Introduction to Programming and Computing for Scientists

Oxana Smirnova

Lund University

Tutorial 2a: writing a document using LaTeX

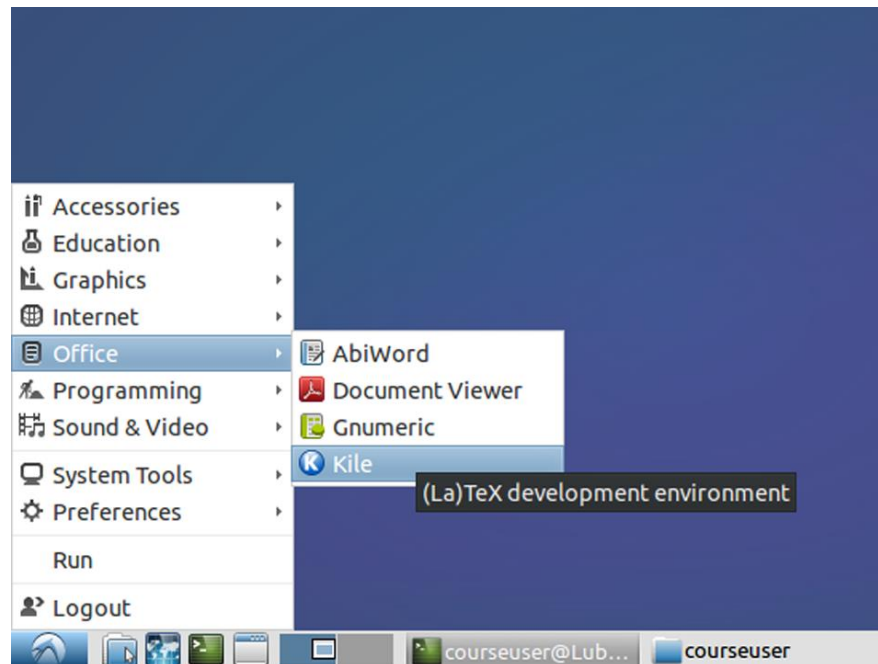# You need a text editor and a LaTeX distribution

- LaTeX files are simple ASCII files, like any program code
- They can be edited on any platform (Linux, Windows, anything) using any text editor
- These days everybody prefers to have the result in PDF
  - This was not the case 20 years ago, so by default LaTeX produces DVI files
  - All modern LaTeX systems can build PDF as well (**pdflatex** command in Linux)
- There are different LaTeX distributions, all based on the same LaTeX2e version

Platform	LaTeX distribution
Ubuntu, Debian	**texlive, texlive-base, texlive-full**
RedHat, CentOS, Fedora, SuSE	**texlive, texlive-base, texlive-latex**
Linux	**tetex** *– not supported since 2006*
Windows	**MiKTeX**
Mac OS	**MacTeX**

- There are many packages not included in the typical distributions, but they always can be added later

Highly recommended way: use a LaTeX IDE

- LaTeX IDEs can:
    - Edit the text, highlighting elements and environments
    - Assist in typing the environments and tags
    - Offer menus for most common environments, tags, symbols etc
    - Offer single-click interface to build and view LaTeX files
- Many such IDEs exist, today we will use **`Kile`**
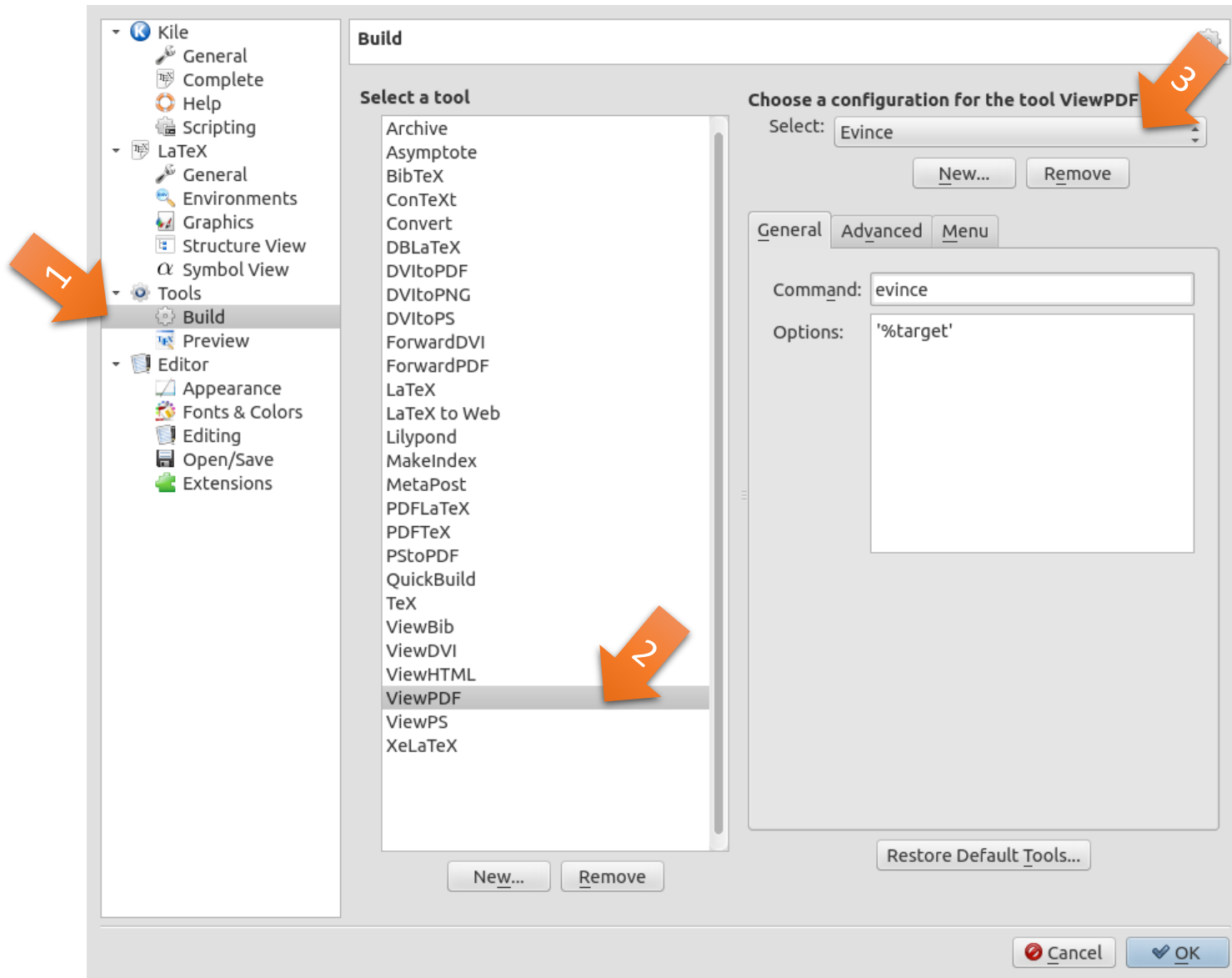   - Find it in the menu, or type **`kile`** in "Run"
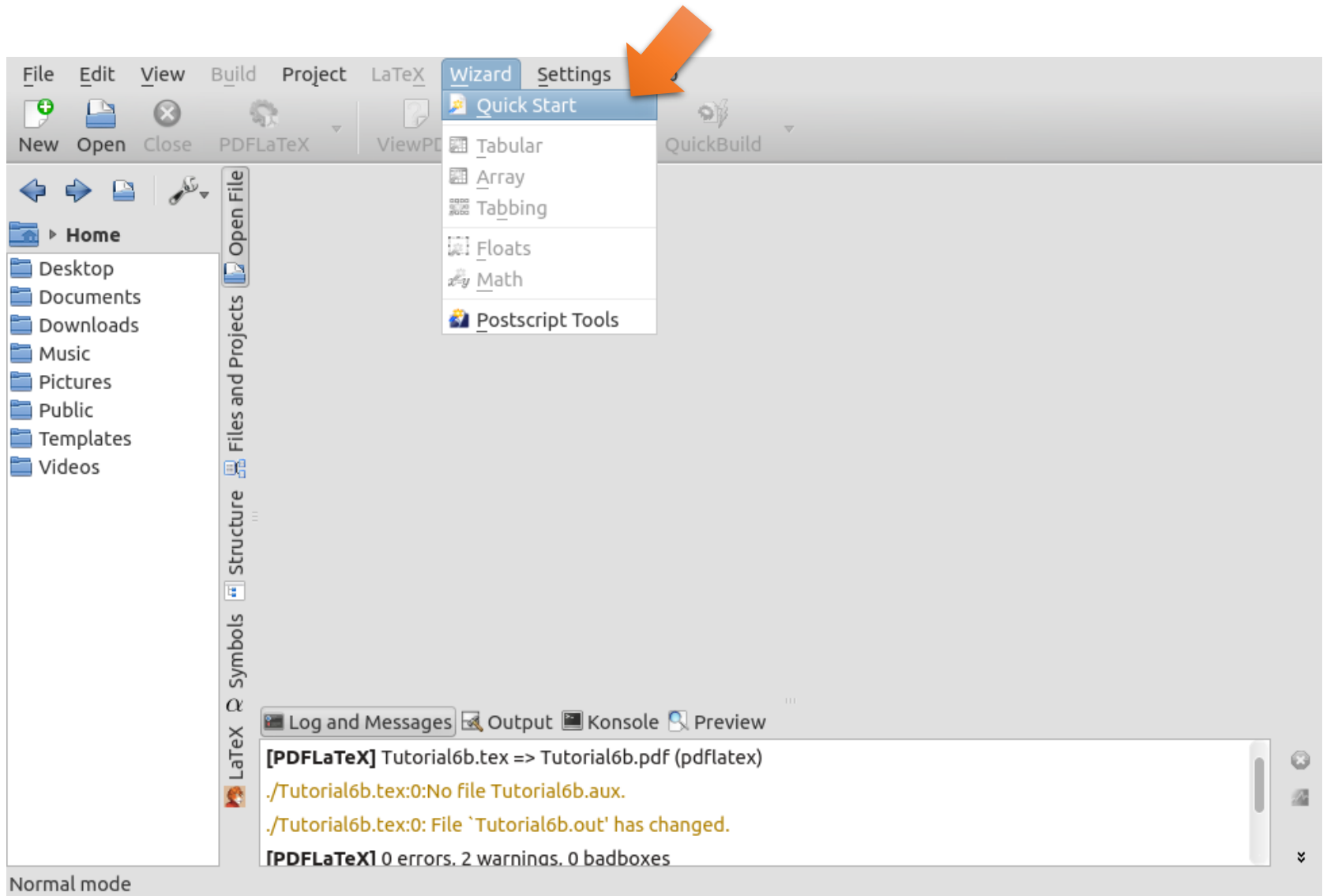
Configure your Kile

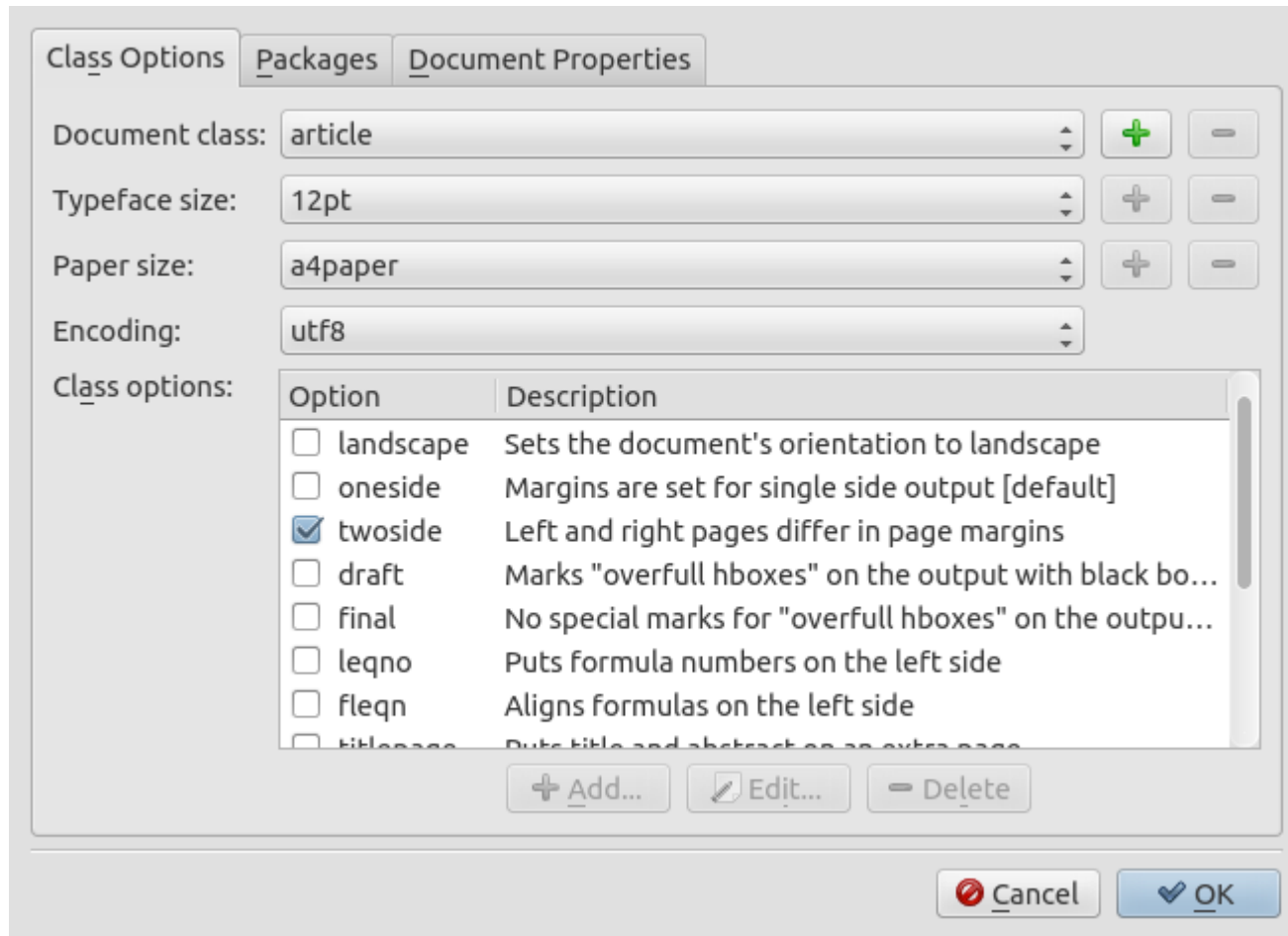# Configure your Kile: select Evince as PDF viewer

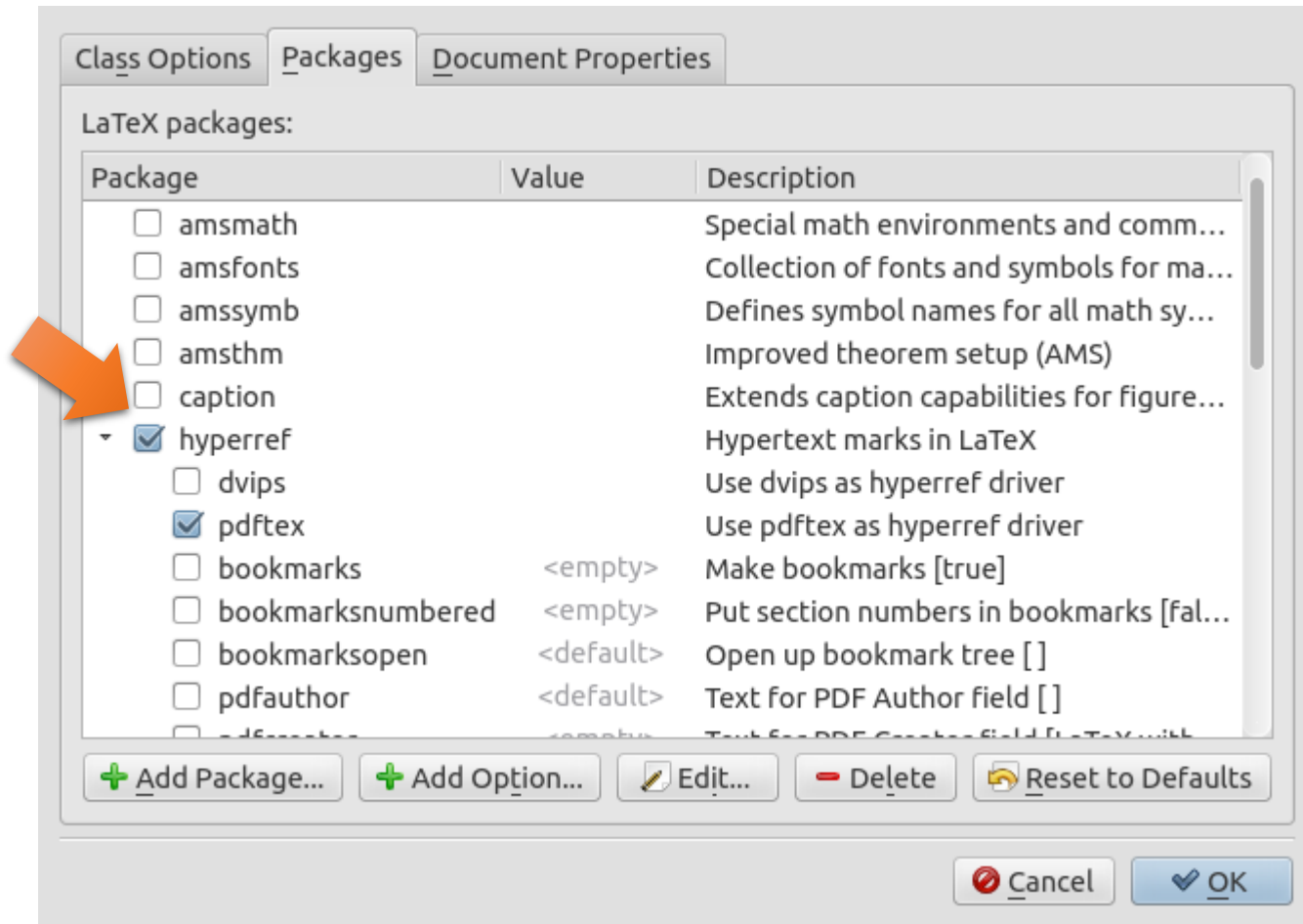# Quick-start the new document using Kile Wizard

We will make an article for a two-sided A4 printing

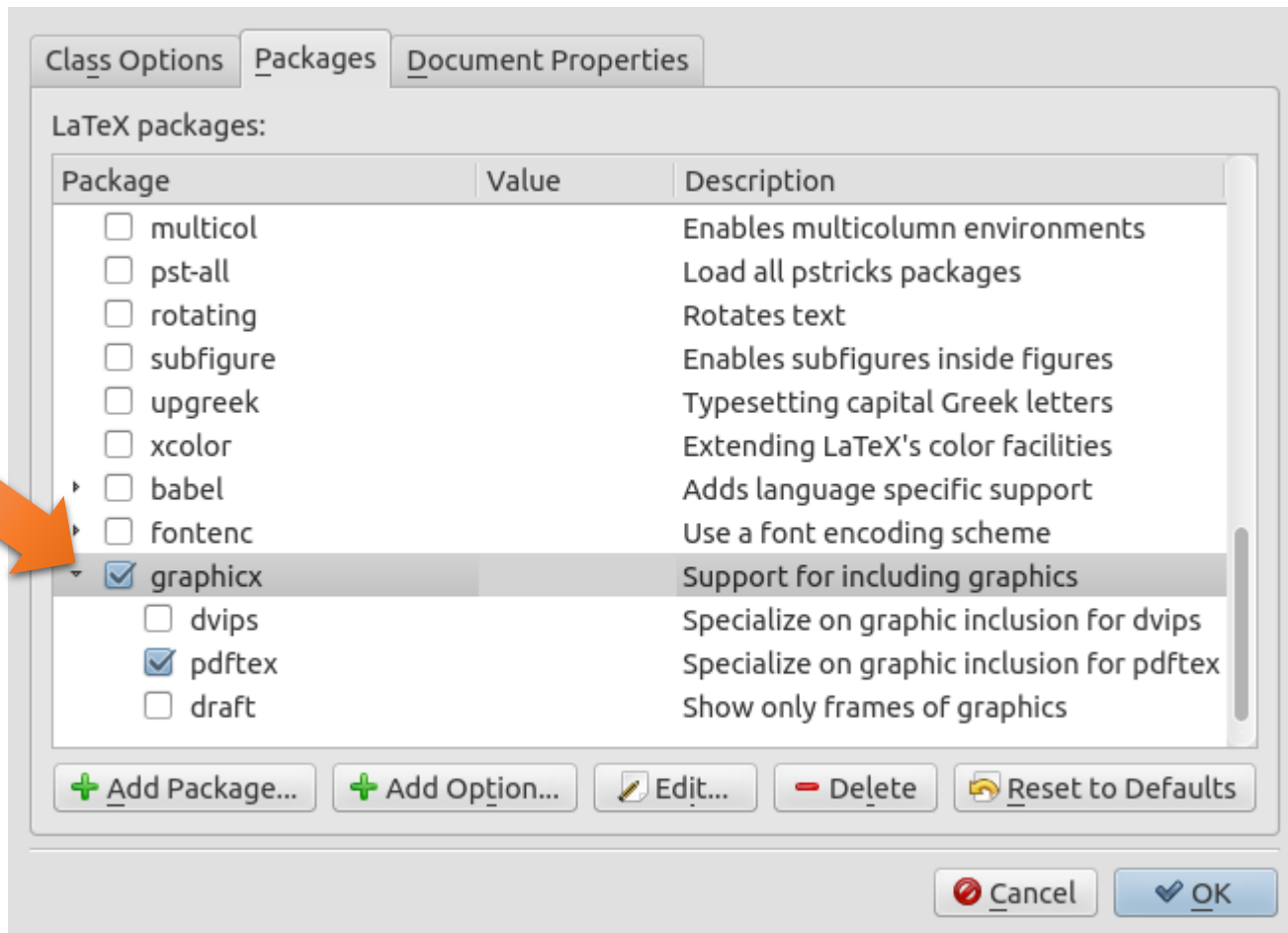Don't click OK yet, let's go to the Packages tab

Let's pick some useful LaTeX packages

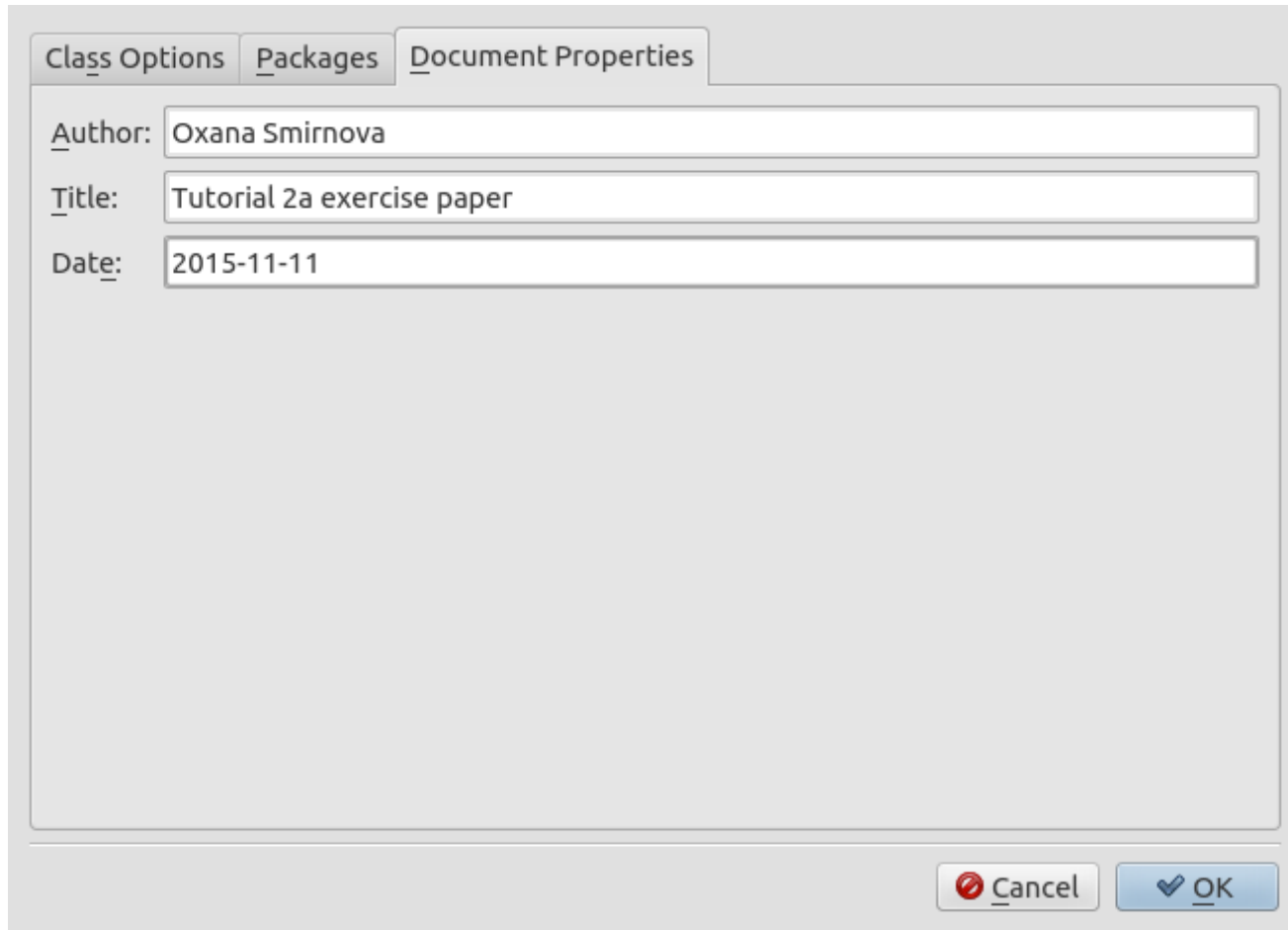**hyperref** with **pdftex** will make PDF files with clickable cross-references

More useful packages

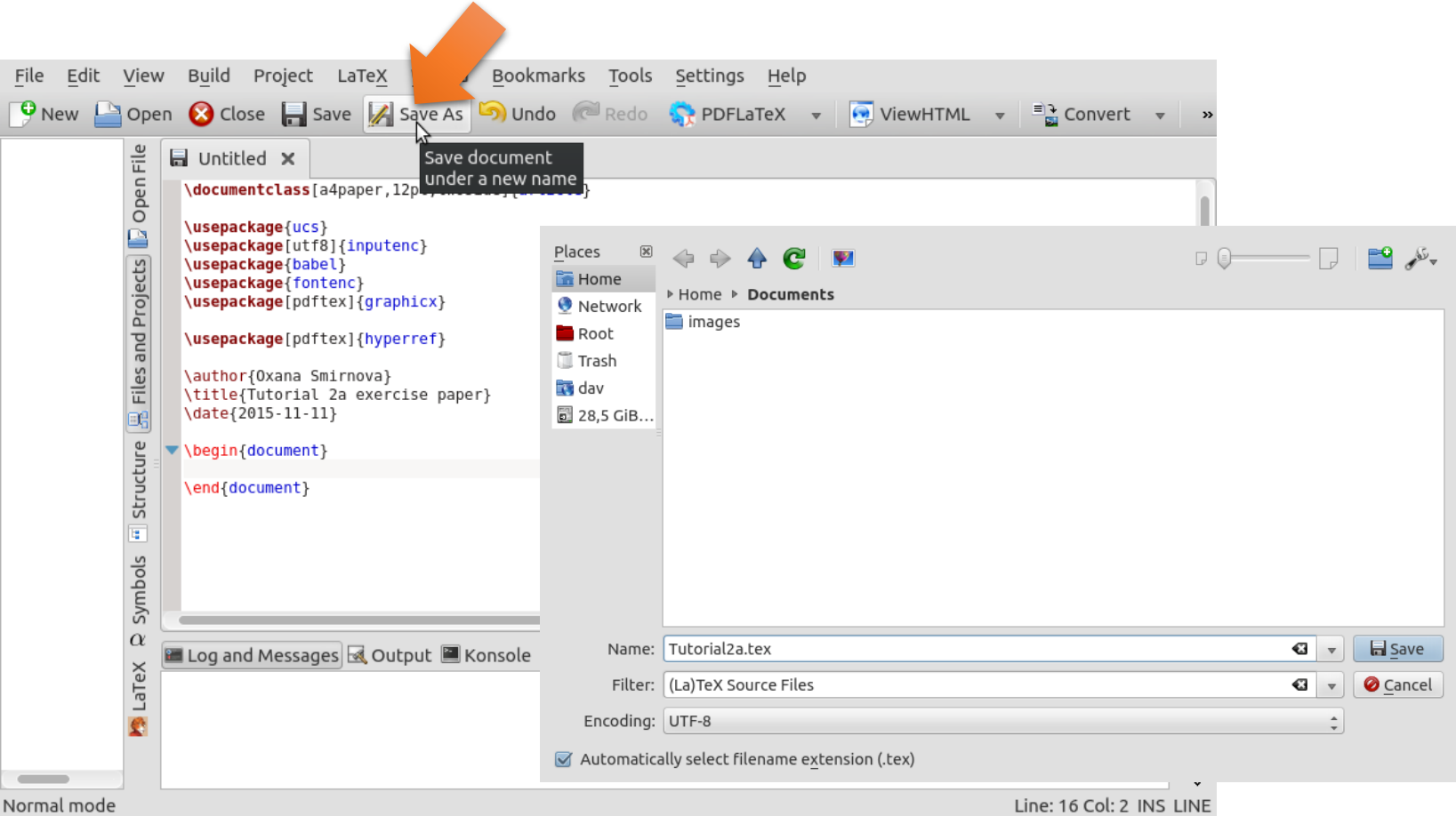**graphicx** with **pdftex** will allow to insert raster graphics (JPG, PNG etc)

And now some metadata

Now it is OK to click OK

Time to save the file

And now let's build it

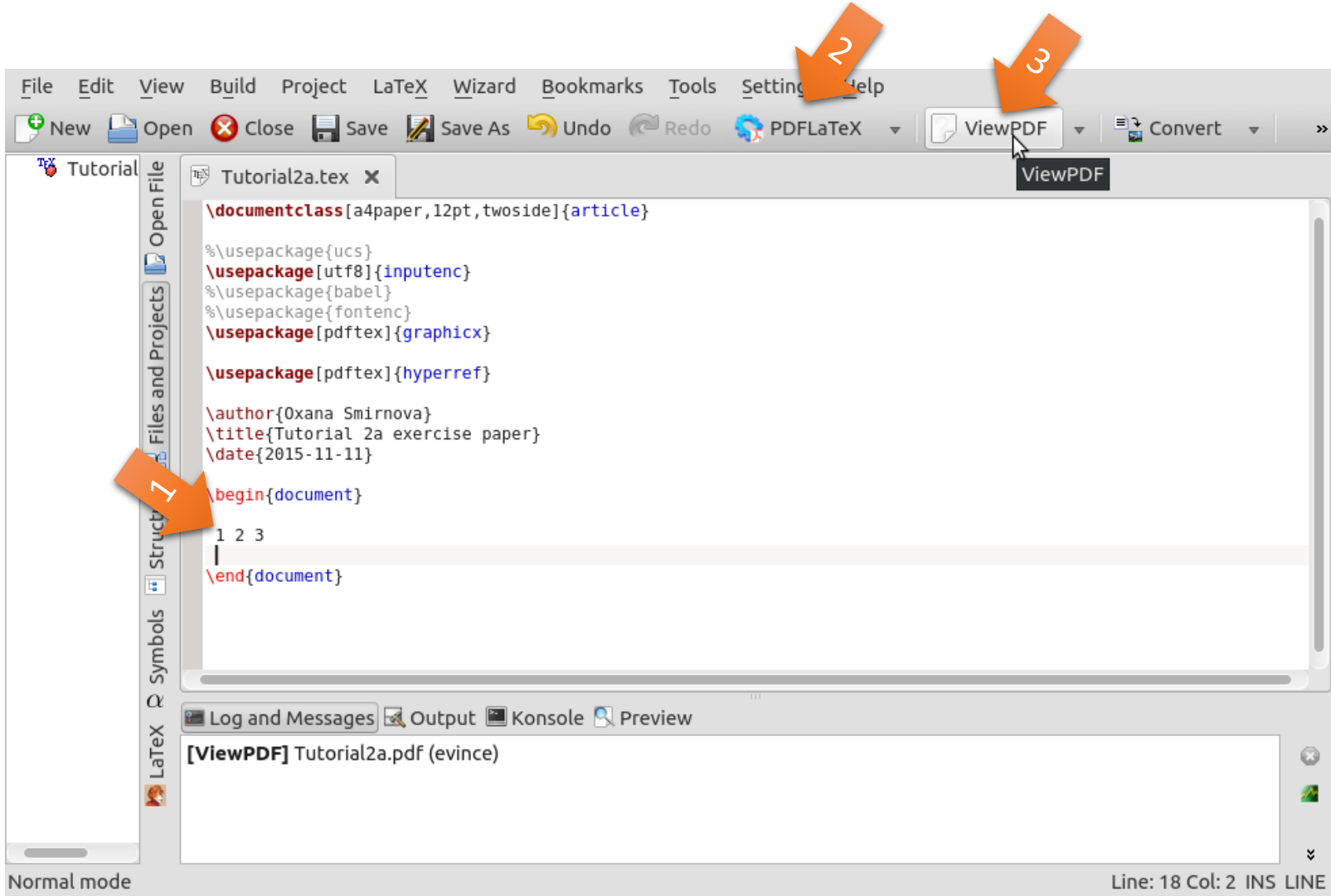# Whatever, we don't need this package, *comment* it out

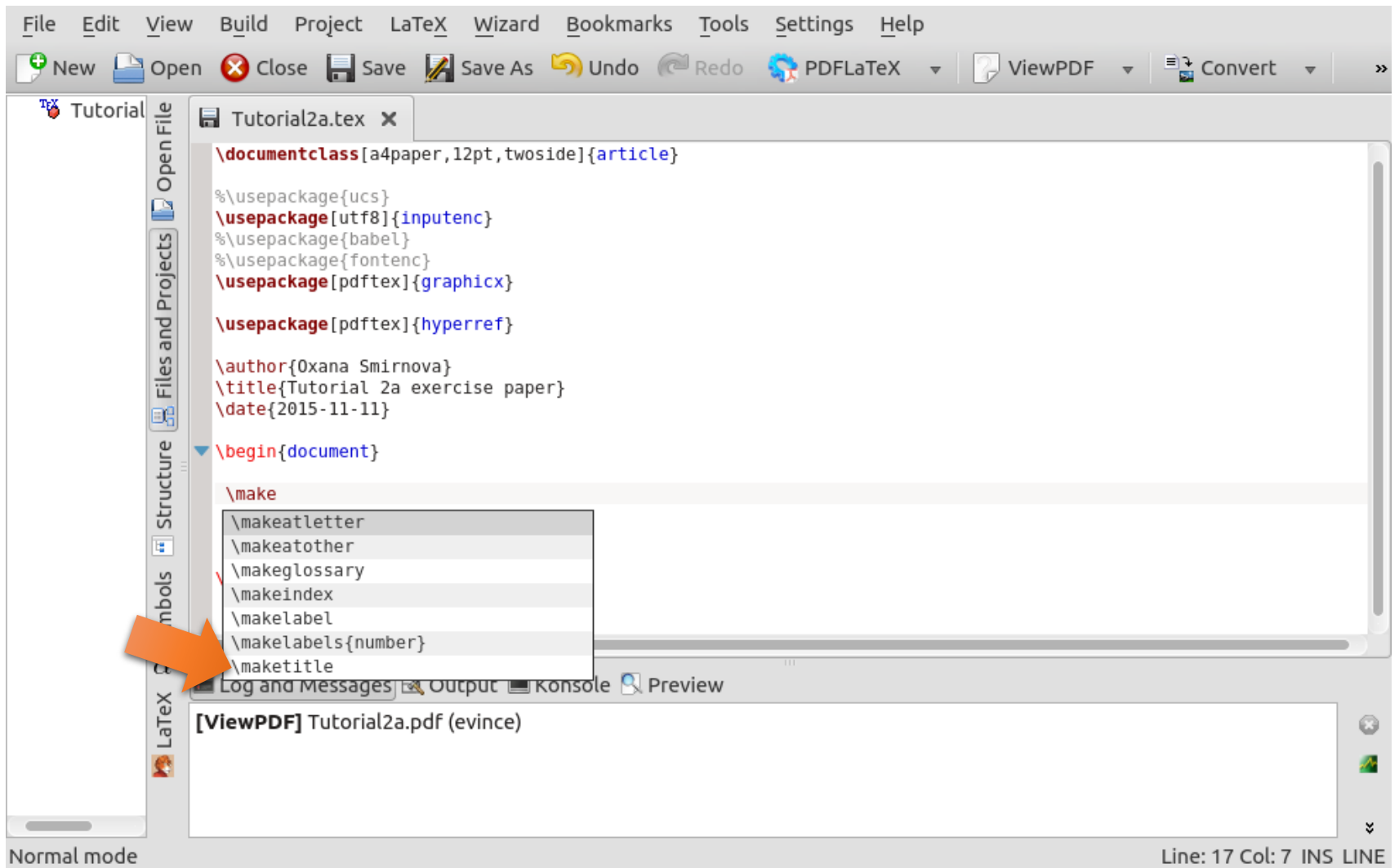Use % to *comment* (inactivate) any line in LaTeX; you can turn off many packages

Add some text, build and view the result

Where's the title? Let's make it: `\maketitle`

Would be nice to add e-mail, centered

- **\begin{center}**
  \end{center}
  this environment center-aligns everything inside it

- **\texttt{…}** tag applies equidistant "typewriter"-like font

Time to add some sections and labels for cross-reference

- **\section{name}** tag creates a numbered section

- **\label{label-name}** tag sets a cross-reference target. Label name can be anything, people use prefixes like **sec:** or **fig:** to avoid name clashes

So how do we do cross-referencing?

- **`\ref{label-name}`**
  a very smart tag that inserts numbering of the labelled environments and even creates clickable cross-references in PD

Let's add a picture

- Get yourself a penguin (or a cat) from Google

- `\begin{figure}`
  `\end{figure}`
  the environment for figures

- `\includegraphics{…}` inserts actual files

This looked ugly, let's pin it and center it

The screenshot shows a LaTeX editor (Kile) with the following code visible:

```
\texttt{oxana.smirnova@hep.lu.se}
\end{center}


\section{Introduction}
\label{sec:intro}

This is introduction. Summary will be given in Sec

\section{About Linux}
\label{sec:linux}

\begin{figure}[h]
  \begin{center}
    \includegraphics{penguin.png}
  \end{center}
\end{figure}

\section{Summary}
\label{sec:sum}


\end{document}
```
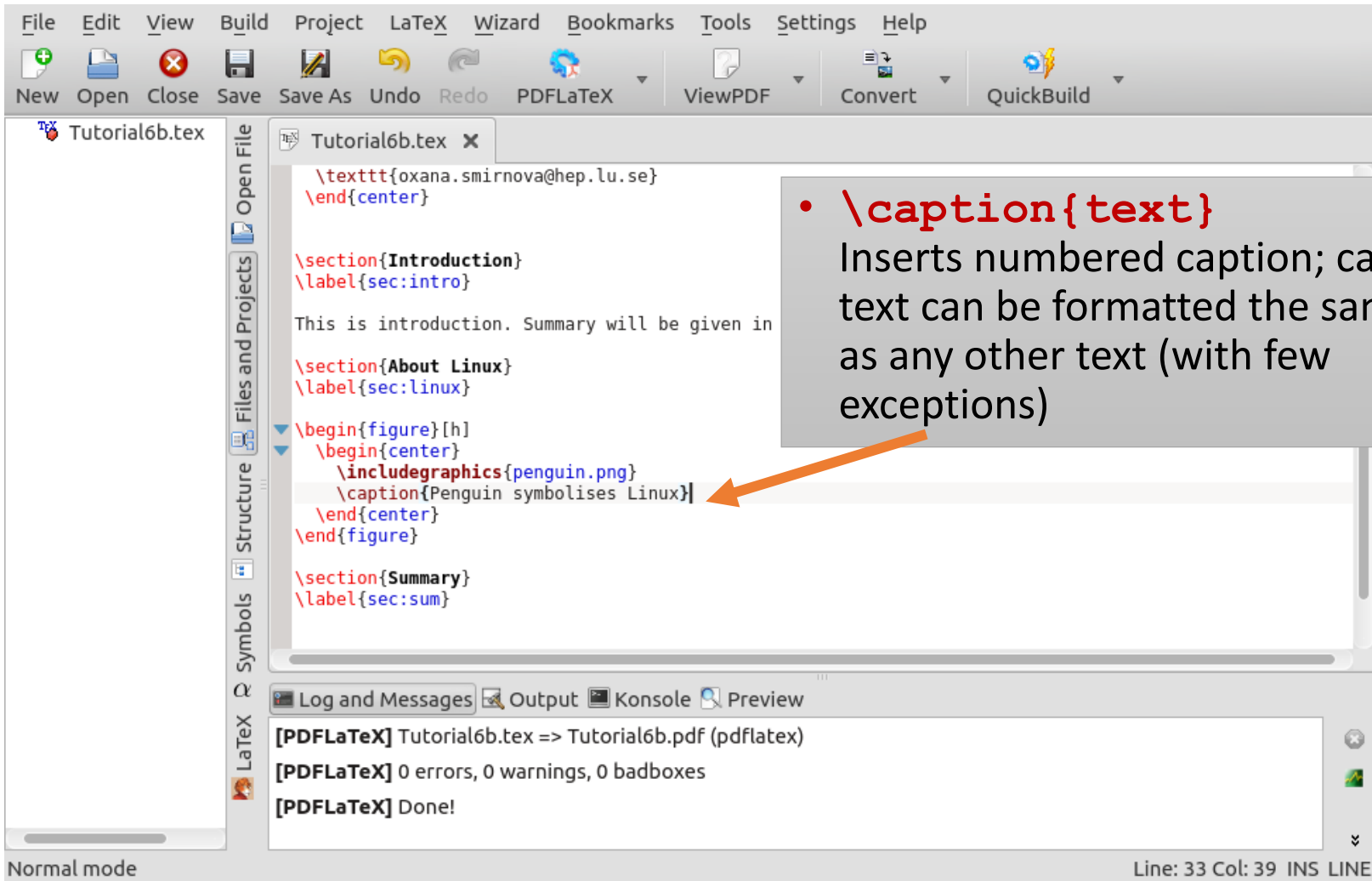
Log and Messages / Output / Konsole / Preview

[PDFLaTeX] Tutorial6b.tex => Tutorial6b.pdf (pdflatex)

[PDFLaTeX] 0 errors, 0 warnings, 0 badboxes

[PDFLaTeX] Done!

- **[h]** means "here"; also exist H, t, b, p and $!$ (can be used together)
  - LaTeX has its own ideas what means "here": figures and tables are placed according to some optimal rules. Use "$!$" to override them (good luck…)

Every figure needs a caption

- **\caption{text}**
  Inserts numbered caption; caption text can be formatted the same way as any other text (with few exceptions)

We also want to cross-reference figures

- **\label{label-name}** and **\ref{label-name}** are used in the same way as for sections (and anything else)

Final adjustments

- **`\includegraphics[]{…}`** can take various options specified in []

- **`\textit{…}`** applies *italic* (slanted) font to the text

We have to cite bibliography reference now

- **\cite{item-name}** inserts cross-reference to the named bibliography item

- **\begin{thebibliography}** environment lists bibliography items
  - Each item is defined via **\bibitem{item-name}**

- **\url{…}** creates clickable Web links in the PDF file

File   Edit   View   Build   Project   LaTeX   Wizard   Bookmarks   Tools

New   Open   Close   Save   Save As   Undo   Redo   PDFLaTeX   ViewPDF

Tutorial6b.tex

Tutorial6b.tex ✕

```
This is introduction. Summary will be given in

\section{About Linux}
\label{sec:linux}

\begin{figure}[h]
  \begin{center}
    \includegraphics[width=2cm]{penguin.png}
    \caption{Penguin symbolises Linux}
    \label{fig:penguin}
  \end{center}
\end{figure}

Figure \ref{fig:penguin} shows a \textit{penguin}. For more details, check
the Linux Web page \cite{linux}.

\section{Summary}
\label{sec:sum}

\begin{thebibliography}{99}
  \bibitem{linux} Linux web site: \url{www.linux.com}
\end{thebibliography}
```

Log and Messages Output Konsole Preview

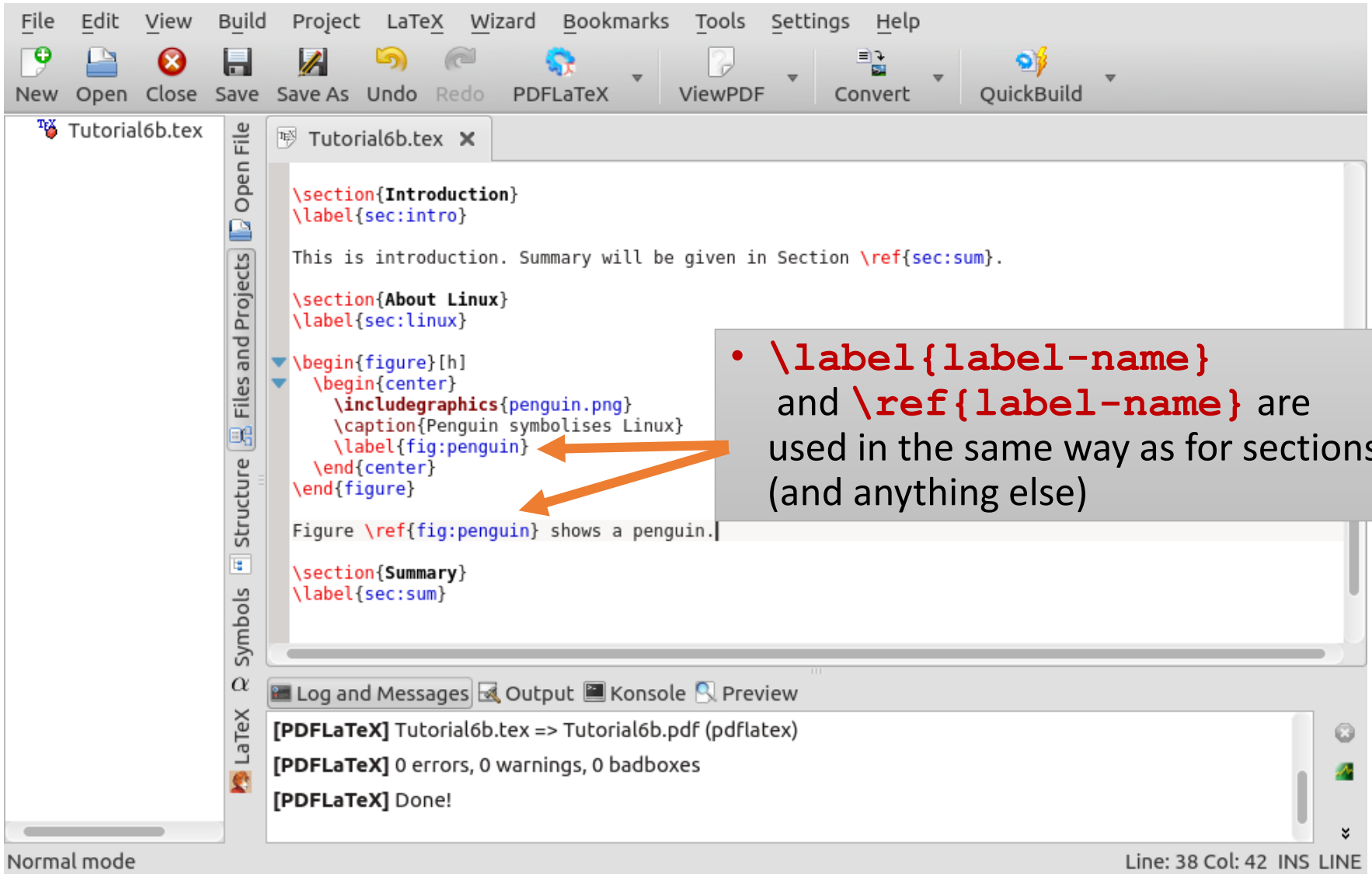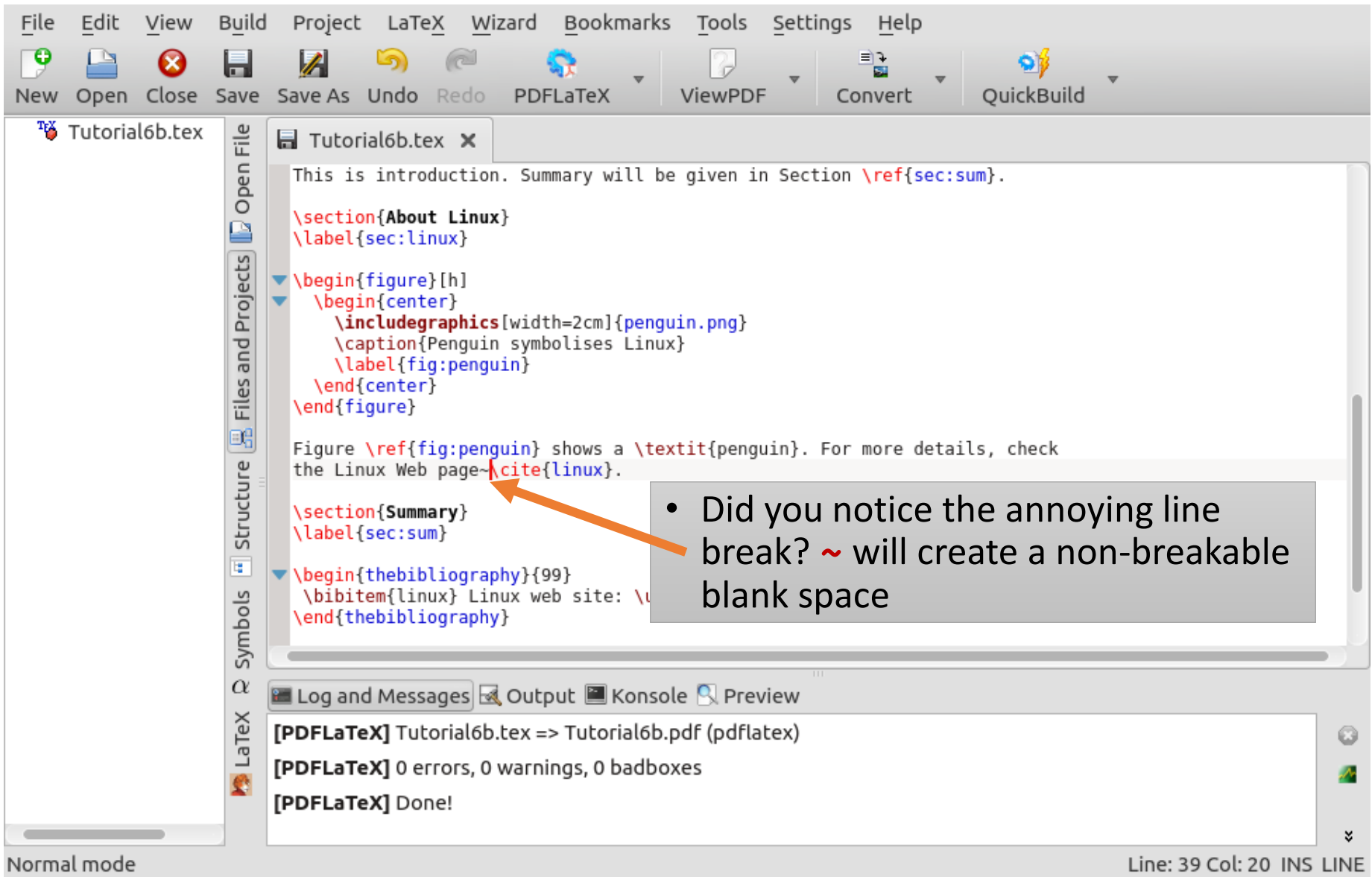**[PDFLaTeX]** Tutorial6b.tex => Tutorial6b.pdf (pdflatex)

[PDFLaTeX] 0 errors, 0 warnings, 0 badboxes

[PDFLaTeX] Done!

Normal mode

Line: 38 Col: 68 INS LINE

One small detail: non-breaking space

File   Edit   View   Build   Project   LaTeX   Wizard   Bookmarks   Tools   Settings   Help

New   Open   Close   Save   Save As   Undo   Redo   PDFLaTeX   ViewPDF   Convert   QuickBuild

Tutorial6b.tex

Tutorial6b.tex

```
This is introduction. Summary will be given in Section \ref{sec:sum}.

\section{About Linux}
\label{sec:linux}

\begin{figure}[h]
  \begin{center}
    \includegraphics[width=2cm]{penguin.png}
    \caption{Penguin symbolises Linux}
    \label{fig:penguin}
  \end{center}
\end{figure}

Figure \ref{fig:penguin} shows a \textit{penguin}. For more details, check
the Linux Web page~\cite{linux}.

\section{Summary}
\label{sec:sum}

\begin{thebibliography}{99}
  \bibitem{linux} Linux web site: \u
\end{thebibliography}
```

- Did you notice the annoying line break? **~** will create a non-breakable blank space

Log and Messages   Output   Konsole   Preview

[PDFLaTeX] Tutorial6b.tex => Tutorial6b.pdf (pdflatex)

[PDFLaTeX] 0 errors, 0 warnings, 0 badboxes

[PDFLaTeX] Done!

Normal mode   Line: 39 Col: 20 INS LINE

Make a new \subsection and a table

- **\begin{table}** is very similar to **\begin{figure}**

- Tables themselves are defined by **\begin{tabular}**
  - Each letter in **{c|c}** indicates a column; "**c**" means centered, can be also "**l**" or "**r**"

- **&** separates cells

- **** ends rows

It was an ugly table, let's make it slightly better

- **\hline** adds a horizontal border
  - One can also use **\cline{2-3}** to have borders only for selected columns

A footnote

```
File  Edit  View  Build  Project  LaTeX  Wizard  Bookmarks  Tools  Settings  Help
```

New Open Close Save Save As Undo Redo PDFLaTeX ViewPDF Convert QuickBuild

Tutorial6b.tex

Tutorial6b.tex

```
Figure \ref{fig:penguin} shows a \textit{penguin}. For more details, check
the Linux Web page~\cite{linux}.

\subsection{Linux flavours}
\label{sec:flavours}

Table~\ref{tab:flavours} lists some Linux flavours~\footnote{Only one is shown
for simplicity}.

\begin{table}[h]
  \begin{center}
    \begin{tabular}{c||c|c|c} % | is for border, c is for centering
      \textbf{Distribution}&RedHat&Debian&SuSE\\ \hline \hline
      Fedora 20            & X    &      &      \\ \hline
    \end{tabular}
    \caption{Different flavours of Linux}
    \label{tab:flavours}
  \end{center}
\end{table}


\section{Summary}
```

- **\footnote{text}** puts text in the automatically numbered footnote

Log and Messages | Output | Konsole | Preview

[PDFLaTeX] Tutorial6b.tex => Tutorial6b.pdf (pdflatex)

[PDFLaTeX] 0 errors, 0 warnings, 0 badboxes

[PDFLaTeX] Done!

Normal mode

Line: 45 Col: 16 INS LINE

Now let's try mathematics in a new section


```latex
        \caption{Different flavours of Linux}
        \label{tab:flavours}
    \end{center}
\end{table}

\section{About mathematics}
\label{sec:math}

In-line math in \LaTeX \ is enclosed in \$ symbols. Backslash \textbackslash \
is used to denote special symbols.

Subscripts and superscripts are always math: $A_x$, $A_xy$,
$e^x$ and $e^{x^2}$. Using underscore \_ outside math without \textbackslash
causes big_troubles.

All special symbols are also math: $\alpha$, $\beta$, $\gamma$, $\delta$, $\sin
x$, $\hbar$, $\lambda$, $\ldots$ More information can be
found in Ref.~\cite{latex}.
```
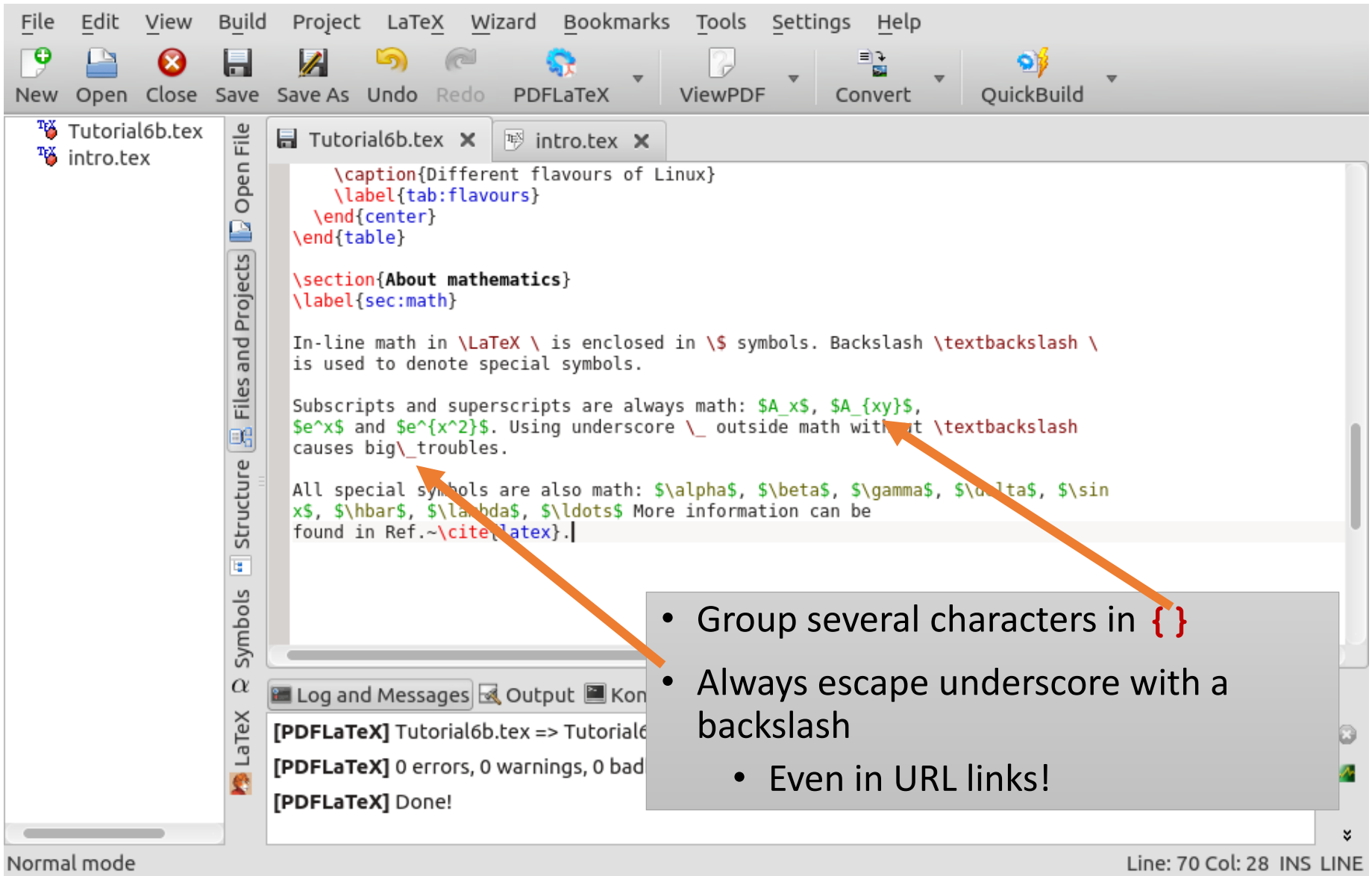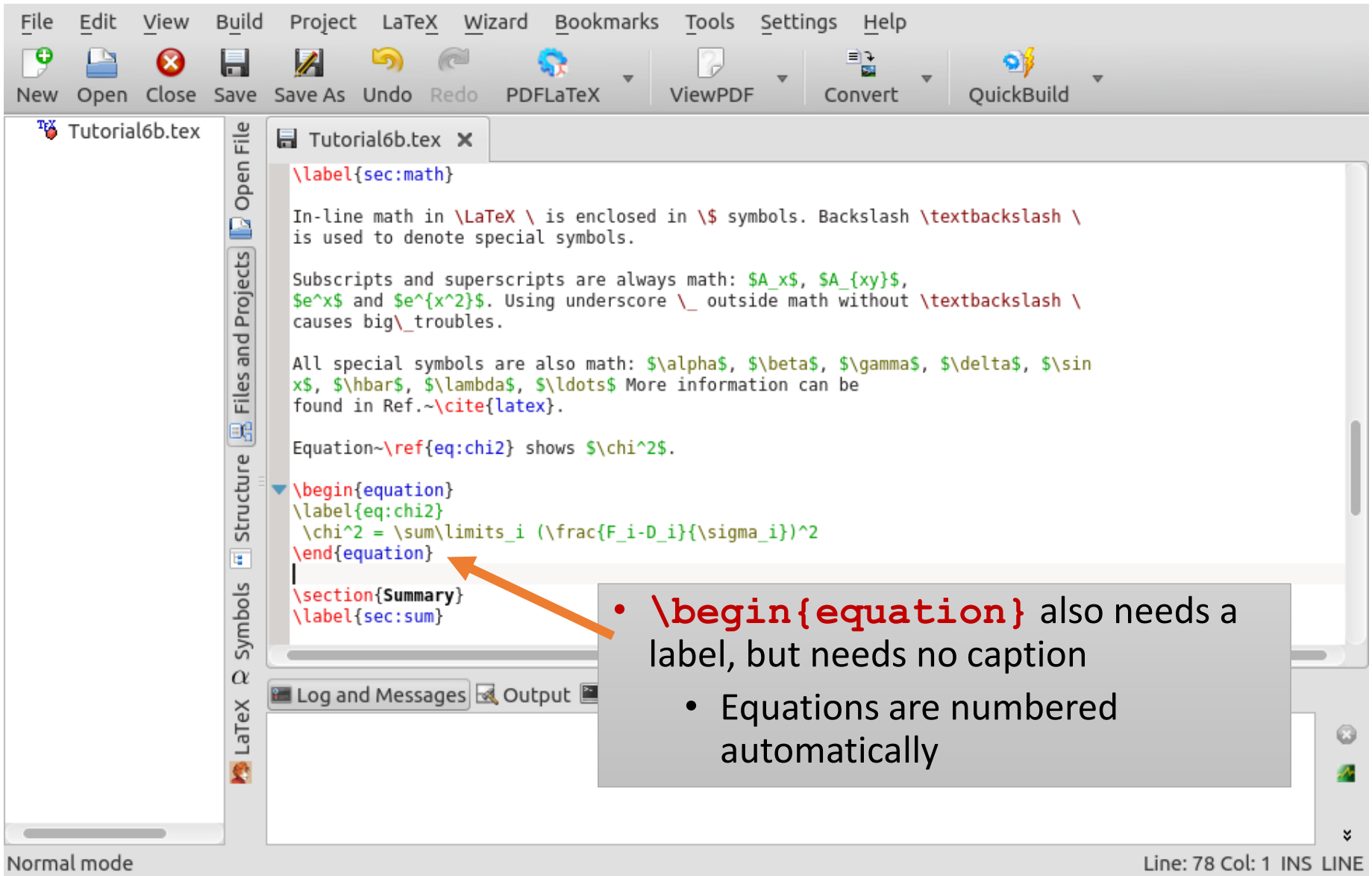
Noticed something wrong?

Log and Messages **Output** **Konsole** **Preview**

[PDFLaTeX] Tutorial6b.tex => Tutorial6b.pdf (pdflatex)

[PDFLaTeX] 0 errors, 0 warnings, 0 badboxes

[PDFLaTeX] Done!

Corrected mathematics text

- Group several characters in **{ }**
- Always escape underscore with a backslash
  - Even in URL links!

And now let's try an equation

- **`\begin{equation}`** also needs a label, but needs no caption
  - Equations are numbered automatically

Oh, that was also ugly. Fixing...

- **\left(** and **\right)** are some of the very many mathematical symbols in LaTeX

And finally, some bulleted lists

- **\begin{itemize}** creates a list of un-numbered items

There are also numbered lists


```
found in Ref.~\cite{latex}.

Equation~\ref{eq:chi2} shows $\chi^2$.

\begin{equation}
\label{eq:chi2}
 \chi^2 = \sum\limits_i \left(\frac{F_i-D_i}{\sigma_i}\right)^2
\end{equation}

\section{Summary}
\label{sec:sum}

We learned the following:
\begin{itemize}
 \item Linux is good
 \item \LaTeX \ is good for:
   \begin{enumerate}
    \item Structuring documents
    \item Writing mathematial equations
   \end{enumerate}
\end{itemize}
```

- **\begin{enumerate}** is similar to **\begin{itemize}**, only the items get numbered
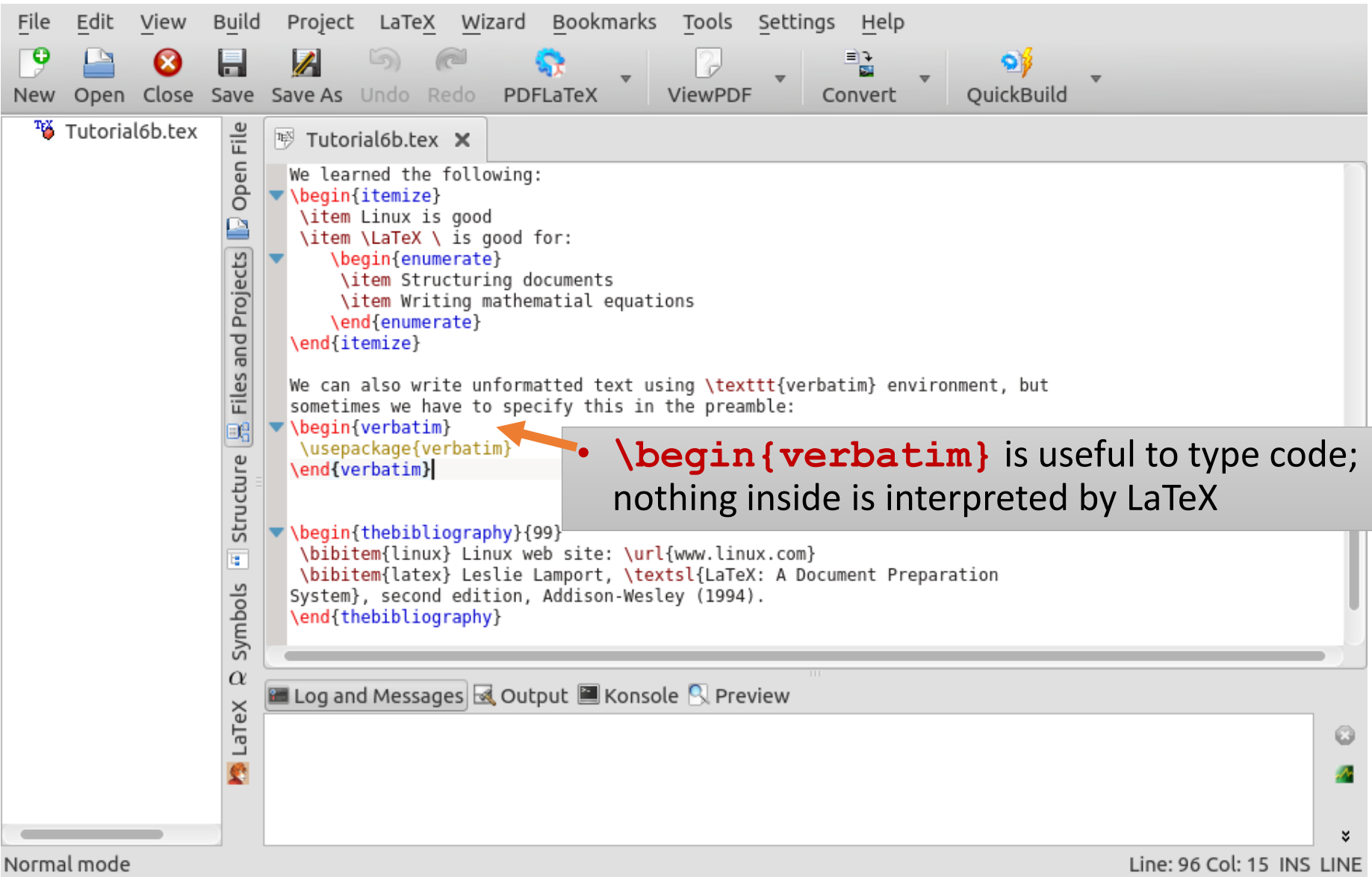
Last, but not least: you can have unformatted text, too

- **\begin{verbatim}** is useful to type code; nothing inside is interpreted by LaTeX

And the result should look like this:

Tutorial 2a exercise paper

Oxana Smirnova

2015-11-11

oxana.smirnova@hep.lu.se

1 Introduction

This is introduction. Summary will be given in Section 4.

2 About Linux

Figure 1: Penguin symbolises Linux

Figure 1 shows a *penguin*. For more details, check the Linux Web page [1].

2.1 Linux flavours

Table 1 lists some Linux flavours [1].

Distribution	RedHat	Debian	SuSE
Fedora 23	X		

Table 1: Different flavours of Linux

---
[1] Only one is shown for simplicity

1

3 About mathematics

In-line math in LaTeX is enclosed in \$ symbols. Backslash \ is used to denote special symbols.

Subscripts and superscripts are always math: A_x, A_{xy}, e^x and e^{x^2}. Using underscore _ outside math without \ causes big_troubles.

All special symbols are also math: α, β, γ, δ, $\sin x$, $\hbar$, λ, ... More information can be found in Ref. [2].

Equation 1 shows χ^2.

$$\chi^2 = \sum_i \left(\frac{F_i - D_i}{\sigma_i} \right)^2 \tag{1}$$

4 Summary

We learned the following:

- Linux is good
- LaTeX is good for:
  1. Structuring documents
  2. Writing mathematial equations

We can also write unformatted text using `verbatim` environment, but sometimes we have to specify this in the preamble:

```
\usepackage{verbatim}
```

References

[1] Linux web site: www.linux.com

[2] Leslie Lamport, *LaTeX: A Document Preparation System*, second edition, Addison-Wesley (1994).

2

Concluding notes

- There are many more LaTeX tags and environments

- Those tags and environments we tried have many different options

- Every tag and environment can be modified and tailored to your needs

- There is no way you can remember all the tags; get yourself a book (many good books exist), or use any of the multiple online references
  - Wikibooks: http://en.wikibooks.org/wiki/LaTeX
  - LaTeX Reference Manual: http://home.gna.org/latexrefman/

- All serious scientific journals have official LaTeX templates and styles, usually complete with instructions

- **Homework**: upload the LaTeX document (and the picture) you have just created to L@L, assignment HW2A
  - If you did not finish it now, please complete it at home
  - Consider using `tar` or `zip` if you have many files (LaTeX, image and PDF)
  - Deadline: the best is to have it ready by TOMORROW's tutorial!