidRDefault="0061420B">
      <w:pPr><w:rPr><w:b/></w:rPr></w:pPr><w:r w:rsidRPr="002F74B2"><w:rPr><w:b/></w:rPr><w:t>Hello world!</w:t></
      <w:bookmarkStart w:id="0" w:name="_GoBack"/><w:bookmarkEnd w:id="0"/>
    </w:p>
    <w:sectPr w:rsidR="00781A5D">
      <w:pgSz w:w="12240" w:h="15840"/>
      <w:pgMar w:top="1440" w:right="1440" w:bottom="1440" w:left="1440" w:header="720" w:footer="720" w:gutter="0
      <w:cols w:space="720"/>
      <w:docGrid w:linePitch="360"/>
    </w:sectPr>
  </w:body>
</w:document>
```

Structure of a "Document"

```
\documentclass{article}

\begin{document}
Hello world!
\end{document}
```

Type →

```
\documentclass{article}

\begin{document}
\textbf{Hello world!}
\end{document}
```

Conclusion: The structure of a LaTeX "document" is much simpler than a Word "document"

What is LaTeX?

http://tex.stackexchange.com/questions/94889/how-can-i-explain-the-meaning-of-latex-to-my-grandma

- LaTeX is to a book what a set of blueprints is to a building.
- It is a markup language (separates semantics and presentation)
- All work is done in text files
- LaTeX processes these files and outputs a PDF (or one of many other formats)

History of LaTeX

TeX

- Typesetting engine created by Donald Knuth in 1982

- Wanted to improve poor typographic quality in books and articles

LaTeX

- Macros to improve TeX, designed by Leslie Lamport in mid 1980's

- Usually refers to LaTeX2e

Better discussion of difference between TeX / LaTeX

http://tex.stackexchange.com/questions/49/what-is-the-difference-between-tex-and-latex

Levels of LaTeX

http://www.tug.org/levels.html

1. **Distributions:** large collections of TeX-related software to be downloaded and installed
   - MiKTeX, TeX Live for Windows
   - MacTeX for OS X

2. **Front ends:** editors used to create a document file
   - TeXworks, TeXshop, TeXnicCenter, …

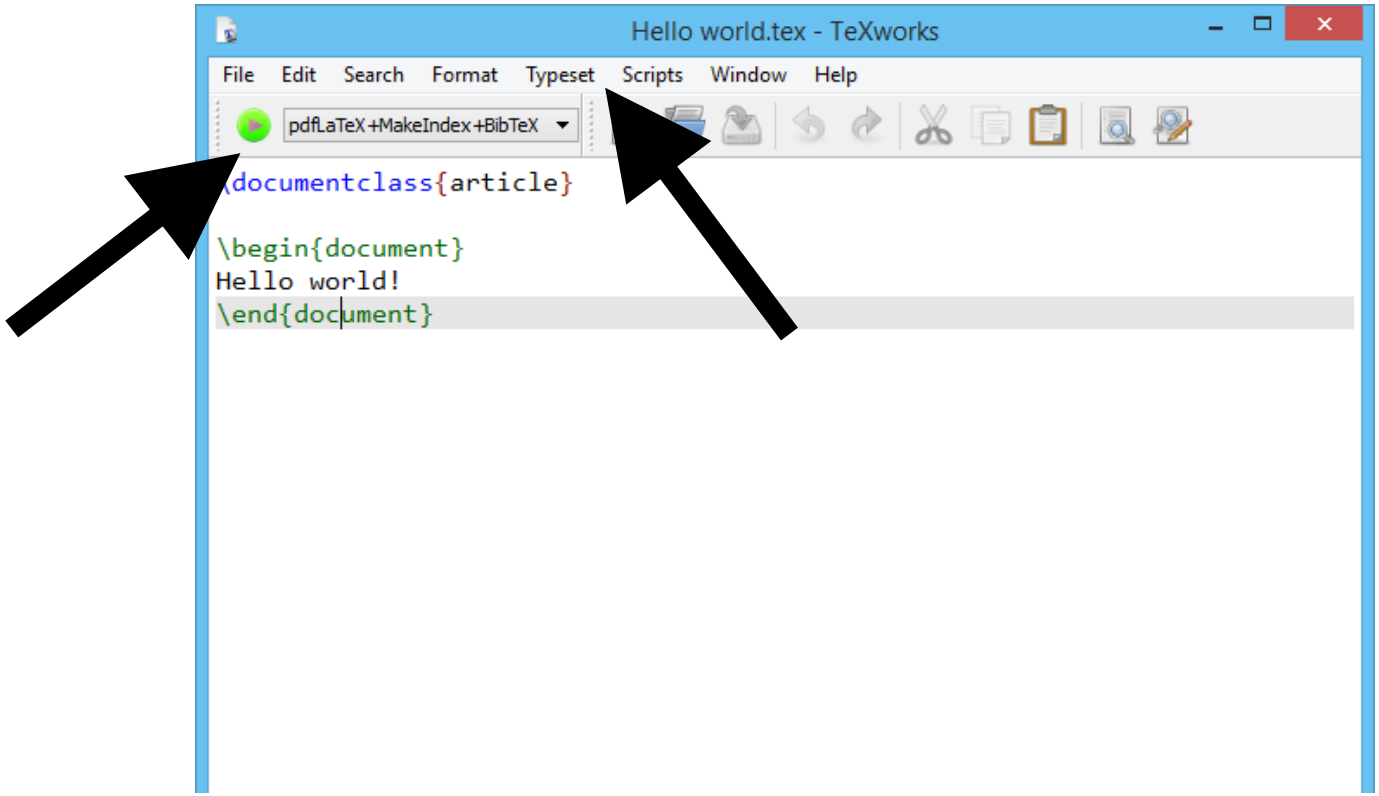
3. **Engines:** executable binaries which implement different TeX variants
   - pdfLaTeX: Takes LaTeX as input and outputs a PDF file

4. **Formats:** TeX-based languages in which one actually writes documents
   - LaTeX(2e) vs plain TeX vs …

5. **Packages:** add-ons to the basic TeX system, providing additional typesetting features, fonts, documentation, etc.
   - geometry: for modifying document margins and layout
   - graphicx: for including figures

Creating a LaTeX Document

1. Install a **distribution**
2. Create document using a **front end** using a chosen **format**
   - Include whatever **packages** you wish
3. Compile/typeset/build document using the **front end** or console
   - Behind the scenes an **engine** is executed
   - If a **package** is missing, smart **distributions** will fetch it for you



LaTeX Document Structure

```
\documentclass{article}
```

preamble

```
\begin{document}
Hello world!
\end{document}
```

body

Preamble

Controls margin settings, document style definitions, paragraph spacing settings, custom function definition, page numeration style, …

Body

Where the content goes.

Basic LaTeX Structures

The Not So Short Introduction to LaTeX2e

- Multiple spaces/tabs/line breaks are interpreted as a single "whitespace"

Input

```
Spaces do          not


matter all that      much.
```

Output

Spaces do not
matter all that much.

- The characters # $ % ^ & _ { } ~ \ have a special meaning. You must use a backslash as a prefix to use these (except the \ character).

Input

```
\# \$ \% \^{} \& \_ \{ \} \~{}
\textbackslash
```

Output

$ % ^ & _ { } ~ \

Basic LaTeX Structures

The Not So Short Introduction to LaTeX2e

- LaTeX commands look like: `\command[optional parameter]{parameter}`

Input	Output
`Start a new line \newline right now.`	Start a new line right now.
`\textbf{Hello world!}`	**Hello world!**
`\^{a} \~{f}`	â ñ
`Look \includegraphics[scale=0.5]{arrow}`	Look ➡

`\documentclass{article}`
 	
`\begin{document}`
`Hello world!`
`\end{document}`
	PDF
	Hello world!

Basic LaTeX Structures

[The Not So Short Introduction to LaTeX2e]

- Anything after a % is a comment

Input

```
% Hello this is a comment
Hello world!
```

Output

Hello world

- Anything between `\begin{name}` is called the content of the `name` environment
  and
  `\end{name}`

Input

```
\documentclass{article}


\begin{document}
Hello world!
\end{document}
```

Output

Hello world!

Basic LaTeX Structures

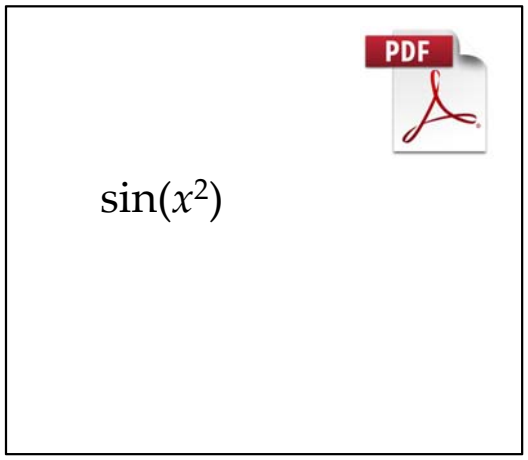
The Not So Short Introduction to LaTeX2e

- Enhancements to basic LaTeX is done through the inclusion of packages. Packages are included in the preamble.

Input

```
\documentclass{article}
\usepackage{amsmath}

\begin{document}
$\sin(x^2)$
\end{document}
```

Output



- Use single (` and ‘) rather than double (“) apostrophes for quotes.

Input

```
`Hello' vs ``Hello'' vs ”Hello”
```

Output

‘Hello’ vs “Hello” vs Hello

Basic LaTeX Structures

The Not So Short Introduction to LaTeX2e

- There are different length dashes.

Input	Output
`third-world 3--4 what---no way`	third-world 3–4 what—no way

- Text emphasis is done using the following commands.

Input	Output
`\textbf{Bold}`	**Bold**
`\underline{Underline}`	Underline
`\textit{Italic}`	*Italic*
`\textsc{Small Caps}`	SMALL CAPS
`\texttt{Typewriter}`	`Typewriter`

Basic LaTeX Structures

The Not So Short Introduction to LaTeX2e

- Lists can be created using the `itemize` environment.

Input

```
\begin{itemize}
  \item First item
  \item Second item
  \begin{itemize}
    \item First subitem
    \item Second subitem
  \end{itemize}
\end{itemize}
```

Output

- First item
- Second item
  - First subitem
  - Second subitem

You can change the bullets using an additional argument.

Input

```
\begin{itemize}
  \item[a)] First item
  \item[b)] Second item
\end{itemize}
```

Output

a) First item
b) Second item

Basic LaTeX Structures

[The Not So Short Introduction to LaTeX2e]

- Tables can created using the tabular environment `\begin{tabular}{`*`tablespec`*`}` where *tablespec* is a combination of
  - `l` left-aligned column
  - `r` right-aligned column
  - `c` center-aligned column
  - `|` vertical border
- Each column is separated using `&` (alignment character).
- Each row must end with `\\` (newline).
- Horizontal borders are created using `\hline`.

Input

```
\begin{tabular}{r|c|l}
\hline
aa & bbb & cc \\
\hline
aaa & bb & ccc
\end{tabular}
```

Output

aa	bbb	cc
aaa	bb	ccc

Basic LaTeX Structures

The Not So Short Introduction to LaTeX2e

- Items can be centered by using the `center` environment.

Input

```
Text
\begin{center}
some text
\end{center}
More text
```

Output

Text

some text

More text

Document Structure

Level	Command
1	\section{section}
2	\subsection{subsection}
3	\subsubsection{subsubsection}

Input

```
\section{Section Name}

Stuff

\subsection{Subsection Name}

More stuff

\subsubsection{Subsubsection Name}

Even more stuff
```

Output

1 Section Name

Stuff

1.1 Subsection Name

More stuff

1.1.1 Subsubsection Name

Even more stuff

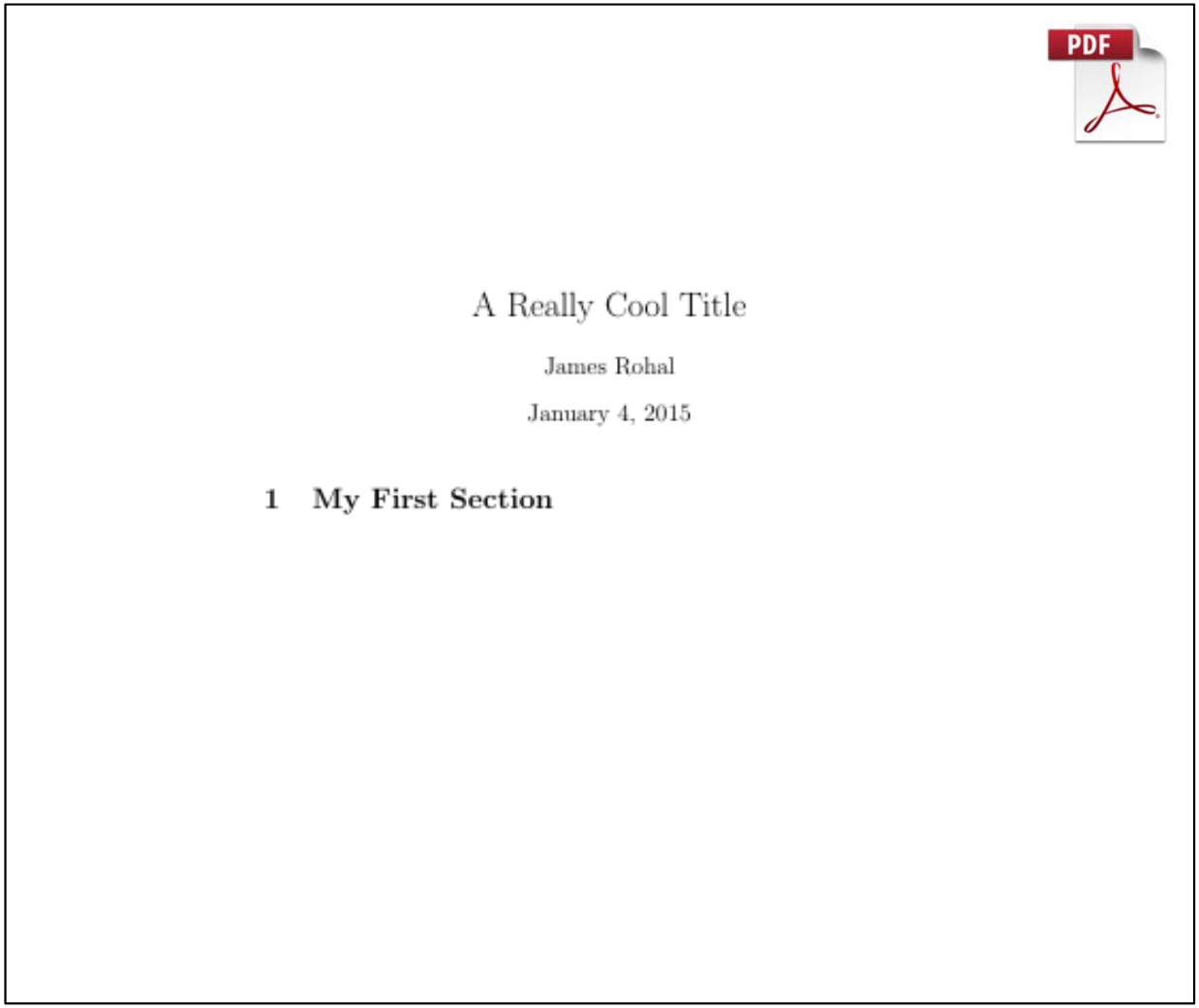
Document Structure

- A basic title is created using `\title`, `\author`, `\date`, `\maketitle`.

Input

```
\documentclass{article}

\begin{document}

\title{A Really Cool Title}
\author{James Rohal}
\date{\today}

\maketitle

\section{My First Section}

\end{document}
```

Output



Cross Referencing

- To reference another portion of a document:
  1. Give it a label: `\label{name}`
  2. Reference it: `\ref{name}`

Input

```
\section{Section Name}\label{firstsec}

Stuff

\subsection{Subsection Name}

More stuff

\subsubsection{Subsubsection Name}

We talked about stuff in
Section \ref{firstsec}.
```

Output

1 Section Name

Stuff

1.1 Subsection Name

More stuff

1.1.1 Subsubsection Name

We talked about stuff in Section 1.

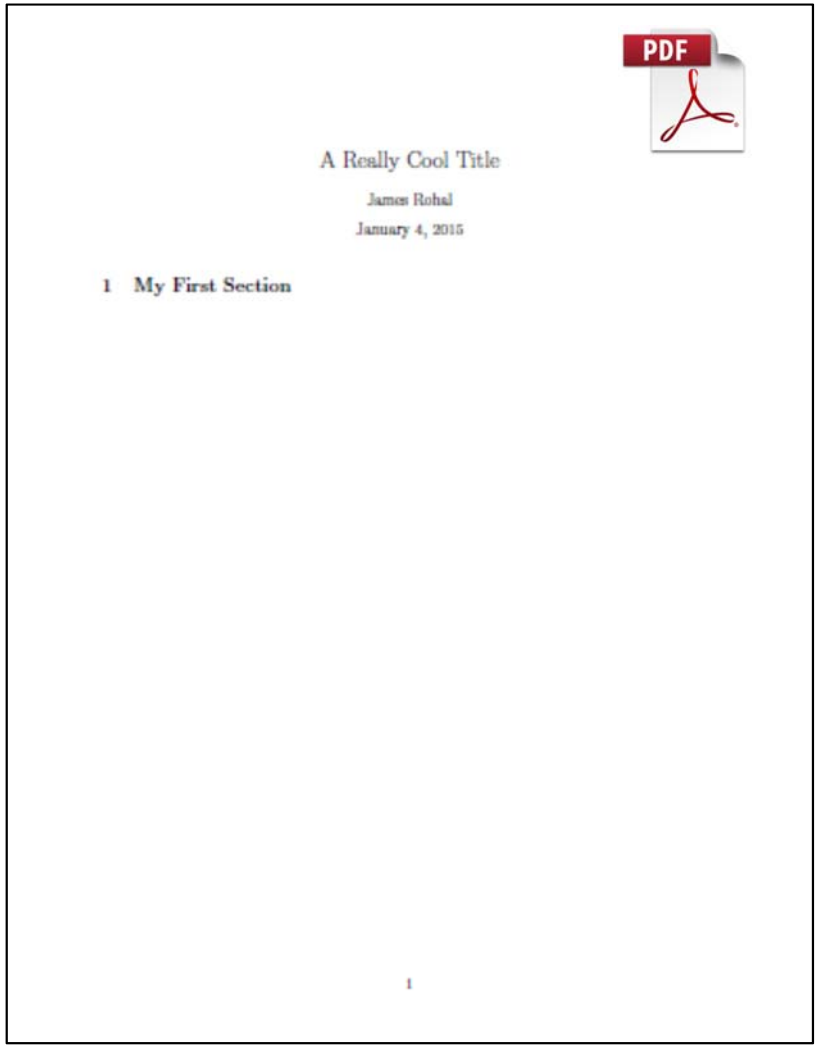
Useful Packages: geometry

- Allows you to control the margins and page layout.

Input

```
\documentclass{article}
\usepackage[margin=1in]{geometry}

\begin{document}

\title{A Really Cool Title}
\author{James Rohal}
\date{\today}

\maketitle

\section{My First Section}

\end{document}
```

Output



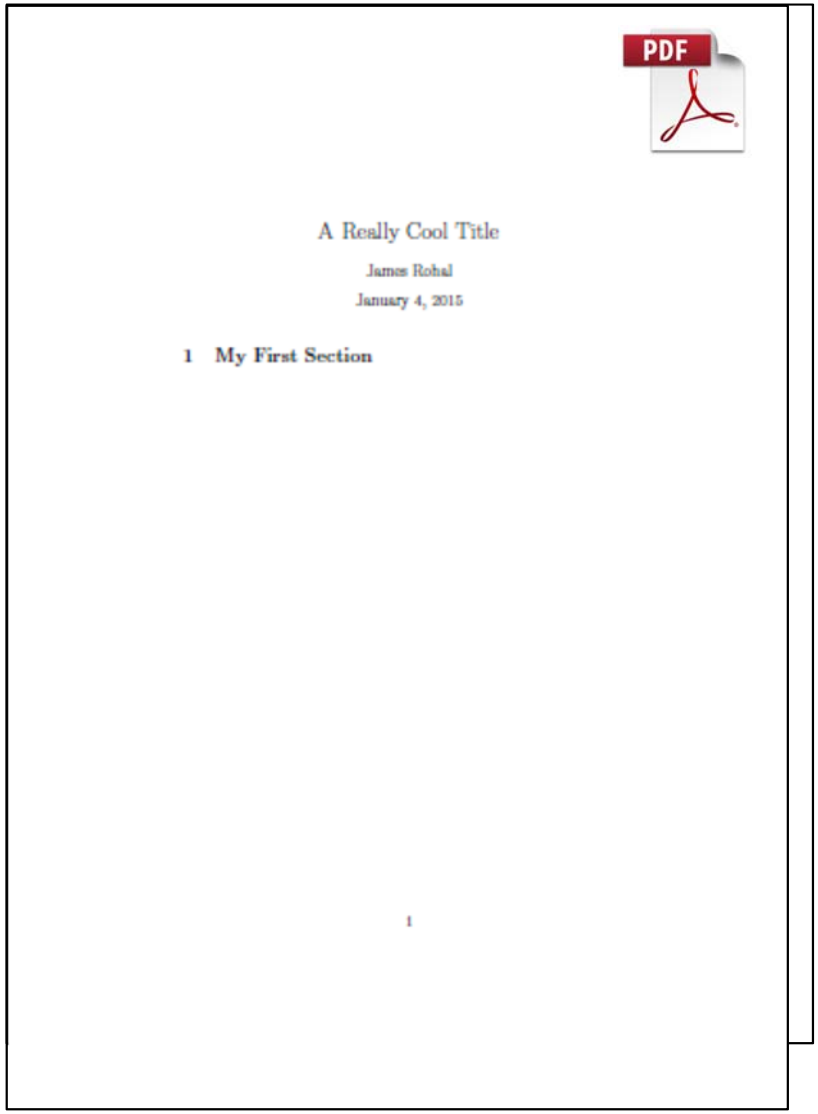
Useful Packages: geometry

- Allows you to control the margins and page layout.

Input

```
\documentclass{article}

\begin{document}

\title{A Really Cool Title}
\author{James Rohal}
\date{\today}

\maketitle

\section{My First Section}

\end{document}
```

Output



Useful Packages: graphicx

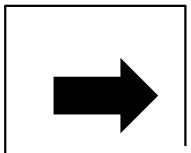
- Allows you to include graphics.
- The image file must be in the same directory as the input file.
- Use the command \includegraphics[*options*]{*file*} where *file* is the name of the graphics file (PDF, PNG, JPEG,…)

Input

```
\documentclass{article}
\usepackage{graphicx}

\begin{document}

Look this way \includegraphics{arrow}

\end{document}
```

file.tex

and



arrow.pdf

Output

Look this way ➡

Useful Packages: `graphicx`

- You can change the size of the graphic included using the `scale` option. Try not to blow up bitmap graphics too much.

Input

```
\documentclass{article}
\usepackage{graphicx}

\begin{document}

Don't blow up bitmap graphics!
\begin{center}
\includegraphics[scale=20]{link}
\end{center}

\end{document}
```

file.tex

and

link.png

Output

Useful Packages: amsmath

- If you are typing a paper with mathematics, you need to include this. Reference: ftp://ftp.ams.org/ams/doc/amsmath/amsldoc.pdf

- Two types of typed math.

1. Inline math: `$math goes here$`

Input

```
What is the integral of $x^2$?
```

Output

What is the integral of x^2?

2. Display math: `\[ math goes here \]`

Input

```
This is the integral
\[
\int x^2 dx = \frac{x^3}{3}.
\]
```

Output

This is the integral

$$\int x^2 dx = \frac{x^3}{3}.$$

Errors/Warnings

- Errors: some problem that occurs at compile time.
  You must fix these otherwise you have no document!

Input

```
Oops, I forgot a closing money sign in $x^2
```

Console

```
6   Missing $ inserted.
    <inserted text>
                $
    l.6
```

- Warnings: fix these before submitting final draft (if possible)

Bad Boxes

- Occur when your document does not look “nice.”

Input

```
aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
```

Output

aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa

Console

```
Overfull \hbox (110.00134pt too wide) in paragraph at lines 5--6
```

- You might intentionally trigger these.