



# CALTECH BOOTCAMP

# LATEX

presented by Eve Stenson

18 February 2012

# Outline

## Introduction:

- What is LaTeX?
- Why use LaTeX?

## Examples of ways to “use LaTeX”

## Under the hood:

- What is LaTeX? (revisited)
- distributions, packages, commands, types of files

## Methods and tools for TeXing

- “The Not So Short Introduction to LaTeX2e”
- cheat sheet, Detexify
- Google

**Useful tools:**    Editing figures in Inkscape

                         Reference management

## A few installation examples

## Exercises

## References

# L<sup>A</sup>T<sub>E</sub>X

L<sup>A</sup>T<sub>E</sub>X is a document preparation system for the T<sub>E</sub>X typesetting program. It offers programmable desktop publishing features and extensive facilities for automating most aspects of typesetting and desktop publishing, including numbering and cross-referencing, tables and figures, page layout, bibliographies, and much more. L<sup>A</sup>T<sub>E</sub>X was originally written in 1984 by Leslie Lamport and has become the dominant method for using T<sub>E</sub>X; few people write in plain T<sub>E</sub>X anymore. The current version is L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub>.

$$E = mc^2 \tag{1}$$

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}} \tag{2}$$

```

\documentclass[12pt]{article}
\usepackage{amsmath}
\title{\LaTeX}
\date{}
\begin{document}
  \maketitle
  \LaTeX{} is a document preparation system for the \TeX{}
typesetting program. It offers programmable desktop publishing
features and extensive facilities for automating most aspects of
typesetting and desktop publishing, including numbering and
cross-referencing, tables and figures, page layout, bibliographies,
and much more. \LaTeX{} was originally written in 1984 by Leslie
Lamport and has become the dominant method for using \TeX; few
people write in plain \TeX{} anymore. The current version is
\LaTeXe.

% This is a comment; it will not be shown in the final output.
% The following shows a little of the typesetting power of LaTeX:
\begin{align}
  E &= mc^2 && \\\
  m &= \frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}}
\end{align}
\end{document}

```

# Why use LaTeX?

- aesthetics, elegance, logical structure
- convenience, ease, portability, reproducibility
- necessity? peer pressure
- source documents are amenable to version control

## For what?

- abstracts
- journal articles
- problem sets, solution sets
- theses!

## What are some things at which LaTeX excels?

- handling of mathematical symbols
- auto-numbering of figures, equations, references, etc.
- auto-generation of T.O.C., etc

*You can become a TeXspert if you want, but there are huge advantages to just being a TeXnician.*

```
\documentclass[aps,prl,preprint,groupedaddress]{revtex4-1}
\documentclass[aps,prl,twocolumn,groupedaddress]{revtex4-1}
```

```
\usepackage{graphicx}
\usepackage{wasysym}
\usepackage{natbib}
```

```
\begin{document}
```

```
\s\preprint{}
```

```
\title{Magnetically-driven flows in arched plasma structures}
```

```
\author{E. V. Stenson}
\email[{}]{eve@caltech.edu}
```

```
\author{P. M. Bellan}
\email[{}]{pbellan@caltech.edu}
```

```
\affiliation{California Institute of Technology}
```

```
\date{\today}
```

```
\begin{abstract}
```

```
Laboratory experiments demonstrate high-speed
```

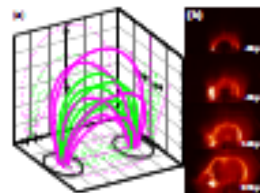


FIG. 1. (color online) (a.) Two sets of vacuum magnetic field lines link a pair of solenoids (not last, but one of which are shown). Dashed lines show the projection of the magnetic field lines onto the three orthogonal planes; arrows indicate flow separation, which is 5 to 8 times greater at the top of the arch than at the footpoints. (b.) A hydrogen flux tube (shown with a red temperature color scale) exhibits a comparatively narrow, uniform cross-section both shortly after its formation (0.03  $\mu$ s) and even as its size lengthens and kinks at later times (0.75, 1.45, 2.15  $\mu$ s).

it falls off exponentially [19]. At this time high voltage from a 50  $\mu$ F capacitor is applied to the electrodes, thereby ionizing the gas to form an initial low-density plasma. This quickly evolves into a current-carrying, plasma-filled flux tube, or “loop” (Fig. 1b) [18].

The capacitor is typically charged to 3–6 kV, resulting in a peak plasma current of 20–60 kA at  $\sim 1$   $\mu$ s after initial breakdown. A B-dot probe array indicates the flux tube magnetic field peak magnitude is 0.1–0.2 T. The absence of nested lines in non-hydrogen plasmas indicates that the plasma is almost completely ionized. (In hydrogen plasmas, only nested atomic neutral line species.) Plasma densities are  $10^{17}$ – $10^{18}$   $\text{m}^{-3}$  inside the flux tube, corresponding to  $\beta = 0.1$ – $1.0$ . The configuration evolves over 2–3  $\mu$ s.

Although the plasma-filled loop is essentially static when it forms, magnetic forces drive a rapid evolution toward more complex structures. Two parameters characterize the loop geometry: the flux tube minor radius and the form of the flux tube axis. Plasma is confined inside the minor radius, corresponding to a radial “quasi-equilibrium” condition. By contrast, the axis is observed to evolve dramatically, increasing to as much as 10 times its initial length and undergoing a kink instability. (The observation of the kink instability

## Magnetically-driven flows in arched plasma structures

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California Institute of Technology  
(Submitted February 17, 2022)

Laboratory experiments demonstrate high-speed plasma flows from both footpoints of nested magnetic flux tubes, resulting in both plasma transport into the flux tube and potential axial collimation near to the flux tube lengthwise ends. The observed flows are in agreement with the predictions of loop force and collimation models involving fundamental MHD forces. These flows are expected to drive plasma acceleration in other open flux configurations with nested geometries, such as those found on the solar surface.

Magnetic field structures that interrupt a boundary are important to a wide variety of plasma systems, examples include solar coronal plasmoids [1]–[4], astrophysical jets [5], magnetospheric formation [6], and structures in magnetic fusion confinement devices [7]–[9]. Computational models that assume reduced dimensionality [1]–[6], zero velocity at the boundary [8], or periodic boundary conditions [10] may not fully capture boundary interactions. Furthermore, questions have been raised about force-free assumptions [11] in solar coronal models, and about the mechanisms for transporting magnetic flux into the corona [6]. Given solar observations also have limitations, coronal events are not reproducible and cannot be measured *in situ*. Although advancements have been made in measuring the solar coronal magnetic field [12], the field is typically calculated from models that assume it is potential or force-free above the photosphere [2]; models differ [13] and may not represent the real system [14]. By contrast, laboratory plasmas are diagnostically accessible and can be highly reproducible, allowing systematic study of configurations where field lines interrupt boundaries and exhibit solar-like dynamics [15].

We show in this Letter that MHD forces transport plasma from the footpoints to the apex of an arched magnetic flux tube. By effectively “color coding” a laboratory plasma, we distinguish two high-speed flows, one from each footpoint, and track the sub-millisecond evolution. This technique reveals a dependence of flow speed on the electric current along the flux tube and on the plasma mass density. We further show that these results are consistent with the continued predictions of two complementary models: first, the observed expansion of the major radius of the arched flux tube is consistent with the loop force; and second, the flow of plasma along the flux tube axis is consistent with the “pinch” model [16].

The experimental set-up is a pulsed, magnetized plasma gun mounted on the end of a 1.6-meter-long, 1.5-meter-wide vacuum chamber (base pressure  $\sim 10^{-7}$  torr), as described in Ref. [17]. The chamber is much larger than the plasma and so simulates a half-infinite space. Two magnetic field coils – one located behind each electrode – are pulsed to produce an arched vacuum magnetic field (i.e., potential field) akin to that of a betatron magnet (Fig. 1a). The field strength has a temporal

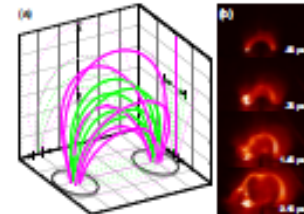


FIG. 1. (color online) (a.) Two sets of vacuum magnetic field lines link a pair of solenoids (only the last, but one of which are shown). Dashed lines show the projection of the magnetic field lines onto the three orthogonal planes; arrows indicate flow separation, which is 5 to 8 times greater at the top of the arch than at the footpoints. (b.) A hydrogen flux tube (shown with a red temperature color scale) exhibits a comparatively narrow, uniform cross-section both shortly after its formation (0.03  $\mu$ s) and even as its size lengthens and kinks at later times (0.75, 1.45, 2.15  $\mu$ s).

FWHM of 7 ns and spatially varies from 0.35 T near the footpoints to 0.01 T near the apex of the arch. At each footpoint is a gas nozzle, connected to a fast gas valve [18]. There is no neutral gas flow. The fast gas is pulsed, shortly after which a strongly divergent flow of neutral gas (peak speed 0.5–1.5 km/s) enters the chamber; the peak density occurs  $\sim 3$  cm from the electrode, beyond which it falls off exponentially [18]. At this time high voltage from a 50  $\mu$ F capacitor is applied to the electrodes, thereby ionizing the gas to form an initial low-density plasma. This quickly evolves into a current-carrying, plasma-filled flux tube, or “loop” (Fig. 1b) [18].

The capacitor is typically charged to 3–6 kV, resulting in a peak plasma current of 20–60 kA at  $\sim 1$   $\mu$ s after initial breakdown. A B-dot probe array indicates the flux tube magnetic field peak magnitude is 0.1–0.2 T. The absence of nested lines in non-hydrogen plasmas indi-

icates the source of material entering a hot plasma loop, experiments are performed using a different gas at each of the two footpoint nozzles. Because the experiment is highly reproducible, subsequent plasma shots can be photographed with optical fibers chosen to transmit only the optical line emission of one species. The images are then be combined digitally. Figure 2a presents typical images produced by this color coding technique [22]. (A preliminary report on this imaging method can be found in Ref. [23].) These images indicate that plasma flows into the loop from both footpoints, and that the flow dynamics depend strongly on the mass density.

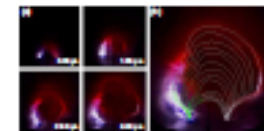


FIG. 2. (color online) a.) A nitrogen/hydrogen plasma loop at four consecutive times. Color pictures were produced by combining images from three different shots; two of the images were taken through optical fibers, then used to color the third, unfiltered image. Nitrogen emissions of the plasma are tinted blue and hydrogen emissions of the plasma are tinted red. b.) Loops of the loop axis at 14 different times, all overlaid on top of the 220  $\mu$ s frame. Thin green and white contours indicate the nitrogen and hydrogen emissions of the loop, respectively.

## .tex file:

```
Magnetic field structures that intercept a boundary are important to a wide
variety of plasma systems; examples include solar coronal phenomena
\cite{Alexander_book} \cite{Aschwanden_book}, astrophysical jets
\cite{astrophysicaljets}, spheromak formation \cite{Spheromaks_book}, and
divertors in magnetic fusion confinement devices \cite{Fusion_book}
\cite{DED_fluxtubes}. Computational models that assume reduced dimensionality
\cite{Archontis_fluxtubes} \cite{leake_fluxemergence}, zero velocity at the
boundary \cite{germanloop_paper}, or periodic boundary conditions
```

## .bib file:

```
@BOOK{Aschwanden_book,
  author = {{Aschwanden}, M.~J.},
  title = "{Physics of the Solar Corona: An Introduction with
Solutions (2nd ed.)}",
  keywords = {solar physics, corona, flares, coronal mass
  year = 2005,
  month = dec,
}

@BOOK{Alexander_book,
  author = {{Alexander}, D.},
  title = "The Sun",
  publisher={Greenwood Press},
  year = 2009
}

@BOOK{Fluxsurfaces_book,
  author = {W D. D'haeseleer and W.N. G. Hitchon and J.D.
Shohet},
  title = {Flux Coordinates and Magnetic Field Structure:
Fundamental Tool of Plasma Theory},
  year = 1991,
  publisher={Springer-Verlag},
```

## output:

Magnetic field structures that intercept a boundary are important to a wide variety of plasma systems; examples include solar coronal phenomena [1] [2], astrophysical jets [3], spheromak formation [4], and divertors in magnetic fusion confinement devices [5] [6]. Computational models that assume reduced dimensionality [7] [8], zero velocity at the boundary [9], or periodic boundary conditions [10] may not fully capture boundary interac-

⋮

- [1] D. Alexander, *The Sun* (Greenwood Press, 2009).
- [2] M. J. Aschwanden, *Physics of the Solar Corona: An Introduction with Problems and Solutions (2nd ed.)* (2005).
- [3] D. S. De Young, *Science* **252**, 389 (1991).
- [4] P. M. Bellan, *Spheromaks: A Practical Application of Magnetohydrodynamic Dynamos and Plasma Self-Organization* (Imperial College Press, 2000).
- [5] W. M. Stacey, *Fusion: An Introduction to the Physics and Technology of Magnetic Confinement Fusion* (Wiley-VCH, 2010).
- [6] K. H. Finken *et al.*, *Phys. Rev. Lett.* **98**, 065001 (2007).
- [7] V. Archontis, A. W. Hood, and C. Brady, *Astron. and Astrophys.* **402**, 687 (2003).

student at Caltech looking for a research group, I heard a talk by Professor Paul Bellan . . .

More acknowledgements . . .  
`.\end{acknowledgements}`

`]\begin{abstract}`  
Highly dynamic. Field lines connected to the wall.  
`.\end{abstract}`

`\tableofcontents`

`\listoffigures`

`\mainmatter`

`%-----`  
`.\chapter{Introduction}`

Acknowledgements

Mr. Spock: "Gus, Gus, Captain. Under impulse  
strut. We call it 'plasma'. But whatever the Kll  
gas."

Lt. Uhura: "Well what about all that equipment  
anomalies? Well the thing's got to have a tuliply  
-Standard 9-027.8, figuring out how to detect a c  
Undiscovered Country)

I once thought plasmas were "merely ionized gas"  
plasma propulsion). I had learned back in third grade  
when my sixth grade teacher suddenly added another  
skepticism all the way through junior high, high scho  
student at Caltech looking for a research group, I hear  
More acknowledgements . . .

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# Outline

## Introduction:

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- Why use LaTeX?



## Examples of ways to “use LaTeX”

### Under the hood:

- What is LaTeX? (revisited)
- distributions, packages, commands, types of files

### Methods and tools for TeXing

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- cheat sheet, Detexify
- Google

**Useful tools:**    Editing figures in Inkscape

Reference management

### A few installation examples

### Exercises

### References

# Basic set-up: Text editor

The screenshot displays a Linux desktop environment with the following components:

- Terminal (Top Left):** Shows the command `latex paper.tex` being executed, indicating the use of TeX Live.
- GVIM Text Editor (Center):** Displays a LaTeX document titled `paper.tex`. The document content includes:
  - Text: "Time derivatives of the quadratic fits yield well-defined velocities. When plotted against the plasma current, the velocity thus determined is directly proportional to the electrical current at early times, with a single proportionality constant applying to all loops of a given species. Fig. \ref{fig:flowspeeds-current}c shows this result for hydrogen. \footnote{See Supplemental Material for nitrogen and argon.}"
  - Text: "By taking advantage of the nearly linear time dependence of the electric current at early times, we now construct a model showing that the observed proportionality of flow speed to electric current is consistent with the hoop force driving the loop expansion."
  - Text: "A circular, current-carrying hoop with major radius  $R$ , minor radius  $a$ , and internal inductance per unit length  $l_i$  experiences an outward radial force per unit length \cite{Shafranov\_review}"
  - Equation: 
$$F_{\text{hoop}} = \frac{\mu_0}{4\pi} I^2 \left( \ln \left( \frac{R}{a} \right) + 1.08 + \frac{l_i^2}{2} \right)$$
  - Text: "where  $I$  is the current around the hoop."
  - Text: "Assuming  $F_{\text{hoop}}$  is the dominant radial force (i.e., neglecting, for the moment, field line tension and centrifugal forces), the equation of motion for an infinitesimal segment of the hoop with length  $ds$  and mass  $dm$  is"
  - Equation: 
$$F_{\text{hoop}} ds = \ddot{R} dm = \ddot{R} m_i n \pi a^2 ds$$
  - Text: "where  $n$  is the number density and  $m_i$  is the ion mass."
  - Text: "Because the term in parentheses in Eq. (\ref{eq:hoopforce}) is approximately constant due to the logarithm, most of the dependence is in the  $R^{-1}$  factor. Eq. (\ref{eq:NewtonsLaw}) can then be written"
  - Equation: 
$$\ddot{R} \left( \frac{1}{R} \right) = \frac{\alpha}{4\pi} \frac{\mu_0}{m_i n a^2} \frac{I(t)^2}{R \left( \frac{1}{R} \right)}$$
  - Text: "where  $\alpha$  is a constant representing the term in parentheses in Eq. (\ref{eq:hoopforce})"
- PDF Viewer (Right):** Shows the rendered output of the document, including plots and equations.

**OS:** Arch Linux, **TeX distribution:** TeX Live, **Editor:** GVIM,  
**DVI/PDF viewer:** Evince, **EPS viewer:** GV

# Additional features: Text editing in an environment

LEd (build 0.536501) [D:\LaTeX\hoopforce\hoopforce.tex]

File Edit View Tools Configuration Window Help

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11 12 13 14 15 16 17 18 19 20

21 22 23 24 25 26

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657 658 659 660 661 662 663 664 665 666

667 668 669 670 671 672 673 674 675 676

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1617 1618 1619 1620 1621 1622 1623 1624 1625 1626

1627 1628 1629 1630 1631 1632 1633 1634 1635 1636

1637 1638 1639 1640 1641 1642 1643 1644 1645 1646

1647 1648 1649 1650 1651 1652 1653 1654 1655 1656

1657 1658 1659 1660 1661 1662 1663 1664 1665 1666

1667 1668 1669 1670 1671 1672 1673 1674 1675 1676

1677 1678 1679 1680 1681 1682 1683 1684 1685 1686

1687 1688 1689 1690 1691 1692 1693 1694 1695 1696

1697 1698 1699 1700 1701 1702 1703 1704 1705 1706

1707 1708 1709 1710 1711 1712 1713 1714 1715 1716

1717 1718 1719 1720 1721 1722 1723 1724 1725 1726

1727 1728 1729 1730 1731 1732 1733 1734 1735 1736

1737 1738 1739 1740 1741 1742 1743 1744 1745 1746

1747 1748 1749 1750 1751 1752 1753 1754 1755 1756

1757 1758 1759 1760 1761 1762 1763 1764 1765 1766

1767 1768 1769 1770 1771 1772 1773 1774 1775 1776

1777 1778 1779 1780 1781 1782 1783 1784 1785 1786

1787 1788 1789 1790 1791 1792 1793 1794 1795 1796

1797 1798 1799 1800 1801 1802 1803 1804 1805 1806

1807 1808 1809 1810 1811 1812 1813 1814 1815 1816

1817 1818 1819 1820 1821 1822 1823 1824 1825 1826

1827 1828 1829 1830 1831 1832 1833 1834 1835 1836

1837 1838 1839 1840 1841 1842 1843 1844 1845 1846

1847 1848 1849 1850 1851 1852 1853 1854 1855 1856

1857 1858 1859 1860 1861 1862 1863 1864 1865 1866

1867 1868 1869 1870 1871 1872 1873 1874 1875 1876

1877 1878 1879 1880 1881 1882 1883 1884 1885 1886

1887 1888 1889 1890 1891 1892 1893 1894 1895 1896

1897 1898 1899 1900 1901 1902 1903 1904 1905 1906

1907 1908 1909 1910 1911 1912 1913 1914 1915 1916

1917 1918 1919 1920 1921 1922 1923 1924 1925 1926

1927 1928 1929 1930 1931 1932 1933 1934 1935 1936

1937 1938 1939 1940 1941 1942 1943 1944 1945 1946

1947 1948 1949 1950 1951 1952 1953 1954 1955 1956

1957 1958 1959 1960 1961 1962 1963 1964 1965 1966

1967 1968 1969 1970 1971 1972 1973 1974 1975 1976

1977 1978 1979 1980 1981 1982 1983 1984 1985 1986

1987 1988 1989 1990 1991 1992 1993 1994 1995 1996

1997 1998 1999 2000 2001 2002 2003 2004 2005 2006

2007 2008 2009 2010 2011 2012 2013 2014 2015 2016

2017 2018 2019 2020 2021 2022 2023 2024 2025 2026

2027 2028 2029 2030 2031 2032 2033 2034 2035 2036

2037 2038 2039 2040 2041 2042 2043 2044 2045 2046

2047 2048 2049 2050 2051 2052 2053 2054 2055 2056

2057 2058 2059 2060 2061 2062 2063 2064 2065 2066

2067 2068 2069 2070 2071 2072 2073 2074 2075 2076

2077 2078 2079 2080 2081 2082 2083 2084 2085 2086

2087 2088 2089 2090 2091 2092 2093 2094 2095 2096

2097 2098 2099 2100 2101 2102 2103 2104 2105 2106

2107 2108 2109 2110 2111 2112 2113 2114 2115 2116

2117 2118 2119 2120 2121 2122 2123 2124 2125 2126

2127 2128 2129 2130 2131 2132 2133 2134 2135 2136

2137 2138 2139 2140 2141 2142 2143 2144 2145 2146

2147 2148 2149 2150 2151 2152 2153 2154 2155 2156

2157 2158 2159 2160 2161 2162 2163 2164 2165 2166

2167 2168 2169 2170 2171 2172 2173 2174 2175 2176

2177 2178 2179 2180 2181 2182 2183 2184 2185 2186

2187 2188 2189 2190 2191 2192 2193 2194 2195 2196

2197 2198 2199 2200 2201 2202 2203 2204 2205 2206

2207 2208 2209 2210 2211 2212 2213 2214 2215 2216

2217 2218 2219 2220 2221 2222 2223 2224 2225 2226

2227 2228 2229 2230 2231 2232 2233 2234 2235 2236

2237 2238 2239 2240 2241 2242 2243 2244 2245 2246

2247 2248 2249 2250 2251 2252 2253 2254 2255 2256

2257 2258 2259 2260 2261 2262 2263 2264 2265 2266

2267 2268 2269 2270 2271 2272 2273 2274 2275 2276

2277 2278 2279 2280 2281 2282 2283 2284 2285 2286

2287 2288 2289 2290 2291 2292 2293 2294 2295 2296

2297 2298 2299 2300 2301 2302 2303 2304 2305 2306

2307 2308 2309 2310 2311 2312 2313 2314 2315 2316

2317 2318 2319 2320 2321 2322 2323 2324 2325 2326

2327 2328 2329 2330 2331 2332 2333 2334 2335 2336

2337 2338 2339 2340 2341 2342 2343 2344 2345 2346

2347 2348 2349 2350 2351 2352 2353 2354 2355 2356

2357 2358 2359 2360 2361 2362 2363 2364 2365 2366

2367 2368 2369 2370 2371 2372 2373 2374 2375 2376

2377 2378 2379 2380 2381 2382 2383 2384 2385 2386

2387 2388 2389 2390 2391 2392 2393 2394 2395 2396

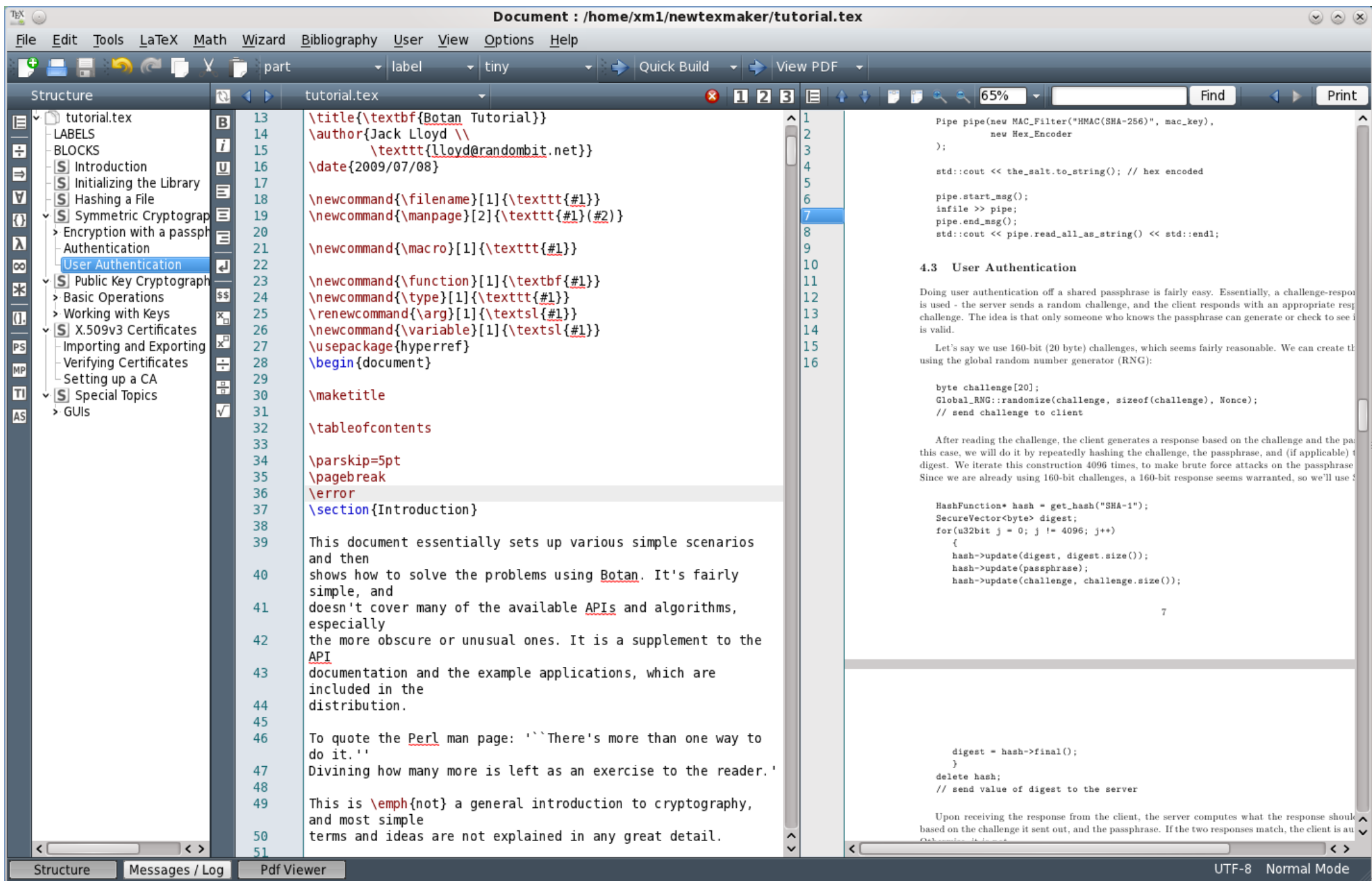
2397 2398 2399 2400 2401 2402 2403 2404 2405 2406

2407 2408 2409 2410 2411 2412 2413 2414 2415 2416

2417 2418 2419 2420 2421 2422 2423 2424 2425 2426

2427 2428 2429 2430 2431

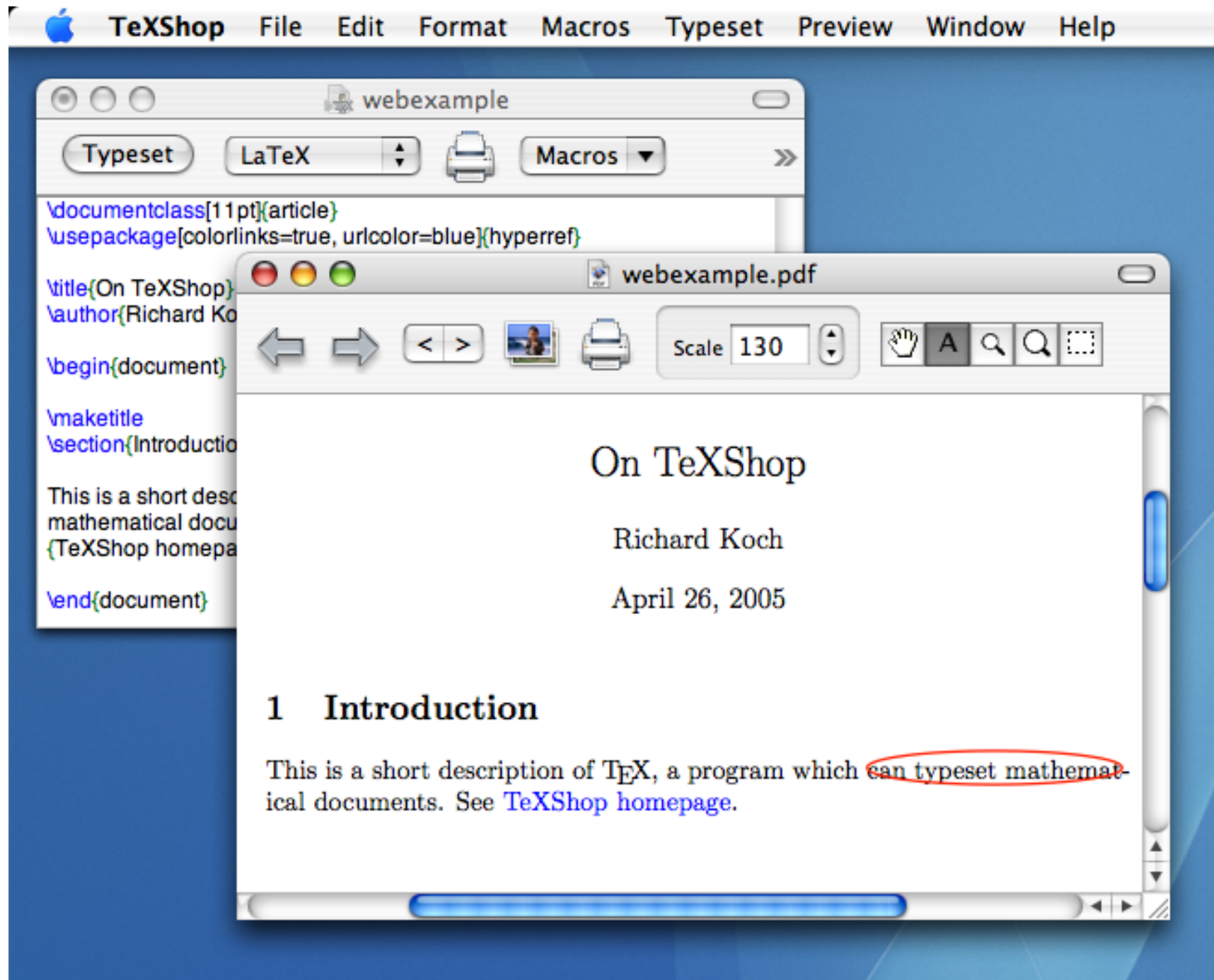
# Texmaker (cross-platform: linux, macosx and windows)



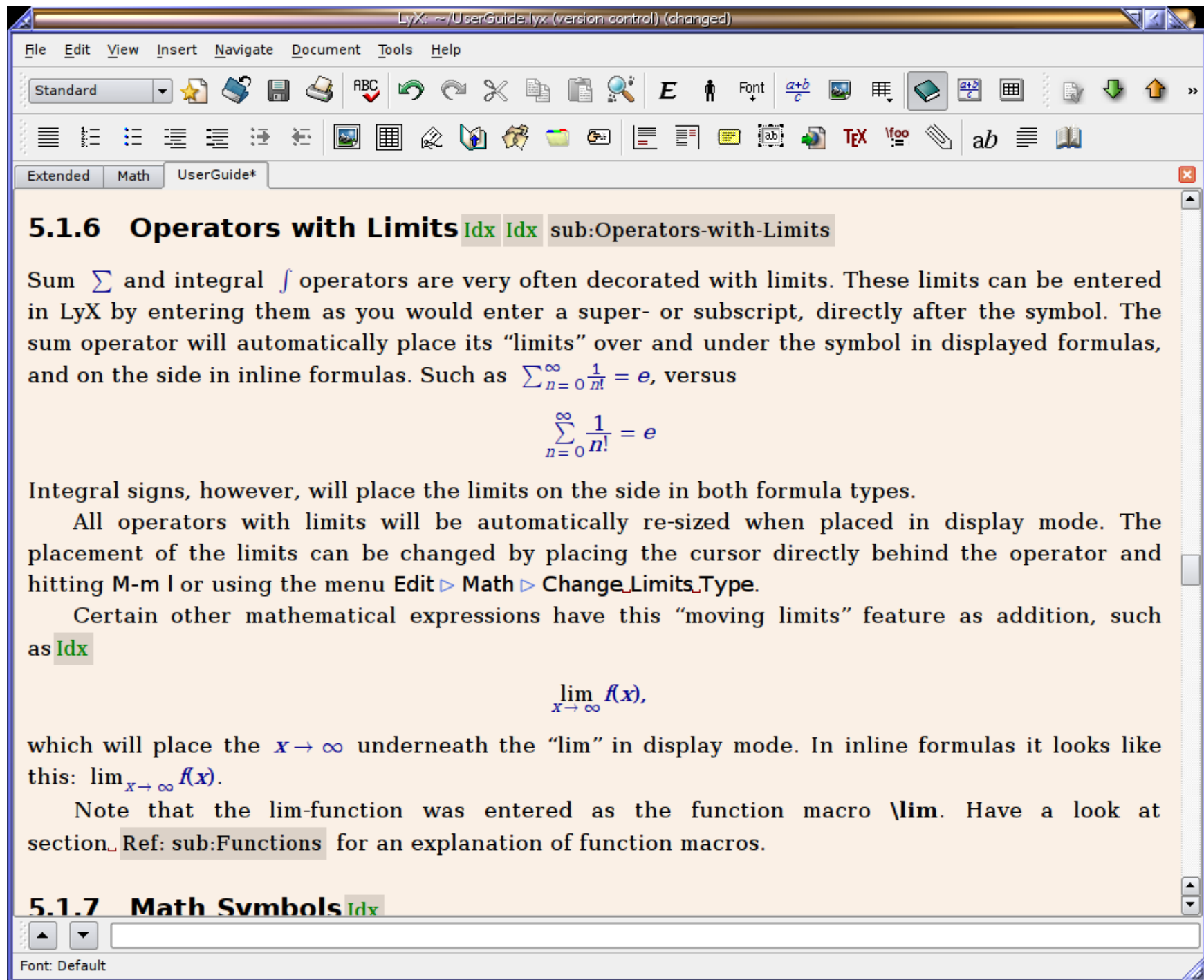
additional features: spell check, code folding, code completion, math symbols, and more . . .



# TeXShop (Mac – Lion)



# LyX (Linux/Unix, Windows, and Mac OS X)



# Scientific Word (Windows)

The screenshot shows the Scientific Word application window. The menu bar includes File, Edit, Insert, View, Go, Tag, Tools, Window, and Help. The Insert menu is open, showing options like Fraction, Radical, Superscript, Subscript, Display, Operator..., Brackets..., Matrix..., Math Name..., Binomial, Label..., Decoration..., Unit Name..., Spacing, Table..., Note..., Formula..., Hypertext Link..., Marker..., and HTML Field... The document text includes a paragraph about Alice, a code snippet for a program, a mathematical expression 
$$ux - \Delta u + u^3 + u|\mu|^{p-2} = 0 \text{ in } \mathbb{R}^3 \times [0, \infty[$$
, and a section titled "List Environments". The "List Environments" section explains how to create numbered, bulleted, and description lists using the Item Tag popup list on the Tag toolbar. It provides examples of list structures and their typeset styles.

Scientific Word - [Untitled3]

File Edit Insert View Go Tag Tools Window Help

Math

Fraction Ctrl+F  
Radical Ctrl+R  
Superscript Ctrl+H  
Subscript Ctrl+L  
Display Ctrl+D

Operator...  
Brackets...  
Matrix...  
Math Name...  
Binomial...  
Label...  
Decoration...  
Unit Name...

Use the...  
#include...  
void...  
{  
cout...  
}

Math Environment

Let  $H$  be a closed bounded convex subset of  $H$ .  $T$  a nonexpansive self map of  $C$ . Suppose that as  $n \rightarrow \infty$ ,  $a_{n,k} \rightarrow 0$  for each  $k$ , and for each  $x$  in  $C$ ,  $A_n x = \sum_{k=0}^n a_{n,k} T^k x$  converges weakly to a fixed point of  $T$ .

The number...

is automatically generated by the equation ref: eqn1

**List Environments**

You can create numbered, bulleted, and description lists using the Item Tag popup list on the Tag toolbar.

1. List item 1
2. List item 2
  - a. A list item under a list item.

The typeset style for this level is different than the screen style. The screen shows a lower case alphabetic character followed by a period while the typeset style uses a lower case alphabetic character surrounded by parentheses.
  - b. Just another list item under a list item.
    - i. Third level list item under a list item.
      - A. Fourth and final level of list items allowed.

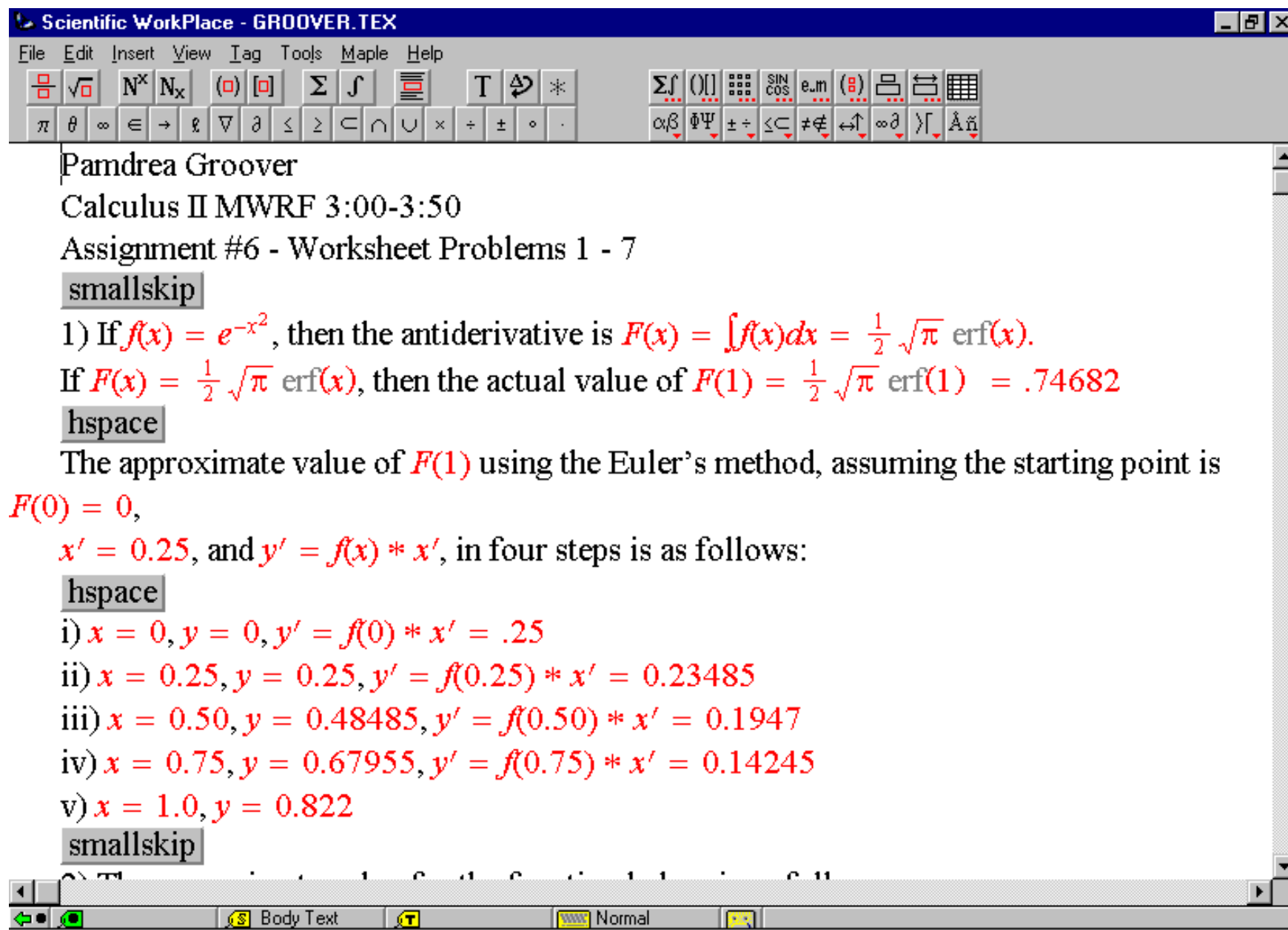
- Bullet item 1
- Bullet item 2
  - Second level bullet item.
    - Third level bullet item.
      - Fourth (and final) level bullet item.

**Description List** Each description list item has a term followed by the description of that term. Double click the term box to enter the term, or to change it.

**Bunyip** Mythical beast of Australian Aboriginal legends.

Section

# Scientific Workplace (Windows)



In addition to type-setting, can also do calculations in line, plot functions, and much more.  
 Available from [software.caltech.edu](http://software.caltech.edu) for Caltech-owned computers.



# Outline

## Introduction:

- What is LaTeX?
- Why use LaTeX?

## Examples of ways to “use LaTeX”



## Under the hood:

- What is LaTeX? (revisited)
- distributions, packages, commands, types of files

## Methods and tools for TeXing

- “The Not So Short Introduction to LaTeX2e”
- cheat sheet, Detexify
- Google

**Useful tools:**    Editing figures in Inkscape

Reference management

## A few installation examples

## Exercises

## References

# TeX is . . .

a typesetting system written by Donald E. Knuth.

a macro processor.

written in WEB.

currently on version 3.1415926.

To produce a document, you write macros and text interleaved with each other. The macros define an environment in which the text is to be typeset.

# LaTeX is . . .

a TeX-based language in which you actually write documents.

a TeX macro package, originally written by Leslie Lamport.

currently on version 2e.

LaTeX allows markup to describe the structure of a document, so that the user need not think about presentation. By using document classes and add-on packages, the same document can be produced in a variety of different layouts.

# PDFTeX is . . .

a modified tex executable that implements the the LaTeX format.

a development of TeX that is capable of generating typeset PDF output in place of DVI.

PDFTeX is (today) the main stream of TeX distributions: most LaTeX users nowadays use PDFTeX whether they know it or not.

# Running *latex* creates a DVI file:

Required:  
hoopforce.tex

```
D:\LaTeX\hoopforce>latex hoopforce.tex
This is pdfTeX, Version 3.1415926-1.40.10 (MiKTeX 2.8)
entering extended mode
(D:\LaTeX\hoopforce\hoopforce.tex
LaTeX2e <2009/09/24>
Babel <v3.81> and hyphenation patterns for english, dumylang, nohyph
rman, ngerman, german-x-2009-06-19, ngerman-x-2009-06-19, french, lo
<"C:\Program Files\MiKTeX 2.8\tex\latex\base\article.cls"
Document Class: article 2007/10/19 v1.4h Standard LaTeX document cla
<"C:\Program Files\MiKTeX 2.8\tex\latex\base\size10.clo">>
<"C:\Program Files\MiKTeX 2.8\tex\latex\graphics\graphicx.sty"
<"C:\Program Files\MiKTeX 2.8\tex\latex\graphics\keyval.sty">
<"C:\Program Files\MiKTeX 2.8\tex\latex\graphics\graphics.sty"
<"C:\Program Files\MiKTeX 2.8\tex\latex\graphics\trig.sty">
<"C:\Program Files\MiKTeX 2.8\tex\latex\00miktex\graphics.cfg">
<"C:\Program Files\MiKTeX 2.8\tex\latex\graphics\dvips.def">>>
<"C:\Program Files\MiKTeX 2.8\tex\latex\wasysym\wasysym.sty">
(D:\LaTeX\hoopforce\hoopforce.aux)
<"C:\Program Files\MiKTeX 2.8\tex\latex\wasysym\uwasy.fd"> [1]
<Lprime_vs_rprime.eps> [2] [3] <lowerLprime.eps> <IUtrace.eps>
<curvelengths.eps>
Overfull \hbox <5.30875pt too wide> in paragraph at lines 137--138
[1][1]
[4] [5] <calculatingemf.eps> [6] [7]
Underfull \hbox <badness 10000> in paragraph at lines 204--208

[8] (D:\LaTeX\hoopforce\hoopforce.aux) >
<\end occurred inside a group at level 2>

### simple group <level 2> entered at line 173 <>
### simple group <level 1> entered at line 113 <>
### bottom level
<see the transcript file for additional information>
Output written on hoopforce.dvi <8 pages, 23476 bytes>.
Transcript written on hoopforce.log.

D:\LaTeX\hoopforce>_
```

Generated:  
hoopforce.aux  
hoopforce.dvi  
hoopforce.log

To convert the DVI file to a PDF, run *dvipdfm*:

```
D:\LaTeX\hoopforce>dvipdfm hoopforce.dvi
hoopforce.dvi -> hoopforce.pdf
[1][2][3][4][5][6][7][8]
309270 bytes written

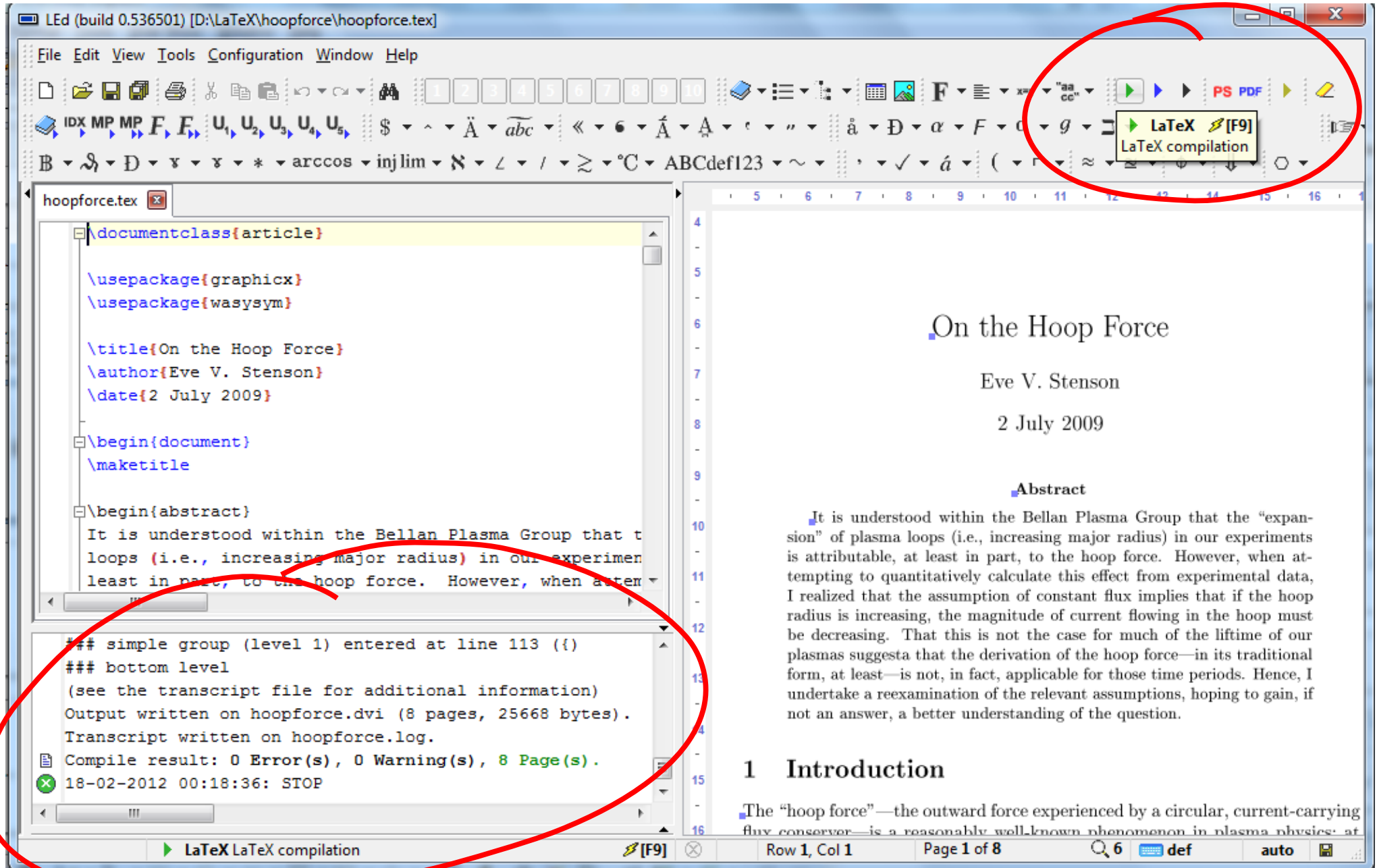
** WARNING ** -5 memory objects still allocated

D:\LaTeX\hoopforce>_
```

To skip the DVI, run *pdflatex* instead.

Note: If going this route, use PDF figures instead of EPS figures.

# In GUIs, there's usually a button and an output window:

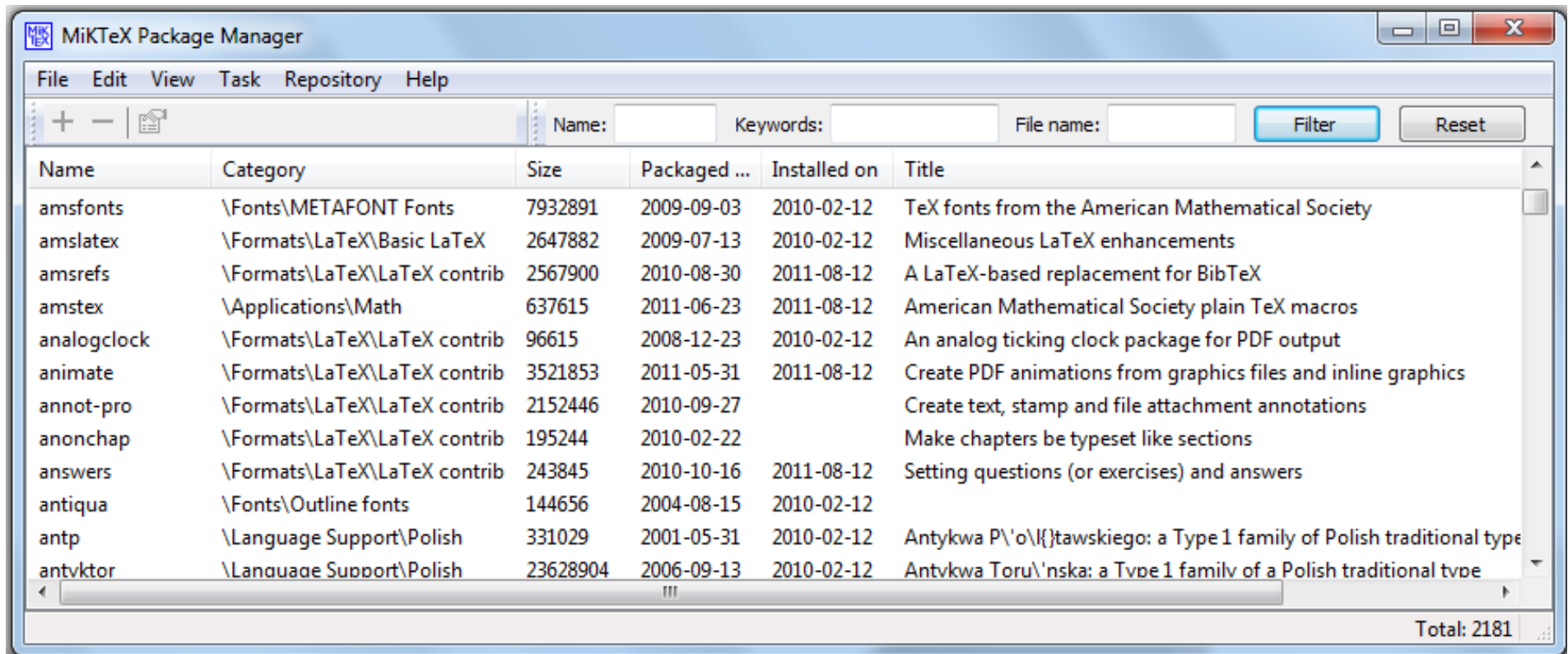


# A TeX distribution (such as MiKTeX or TeXLive) . . .

provides a structured collection of TeX-related software.

generally includes:

- a set of “core” TeX executables such as *tex* and *latex*;
- various fonts optimized for use with TeX;
- helper programs such as the BibTeX bibliographic-database formatter, editors, integrated development environments, file-format-conversion programs;
- numerous LaTeX packages;
- configuration tools;
- and any other goodies the distributor chooses to include.



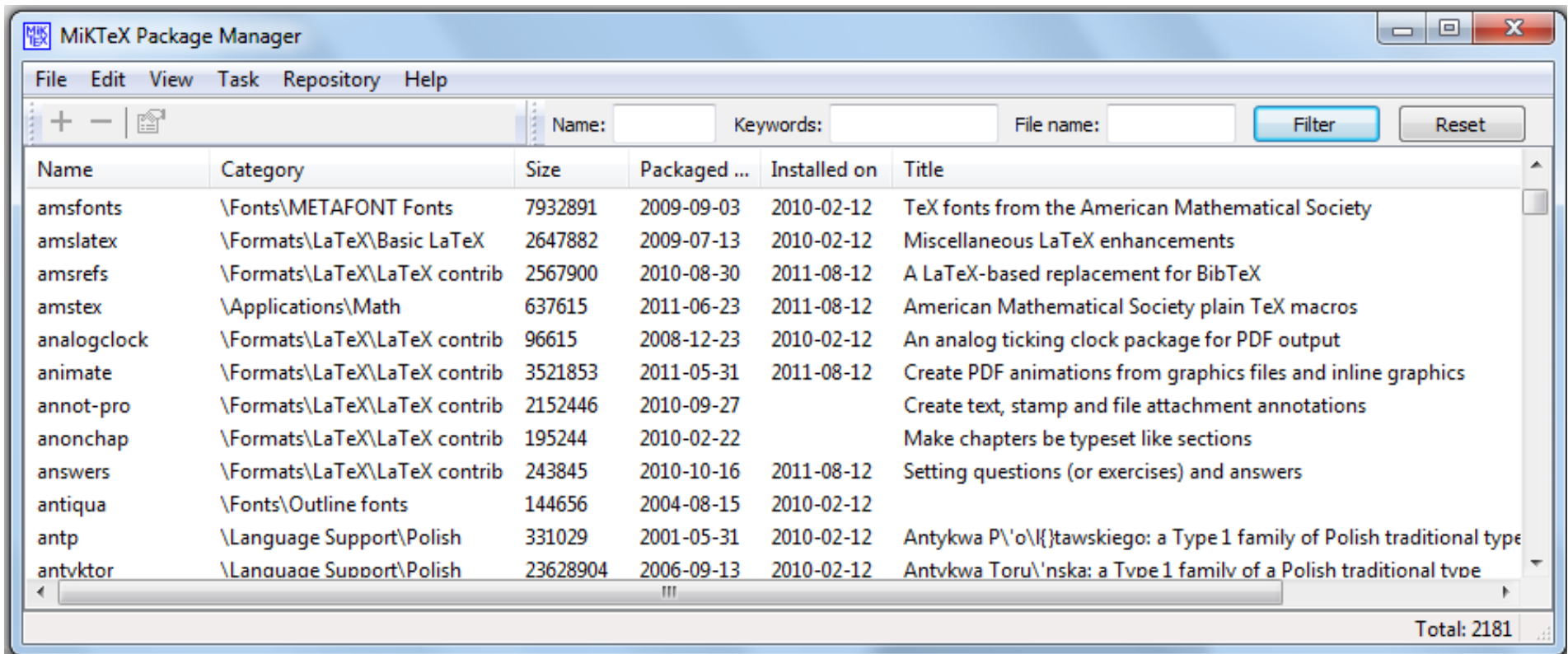
much of the above is from “The UK List of TeX Frequently Asked Questions on the Web”, or the TeX Users Group (<http://tug.org/levels.html>)

# A TeX package . . .

is basically a set of macros – or pre-programmed “shortcuts” – that take care of formatting for a specific set of scenarios.

For example: AMSLaTeX

- provides many features for producing more professional-looking math formulas
- pays attention to the finer details of sizing and positioning that mathematical publishers care about
- includes multi-line displayed equations, matrices, double accents, multi-line subscripts, etc.



much of the above is from “The UK List of TeX Frequently Asked Questions on the Web”, or the TeX Users Group (<http://tug.org/levels.html>)

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                         Reference management

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# “The Not So Short Introduction to LaTeX2e”

**Chapter 1** tells you about the basic structure of  $\text{\LaTeX} 2_{\epsilon}$  documents. You will also learn a bit about the history of  $\text{\LaTeX}$ . After reading this chapter, you should have a rough understanding how  $\text{\LaTeX}$  works.

**Chapter 2** goes into the details of typesetting your documents. It explains most of the essential  $\text{\LaTeX}$  commands and environments. After reading this chapter, you will be able to write your first documents.

**Chapter 3** explains how to typeset formulae with  $\text{\LaTeX}$ . Many examples demonstrate how to use one of  $\text{\LaTeX}$ 's main strengths. At the end of the chapter are tables listing all mathematical symbols available in  $\text{\LaTeX}$ .

**Chapter 4** explains indexes, bibliography generation and inclusion of EPS graphics. It introduces creation of PDF documents with  $\text{pdf\LaTeX}$  and presents some handy extension packages.

**Chapter 5** shows how to use  $\text{\LaTeX}$  for creating graphics. Instead of drawing a picture with some graphics program, saving it to a file and then including it into  $\text{\LaTeX}$  you describe the picture and have  $\text{\LaTeX}$  draw it for you.

**Chapter 6** contains some information on how to alter the standard document style, how to change things to look ugly or stunning, de

(a.k.a. “ $\text{\LaTeX} 2_{\epsilon}$  in 141 minutes”) by Tobias Oetiker

Tons of useful information and clear examples!

This is text style:

```
 $\lim_{n \rightarrow \infty} \sum_{k=1}^n \frac{1}{k^2}$   
=  $\frac{\pi^2}{6}$ .
```

And this is display style:

```
\begin{equation}  
  \lim_{n \rightarrow \infty} \sum_{k=1}^n \frac{1}{k^2}  
  = \frac{\pi^2}{6}  
\end{equation}
```

This is text style:  $\lim_{n \rightarrow \infty} \sum_{k=1}^n \frac{1}{k^2} = \frac{\pi^2}{6}$ .  
And this is display style:

$$\lim_{n \rightarrow \infty} \sum_{k=1}^n \frac{1}{k^2} = \frac{\pi^2}{6} \quad (3.3)$$



## tabular environment

```
\begin{array}[pos]{cols}
\begin{tabular}[pos]{cols}
\begin{tabular*}[width]{pos}{cols}
```

## tabular column specification

```
l Left-justified column.
c Centered column.
r Right-justified column.
p{width} Same as \parbox[t]{width}.
@{decl} Insert decl instead of inter-column space.
| Inserts a vertical line between columns.
```

## tabular elements

```
\hline Horizontal line between rows.
\cline{x-y} Horizontal line across columns x through y.
\multicolumn{n}{cols}{text}
A cell that spans n columns, with cols column specification.
```

## Math mode

To use math mode, surround text with \$ or use \begin{equation}.

```
Superscript^ ^{x} Subscript_x _{x}
\frac{x}{y} \frac{x}{y} \sum_{k=1}^n \sum_{k=1}^n
\sqrt[n]{x} \sqrt[n]{x} \prod_{k=1}^n \prod_{k=1}^n
```

## Math-mode symbols

```
< \leq > \geq < \neq < \approx
< \times < \div < \pm < \pm
< \circ < \circ < \circ < \circ
< \infty < \neg < \wedge < \vee
< \supset < \forall < \in < \rightarrow
< \subset < \exists < \exists < \exists
< \cup < \cap < \mid < \leftrightarrow
< \dot{a} < \hat{a} < \bar{a} < \tilde{a}
< \alpha < \beta < \gamma < \delta
< \epsilon < \zeta < \eta < \theta
< \iota < \kappa < \lambda < \mu
< \nu < \xi < \chi < \psi
< \phi < \rho < \sigma < \tau
< \upsilon < \phi < \chi < \psi
< \omega < \Gamma < \Delta < \Theta
< \Lambda < \Xi < \Pi < \Sigma
< \Upsilon < \Phi < \Psi < \Omega
```

## Bibliography and citations

When using BibTeX, you need to run latex, bibtex, and latex twice more to resolve dependencies.

## Citation types

```
\cite{key} Full author list and year. (Watson and Crick 1953)
\citeA{key} Full author list. (Watson and Crick)
\citeW{key} Full author list and year. Watson and Crick (1953)
\shortcite{key} Abbreviated author list and year. ?
\shortciteA{key} Abbreviated author list. ?
\shortciteW{key} Abbreviated author list and year. ?
\citeyear{key} Cite year only. (1953)
All the above have an NP variant without parentheses; Ex.
\citeNP.
```

## BibTeX entry types

```
@article Journal or magazine article.
```

The LaTeX document should have the following two lines just before \end{document}, where bibfile.bib is the name of the BibTeX file.

```
\bibliographystyle{plain}
\bibliography{bibfile}
```

## BibTeX example

The BibTeX database goes in a file called file.bib, which is processed with bibtex file.

```
@String{N = {Na\-tura}}
@Article{WC:1953,
  author = {James Watson and Francis Crick},
  title = {A structure for Deoxyribose Nucleic Acid},
```

# LaTeX 2<sub>ε</sub> Cheat Sheet

## Document classes

```
book Default is two-sided.
report No \part divisions.
article No \part or \chapter divisions.
letter Letter (?).
slides Large sans-serif font.
Used at the very beginning of a document:
\documentclass{class}. Use \begin{document} to start
contents and \end{document} to end the document.
```

## Common documentclass options

```
10pt/11pt/12pt Font size.
letterpaper/a4paper Paper size.
twocolumn Use two columns.
twoside Set margins for two-sided.
landscape Landscape orientation. Must use dvips
-t landscape.
draft Double-space lines.
Usage: \documentclass[options]{class}.
```

## Packages

```
fullpage Use 1 inch margins.
anysize Set margins: \marginwidth{0}{r}{0}{b}.
multicol Use n columns: \begin{multicols}{n}.
latsys Use LaTeX symbol font.
graphicx Show image: \includegraphics[width=z]{file}.
url Insert URL: \url{http://...}.
Use before \begin{document}. Usage: \usepackage{package}
```

## Title

```
\author{text} Author of document.
\title{text} Title of document.
\date{text} Date.
```

These commands go before \begin{document}. The declaration \maketitle goes at the top of the document.

## Miscellaneous

```
\pagestyle{empty} Empty header, footer and no page numbers.
```

## Document structure

```
\part{title} \subsubsection{title}
\chapter{title} \paragraph{title}
\section{title} \subparagraph{title}
\subsection{title}
```

Section commands can be followed with an \*, like \section\*{title}, to suppress heading numbers. \setcounter{secnumdepth}{x} suppresses heading numbers of depth > x, where chapter has depth 0.

## Text environments

```
\begin{comment} Comment block (not printed).
\begin{quote} Indented quotation block.
\begin{quotation} Like quote with indented paragraphs.
\begin{verse} Quotation block for verse.
```

## Lists

```
\begin{enumerate} Numbered list.
\begin{itemize} Bulleted list.
\begin{description} Description list.
\item text Add an item.
\item[x] text Use x instead of normal bullet or number.
Required for descriptions.
```

## References

```
\label{marker} Set a marker for cross-reference, often of the
form \label{sec:item}.
\ref{marker} Give section/body number of marker.
\pageref{marker} Give page number of marker.
\footnote{text} Print footnote at bottom of page.
```

## Floating bodies

```
\begin{table}[place] Add numbered table.
\begin{figure}[place] Add numbered figure.
\begin{equation}[place] Add numbered equation.
\caption{text} Caption for the body.
The place is a list valid placements for the body. t=top,
b=bottom, p=separate page, !-place even if ugly.
Captions and label markers should be within the environment.
```

## Text properties

### Font face

```
Command Declaration Effect
\texttr{text} (\rfamily text) Roman family
\textsf{text} (\sfamily text) Sans serif family
\texttt{text} (\ttfamily text) Typewriter family
\textsd{text} (\ndsorser text) Medium series
\textbf{text} (\bfsorser text) Bold series
\textup{text} (\upshape text) Upright shape
\textit{text} (\itshape text) Italic shape
\textsl{text} (\slshape text) Slanted shape
\textsc{text} (\scshape text) SMALL CAPS SHAPE
\emph{text} (\on text) Emphasized
\textnormal{text} (\normalfont text) Document font
\underline{text} Underline
The command (\ttf) form handles spacing better than the
declaration (\ttf) form.
```

### Font size

```
\tiny tiny \Large Large
\scriptsize scriptsize \LARGE LARGE
\footnotesize footnotesize
\small small \huge huge
\normalsize normalsize \Huge Huge
\large large
```

These are declarations and should be used in the form {\small ...}, or without braces to affect the entire document.

### Verbatim text

```
\begin{verbatim} Verbatim environment.
\begin{verbatim*} Spaces are shown as ~.
\verb!text! Text between the delimiting characters (in
this case '!') is verbatim.
```

## Justification

```
Environment Declaration
\begin{center} \centering
\begin{flushleft} \raggedright
\begin{flushright} \raggedleft
```

## Miscellaneous

\linespread{x} changes the line spacing by the multiplier x.

## Text-mode symbols

### Symbols

```
& \& - \_ ... \ldots • \textbullet
$ \& - \^O | \textbar \ \textbackslash
% \& - \^O # \& § \&
```

### Accents

```
ô \^o ô \^o ô \^o ô \^o ô \^o
ô \^o ô \^o ô \^o ô \^o ô \^o
ç \c c ç \d o ç \b o ç \t oo ç \oe
œ \oe æ \ae Æ \AE ä \aa Å \AA
ø \o Ø \O ï \I Ł \L ł \l
j \j i \i z \z
```

### Delimiters

```
' ' " " { { [ [ ( ( < \textless
' ' " " } } ] ] ) ) > \textgreater
```

### Dashes

```
Name Source Example Usage
hyphen - X-ray In words.
en-dash -- 1-5 Between numbers.
em-dash --- Yes—or no? Punctuation.
```

## Line and page breaks

```
\v Begin new line without new paragraph.
\\* Prohibit pagebreak after linebreak.
\kill Don't print current line.
\pagebreak Start new page.
\noindent Do not indent current line.
```

## Miscellaneous

```
\today April 3, 2009.
$\sim$ Prints ~ instead of \~{ }, which makes ~.
- Space, disallow linebreak (W.J. Clinton).
\@. Indicate that the . ends a sentence when following
an uppercase letter.
\hspace{l} Horizontal space of length l (Ex: l = 20pt).
\vspace{l} Vertical space of length l.
\rule{w}{h} Line of width w and height h.
```

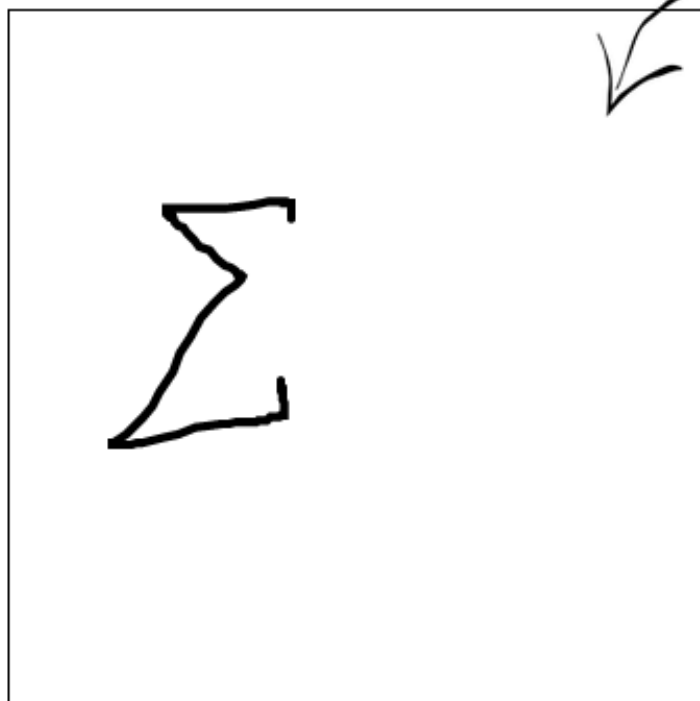
## Tabular environments

### tabbing environment

```
\= Set tab stop. \> Go to tab stop.
Tab stops can be set on "invisible" lines with \kill at the end
of the line. Normally \ is used to separate lines.
```

# Detexify<sup>2</sup> - LaTeX symbol classifier

classify symbols blog



clear

## What is this?

Anyone who works with LaTeX knows how time-consuming it can be to find a symbol in [symbols-a4.pdf](#) that you just can't memorize. Detexify is an attempt to simplify this search.

Draw here!

Did this help?

Hosting Detexify costs money and if it helps you may consider helping to pay the hosting bill.

**DONATE** pledgie.com  
\$1,000.01 Raised!

$\Sigma$

Score: 0.160755192659509

`\Sigma`  
mathmode

$\mathcal{E}$

Score: 0.168587392066755

`\usepackage{amssymb}`  
`\mathcal{E}`  
mathmode

$\epsilon$

Score: 0.169123157322054

`\usepackage{tipa}`  
`\textepsilon`  
textmode

$\textcircled{\epsilon}$

Score: 0.173312128455073

`\usepackage{tipa}`  
`\textrevyogh`  
textmode

$\epsilon$

Score: 0.180613322449149

`\usepackage{amssymb}`

[up](#) ↑

# Outline

## Introduction:

- What is LaTeX?
- Why use LaTeX?

## Examples of ways to “use LaTeX”

## Under the hood:

- What is LaTeX? (revisited)
- distributions, packages, commands, types of files

## Methods and tools for TeXing

- “The Not So Short Introduction to LaTeX2e”
- cheat sheet, Detexify
- Google



**Useful tools:** Editing figures in Inkscape

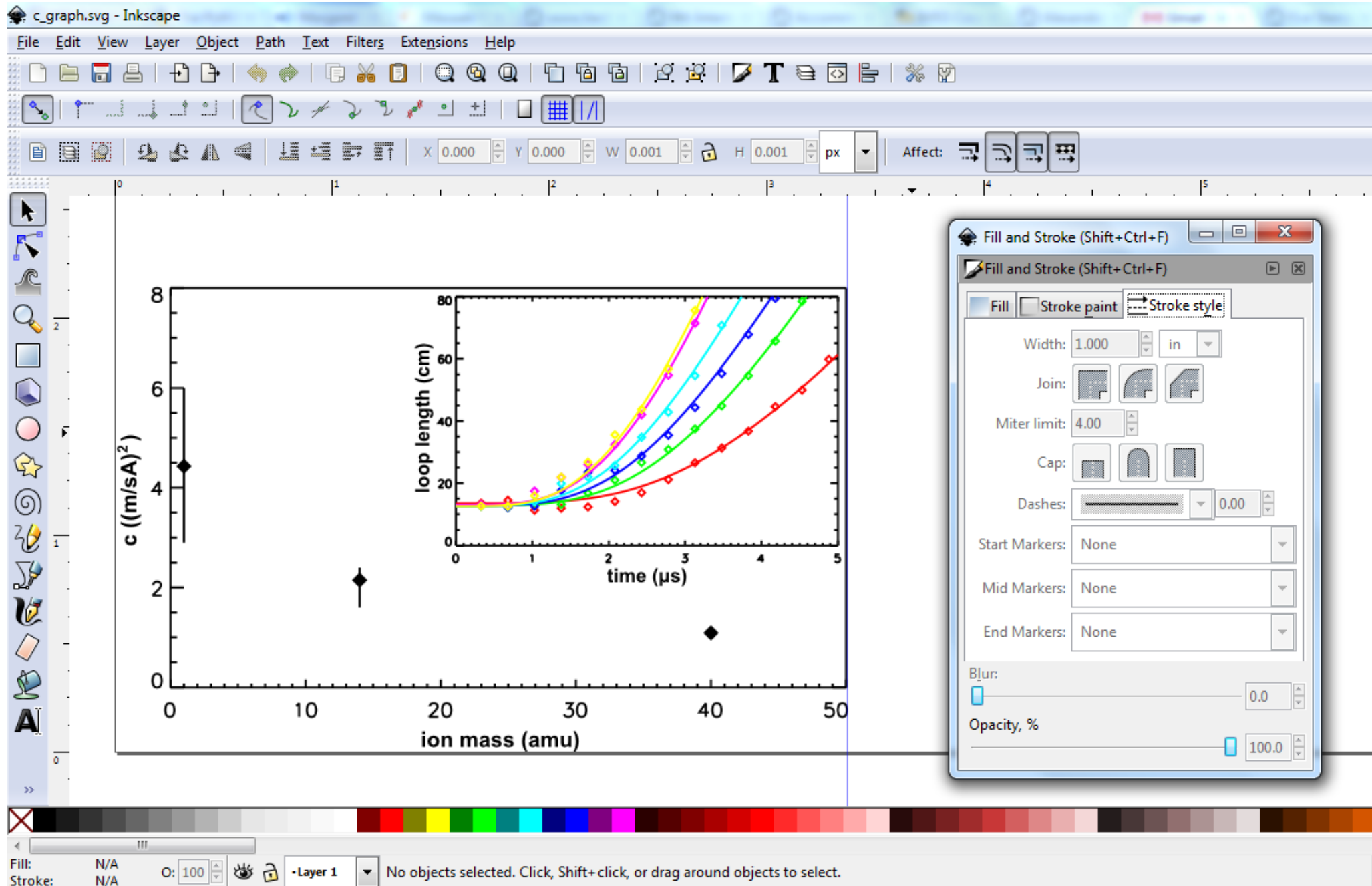
Reference management

## A few installation examples

## Exercises

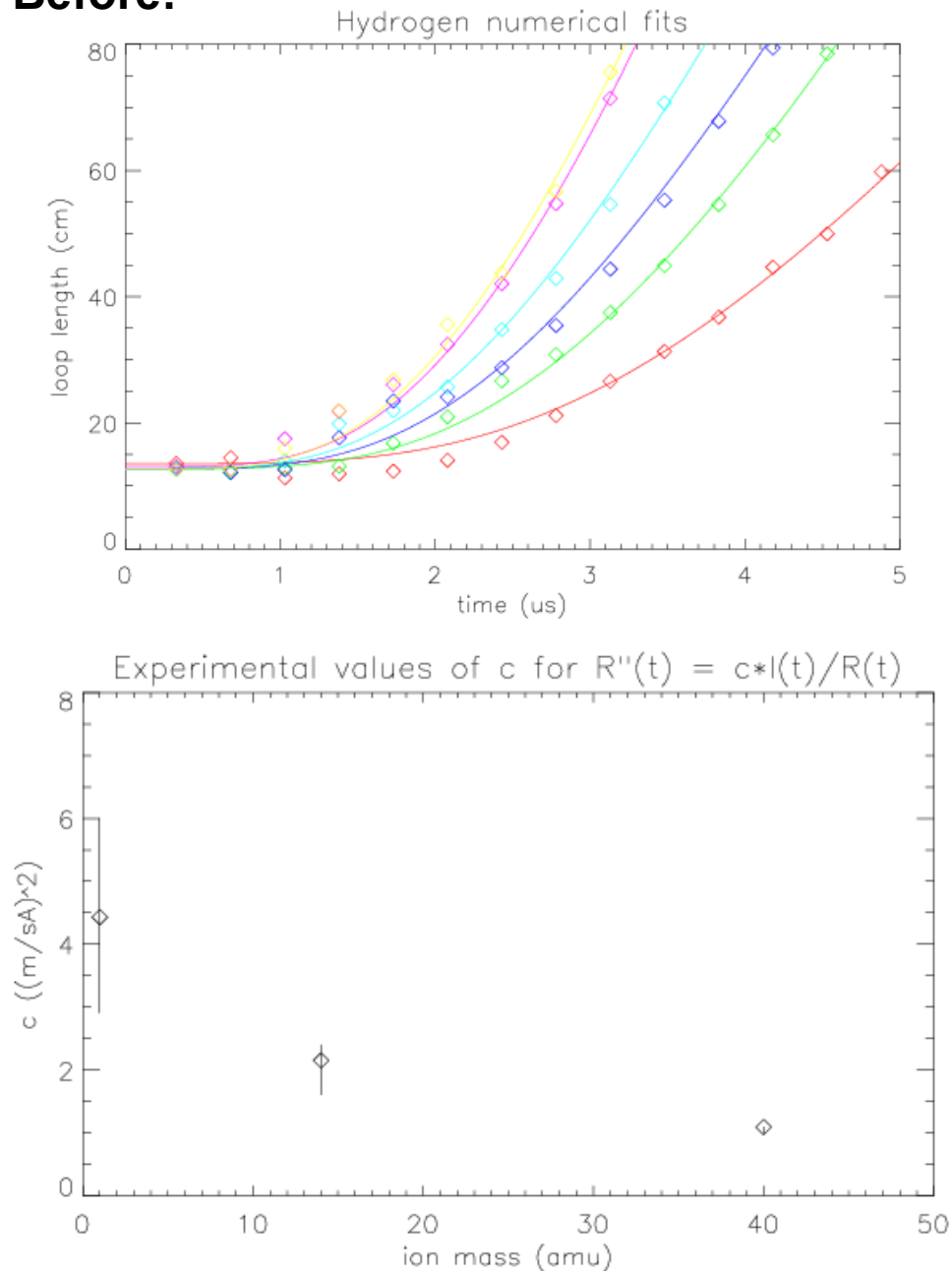
## References

# Inkscape



# How Inkscape transforms figures

**Before:**



**After:**

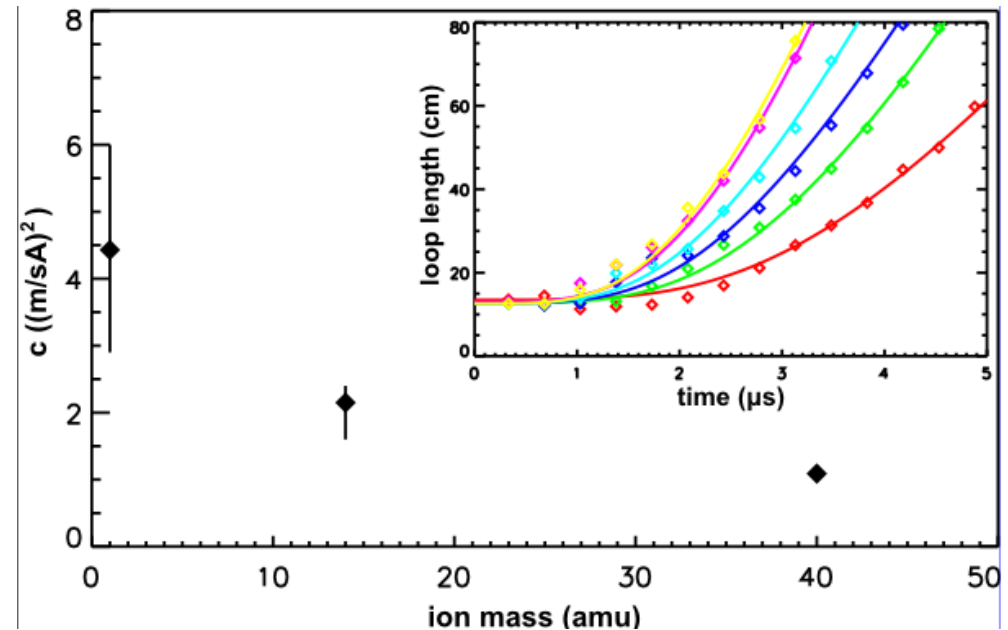


Figure can then be exported (in EPS or PDF format) at exactly the right size for the space it is to occupy.

# Tools for reference management

## Options include:

- a really long .bib file (not recommended)
- a spreadsheet (OK for keeping track of papers, but doesn't have built-in BibTeX stuff)
- CiteULike (online)
- JabRef (L,W; Java)
- Mendeley (L, W, M)
- Endnote (W, M)
- Papers (W, M)

**Remember this sequence:**

```
latex thesis.tex
bibtex thesis.aux
latex thesis.tex
latex thesis.tex
```

The screenshot shows the JabRef application window. The main pane displays a table of bibliographic entries. The selected entry (75) is by Bricaud et al. (1988) titled 'Optical-properties of diverse phytoplanktonic species -- Experimental results and theoretical interpretation' from the Journal of Plankton Research.

#	Entry...	Author	Title	Year	Journal	Timesta...
73	Article	Breckling et al.	Individual-based models as tools for e...	2006	Ecologic...	2006.0...
74	Article	Brett and Müller-Navarra	The role of highly unsaturated fatty aci...	1997	Freshwa...	
75	Article	Bricaud et al.	Optical-properties of diverse phytopla...	1988	Journal ...	2011.0...
76	Article	Bricaud et al.	Natural variability of phytoplanktonic a...	2004	Journal ...	2011.0...
77	Article	Bricaud et al.	Variations of light absorption by suspe...	1998	Journal ...	2010.1...
78	Article	Bricaud et al.	Absorption by dissolved organic matte...	1981	Limnolo...	2011.0...
79	Article	Browman	Embryology, ethology and ecology of o...	1989	Brain Be...	
80	Article	Browman et al.	Perspectives on ecosystem-based app...	2004	Marine E...	
81	Inbook	Brown and N('u){~n}es	Fish Diseases and Disorders	1998		2006.0...
82	Article	Brown	Toward a metabolic theory of ecology	2004	Ecology	2008.1...
83	Article	Brown et al.	Larviculture of Atlantic cod (\textit{Gad...	2003	Aquacult...	
84	Article	Brown et al.	The use of behavioural observations in...	1997	Aquacult...	
85	Article	Brown et al.	Nutritional properties of microalgae for...	1997	Aquacult...	2005.1...

The detailed view of the selected article shows the following fields:

- Author: Bricaud, A. and Bedhomme, A. L. and Morel, A.
- Title: Optical-properties of diverse phytoplanktonic species -- Experimental results and theoretical interpretation
- Journal: Journal of Plankton Research
- Year: 1988
- Volume: 10
- Pages: 851--873
- Editor:
- Bibtexkey: Bricaud1988

Buttons for 'Manage' and 'Toggle abbreviation' are visible next to the journal field.



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**Useful tools:**    Editing figures in Inkscape

Reference management



**A few installation examples**

**Exercises**

**References**

# How to set up MiKTeX + LEd in Windows 7

## 1. Install MiKTeX. (2.8)

- a.) Download installer.
- b.) Run installer with “Download.”
- c.) Run installer with “Install.”

*Notes: Takes forever, especially (b).  
Includes DVI viewer Yap.*

## 2. Install Ghostscript. (8.64)

*Interpreter for PS language.*

## 3. Install GSView. (4.9)

*Ghostscript graphical interface.*

## 4. Install LaTeX Editor. (0.53)

*Configure (as per online “how to”).*

# TeXLive in Arch Linux

```
pacman -S texlive-core  
pacman -S texlive-latexextra
```

*Styles for various journals:*  

```
pacman -S texlive-publishers
```

# Suggested approach for Ubuntu (Debian)

```
apt-get install texlive-base  
apt-get install texlive-latex-extra
```

*Styles for various journals:*  

```
apt-get install texlive-publishers
```

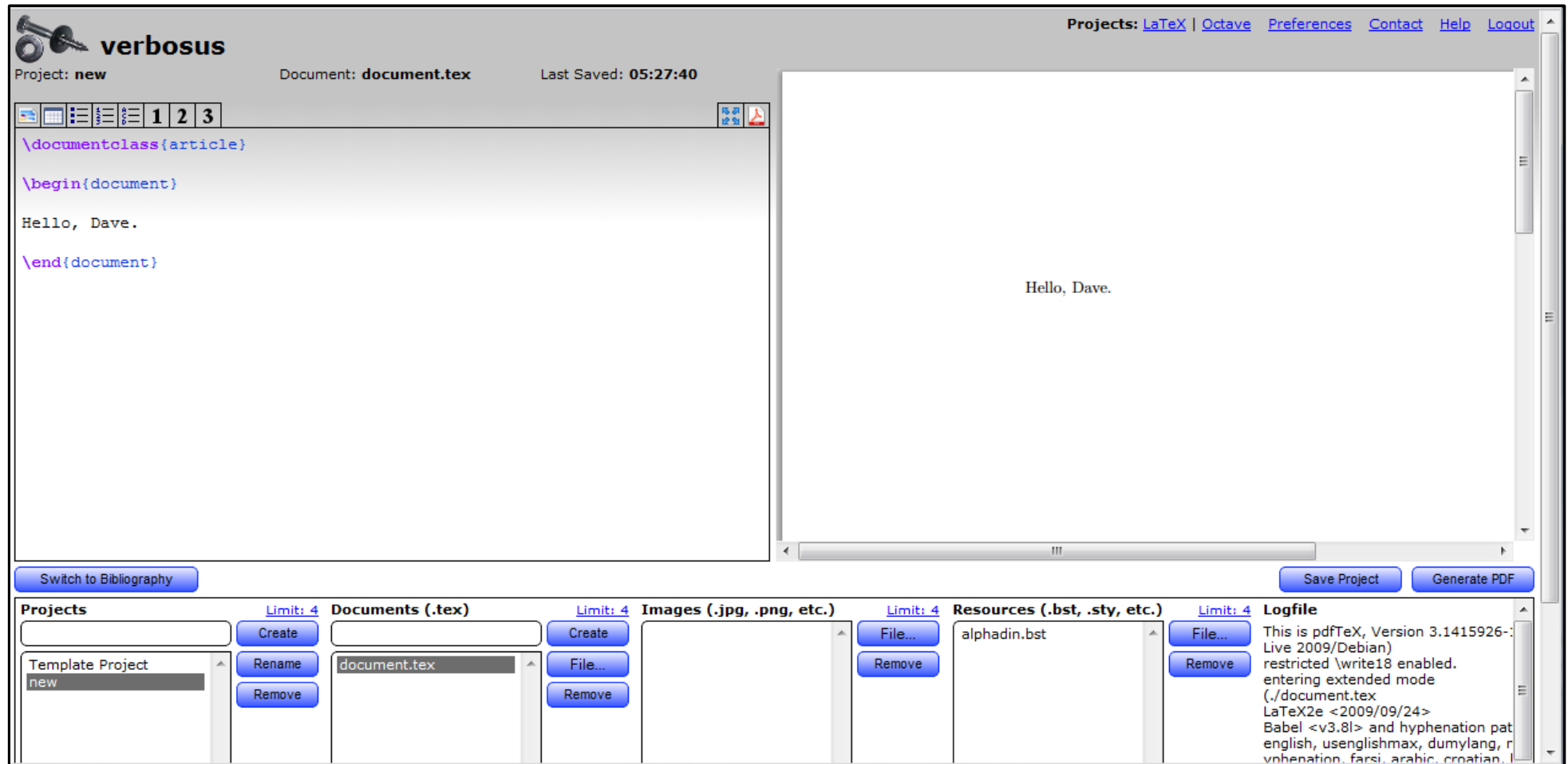
All others, start with:

<http://www.tex.ac.uk/cgi-bin/texfaq2html?label=TeXsystems>



# Exercise 1: My first LaTeX document

If at this point, you don't have some form of LaTeX on your computer (or don't feel like using it), use this free online LaTeX interface: <http://www.verbosus.com>



The screenshot shows the verbosus web interface. At the top, the logo and name 'verbosus' are on the left, and navigation links 'Projects: LaTeX | Octave | Preferences | Contact | Help | Logout' are on the right. Below the logo, it says 'Project: new', 'Document: document.tex', and 'Last Saved: 05:27:40'. The main editing area on the left contains LaTeX code: `\documentclass{article}`, `\begin{document}`, 'Hello, Dave.', and `\end{document}`. To the right is a preview window showing the rendered output: 'Hello, Dave.'. At the bottom, there are several panels: 'Projects' with a list containing 'Template Project' and 'new'; 'Documents (.tex)' with a list containing 'document.tex'; 'Images (.jpg, .png, etc.)'; 'Resources (.bst, .sty, etc.)' with 'alphadin.bst'; and a 'Logfile' panel showing the compilation log. Buttons for 'Switch to Bibliography', 'Save Project', and 'Generate PDF' are also visible.

Create a new project, double click on it to switch to it, clear the contents of the auto-generated document.tex, and start anew. Once you have a document, click “Generate PDF.”

If you are using a set-up on your own computer, create a basic document, run *latex* or *pdflatex* on it, and verify that your output is as expected.

## Exercise 2: Math mode

Typeset your favorite mathematical expression(s).

If you want the expression to be part of a paragraph, surround it with dollar signs:

The Pythagorean theorem states that  $a^2 + b^2 = c^2$ .

To set the equation apart and give it a number (unless you specify otherwise), use the equation environment:

```
\begin{equation}
a^2 + b^2 = c^2
\end{equation}
```

### ***Bonus:***

Give the equation a name by adding `\label{eq:Pythagoras}` into the environment. Then refer back to the equation in a subsequent sentence by using `\ref{eq:Pythagoras}`.

## Exercise 3: Including a figure

You will need to use the `graphicx` package. To do so, add the line

```
\usepackage{graphicx}
```

between the document class specification and the beginning of the document content.

Then use the figure environment:

```
\begin{figure}
\includegraphics{figureofchoice}
\end{figure}
```

### ***Bonus:***

Give the figure a caption by adding `\caption{Caption goes here...}` into the environment.

Give the figure a name by adding `\label{fig:myfavoritefigure}` into the environment. Then refer back to the figure in a subsequent sentence by using `\ref{fig:myfavoritefigure}`.

Example .tex files, graphics, and more can be downloaded from: [eveofdiscovery.com/latex/](http://eveofdiscovery.com/latex/)

## Exercise 4: Citations with BibTeX

You'll need a .bib file (say, citethese.bib) with entries that look something like:

```
@Article{coolstuff_2001,  
author = {Author Name},  
title = {Science is cool},  
journal = {Stuff},  
volume = {10},  
pages = {100},  
year = 2001  
}
```

*In Verbosus, click the “Switch to bibliography” button to edit your .bib file, which has the same name as your .tex file.*

You will also need to add the lines

```
\bibliographystyle{unsrt}  
\bibliography{citethese}
```

just before `\end{document}` in your main document (in your .tex file).

You will now be able to refer to your references by their nicknames (keys), such as `\cite{coolstuff_2001}`.

To resolve all dependencies, be sure to run

```
latex document.tex  
bibtex document.aux  
latex document.tex  
latex document.tex
```

(Or substitute `pdftex` for each `latex`.)  
*Verbosus apparently does all four commands when you click “Generate PDF.”*

## Exercise 5: Document structure

Add a title, author, date, abstract, sections, and/or subsections to your document.

Refer to the cheat sheet to see which sections go before `\begin{document}` and which go after. Note: When the cheat sheet says “`\maketitle` goes at the top of the document” that means immediately after `\begin{document}`.)

### **Bonus:**

Switch to a two-column document. Depending on the size of your figures, this may or may not look very good. If the figures are a bit too wide, perhaps switching to a landscape document would improve things?

# References

The UK List of TeX Frequently Asked Questions on the Web

*<http://www.tex.ac.uk/cgi-bin/texfaq2html?introduction=yes>*

The TeX Users Group web site

*<http://tug.org/>*

LaTeX2e cheat sheet

*<http://mirror.ctan.org/info/latexcheat/latexcheat/latexsheet.pdf>*

The Not So Short Introduction to LaTeX 2 $\epsilon$

*<http://tobi.oetiker.ch/lshort/lshort.pdf>*

Caltech thesis templates:

*<http://libguides.caltech.edu/theses> (Zimmerman's 2001 template)*

*[http://www.work.caltech.edu/ling/tips/cit\\_thesis.html](http://www.work.caltech.edu/ling/tips/cit_thesis.html) (Ling's 2006 update)*