13 A Gentle Reconnaissance

13.1 Page layout in LaTeX

A page in a LaTeX document is built from various elements as shown in figure 13.1. In a *two-sided* document, some parameters will be different for the even and odd pages. The figure shown gives the layout as on any odd page in the document. It also shows most of the parameters required in order to change the page style including the headers, footers and the margins. We shall now briefly discuss these and the other parameters that can be effectively used to control the page layout.

- The horizontal placement of the text can be set by specifying the following parameters:

  \oddsidemargin It denotes the leftside margin (on odd numbered pages). It should be noted that `\leftmargin` does not denote the leftside margin, it is instead used for the indentation of lists.

  \evensidemargin It denotes the leftside margin (on even numbered pages). Note that unless the `twoside` option is chosen, the `\oddsidemargin` and the `\evensidemargin` should be the same.

  \textwidth The width of the text.

- The parameters that control the vertical measurements are:

  \topmargin Denotes the space between the header and the vertical offset. The latter is equal to `1in + \voffset`. `1in` is the default produced by LaTeX.

  \headheight It denotes the height of the header.

  \headsep Refers to the distance between the header and the body of the text.

  \textheight Is the height of the actual text.

- The parameters that control the placement of the footer are:

  \footskip It is the distance between the body of the text and the footer.

  \footheight Denotes the height of the footer.

- Margin notes can be created by using the `\marginpar` command. The parameters controlling the margins are:

  \marginparsep Denotes the separation between the body of the text and the margin. It should be noted that in a two-sided document the margins appear on different sides on two consecutive pages.

  \marginwidth Denotes the width of the margin.

  \marginparpush It is the minimum vertical separation between two marginal notes.

- The commands that are needed in order to control paragraphing are:

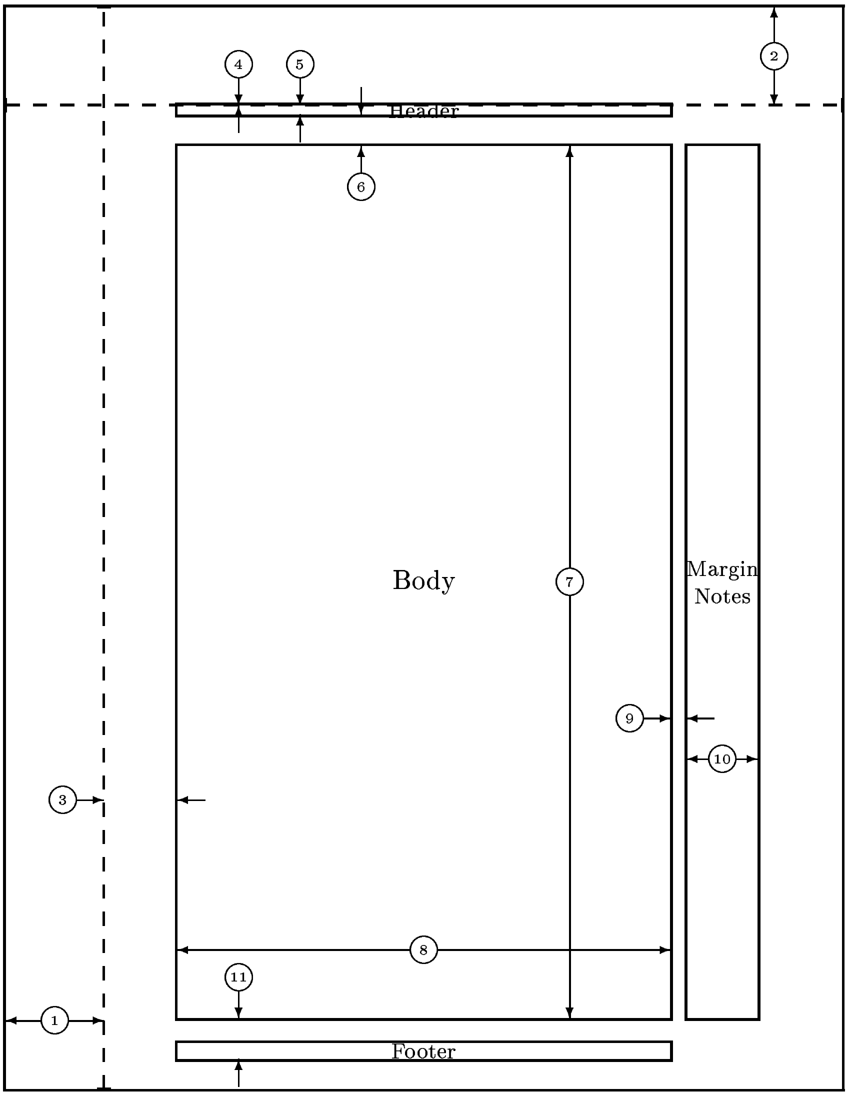
  \parskip Denotes the vertical space between two paragraphs.

  \parindent Denotes the width of paragraph indentation.

  \par Equivalent to a blank line.

  \topsep It is extra vertical space (in addition to `\parskip`), that is added above and below list and paragraphing environments.

\itemsep It is extra vertical space (in addition to \parskip), that is added between two list items.



1	one inch + \hoffset	2	one inch + \voffset
3	\oddsidemargin = 54pt	4	\topmargin = 0pt
5	\headheight = 7pt	6	\headsep = 23pt
7	\textheight = 640pt	8	\textwidth = 362pt
9	\marginparsep = 12pt	10	\marginparwidth = 52pt
11	\footskip = 30pt		\marginparpush = 5pt (not shown)
	\hoffset = 0pt		\voffset = 0pt
	\paperwidth = 597pt		\paperheight = 845pt

Figure 13.1 Page elements. The values shown are those in effect in the current document (on odd pages), *not* the default.

The parameters defined above can be set to a particular value using the command

```
\setlength{parameter}{length}
```

Another command that can be used to change the value of a parameter by a given length is

```
\addtolength{parameter}{length}
```

13.1.1 Page headers and footers

The page headers and footers in LaTeX are defined by the `\pagestyle` and `\pagenumbering` commands. The `\pagestyle` command defines the content of the headers & footers and provides the following options:

empty No headers or footers.

plain No header, footer contains the page number centered. This is the default provided by LaTeX.

headings No footer, header contains the name of the chapter/section and/or subsection and the page number.

myheadings No footer is provided, and the header contains the page number and the information given by the `\markright` and `\markboth` commands. However, for a much better control of the headers and footers, it's recommended to use the *fancyhdr* package.

The command `\thispagestyle` can be used to change the pagestyle of the current page in the document.

The `\pagenumbering` command defines the format of the page number. The different parameters that can be used are:

arabic roman numerals (default)

roman lower case roman numerals

Roman upper case roman numerals

alph lower case letter

Alph upper case letter `\thepage` produces the page number in the format defined by `\pagenumbering`.

13.1.2 The fancyhdr package

The `fancyhdr` package provides another parameter for specifying the pagestyle, the `fancy` style. By use of `\pagestyle{`*fancy*`}`, one can specify three-part headers and footers. We shall illustrate it's use with the help of some examples. The example below shows the page layout that can be created using the package `fancyhdr`.

LeftHeader	CenteredHeader	RightHeader
	page body	
LeftFooter	CenteredFooter	RightFooter

Here is another nice example from the `fancyhdr` documentation.

		The performance of new graduates
	page body	
From: K. Grant	To: Dean A. Smith	3

This is accomplished by the commands following `\pagestyle{fancy}`:

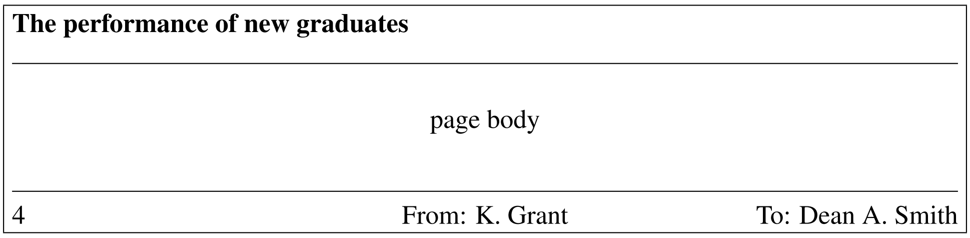
```
\lhead{}
\chead{}
\rhead{\bf The performance of new graduates}
\lfoot{From: K. Grant}
\cfoot{To: Dean A. Smith}
\rfoot{\thepage}
\renewcommand{\headrulewidth}{0.4pt}
\renewcommand{\footrulewidth}{0.4pt}
```

13.1.3 Using fancyhdr in two-sided documents

The `\fancyhdr` package also provides the commands `\fancyhead` and `\fancyfoot` which are more general than the commands described above to define the header and the footer. These provide an additional parameter that specifies for which pages and/or parts of the header/footer those apply. The selectors that can be used are:

E	Even page
O	Odd page
L	Left field
C	Center field
R	Right field
H	Header
F	Footer

Using these we can produce a two-sided document. Assuming the page layout shown above to be for the odd pages, we can have the following for the even pages:



The performance of new graduates

page body

4 From: K. Grant To: Dean A. Smith

This can be produced by using the commands:

```
\fancyhead{} % clear all fields
\fancyhead[RO,LE]{\bf The performance of new graduates}
\fancyfoot[LE,RO]{\thepage}
\fancyfoot[LO,CE]{From: K. Grant}
\fancyfoot[CO,RE]{To: Dean A. Smith}
\renewcommand{\headrulewidth}{0.4pt}
\renewcommand{\footrulewidth}{0.4pt}
```

The default layout in `fancyhdr` is produced by the following commands:

```
\fancyhead[LE,RO]{\slshape\rightmark}
\fancyhead[LO,RE]{\slshape\leftmark}
\fancyfoot[C]{\thepage}
```

The default values for `\headrulewidth` and `\footrulewidth` are `0.4pt` and `0pt` respectively.

13.2 Groups

LaTeX has an extremely nice feature of keeping text in groups thus enabling one to have different kinds of text wherever required. For example, one can have:

The available font sizes are:
tiny, scriptsize, footnotesize, small, normalsize, large, Large, LARGE, huge, and Huge.

A new group is started by the character `{` and terminated by the character `}`. It is also possible to have groups nested within groups.

> If some paragraphs need to be typeset in a different way (like this one!), then it is necessary to include `\par` or to use a blank line before closing the group, since otherwise the normal defaults will be restored before the paragraph is actually typeset.

The empty group `{}` enables one to get some space after TeX in the output. One can also print a tilde using `\~{}` (this will produce ˜). By using `\sim` in math mode, we get $\sim$.

And to quote the advice in **The Not So Short Introduction to LaTeX 2ε**:

> **Remember!** *The* MO RE fonts you use **in** a `document`, *the* more READABLE and *beautiful it* becomeS.

13.3 Creating a nomenclature

In the process of writing a big document[1] which involve a number of symbols, one often feels the need to include a nomenclature for the various symbols used in the text. The `nomencl` package provides a convenient way of doing so. It makes use of the *MakeIndex* program to generate such a list automatically by using the information provided by the author in the text.

13.3.1 Package options

The `nomencl` package provides the following options:

refeq The phrase ", see equation (⟨*eq*⟩)" is appended to every entry in the nomenclature where ⟨*eq*⟩ is the number of the last equation in front of the corresponding command `\nomenclature`.

norefeq This is the default option; using this no equation number is printed.

refpage The phrase ", see page (⟨*page*⟩)" is appended to every entry in the nomenclature where ⟨*page*⟩ is the number of the page on which the corresponding command `\nomenclature` appeared.

norefpage No page reference is printed; default option.

prefix Every sort key is preceded by the letter "a" (changeable); default option.

noprefix No prefix is used for sorting.

cfg A configuration file `nomencl.cfg` is loaded, if it exists; default option.

nocfg The configuration file is not loaded.

[1] esp. mathematical documents, theses, books etc.

croatian, danish, english, french, german, italian, polish, russian, spanish, ukranian The reference texts and the nomenclature title will appear in the corresponding language. In order to use Russian or Ukranian, you'll need to have Cyrillic fonts installed and might need a replacement for *MakeIndex*, e.g. **xindy**[2]. The default option is english.

13.3.2 Usage and examples

The `\nomenclature` command has the following syntax:

```
\nomenclature[⟨perfix⟩]{⟨symbol⟩}{⟨description⟩}
```

where ⟨*prefix*⟩ is used for fine tuning the sort order, ⟨*symbol*⟩ is the symbol to be described, and ⟨*description*⟩ is the actual description. The package provides macros in order to change the referencing behavior for single entries. These macros are: `\refeq`, `\norefeq`, `\refpage`, `\norefpage`, `\refeqpage`, and `\norefeqpage`. Note that the use of these macros locally inside the command `\nomeclature` always supersedes the package options, and can be used in order to produce the desired effect. The following example will more clearly illustrate the usage of the package.

```
\documentclass{article}
\usepackage{nomencl}
\makeglossary
\renewcommand{\nomgroup}[1]{%
  \ifthenelse{\equal{#1}{A}}{\item[\textbf{Roman symbols}]}{%
    \ifthenelse{\equal{#1}{G}}{\item[\textbf{Greek symbols}]}{}}{}}
\begin{document}
\printglossary
\section{Dimensionless ratios of transport coefficients}
The {\em Lewis number} is defined as
\begin{equation}
\mathrm{Le} \equiv \frac{\lambda}{\rho C_p \mathcal{D}} =
\frac{\alpha}{\mathcal{D}} \end{equation}%
\nomenclature[ax ]{$\mathrm{Le}$}{Lewis number}%
\nomenclature[ga ]{$\lambda$}{Thermal conductivity}%
\nomenclature[ga ]{$\rho$}{Density}%
\nomenclature[a ]{$C_p$}{Constant-pressure specific heat}%
\nomenclature[g ]{$\mathcal{D}$}{Mass diffusivity}%
\nomenclature[g ]{$\alpha$}{Thermal diffusivity}%
The {\em Prandtl number} is defined as
\begin{equation}
\mathrm{Pr} \equiv \frac{C_p \mu}{\lambda} = \frac{\nu}{\alpha}
\end{equation}%
\nomenclature[ax ]{$\mathrm{Pr}$}{Prandtl number}%
\nomenclature[ga ]{$\mu$}{Dynamic viscosity}%
\nomenclature[ga ]{$\nu$}{Momentum diffusivity}%
The {\em Schmidt number} is defined as
\begin{equation}
\mathrm{Sc} \equiv \frac{\mu}{\mathcal{D}}\end{equation}%
\nomenclature[ax ]{$\mathrm{Sc}$}{Schmidt number}
\end{document}
```

As mentioned above, the `nomencl` package makes use of the MakeIndex program in or-

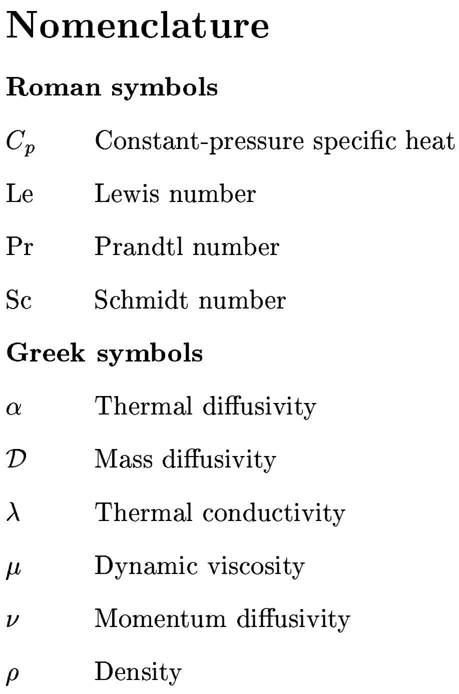
[2] For more information on **xindy**, please see http://gemini.iti.informatik.tu-darmstadt.de/xindy/ or http://sourceforge.net/projects/xindy/.

der to produce the nomenclature list. On running the file through LaTeX, the command `\makeglossary` instructs it to open the glossary file ⟨*jobname*⟩`.glo` corresponding to the LaTeX file ⟨*jobname*⟩`.tex` and writes the information from the `\nomenclature` commands to this file. The next step is to invoke MakeIndex in order to produce the ⟨*jobname*⟩`.gls` file. This can be achieved by making use of the command:

```
makeindex ⟨jobname⟩.glo -s nomencl.ist -o ⟨jobname⟩.gls
```

The next step is to invoke LaTeX on the file ⟨*jobname*⟩`.tex` once more. This will input the `.gls` file and process it according to the given options.

The code given in the above example produces the following nomeclature list:



Nomenclature

Roman symbols

C_p	Constant-pressure specific heat
Le	Lewis number
Pr	Prandtl number
Sc	Schmidt number

Greek symbols

α	Thermal diffusivity
$\mathcal{D}$	Mass diffusivity
λ	Thermal conductivity
μ	Dynamic viscosity
ν	Momentum diffusivity
ρ	Density

13.4 Fun with floats

13.4.1 The subfigure package

Using this package it is possible to include several small figures and tables within a single figure or table environment. This provides a convenient way of refering the subfigures; adding entries to the table of figures is also made possible.

13.4.1.1 Usage

The package can be loaded by using

```
\usepackage[⟨options⟩]{subfigure}
```

in the document preamble. The various options included in the package are:

normal Provides ‘normal’ captions; this is the default.

hang Gives a hanging indentation to the caption paragraph.

center This causes each line of the caption paragraph to be separately centered.

centerlast Only the last line of the caption paragraph is centered.

nooneline A caption line fitting on a single line is centered by default; this option causes the same to be left-justified.

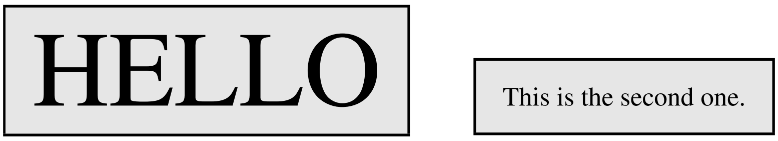
scriptsize, . . . , Large
Sets the font size of the captions.

up, it, sl, sc, md, bf, rm, sf, tt
Sets the font attributes of the captions.

The following commands can be used within a `figure` or `table` environment to create subfigures or subtables. The amount of vertical space between the figure and the caption can be controlled by `\subfigcapskip`. By default, this is set to `10pt`. `\subfigbottomskip` denotes the amount of vertical space added at the bottom; the default value is `10pt`.

13.4.1.2 Examples

The following example makes use of the `subfigure` package to put two figures side by side.



(a) First figure

(b) Second figure

Figure 13.2 A simple example

Note that the subfigures 13.2(a) and 13.2(b) in the figure 13.2 are aligned along the bottom. These are obtained using the following code:

```
\begin{figure}
\centering
\subfigure[First figure]{\label{fig-a}...}\hspace{.75cm}
\subfigure[Second figure]{\label{fig-b}...}
\caption{A simple example}\label{two-figs}
\end{figure}
```

It is similarly possible to obtain tables side by side.

One	Two
Three	Four

(A) Table 1

Another	small	table
But	slightly	bigger
than	previous	one

(B) Second table

Table 13.1 This is it!

13.4.2 Rotating figures

The `rotating` package provides the `\rotcaption` command which makes it possible to rotate the caption thus enabling to typeset a figure in landscape mode.

```
\begin{figure}
\centering
\begin{minipage}[c]{0.6in}
\rotatebox{90}{\fcolorbox{orange}{gray10}{\myfont TEST}}
\end{minipage}
\begin{minipage}[c]{0.4in}
\rotcaption{A rotated figure.}
\end{minipage}
\end{figure}
```

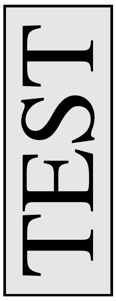


Figure 13.3: A rotated figure.

Another option to obtain the rotated caption is to use the command `\rotatebox` in the same way as in the previous example and include the argument in a `\parbox`. The `rotating` package also provides two environments `sidewaysfigure` and `sidewaystable` which are very similar to the regular `figure` and `table` environments except that these turn the contents through 90 degrees counterclockwise. The package also provides the `turn` environment that allows to rotate the contents through an arbitrary angle.

13.5 Items and lists

13.5.1 The shortlst package

The `shortlst` package is very useful for typesetting a list of short items. The regular `itemize` environment leaves

- a lot
- of
- white
- space.

The `shortlst` package provides the following environments:

- `shortitemize`
- `shortenumerate`
- `runenumerate`
- `runitemize`

The `shortitemize` and the `shortenumerate` environments can be used for small list items in a manner very similar to the regular `itemize` and `enumerate` environments. The following example illustrates the use of `shortitemize`:

```
\begin{shortitemize}
\item{the {\sf itemize} environment}
\item{leaves}
\item{a lot}
\item{of}
\item{white space.}
\end{shortitemize}
```

- the itemize environment
- leaves
- a lot
- of
- white space.

The environment also provides an optional argument that can be used to specify the width of the default allotment of space (the default is `65pt`). For example, using `\begin{shortitemize}[the {\sf itemize} environment]` will produce:

- the itemize environment
- leaves
- a lot
- of
- white space.

Instead of using the optional argument, the width of the item can also be set using the command `\shortitemwidth`. The use of the `shortenumerate` environment is very similar to that of `shortitemize`. Both these environments can be a part of an item of a regular list environment. However, note that no list environment can be used within any of these list environments. The other two environments, `runenumerate` and `runitemize`, provided with this package can be used for items that do not need a displayed paragraph. The following example illustrates the use of the `runenumerate` environment:

```
You have three choices:
\begin{runenumerate}
\item wash your hands,
\item postpone it until tomorrow, or
\item \label{choice}stay dirty.
\end{runenumerate}
I choose \ref{choice}!
```

You have three choices:(1) wash your hands,(2) postpone it until tomorrow, or (3) stay dirty.I choose 3!

The commands `\parbox` or `\minipage` can be used in case a few lists are too long to fit on a single line. The length `\labelsep` denotes the separation between the label and the item; and `\labelwidth` denotes the width of the labels. `\runitemsep` denotes the space between the items of a `\runenumerate` or `\runitemize` environment.

13.5.2 The multienum package

This package is especially useful for generating an enumerated list involving short items, e.g. the solutions manual for a text. The package provides the `multienumerate` environment that has an optional argument for enumerating even-only or odd-only arrays.

```
\begin{multienumerate}[⟨option⟩] ... \end{multienumerate}
```

where the ⟨*option*⟩ `evenlist` produces an enumerated array using only even numbers, the ⟨*option*⟩ `oddlist` produces one using only odd numbers, and no ⟨*option*⟩ produces a consecutively enumerated array. Each row of the enumerated array is set using commands of the following form:

\mitemx{} A single item in the row.

\mitemxx{}{} Two items in the row.

\mitemxxx{}{}{} Three items in the row.

\mitemxox{}{} Three items in the row with the center item space left blank so the first item can extend into its space.

\mitemxxo{}{} Three items in the row with the last item left blank so the second item can extend into its space.

\mitemxxxx{}{}{}{} Four items in the row.

\mitemxoxx{}{}{} Four items in the row with the second space left blank so the first item can extend into its space.

\mitemxxox{}{}{} Four items in the row with the third space left blank so the second item can extend into its space.

\mitemxxxo{}{}{} Four items in the row with the last space left blank so the third item can extend into its space.

There can be a maximum of 4 enumerated entries in a single line[3]. The character `x` in the above commands refer to an entry, while the character `o` refers to a blank entry, and the space for that entry gets utilized by the previous entry.

The following example illustrates the use of the different commands that can be used to generate the enumerated list:

2. 3 X 2   4. 2   6. 3   8. 1   10. Not defined

12. $\begin{pmatrix}-5\\1\\5\end{pmatrix}$ 14. $\begin{pmatrix}20\\-5\end{pmatrix}$ 16. $\begin{pmatrix}-2\\4\\0\end{pmatrix}$ 18. $\begin{pmatrix}41\\52\end{pmatrix}$ 20. $\begin{pmatrix}12\\8\\4\end{pmatrix}$

22. arccos(9/ $\sqrt{85}$) $\approx$ 0.22 radians   24. $\sqrt{10}$ 26. $\sqrt{3}$ 28. Not defined

30. $x = 2$ and $y = 1/2$ 32. $C + A = 2\pi r + \pi r^2$ 34. $\begin{pmatrix}-1\\2\end{pmatrix}$

The code that produced the above enumerated list is given below[4]:

```
\def\Matrix#1{\begin{pmatrix}#1\end{pmatrix}}
\begin{multienumerate}[evenlist]
\mitemxxxxx{3 X 2}{2}{3}{1}{Not defined}
\mitemxxxxx{$\Matrix{-5 \cr 1 \cr 5}$}{$\Matrix{20 \cr -5}$}%
{$\Matrix{-2 \cr 4 \cr 0}$}{$\Matrix{41 \cr 52}$}{$\Matrix{12 \cr 8 \cr 4}$}
\mitemxoxxx{arccos(9/$\sqrt{85}$) $\approx$ 0.22 radians}%
{$\sqrt{10}$}{$\sqrt{3}$}{Not defined}
\mitemxoxox{$x = 2$ and $y = 1/2$}{$C + A = 2\pi r + \pi r^2$}{$\Matrix{-1 \cr 2}$}
\end{multienumerate}
```

13.6 Some more tricks

13.6.1 The romannum package

The `romannum` package can be used to change the numbers generated by LaTeX for chapters, sections, equations, list items, footnotes, etc. from arabic to roman numerals. The package options, as described below, can be used to typeset uppercase or lowercase roman numerals.

Section Sectional numbers in uppercase roman.

section Sectional numbers in lowercase roman.

Equation Equation numbers in uppercase roman.

equation Equation numbers in lowercase roman.

Caption Table and Figure caption numbers in uppercase roman.

caption Table and Figure caption numbers in lowercase roman.

Footnote Footnote numbers in uppercase roman.

footnote Footnote numbers in lowercase roman.

Enumerate First level items in uppercase roman and third level items in lowercase roman.

[3] The example below illustrates 5 enumerated entries in a line; this is obtained by adding some simple macros in the package.

[4] The `\mitemxoxxx` and `\mitemxoxox` commands have been defined in a similar manner to the other commands in the package.

enumerate First level items in lowercase roman and third level items in uppercase roman.

Year The year number from the `\today` command in uppercase roman.

Day The year number from the `\today` command in uppercase roman and the day number in uppercase roman.

day The year number from the `\today` command in uppercase roman and the day number in uppercase roman.

Most A shorthand option equivalent to using all these options: `Section`, `Equation`, `Caption`, `Footnote`, `Enumerate`; that is, all the uppercasing options except for `Year` and `Day`.

most A shorthand option equivalent to using all these options: `section`, `equation`, `caption`, `footnote`, `enumerate`; that is, all the lowercasing options except for `day`.

13.6.2 The epigraph package

> A good question is never answered. It is not a bolt to be tightened into place but a seed to be planted and to bear more seed toward the hope of greening the landscape of idea.
>
> *John Ciardi*

This package provides fancy styles for typesetting quotes just after a sectional heading. The epigraphs can be typeset either at the left, the center, or the right of the typeblock. The command

```
\epigraph{⟨text⟩}{⟨source⟩}
```

typesets an epigraph using ⟨*text*⟩ as the main text of the epigraph, and the ⟨*source*⟩ as it's reference. The package provides the following commands:

\qitem The `\qitem{`⟨*text*⟩`}{`⟨*source*⟩`}` command is used in the epigraphs environment in order to specify each epigraph in the list. It's use is essentially similar to the `\item` command in the ordinary list environments.

\epigraphwidth It denotes the width of the epigraph; the default is `0.4\textwidth`.

\textflush It controls the ⟨*text*⟩ typesetting style; set to `flushleft` by default.

\epigraphflush The default position of the epigraphs is at the right hand side of the textblock (set to `flushright`). Using this command, the position of the textblock can be changed.

\sourceflush It controls the position of the ⟨*source*⟩; default is `flushright`.

\epigraphsize It can be used to redefine the fontsize in which the epigraphs are typeset; default is `small`.

\epigraphrule This denotes the thickness of the rule drawn between the ⟨*text*⟩ and the ⟨*source*⟩; default is `0.4pt`.

\beforeepigraphskip, \afterepigraphskip
These commands control the amount of vertical space instered before and after the typeset epigraphs; default value for both the lengths is `0.5\baselineskip`.