

math

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math on bookdown started on 2024/01/28

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1.2 discipline

Chapter 2

physics

2.1 discipline

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plot

- LaTeX
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 - * R Markdown Guide [section 5.1](#)
 - tool
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neural network plot/draw <https://github.com/ashishpatel26/Tools-to-Design-or-Visualize-Architecture-of-Neural-Network>

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programming language

4.1 discipline

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- SQL = structured query language
- [R](#)^[??]
 - RMarkdown
 - * Bookdown
 - knitr: engine
 - * [TikZ](#)^[??]
 - reticulate: Python
 - Jamovi
- C#
 - web
 - * MVC
 - * .NET
 - desktop
 - * UWP = Universal Windows Platform
 - * WPF = Windows Presentation Foundation
 - * WinForms = Windows Forms
 - 3D/game
 - * Unity

4.2 learning map

- [W3School](#)
- [SoloLearn](#)
- [Codecademy](#)

Chapter 5

machine learning

Part II

by date

Chapter 6

A Minimal Book Example

6.1 About

This is a *sample* book written in **Markdown**. You can use anything that Pandoc’s Markdown supports; for example, a math equation $a^2 + b^2 = c^2$.

6.1.1 Usage

Each **bookdown** chapter is an .Rmd file, and each .Rmd file can contain one (and only one) chapter. A chapter *must* start with a first-level heading: **# A good chapter**, and can contain one (and only one) first-level heading.

Use second-level and higher headings within chapters like: **## A short section** or **### An even shorter section**.

The **index.Rmd** file is required, and is also your first book chapter. It will be the homepage when you render the book.

6.1.2 Render book

You can render the HTML version of this example book without changing anything:

1. Find the **Build** pane in the RStudio IDE, and
2. Click on **Build Book**, then select your output format, or select “All formats” if you’d like to use multiple formats from the same book source files.

Or build the book from the R console:

```
bookdown::render_book()
```

To render this example to PDF as a **bookdown::pdf_book**, you’ll need to install XeLaTeX. You are recommended to install TinyTeX (which includes XeLaTeX): <https://yihui.org/tinytex/>.

6.1.3 Preview book

As you work, you may start a local server to live preview this HTML book. This preview will update as you edit the book when you save individual .Rmd files. You can start the server in a work session by using the RStudio add-in “Preview book”, or from the R console:

```
bookdown::serve_book()
```

6.2 Hello bookdown

All chapters start with a first-level heading followed by your chapter title, like the line above. There should be only one first-level heading (#) per .Rmd file.

6.2.1 A section

All chapter sections start with a second-level (##) or higher heading followed by your section title, like the sections above and below here. You can have as many as you want within a chapter.

An unnumbered section

Chapters and sections are numbered by default. To un-number a heading, add a {.unnumbered} or the shorter {-} at the end of the heading, like in this section.

6.3 Cross-references

Cross-references make it easier for your readers to find and link to elements in your book.

6.3.1 Chapters and sub-chapters

There are two steps to cross-reference any heading:

1. Label the heading: # Hello world {#nice-label}.
 - Leave the label off if you like the automated heading generated based on your heading title: for example, # Hello world = # Hello world {#hello-world}.
 - To label an un-numbered heading, use: # Hello world {-#nice-label} or {# Hello world .unnumbered}.
2. Next, reference the labeled heading anywhere in the text using \@ref(nice-label); for example, please see Chapter ??.
 - If you prefer text as the link instead of a numbered reference use: [any text you want can go here](#).

6.3.2 Captioned figures and tables

Figures and tables *with captions* can also be cross-referenced from elsewhere in your book using \@ref(fig:chunk-label) and \@ref(tab:chunk-label), respectively.

See Figure ??.

```
par(mar = c(4, 4, .1, .1))
plot(pressure, type = 'b', pch = 19)
```

Don't miss Table ??.

```
knitr::kable(
  head(pressure, 10), caption = 'Here is a nice table!',
  booktabs = TRUE
)
```

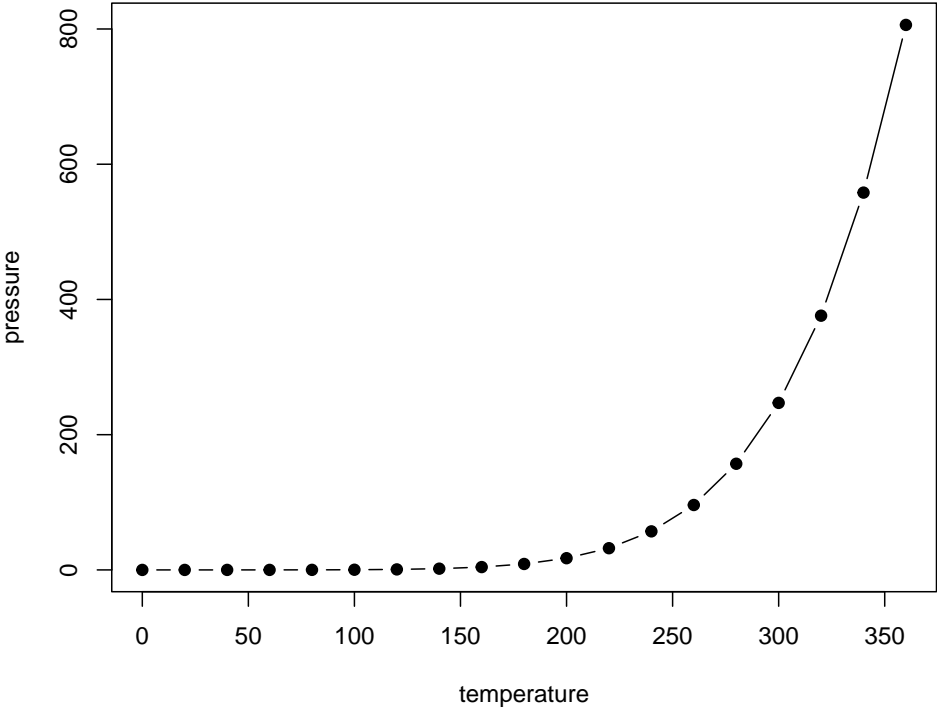


Figure 6.1: Here is a nice figure!

Table 6.1: Here is a nice table!

temperature	pressure
0	0.0002
20	0.0012
40	0.0060
60	0.0300
80	0.0900
100	0.2700
120	0.7500
140	1.8500
160	4.2000
180	8.8000

6.4 Parts

You can add parts to organize one or more book chapters together. Parts can be inserted at the top of an `.Rmd` file, before the first-level chapter heading in that same file.

Add a numbered part: `# (PART) Act one {-}` (followed by `# A chapter`)

Add an unnumbered part: `# (PART*) Act one {-}` (followed by `# A chapter`)

Add an appendix as a special kind of un-numbered part: `# (APPENDIX) Other stuff {-}` (followed by `# A chapter`). Chapters in an appendix are prepended with letters instead of numbers.

6.5 Footnotes and citations

6.5.1 Footnotes

Footnotes are put inside the square brackets after a caret `^[]`. Like this one ¹.

6.5.2 Citations

Reference items in your bibliography file(s) using `@key`.

For example, we are using the **bookdown** package¹ (check out the last code chunk in `index.Rmd` to see how this citation key was added) in this sample book, which was built on top of R Markdown and **knitr**² (this citation was added manually in an external file `book.bib`). Note that the `.bib` files need to be listed in the `index.Rmd` with the YAML **bibliography** key.

The RStudio Visual Markdown Editor can also make it easier to insert citations: <https://rstudio.github.io/visual-markdown-editing/#/citations>

6.6 Blocks

6.6.1 Equations

Here is an equation.

$$f(k) = \binom{n}{k} p^k (1-p)^{n-k} \quad (6.1)$$

You may refer to using `\@ref(eq:binom)`, like see Equation (??).

6.6.2 Theorems and proofs

Labeled theorems can be referenced in text using `\@ref(thm:tri)`, for example, check out this smart theorem ??.

Theorem 6.1. *For a right triangle, if c denotes the length of the hypotenuse and a and b denote the lengths of the **other** two sides, we have*

$$a^2 + b^2 = c^2$$

Read more here <https://bookdown.org/yihui/bookdown/markdown-extensions-by-bookdown.html>.

¹This is a footnote.

6.6.3 Callout blocks

The R Markdown Cookbook provides more help on how to use custom blocks to design your own callouts: <https://bookdown.org/yihui/rmarkdown-cookbook/custom-blocks.html>

6.7 Sharing your book

6.7.1 Publishing

HTML books can be published online, see: <https://bookdown.org/yihui/bookdown/publishing.html>

6.7.2 404 pages

By default, users will be directed to a 404 page if they try to access a webpage that cannot be found. If you'd like to customize your 404 page instead of using the default, you may add either a `_404.Rmd` or `_404.md` file to your project root and use code and/or Markdown syntax.

6.7.3 Metadata for sharing

Bookdown HTML books will provide HTML metadata for social sharing on platforms like Twitter, Facebook, and LinkedIn, using information you provide in the `index.Rmd` YAML. To setup, set the `url` for your book and the path to your `cover-image` file. Your book's `title` and `description` are also used.

This `gitbook` uses the same social sharing data across all chapters in your book- all links shared will look the same.

Specify your book's source repository on GitHub using the `edit` key under the configuration options in the `_output.yml` file, which allows users to suggest an edit by linking to a chapter's source file.

Read more about the features of this output format here:

<https://pkgs.rstudio.com/bookdown/reference/gitbook.html>

Or use:

```
?bookdown::gitbook
```


Chapter 7

test

<https://bookdown.org/yihui/rmarkdown-cookbook/verbatim-code-chunks.html>

7.1 RStudio

7.1.1 writer options

<https://rstudio.github.io/visual-markdown-editing/markdown.html#writer-options>

7.1.1.1 line wrapping

<https://rstudio.github.io/visual-markdown-editing/markdown.html#line-wrapping>

7.1.1.2 ensuring the same markdown between source / visual mode

<https://stackoverflow.com/questions/71775027/rstudio-switch-markdown-editing-mode-between-source-and-visual-changes-special>

canonical mode

<https://rstudio.github.io/visual-markdown-editing/markdown.html#canonical-mode>

```
---  
title: "My Document"  
editor_options:  
  markdown:  
    wrap: 72  
  references:  
    location: block  
  canonical: true  
---
```

7.1.2 Rtools

Rtools43 for Windows <https://cran.r-project.org/bin/windows/Rtools/rtools43/rtools.html>

7.1.3 addins

<https://github.com/rstudio/addinexamples>

```
if (!requireNamespace("devtools", quietly = TRUE))
  install.packages("devtools")
```

```
devtools::install_github("rstudio/htmltools")
devtools::install_github("rstudio/shiny")
devtools::install_github("rstudio/miniUI")
```

7.1.4 Git

commit: filename or extension is too long

<https://stackoverflow.com/questions/22575662/filename-too-long-in-git-for-windows>

<https://stackoverflow.com/questions/55327408/how-to-fix-git-for-windows-error-could-not-lock-config-file-c-file-path-to-g>

7.2 RMarkdown

R Markdown <https://cosname.github.io/rmarkdown-guide/index.html>

<https://www.rstudio.com/wp-content/uploads/2015/02/rmarkdown-cheatsheet.pdf>

<https://slides.yihui.org/2020-taipei-satrdy-rmarkdown.html#1>

7.2.1 Pandoc link

<https://pandoc.org/chunkedhtml-demo/8.16-links-1.html>

<https://stackoverflow.com/questions/39281266/use-internal-links-in-rmarkdown-html-output>

<https://community.rstudio.com/t/how-to-hyperlink-between-different-rmd-files-in-rmarkdown/62289>

7.2.2 URL

<https://stackoverflow.com/questions/29787850/how-do-i-add-a-url-to-r-markdown>

[I'm an inline-style link] (<https://www.google.com>)

[I'm an inline-style link with title] (<https://www.google.com> "Google's Homepage")

[I'm a reference-style link][Arbitrary case-insensitive reference text]

[I'm a relative reference to a repository file](../blob/master/LICENSE)

[You can use numbers for reference-style link definitions][1]

Or leave it empty and use the [link text itself]

Some text to show that the reference links can follow later.

[arbitrary case-insensitive reference text]: <https://www.mozilla.org>

```
[1]: http://slashdot.org
[link text itself]: http://www.reddit.com
```

7.2.3 arrow

<https://reimbar.org/dev/arrows/>

- Up arrow: `↑`
- Down arrow: `↓`
- Left arrow: `←`
- Right arrow: `→`
- Double headed arrow: `↔`

7.2.4 superscript and subscript

```
scriptsuperscriptsubscript
scriptsuperscript
scriptsubscript
```

7.2.4.1 LaTeX

- <https://tex.stackexchange.com/questions/580824/subscript-not-distinguished-enough>
- <https://tex.stackexchange.com/questions/262295/make-subscript-size-smaller-always>

7.2.5 equation

<https://stackoverflow.com/questions/26049762/erroneous-nesting-of-equation-structures-in-using-beginalign-in-a-multi-l>

7.2.5.1 proof QED

<https://math.meta.stackexchange.com/questions/3582/qed-for-mathjax-here-on-stackexchange>

```
\tag*{$\Box$}
\tag*{$\blacksquare$}
```

$$a^2 + b^2 = c^2$$

□

$$a^2 + b^2 = c^2$$

■

7.2.6 image

<https://stackoverflow.com/questions/25166624/insert-picture-table-in-r-markdown>

7.2.6.1 DiagrammeR / mermaid flowchart

Error: Functions that produce HTML output found in document targeting latex output. Please change the output type of this document to HTML.
 If your aiming to have some HTML widgets shown in non-HTML format as a screenshot, please install webshot or webshot2 R package for knitr to do the screenshot.
 Alternatively, you can allow HTML output in non-HTML formats by adding this option to the YAML front-matter of your rmarkdown file:

```
always_allow_html: true
```

Note however that the HTML output will not be visible in non-HTML formats.

<https://bookdown.org/yihui/rmarkdown-cookbook/diagrams.html#diagrams>

<https://stackoverflow.com/questions/40803017/how-to-include-diagrammer-mermaid-flowchart-in-a-rmarkdown-file>

```
{r}
library(DiagrammeR)
mermaid("
graph LR
  A-->B
",
width = 100
)
```

<https://github.com/rich-iannone/DiagrammeR/issues/364>

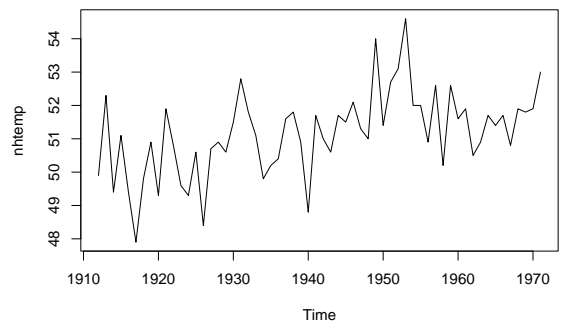
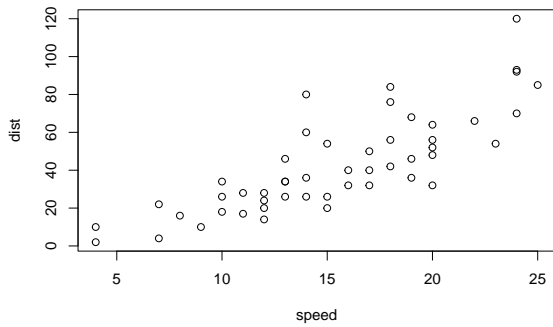
<https://stackoverflow.com/questions/55994210/how-to-solve-diagrammer-waste-of-space-issue-in-rmarkdown>

7.2.6.2 multiple images / figures in the same line

<https://cosname.github.io/rmarkdown-guide/rmarkdown-base.html#element-figure>

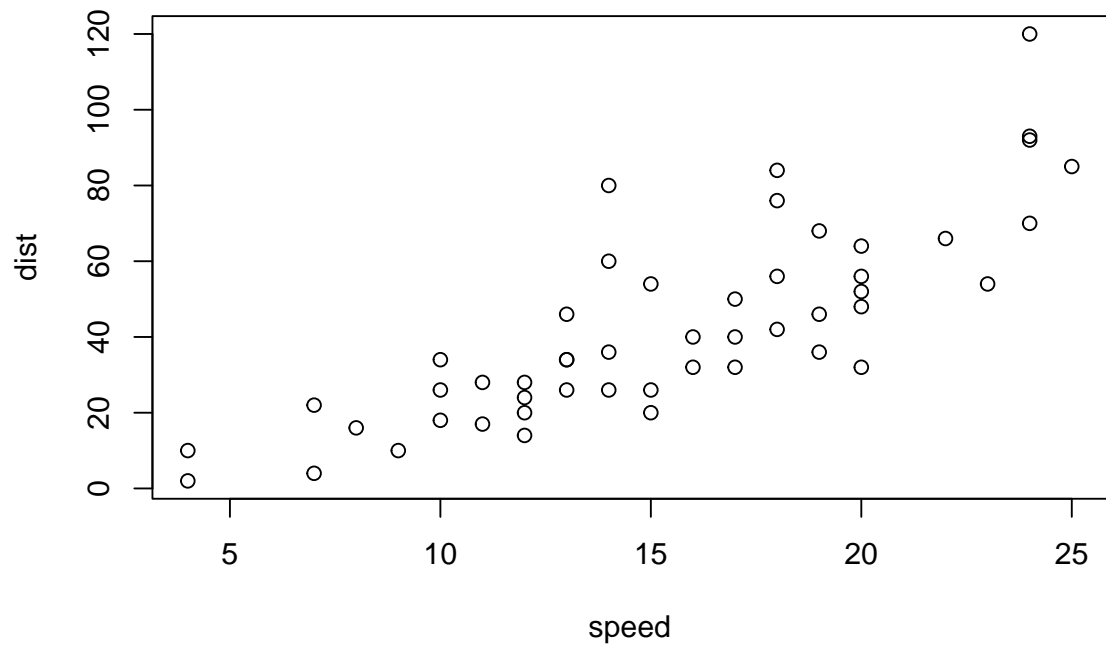
```
{r, fig.show = "hold", out.width = "50%"}
plot(cars)
plot(nhtemp)

plot(cars)
plot(nhtemp)
```

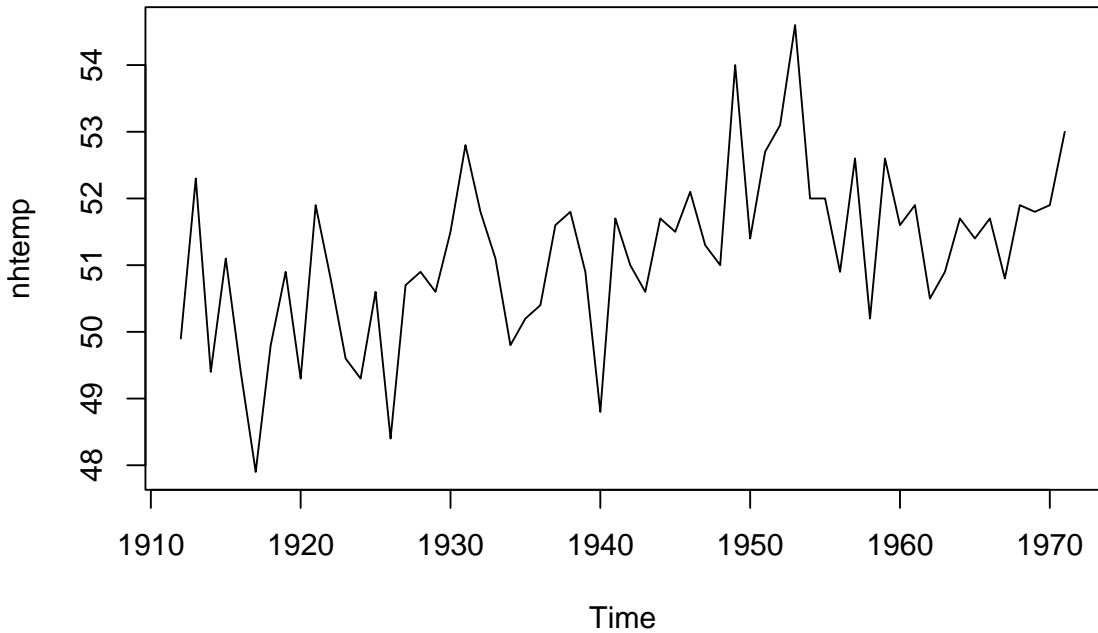


cf.

```
{r}
plot(cars)
plot(nhtemp)
plot(cars)
```



```
plot(nhtemp)
```



7.2.6.3 figure size

https://sebastiansauer.github.io/figure_sizing_knitr/

YAML in index.Rmd

```
---
title: "My Document"
output: html_document:
fig_width: 6
fig_height: 4
---
```

first R-chunk in your RMD document

```
knitr::opts_chunk$set(fig.width=12, fig.height=8)
```

width, height and options

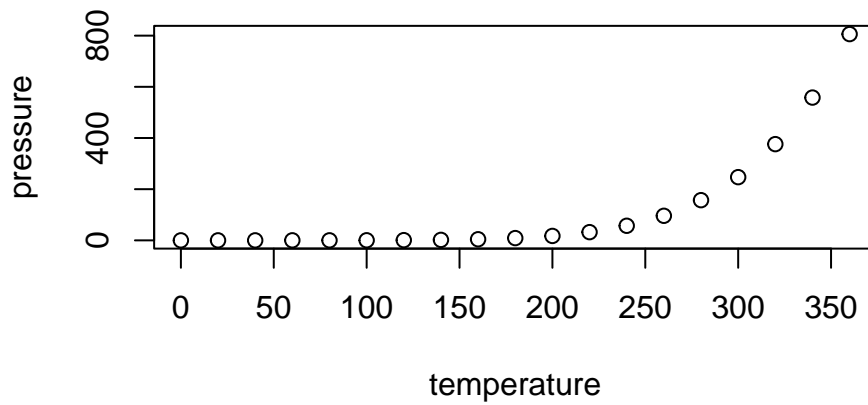
```
```${r fig.height = 3, fig.width = 5
```

```
plot(pressure)
```

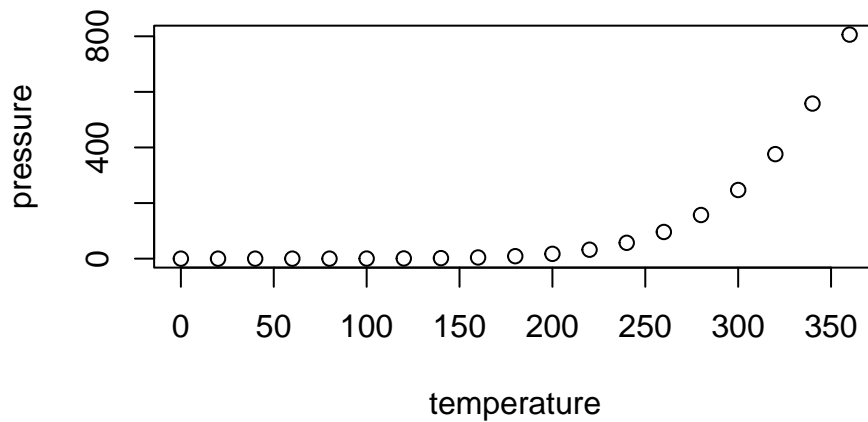
```
```
```

```
{r fig.height = 3, fig.width = 5
```

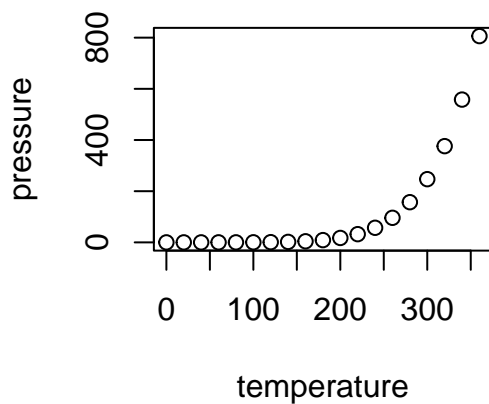
```
plot(pressure)
```

```
{r fig.height = 3, fig.width = 3, fig.align = "center"  
plot(pressure)
```



```
{r fig.width = 5, fig.asp = .62  
plot(pressure)
```

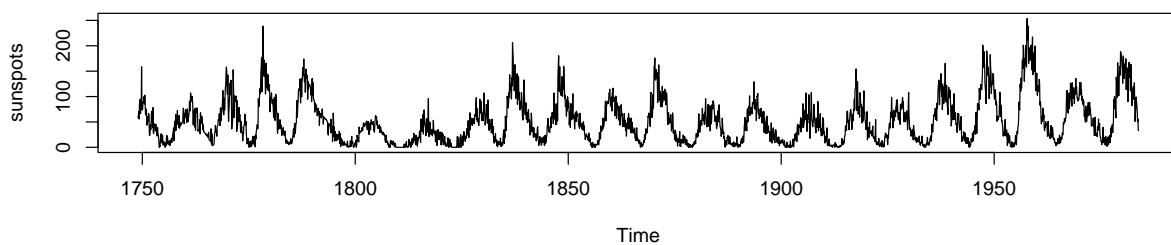


```
<center>
![] (https://bookdown.org/yihui/rmarkdown-cookbook/images/cover.png){width=20%}
</center>
```

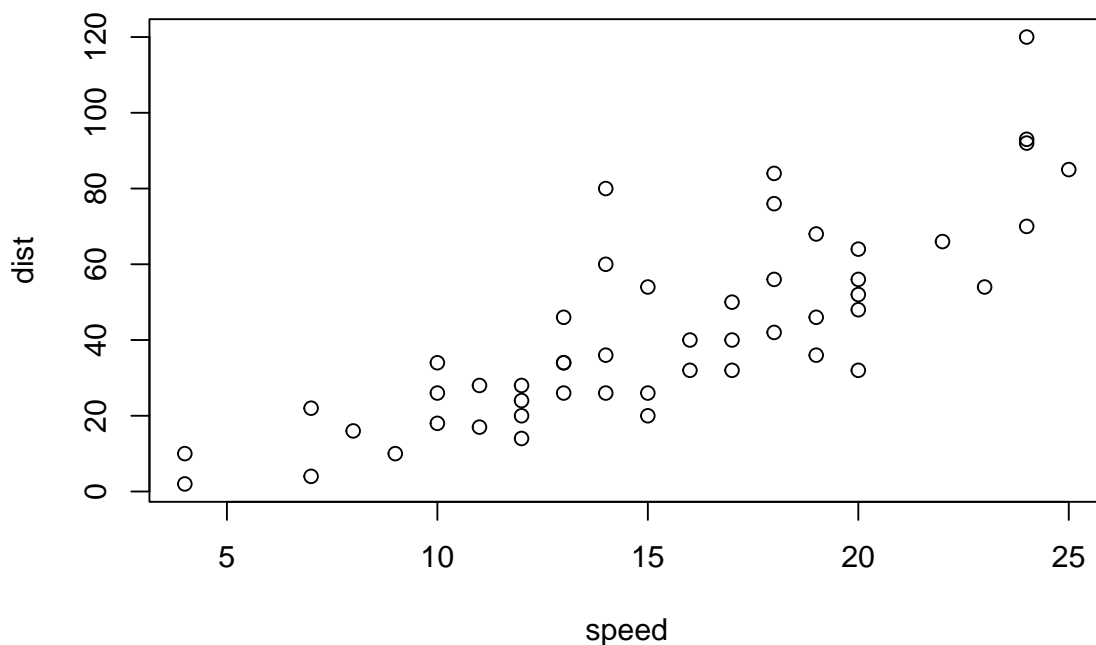
7.2.6.3.1 knitr <https://yihui.org/knitr/options/>

<https://bookdown.org/yihui/rmarkdown/tufte-figures.html>

```
par(mar = c(4, 4, .1, .2)); plot(sunspots)
```



```
plot(cars)
```



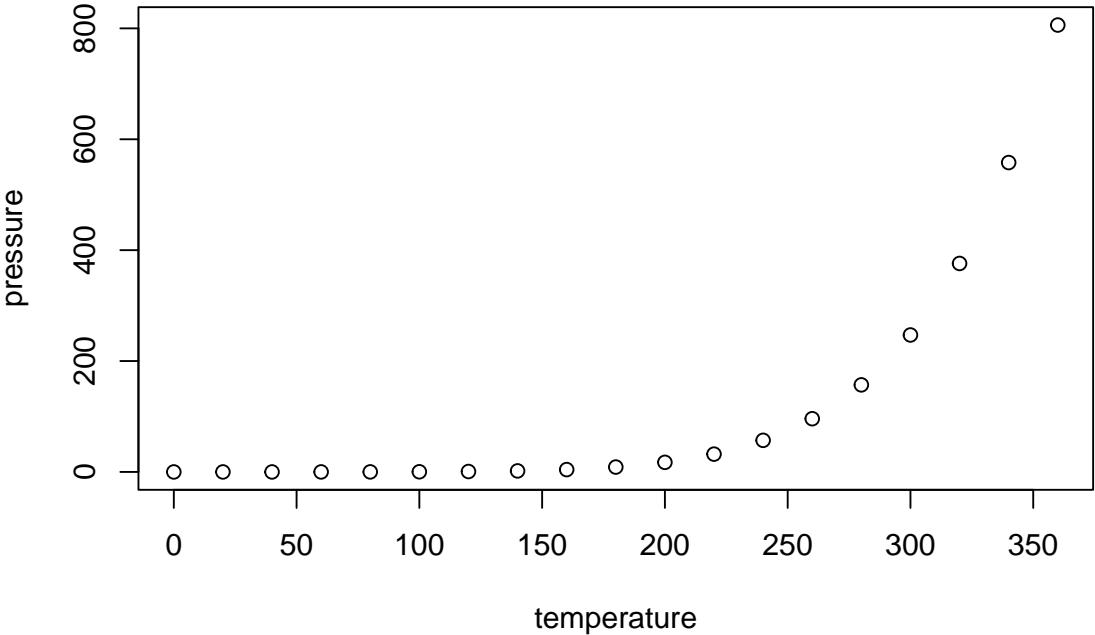
We know from `_the first fundamental theorem of calculus_` that
 for x in $[a, b]$:

$$\frac{d}{dx} \left(\int_a^x f(u) du \right) = f(x).$$

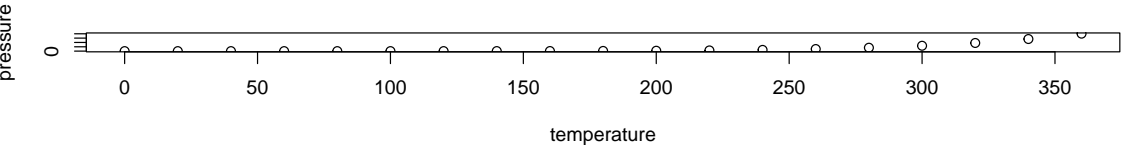
7.2.6.3.2 out.width vs. fig.width <https://stackoverflow.com/questions/29657777/how-to-make-fig-width-and-out-width-consistent-with-knitr>

when chunk option `cache=FALSE` is set, then `out.width` has no effect because no PDF output is created. Hence one has to specify exact measures in inches for `fig.width` and `fig.height` for each chunk

<https://stackoverflow.com/questions/59567235/a-ggmap-too-small-when-rendered-within-a-rmd-file>



```
plot(pressure)
```



problem: `out.width='100%'` causing LaTeX Error: Not in outer par mode.

solution: `out.width=if (knitr::is_html_output()) '100%'`

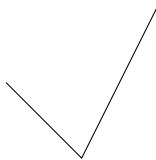
```
\begin{tikzpicture}
  \draw (-1,1)--(0,0)--(1,2);
\end{tikzpicture}
```

`fig.width=10, fig.height=2`

```
\begin{tikzpicture}
  \draw (-1,1)--(0,0)--(1,2);
\end{tikzpicture}
```

`out.width=if (knitr::is_html_output()) '100%'`

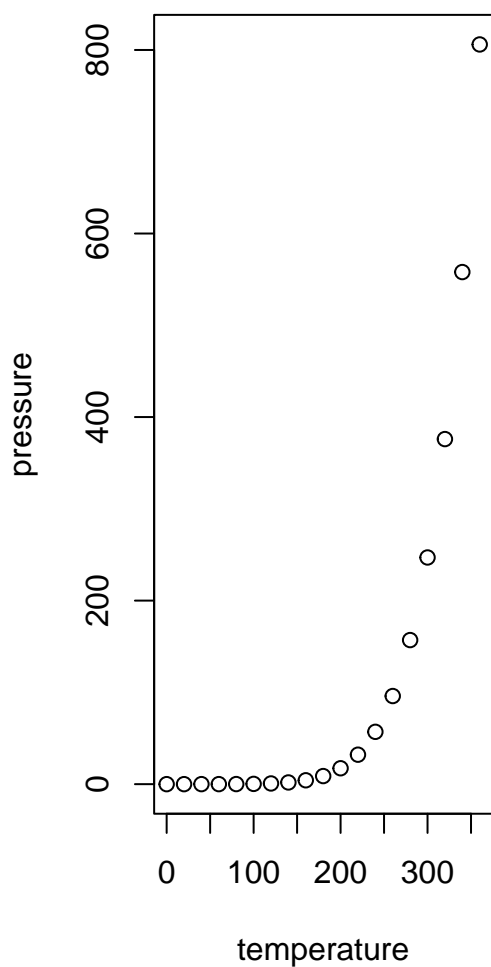
```
\begin{tikzpicture}  
  \draw (-1,1)--(0,0)--(1,2);  
\end{tikzpicture}
```



7.2.6.4 dynamic knitr plot width and height

<https://stackoverflow.com/questions/15365829/dynamic-height-and-width-for-knitr-plots>

```
plot(pressure)
```



7.2.6.5 web image in PDF

<https://stackoverflow.com/questions/46331896/how-can-i-insert-an-image-from-internet-to-the-pdf-file-produced-by-r-bookdown-i>

```
cover_url = 'https://bookdown.org/yihui/bookdown/images/cover.jpg'
if (!file.exists(cover_file <- xfun::url_filename(cover_url)))
  xfun::download_file(cover_url)
knitr::include_graphics(if (knitr::pandoc_to('html')) cover_url else cover_file)
```

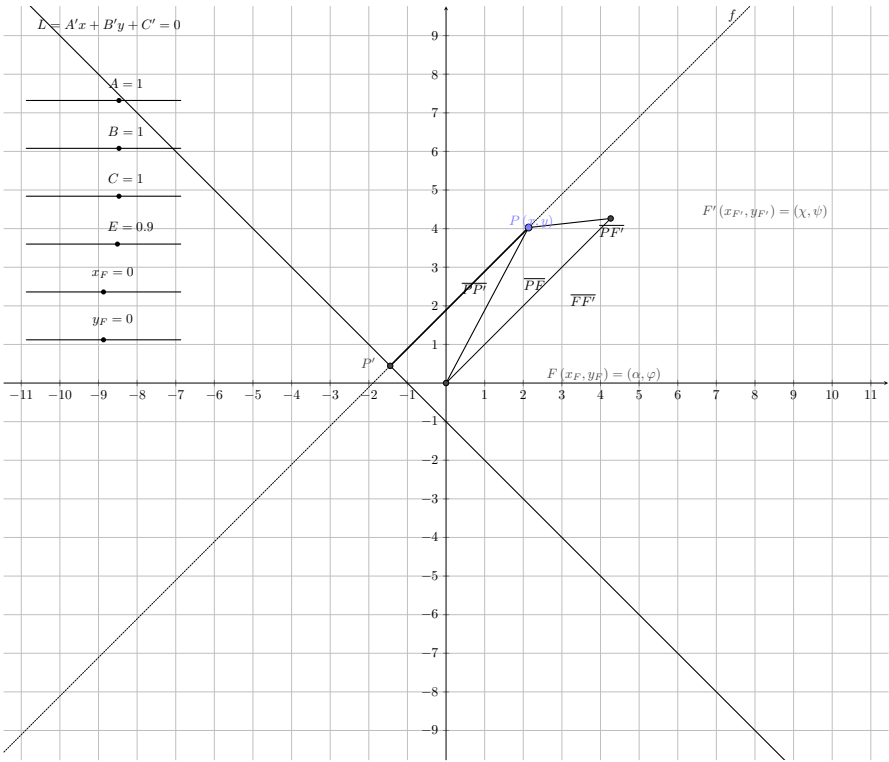
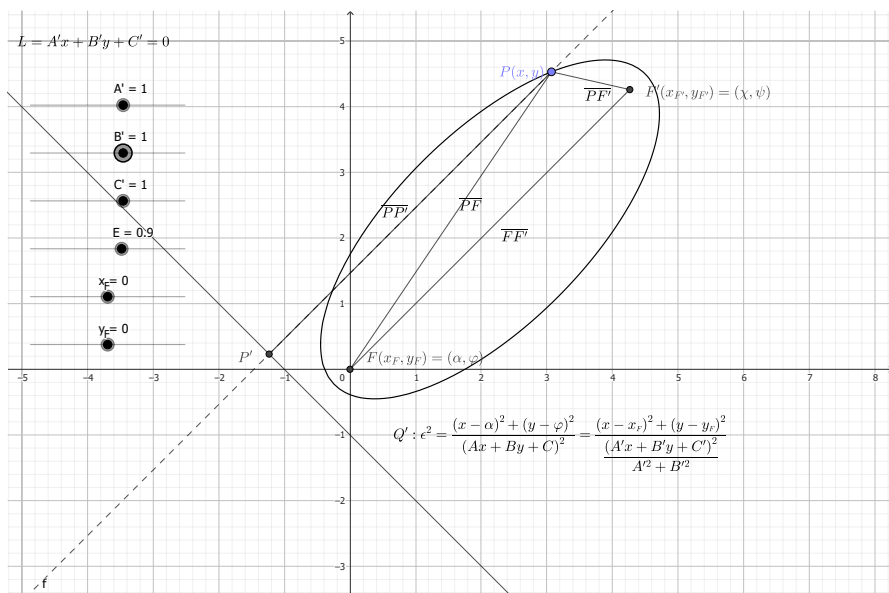


Figure 7.1: conic sections

7.2.6.6 SVG

<https://stackoverflow.com/questions/50165404/how-to-make-a-pdf-using-bookdown-including-svg-images>



<https://stackoverflow.com/questions/34064292/is-it-possible-to-include-svg-image-in-pdf-document-rendered-by-rmarkdown>

7.2.7 horizontal rule

horizontal rule (or slide break)

```
dim(iris)
```

```
## [1] 150    5
```

7.2.8 footnote

7.2.9 hyperlink

PDF pandoc internal link will lose focus

equivalence relation [??] equivalence relation¹ equivalence relation[??]

equivalence class [??] equivalence class² equivalence class[??]

partition [??] partition³ partition[??]

- LaTeX
 - TikZ[??]
 - * TikZ-3Dplot
 - * PGFplots
 - xypic = xy-pic⁴
- OverLeaf
- MathCha
- GeoGebra
- Python
 - Matplotlib
 - Seaborn
 - Plotly

7.2.10 code chunk

7.2.10.1 code folding

<https://cosname.github.io/rmarkdown-guide/rmarkdown-document.html#html-code-folding>

7.2.11 xaringan

slide realtime preview with RStudio addin Infinite Moon Reader in RStudio viewer

<https://github.com/yihui/xaringan>

<https://www.youtube.com/watch?v=3n9nASHg9gc>

¹{??} equivalence relation

²{??} equivalence class

³{??} partition

⁴{??} xy-pic

7.3 Bookdown

7.3.1 system locale

<https://bookdown.org/tpemartin/ntpu-programming-for-data-science/appendix-d-.html>

`Sys.getlocale()`

Windows

`Sys.setlocale(category = "LC_ALL", locale = "UTF-8")`

MacOS

`Sys.setlocale(category = "LC_ALL", locale = "en_US.UTF-8")`

<https://bookdown.org/yihui/rmarkdown-cookbook/multi-column.html>

7.3.2 render_book()

<https://bookdown.org/yihui/bookdown/build-the-book.html>

```
render_book(input = ".", output_format = NULL, ..., clean = TRUE,
  envir = parent.frame(), clean_envir = !interactive(),
  output_dir = NULL, new_session = NA, preview = FALSE,
  config_file = "_bookdown.yml")
```

7.3.3 serve_book()

<https://bookdown.org/yihui/bookdown/serve-the-book.html>

```
serve_book(dir = ".", output_dir = "_book", preview = TRUE,
  in_session = TRUE, quiet = FALSE, ...)
```

7.3.4 LaTeX

7.3.4.1 hyperlink, URL, href

<https://www.baeldung.com/cs/latex-hyperref-url-hyperlinks>

<https://www.omdte.com/> -facebook -line /

7.3.4.2 ugly mathptmx \sum

PDF LaTeX `\usepackage{fdsymbol}` to have `\overrightarrow` vector; however, there are too many side effects, including ugly mathptmx \sum , ...

```
\usepackage{fdsymbol} % vector over accent, but will use mathptmx
% replace the rather ugly mathptmx \sum operator with the equivalent Computer Modern one
\let\sum\relax
\DeclareSymbolFont{CMLargesymbols}{OMX}{cmex}{m}{n}
\DeclareMathSymbol{\sum}{\mathop}{CMLargesymbols}{"50}
```

<https://tex.stackexchange.com/questions/315102/different-sum-signs>

<https://tex.stackexchange.com/questions/275038/how-to-replace-mathptmx-sum-with-cm-sum>

<https://tex.stackexchange.com/questions/391410/calligraphic-symbols-are-too-fancy-with-mathptmx-package>

<https://blog.csdn.net/kongtaoxing/article/details/131005044>

In `preamble.tex`, add

```
% replace the rather ugly mathptmx \sum operator with the equivalent Computer Modern one
\let\sum\relax
\DeclareSymbolFont{CMLargesymbols}{OMX}{cmex}{m}{n}
\DeclareMathSymbol{\sum}{\mathop}{CMLargesymbols}{"50}

\DeclareMathAlphabet{\mathcal}{OMS}{cmsy}{m}{n}
\DeclareSymbolFont{largesymbols}{OMX}{cmex}{m}{n}
```

7.3.4.3 LaTeX package in HTML document

<https://github.com/rstudio/rmarkdown/issues/1829>

```
---
title: "assignment"
author: "author"
output: html_document
---
```

```
$$
  \require{cancel}
  \cancel{x}
$$
```

\not{x}

<https://stackoverflow.com/questions/18189175/how-to-use-textup-with-mathjax>

`\textup` is not available in MathJax. You can replace it with `\mathrm`, but `\mathrm` does not interpret spaces.

7.3.5 depth of table of contents `toc_depth`

<https://stackoverflow.com/questions/49009212/how-to-change-toc-depth-in-r-bookdown-gitbook>

```
bookdown::gitbook:
  toc_depth: 2
```

<https://stackoverflow.com/questions/68537309/how-can-i-specific-the-initial-level-to-have-my-table-of-contents-be-expanded-to>

```
toc:
  collapse: section
```

7.3.6 multi-column layout / two columns

<https://bookdown.org/yihui/rmarkdown-cookbook/multi-column.html>

7.3.6.1 for both HTML and PDF

figure size^[??]

Below is a Div containing three child Divs side by side. The Div in the middle is empty, just to add more space between the left and right Divs.

```
..... { .cols data-latex="" }

::: { .col data-latex="{0.55\textwidth}" }
![] (202401280001-test_files/figure-latex/unnamed-chunk-32-1.pdf)<!-- -->
:::

::: { .col data-latex="{0.05\textwidth}" }
\
<!-- an empty Div (with a white space), serving as
a column separator -->
:::

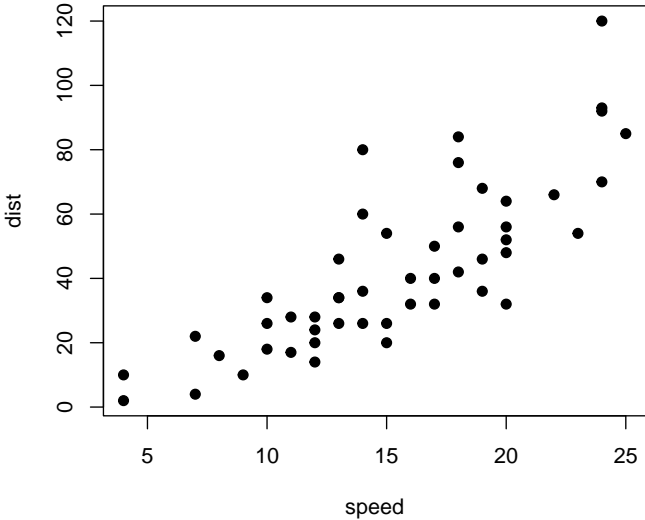
::: { .col data-latex="{0.4\textwidth}" }
The figure on the left-hand side shows the `cars` data.
```

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur.

:::

.....

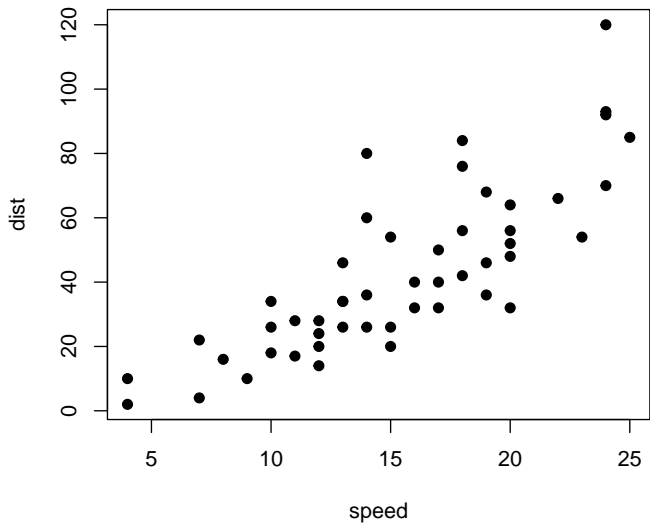
```
{r, echo=FALSE, fig.width=5, fig.height=4}
```



The figure on the left-hand side shows the cars data.

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur.

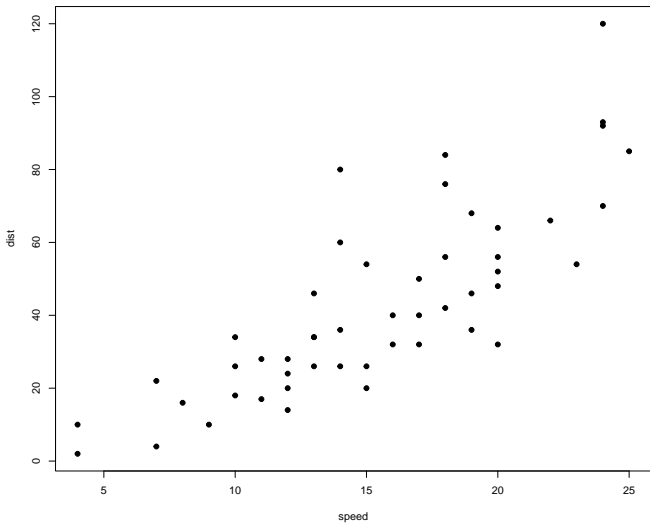
```
{r, echo=FALSE, fig.width=10, fig.height=8, out.width = "100%"}
```



The figure on the left-hand side shows the cars data.

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur.

```
{r, echo=FALSE, fig.width=10, fig.height=8}
```



The figure on the left-hand side shows the cars data.

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur.

7.3.6.2 multi-column fig.cap must use fig.pos="H"

<https://community.rstudio.com/t/adding-fig-cap-caption-text-to-code-chunk-causes-figure-to-print-at-top-of-page-instead-of-where-it-should-be/30297>

<https://bookdown.org/yihui/rmarkdown-cookbook/figure-placement.html>

to avoid LaTeX Error: Not in outer par mode for caption in multi-column LaTeX PDF

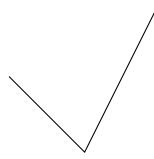
in output.yml add extra_dependencies: ["float"] under bookdown::pdf_book:

include first chunk knitr::opts_chunk\$set(fig.pos = "H", out.extra = "") in .Rmd

add out.width=if (knitr:::is_html_output()) '50%' for TikZ chunk

thus complete chunk beginning with {r, echo=FALSE, cache=TRUE, engine='tikz', fig.ext=if (knitr:::is_latex_output()) 'pdf' else 'png', fig.width=10, fig.height=2, out.width=if (knitr:::is_html_output()) '100%', fig.cap=''}

```
\begin{tikzpicture}
  \draw (-1,1)--(0,0)--(1,2);
\end{tikzpicture}
```



LaTeX package `caption`

<https://tex.stackexchange.com/questions/128485/how-to-make-a-caption-via-captionof-and-extra-margins-adhere-to-minipage-marg>

What is the different between using `\captionof{table}{ABC}` and `\caption{ABC}`?

<https://tex.stackexchange.com/questions/514286/what-is-the-different-between-using-captionof-table-abc-and-captionabc>

side-by-side table

<https://stackoverflow.com/questions/73745714/how-to-print-gt-tbl-tables-side-by-side-with-knitr-kable>

R ternary operator

<https://stackoverflow.com/questions/8790143/does-the-ternary-operator-exist-in-r>

7.3.6.3 caption above figure

<https://stackoverflow.com/questions/56979022/caption-above-figure-in-html-rmarkdown>

```
fig.topcaption=TRUE
```

7.3.6.4 for only HTML

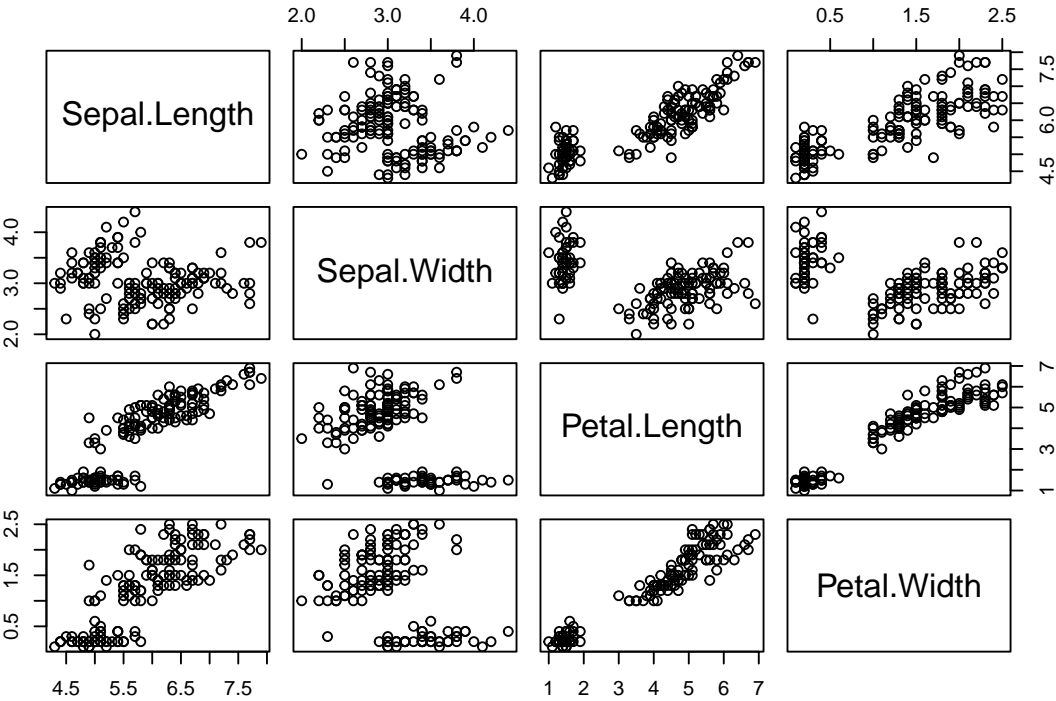
7.3.6.4.1 CSS flex Here is the **first** Div.

```
str(iris)
```

```
## 'data.frame':   150 obs. of  5 variables:
## $ Sepal.Length: num  5.1 4.9 4.7 4.6 5 5.4 4.6 5 4.4 4.9 ...
## $ Sepal.Width : num  3.5 3 3.2 3.1 3.6 3.9 3.4 3.4 2.9 3.1 ...
## $ Petal.Length: num  1.4 1.4 1.3 1.5 1.4 1.7 1.4 1.5 1.4 1.5 ...
## $ Petal.Width : num  0.2 0.2 0.2 0.2 0.2 0.4 0.3 0.2 0.2 0.1 ...
## $ Species : Factor w/ 3 levels "setosa","versicolor",...: 1 1 1 1 1 1 1 1 1 1 ...
```

And this block will be put on the right:

```
plot(iris[, -5])
```



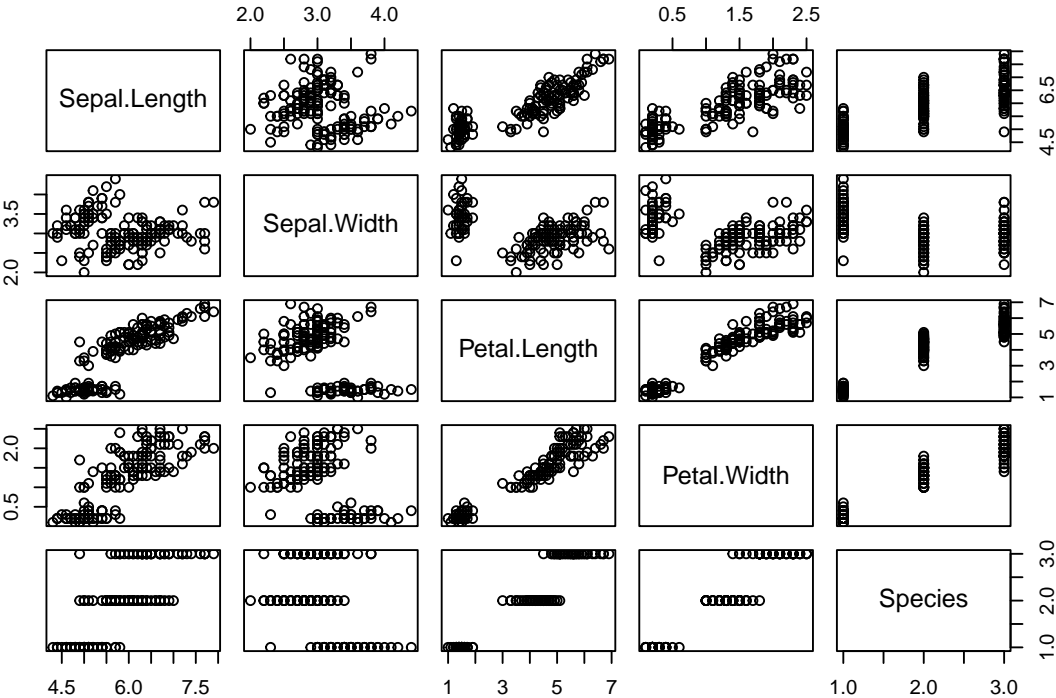
7.3.6.4.2 CSS grid <https://github.com/yihui/knitr/issues/1743>

[https://medium.com/enjoy-life-enjoy-coding/css-](https://medium.com/enjoy-life-enjoy-coding/css-grid) -grid- -cd763091cf70

```
head(iris)
```

##	Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
## 1	5.1	3.5	1.4	0.2	setosa
## 2	4.9	3.0	1.4	0.2	setosa
## 3	4.7	3.2	1.3	0.2	setosa
## 4	4.6	3.1	1.5	0.2	setosa
## 5	5.0	3.6	1.4	0.2	setosa
## 6	5.4	3.9	1.7	0.4	setosa

```
plot(iris)
```



7.4 conditional block/chunk for either HTML or PDF, and Chinese issue

<https://stackoverflow.com/questions/76240244/bookdown-conditional-display-of-text-and-code-blocks-latex-pdf-vs-html>

equivalence relation

R is an equivalence relation over $A \times B$

$$\Leftrightarrow \begin{cases} R = \sim = \{ \langle x, y \rangle | x \sim y \} \subseteq A \times B & \text{(e) equivalence} \\ \vdots & \vdots \end{cases}$$

$$\Leftrightarrow \begin{cases} R = \{ \langle x, y \rangle | xRy \} \subseteq A \times B \\ \forall \langle x, y \rangle \in R (xRx) \\ \forall \langle x, y \rangle \in R (xRy \Rightarrow yRx) \\ \forall \langle x, y \rangle, \langle y, z \rangle \in R \left(\begin{cases} xRy \\ yRz \end{cases} \Rightarrow xRz \right) \end{cases}$$

(R) relation

(r) reflexive

(s) symmetric

(t) transitive

$$\Leftrightarrow \begin{cases} R = \{ \langle x, y \rangle | xRy \} \subseteq A \times B \\ \forall \langle x, y \rangle \in R (\langle x, x \rangle \in R) \\ \forall \langle x, y \rangle \in R (\langle y, x \rangle \in R) \\ \forall \langle x, y \rangle, \langle y, z \rangle \in R (\langle x, z \rangle \in R) \end{cases}$$

7.5 video embedding

<https://stackoverflow.com/questions/42543206/r-markdown-compile-error>

always_allow_html: true

```
install.packages("webshot")
webshot::install_phantomjs()
```

however webshot not work

Error: cannot find bilibili.com

<https://cran.r-project.org/web/packages/vembedr/vignettes/embed.html>

```
## embed_youtube("qeMqtt7NFDM")
```

7.5.1 timestamp

- YouTube: <https://www.youtube.com/embed/%7BvideoID%7D?start=%7Bsecond%7D>
- BiliBili: <https://player.bilibili.com/player.html?bvid=%7BvideoID%7D&autoplay=0&t=%7Bsecond%7D>

7.6 equation term coloring

7.6.1 font color

RegEx replacement in RStudio for `{\\color{\\w+}}` in LyX to be replaced with `\\color{$1}{` in HTML document, and remain the same for PDF document

In HTML document, if no `{}` for text range, only the first following term will take effect

```
\\color{orange}x=y
```

$x = y$

`\\color{orange}` and `\\color{cyan}` are better color for HTML GitBook White and Night themes and PDF

```
\\color{cyan}{x=y}
```

$x = y$

```
\\color{cyan}{x=y}
```

$x = y$

```
::: {show-in="html"}
```

```
$$
\dfrac{\colorbox{#FFD1DC}{\epsilon^2}\left(y_{\scriptscriptstyle
\hookrightarrow F}-y_{\scriptscriptstyle L}\right)^2}{1-\epsilon^2}
$$
```

```
:::
```

```
::: {show-in="pdf"}
```



```

$$
\frac{\colorbox{red!50}{\text{\ensuremath{\epsilon^2}\left(y_{\scriptscriptstyle
\hookrightarrow F})-y_{\scriptscriptstyle L}\right)^2}}}{1-\epsilon^2}
$$

:::

```

7.6.2 background color

<https://bookdown.org/yihui/rmarkdown-cookbook/font-color.html>

LaTeX color

<https://latexcolor.com/>

https://www.overleaf.com/learn/latex/Using_colors_in_LaTeX

<https://latex-tutorial.com/color-latex/#:~:text=To%20summarize%2C%20pyellow!50efined%20colors%20in>

LaTeX color methods

color frame

<https://tex.stackexchange.com/questions/582748/highlight-equation-with-boxes-and-arrows>

color box

<https://tex.stackexchange.com/questions/567739/how-to-move-and-size-colorbox>

color box with round corners

<https://tex.stackexchange.com/questions/568880/color-box-with-rounded-corners>

highlighting

<https://tex.stackexchange.com/questions/318991/highlighting-math>

<https://forum.remnote.io/t/highlighting-latex-formulas/149>

LyX

<https://tex.stackexchange.com/questions/250069/create-a-color-box> <https://latexlyx.blogspot.com/2013/12/lyx.html>

<https://tex.stackexchange.com/questions/635486/prevent-lyx-from-escaping-math-in-color-box-title>

Bookdown - conditional display of text and code blocks (LaTeX/PDF vs. HTML) <https://stackoverflow.com/questions/76240244/bookdown-conditional-display-of-text-and-code-blocks-latex-pdf-vs-html>

$$F = ma$$

<https://community.rstudio.com/t/highlighting-text-inline-in-rmarkdown-or-bookdown-pdf/35118/4>

$$F = ma$$

$$F = F$$

$$F = ma \tag{7.1}$$

$$F = ma$$

$$Y = \beta_0 + \beta_1 X_1 + \dots + \beta_n X_n$$

7.7 link and reference

<https://stackoverflow.com/questions/57469501/cross-referencing-bookdownhtml-document2-not-working>

$$E = mc^2 \tag{7.2}$$

`\@ref(nice-label) ??`

`[link to partition] [partition] link to partition`

`[partition] \@ref(partition)`

`partition [#partition] (??) \@ref(#partition)`

`[equivalence class] \@ref(equivalence-class)`

`equivalence class (??)`

`equivalence class [#equivalence class] (@ref(equivalence class)) @ref(#equivalence class)`

`[equivalence-class] [#equivalence-class] (??) @ref(#equivalence-class)`

`X [equivalence-class.html] [equivalence-class.html#equivalence-class] (@ref(equivalence-class.html))`

`@ref(equivalence-class.html#equivalence-class)`

`equivalence relation [#equivalence relation] (@ref(equivalence relation)) @ref(#equivalence relation)`

`[equivalence-relation] [#equivalence-relation] (??) @ref(#equivalence-relation)`

`X [equivalence-relation.html] [equivalence-relation.html#equivalence-relation] (@ref(equivalence-relation.html))`

`@ref(equivalence-relation.html#equivalence-relation)`

7.8 number and reference equations

<https://stackoverflow.com/questions/71595882/rstudio-error-in-windows-running-pdflatex-exe-on-file-name-tex-exit-code-10>

<https://bookdown.org/yihui/rmarkdown/bookdown-markdown.html#equations>

`\#eq:emc \@ref(eq:emc)`

<https://stackoverflow.com/questions/55923290/consistent-math-equation-numbering-in-bookdown-across-pdf-docx-html-output>

$$C \text{ is an equivalence class of } a \text{ on } A$$
$$\Leftrightarrow [a]_{\sim} = C = \left\{ x \left| \begin{array}{l} a \in A \\ x \in A \\ x \sim a \\ \sim \text{ is an equivalence relation over } A \times A = A^2 \end{array} \right. \right\} \subseteq A \neq \emptyset$$
$$\Leftrightarrow [a] = [a]_{\sim} = \left\{ x \left| \begin{array}{l} a \in A \\ x \in A \\ x \sim a \\ \sim \text{ is an equivalence relation on } A \end{array} \right. \right\} \subseteq A \neq \emptyset$$
$$\Rightarrow [a]_{\sim} = \{x|x \sim a\} \subseteq A \neq \emptyset$$

(7.3)

<https://bookdown.org/yihui/rmarkdown/bookdown-markdown.html#cross-referencing>

This cross reference is the Fig. ??

<https://stackoverflow.com/questions/51595939/bookdown-cross-reference-figure-in-another-file>

I ran into the same issue and came up with this solution if you aim at compiling 2 different pdfs. It relies on LaTeX’s xr package for cross references: <https://stackoverflow.com/a/52532269/576684>

7.9 footnote

```
noun^[This is a footnote]

noun[^202401260000-test-cross-link-1]

[^202401260000-test-cross-link-1]: This is a footnote.
```

noun⁵

7.10 citation

<https://stackoverflow.com/questions/48965247/use-csl-file-for-pdf-output-in-bookdown/49145699#49145699>

citation 1³ citation 2³

citation 3⁴ citation 4⁴

7.10.1 citation in fig.cap

<https://tex.stackexchange.com/questions/591882/citation-within-a-latex-figure-caption-in-rmarkdown>

```
(ref:rudolph) *nice* cite: [Lam94].

(ref:campbell1963) *nice* cite: [Campbell1963].
```

⁵This is a footnote.

```
(ref:campbell1963) ([@campbell1963]
(ref:campbell1963) \ [@campbell1963]
```

Sources of Invalidity											
Internal									External		
	History	Maturation	Testing	Instrumentation	Regression	Selection	Mortality	Interaction of Selection and Maturation, etc.	Interaction of Testing and X	Interaction of Selection and X	Reactive Arrangements
<i>Pre-Experimental Designs:</i>											
1. One-Shot Case Study X O	-	-				-	-			-	
2. One-Group Pretest-Posttest Design O X O	-	-	-	-	?	+	+	-	-	-	?
3. Static-Group Comparison X O ----- O	+	?	+	+	+	-	-	-		-	
<i>True Experimental Designs:</i>											
4. Pretest-Posttest Control Group Design R O X O R O O	+	+	+	+	+	+	+	+	-	?	?
5. Solomon Four-Group Design R O X O R O O R X O R O	+	+	+	+	+	+	+	+	+	?	?
6. Posttest-Only Control Group Design R X O R O	+	+	+	+	+	+	+	+	+	?	?

Figure 7.3: pre- and true experimental designs (⁵ p.8)

7.10.2 backreference

<https://community.rstudio.com/t/how-to-create-a-backreference-to-place-of-citation-in-rmarkdown/84866>

<https://blog.csdn.net/RobertChenGuangzhi/article/details/50455429>

<https://latex.org/forum/viewtopic.php?t=3722>

7.11 environment for definition, theorem, proof

<https://bookdown.org/yihui/rmarkdown/bookdown-markdown.html>

<https://github.com/rstudio/rstudio/issues/5264>

@howthebodyworks Ideally, previews of such equations should also work inside a theorem, although I could survive without that.

<https://github.com/rstudio/rstudio/issues/8773>

Theorem 7.1 (Theorem Name). *Here is my theorem.*

Proof Name. Here is my proof. □

Theorem 7.2 (Pythagorean theorem). *For a right triangle, if c denotes the length of the hypotenuse and a and b denote the lengths of the other two sides, we have*

$a^2 + b^2 \stackrel{??}{=} c^2$

Definition 7.1 (Definition Name). Here is my definition.

number and reference equations

(??)

(??)

??

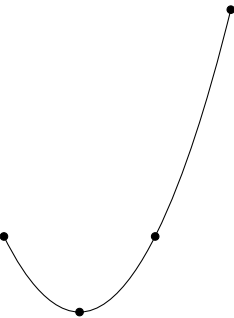


Figure 7.4: parabola arc with points

7.12 slide or presentation

7.12.1 Xaringan and Infinite Moon Reader

- <https://rpubs.com/RW1304/xaringan-zh>
- <https://slides.yihui.org/xaringan/#1>
- <https://slides.yihui.org/xaringan/zh-CN.html#1>
- <https://github.com/yihui/xaringan/tree/master>
- <https://bookdown.org/yihui/rmarkdown/xaringan.html>

7.12.2 ioslides

- <https://www.youtube.com/watch?v=gkyjTcpCITM>
- <https://bookdown.org/yihui/rmarkdown/ioslides-presentation.html>
- <https://stackoverflow.com/questions/63749683/how-to-set-up-theorem-environment-in-the-rmarkdown-presentation>

```
---
title: "Theorem demo"
output:
  ioslides_presentation:
    css: style.css
---
```

```

/* theorem environment _ plain */

/*
.theorem {
  display: block;
  font-style: italic;
  font-size: 24px;
  font-family: "Times New Roman";
  color: black;
}
.theorem::before {
  content: "Theorem. ";
  font-weight: bold;
  font-style: normal;
}
.theorem[text]::before {
  content: "Theorem (" attr(text) ") ";
}
.theorem p {
  display: inline;
}
*/

/* theorem environment _ Copenhagen style */

/*
.theorem {
  display: block;
  font-style: italic;
  font-size: 24px;
  font-family: "Times New Roman";
  color: black;
  border-radius: 10px;
  background-color: rgb(222,222,231);
  box-shadow: 5px 10px 8px #888888;
}
.theorem::before {
  content: "Theorem. ";
  font-weight: bold;
  font-style: normal;
  display: inline-block;
  width: -webkit-fill-available;
  color: white;
  border-radius: 10px 10px 0 0;
  padding: 10px 5px 5px 15px;
  background-color: rgb(38, 38, 134);
}
.theorem p {
  padding: 15px 15px 15px 15px;
}

```



7.12.3 PowerPoint

<https://bookdown.org/yihui/rmarkdown/powerpoint-presentation.html>

Chapter 8

test2

8.1 verbatim

<https://community.rstudio.com/t/continued-issues-with-new-verbatim-in-rstudio/139737>

<https://bookdown.org/yihui/rmarkdown-cookbook/verbatim-code-chunks.html>

```
```r
1 + 1
```

```
[1] 2
```
```

We can output arbitrary content **verbatim**.

```
```r
1 + 1
```

```
[1] 2
```
```

The content can contain inline code like
78.5398163, too.

Chapter 9

partition

$$\{A_i\}_{i \in I} = \{A_i | i \in I\} \text{ is a partition of a set } A$$
$$\Leftrightarrow \begin{cases} \forall i \in I (A_i \neq \emptyset) \\ A = \bigcup_{i \in I} A_i \\ \forall i, j \in I (i \neq j \Rightarrow A_i \cap A_j = \emptyset) \end{cases}$$

https://proofwiki.org/wiki/Definition:Set_Partition

Chapter 10

equivalence class

C is an equivalence class of a on A

$$\Leftrightarrow [a]_{\sim} = C = \left\{ x \mid \begin{cases} a \in A \\ x \in A \\ x \sim a \\ \sim \text{ is an equivalence relation over } A \times A = A^2 \end{cases} \right\} \subseteq A \neq \emptyset$$

$$\Leftrightarrow [a] = [a]_{\sim} = \left\{ x \mid \begin{cases} a \in A \\ x \in A \\ x \sim a \\ \sim \text{ is an equivalence relation on } A \end{cases} \right\} \subseteq A \neq \emptyset$$

$$\Rightarrow [a]_{\sim} = \{x \mid x \sim a\} \subseteq A \neq \emptyset$$

where the definition of **equivalence relation** can be found in ??.

Chapter 11

equivalence relation

equivalence relation

R is an equivalence relation over $A \times B$

$$\Leftrightarrow \begin{cases} R = \sim = \{\langle x, y \rangle | x \sim y\} \subseteq A \times B & \text{(e) equivalence} \\ \vdots & \vdots \end{cases}$$

$$\Leftrightarrow \begin{cases} R = \{\langle x, y \rangle | xRy\} \subseteq A \times B & (R) \text{ relation} \\ \forall \langle x, y \rangle \in R (xRx) & (r) \text{ reflexive} \\ \forall \langle x, y \rangle \in R (xRy \Rightarrow yRx) & (s) \text{ symmetric} \\ \forall \langle x, y \rangle, \langle y, z \rangle \in R \left(\begin{cases} xRy \\ yRz \end{cases} \Rightarrow xRz \right) & (t) \text{ transitive} \end{cases} \Leftrightarrow \begin{cases} R = \{\langle x, y \rangle | xRy\} \subseteq A \times B \\ \forall \langle x, y \rangle \in R (\langle x, x \rangle \in R) \\ \forall \langle x, y \rangle \in R (\langle y, x \rangle \in R) \\ \forall \langle x, y \rangle, \langle y, z \rangle \in R (\langle x, z \rangle \in R) \end{cases}$$

Chapter 12

Python

12.1 using Python in R / RMarkdown

<https://bookdown.org/yihui/rmarkdown/language-engines.html>

```
names(knitr::knit_engines$get())
```

```
## [1] "awk"          "bash"         "coffee"      "gawk"         "groovy"
## [6] "haskell"     "lein"         "mysql"        "node"         "octave"
## [11] "perl"        "php"          "psql"         "Rscript"      "ruby"
## [16] "sas"         "scala"        "sed"          "sh"           "stata"
## [21] "zsh"         "asis"         "asy"          "block"        "block2"
## [26] "bslib"       "c"            "cat"          "cc"           "comment"
## [31] "css"         "ditaa"        "dot"          "embed"        "eviews"
## [36] "exec"        "fortran"      "fortran95"    "go"           "highlight"
## [41] "js"          "julia"        "python"       "R"            "Rcpp"
## [46] "sass"        "scss"         "sql"          "stan"         "targets"
## [51] "tikz"        "verbatim"     "theorem"      "lemma"        "corollary"
## [56] "proposition" "conjecture"   "definition"   "example"      "exercise"
## [61] "hypothesis"  "proof"        "remark"       "solution"
```

https://rstudio.github.io/reticulate/articles/python_packages.html

```
x = 'hello, python world!'
print(x.split(' '))
```

```
## ['hello,', 'python', 'world!']
```

```
library(reticulate)
virtualenv_python()
```

```
library(reticulate)
# conda_list()
```

```
library(reticulate)
virtualenv_list()
```

https://rstudio.github.io/reticulate/reference/install_python.html