

math

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index

math on bookdown started on 2024/01/28

script^{superscript}_{subscript}

Part I

ordered by discipline

math

Chapter 1

test cross-link

1.1 link and reference

2

link to partition

partition [#partition] (3) @ref(#partition)

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

[equivalence-class] [#equivalence-class] (2) @ref(#equivalence-class)

[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] (2) @ref(#equivalence-relation)

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

1.2 footnote

noun¹

1.3 citation

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

citation 1¹ citation 2¹

citation 3² citation 4²

¹This is a footnote.

1.4 bookdown environment for definition, theorem, proof

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

Theorem 1.1 (Theorem Name). *Here is my theorem.*

Proof Name. Here is my proof. □

Theorem 1.2 (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*

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

Definition 1.1 (Definition Name). Here is my definition.

Chapter 2

math

equivalence relation 2

equivalence class 2

partition 3

equivalence relation

等價關係 equivalence relation

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

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

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

equivalence class

C is an equivalence class of a on A

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

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

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

where [equivalence relation 2](#)

Chapter 3

physics

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 4

plot

TiKZ/PgfPlot

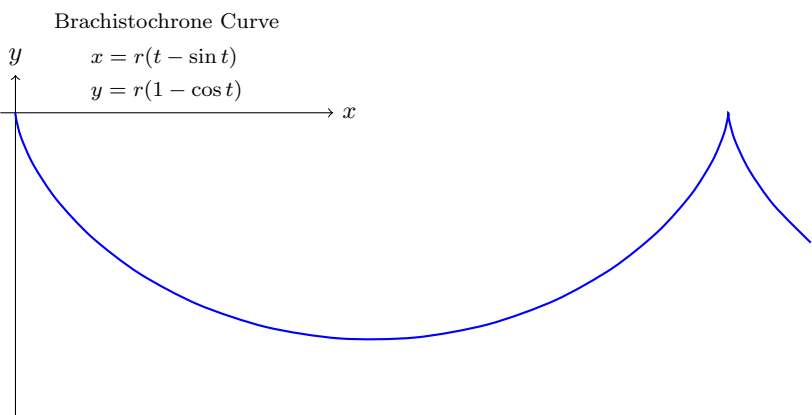


Figure 4.1: Brachistochrone Curve

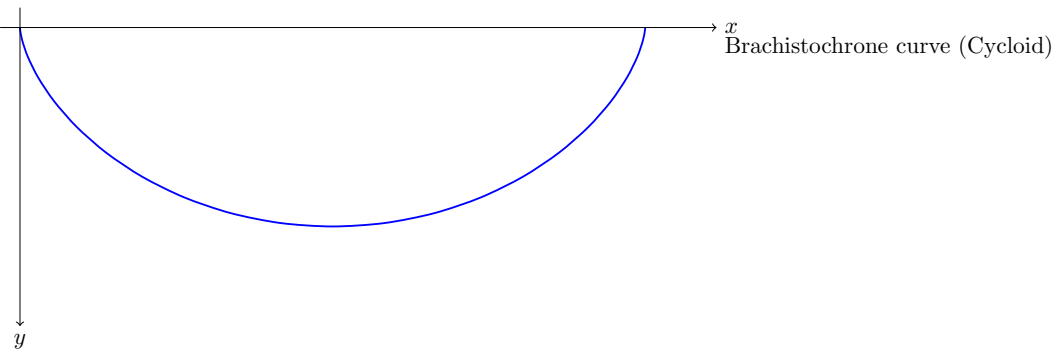


Figure 4.2: Brachistochrone Curve

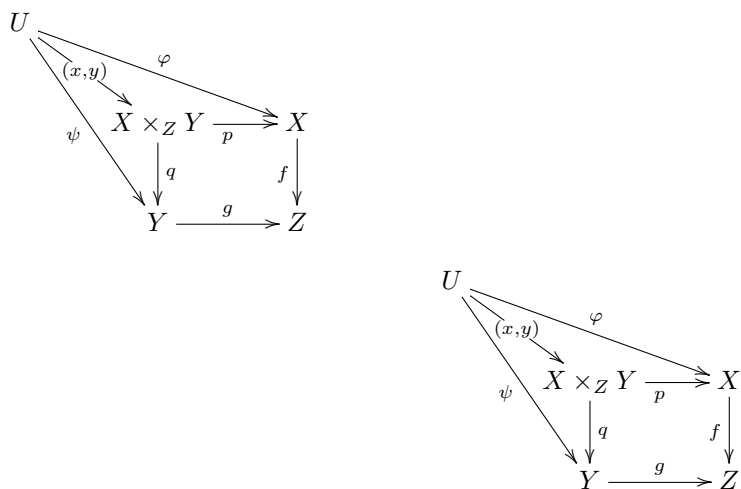
xy-pic

<https://bookdown.org/yihui/rmarkdown-cookbook/install-latex-pkgs.html>

```
tinytex::install_tinytex()
```

the following xymatrix from LaTeX package xy for xy-pic is not shown or rendered in HTML:

\LaTeX can only be used in HTML, not PDF



Part II

ordered by date

Chapter 5

ordered by date

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

202401281000

equivalence class

C is an equivalence class of a on A

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

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

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

where [equivalence relation 2](#)

equivalence relation

等價關係 equivalence relation

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

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

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

Chapter 6

Python

<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"    "glue"
## [66] "glue_sql"    "gluesql"
```

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

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

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

```
library(reticulate)
```

```
## Warning: package 'reticulate' was built under R version 4.2.3
```

```
virtualenv_python()
```

```
## [1] "D:/Users/115381/Documents/.virtualenvs/r-reticulate/Scripts/python.exe"
```

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

```
##               name               python
```

```
## 1          base                      D:\\Anaconda3\\python.exe
## 2      fiftyone                    D:\\Anaconda3\\envs\\fiftyone\\python.exe
## 3          keras                    D:\\Anaconda3\\envs\\keras\\python.exe
## 4      labelme                      D:\\Anaconda3\\envs\\labelme\\python.exe
## 5          manim                    D:\\Anaconda3\\envs\\manim\\python.exe
## 6      mmyolo                      D:\\Anaconda3\\envs\\mmyolo\\python.exe
## 7 rsconnect-jupyter D:\\Anaconda3\\envs\\rsconnect-jupyter\\python.exe
## 8      sandbox                      D:\\Anaconda3\\envs\\sandbox\\python.exe
## 9      sandbox-3.9                  D:\\Anaconda3\\envs\\sandbox-3.9\\python.exe
```

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

```
library(reticulate)
version <- "3.9.12"
# install_python(version)

# create a new environment
# virtualenv_create("r-reticulate", version = version)

# use_virtualenv("r-reticulate")

# install Matplotlib
# virtualenv_install("r-reticulate", "matplotlib")

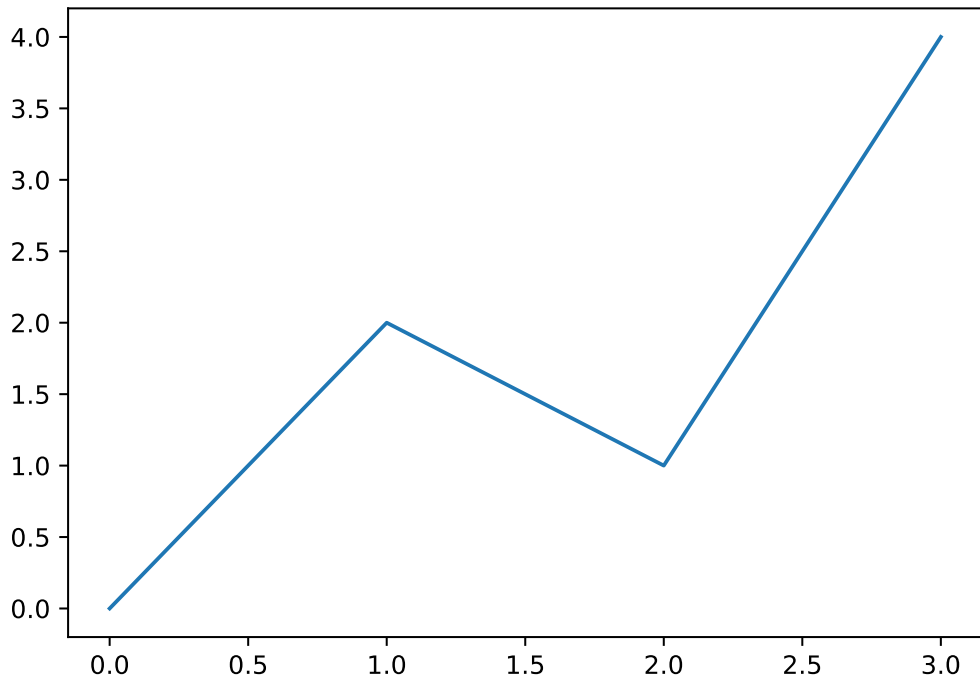
# import Matplotlib (it will be automatically discovered in "r-reticulate")
matplotlib <- import("matplotlib")
```

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

```
## [1] "r-reticulate"

# library(reticulate)
# use_virtualenv("r-reticulate")
# matplotlib <- import("matplotlib")
# matplotlib$use("Agg", force = TRUE)
```

```
import matplotlib.pyplot as plt
plt.plot([0, 2, 1, 4])
plt.show()
```



TiKZ/PgfPlot

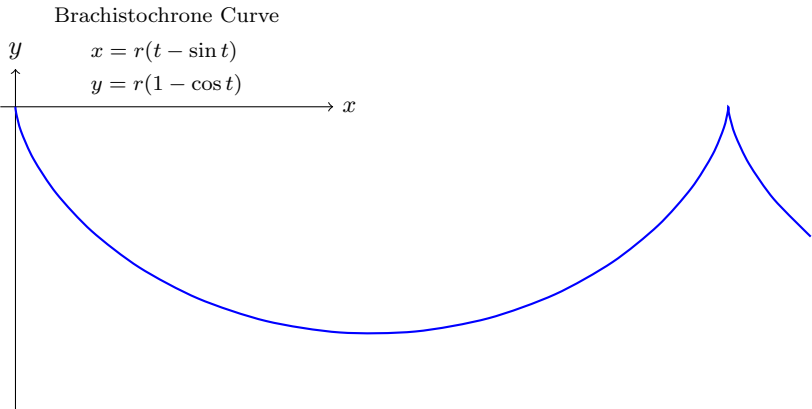


Figure 6.1: Brachistochrone Curve

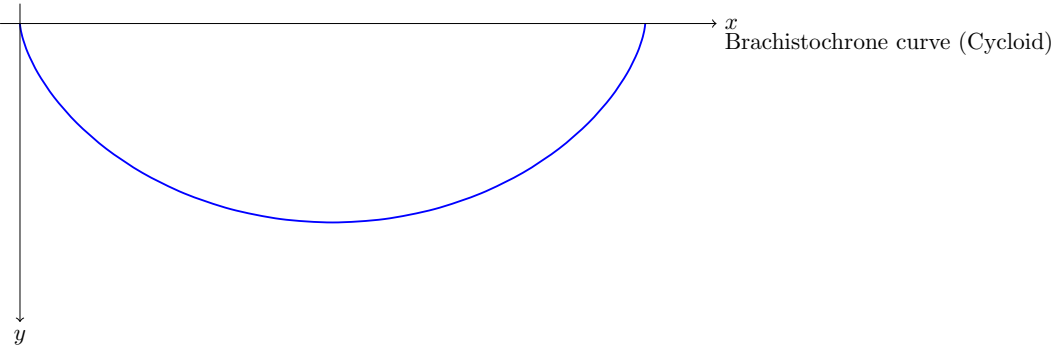


Figure 6.2: Brachistochrone Curve

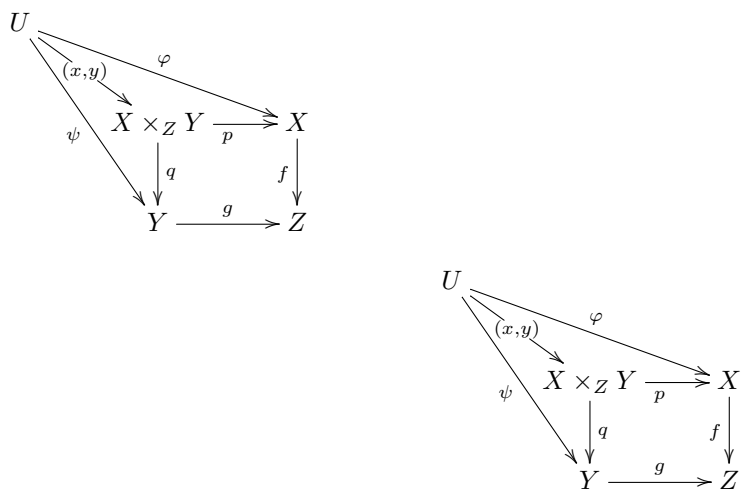
xy-pic

<https://bookdown.org/yihui/rmarkdown-cookbook/install-latex-pkgs.html>

```
tinytex::install_tinytex()
```

the following xymatrix from LaTeX package xy for xy-pic is not shown or rendered in HTML:

\LaTeX can only be used in HTML, not PDF



references

1. [Bookdown books on the web: Downloading and converting to pdf - R Markdown](#). *Posit Community* (2019).
2. ccjou. [二次型與正定矩陣](#). (2009).