THE BOOK

LaTeX TEMPLATES

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Preface

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

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The first chapter

1.1 The first section

LaTeX is a high-quality typesetting system; it includes features designed for the production of technical and scientific documentation. LaTeX is the de facto standard for the communication and publication of scientific documents.

The unnumbered list

- item one
- item two
- item three

The numbered list

1. item one
2. item two
3. item three

1.1.1 A sub section

LaTeX is not a word processor! Instead, LaTeX encourages authors not to worry too much about the appearance of their documents but to concentrate on getting the right content. For example consider this document:

$$\sin^2\theta + \cos^2\theta = 1. \tag{1.1}$$

LaTeX is based on the idea that it is better to leave document design to document designers, and to let authors get on with writing documents.

The `align` environment

$$\begin{aligned} a &= b + c \quad (1.2) \\ &= d + e. \quad (1.3) \end{aligned}$$

Use command `\notag` or `\nonumber` to remove number of equation.

$$\begin{aligned} a &= b + c \quad (1.4) \\ &= d + e + f + g + h + i + j \\ &\quad + m + n + o \quad (1.5) \\ &= p + q + r + s. \quad (1.6) \end{aligned}$$

The `gather` environment

$$\begin{gathered} a = b + c \quad (1.7) \\ d = e + f + g \\ h + i = j \quad (1.8) \\ l + m = n \quad (1.9) \end{gathered}$$

An example of the `\cite` command to cite within the book:

This statement requires citation [1] and [3–5]

we present a new method for solving the model equation

$$\begin{cases} \partial_t u - \varepsilon^2 \Delta u + u^3 - u = 0, & \text{in } \Omega \times \mathcal{T}, \\ u(x, y, t) = g(t), & \text{on } \partial\Omega, \\ u(x, y, 0) = \varphi(x, y), & \text{on } \Omega. \end{cases} \quad (1.10)$$

where ε is a small parameter.

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1.2 The second section

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1.2.1 A sub section

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Definition 1.1. *This is a definition environment.*

Lemma 1.1. *This is a lemma environment.*

Theorem 1.1. *This is a theorem environment.*

Proposition 1.1. *This is a proposition environment.*

Lemma 1.2. *This is a lemma environment*

(i) *item A*

(ii) *item B*

$$\lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n = e. \tag{1.11}$$

Theorem 1.2 (Mass–energy)**.** *This is a theorem environment.*

Proof. This is a proof environment. □

Remarks 1.1. *This is a remark environment.*

Example 1.1. *This is example environment.*

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

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1.3 The third section

LaTeX is a high-quality typesetting system; it includes features designed for the production of technical and scientific documentation. LaTeX is the de facto standard for the communication and publication of scientific documents.

Here we state our main result as 1.3.

Theorem 1.3 (LDL^T Factorization [2])**.** *If $A \in \mathbb{R}^{n\times n}$ is symmetric and the principal submatrix $A(1:k,1:k)$ is nonsingular for $k = 1:n-1$, then there exists a unit lower triangular matrix L and a diagonal matrix*

$$D = \operatorname{diag}(d_1, \ldots, d_n),$$

such that $A = LDL^T$. The factorization is unique.

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Theorem 1.4 (Mean Value Theorem)**.** *Suppose f is a function that is continuous on the closed interval $[a,b]$. and differentiable on the open interval (a,b). Then there exists a number c such that $a < c < b$ and*

$$f'(c) = \frac{f(b) - f(a)}{b - a}.$$

In other words,

$$f(b) - f(a) = f'(c)(b - a).$$

Remarks 1.2. *Observe that 1.3, 1.4 correctly mix references to multiple labels.*

Corollary 1.1. *Let $f(x)$ be continuous and differentiable everywhere. If $f(x)$ has at least two roots, then $f'(x)$ must have at least one root.*

Proof. Let a and b be two distinct roots of f. By 1.4, there exists a number c such that

$$f'(c) = \frac{f(b) - f(a)}{b - a} = \frac{0 - 0}{b - a} = 0.$$

□

Note that it may require two LaTeX compilations for the proof marks to show.

Display matrices can be rendered using environments from `amsmath`:

$$S = \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix} \quad \text{and} \quad C = \begin{pmatrix} 1 & 1 & 0 \\ 1 & 1 & 0 \\ 0 & 0 & 0 \end{pmatrix}. \tag{1.12}$$

Equation 1.12 shows some example matrices.

We calculate the Fréchet derivative of F as follows:

$$\begin{aligned} F'(U,V)(H,K) &= \langle R(U,V), H\Sigma V^T + U\Sigma K^T - P(H\Sigma V^T + U\Sigma K^T)\rangle && (1.13a) \\ &= \langle R(U,V), H\Sigma V^T + U\Sigma K^T\rangle \\ &= \langle R(U,V)V\Sigma^T, H\rangle + \langle \Sigma^T U^T R(U,V), K^T\rangle. && (1.13b) \end{aligned}$$

1.13a is the first line, and 1.13b is the last line.

1.4 Algorithm

Our analysis leads to the algorithm in 1.

Algorithm 1 Build tree

Define $P := T := \{\{1\}, \ldots, \{d\}\}$
while $\#P > 1$ **do**
  Choose $C' \in \mathcal{C}_p(P)$ with $C' := \operatorname{argmin}_{C \in \mathcal{C}_p(P)} \varrho(C)$
  Find an optimal partition tree $T_{C'}$
  Update $P := (P \backslash C') \cup \{\bigcup_{t \in C'} t\}$
  Update $T := T \cup \{\bigcup_{t \in \tau} t : \tau \in T_{C'} \backslash \mathcal{L}(T_{C'})\}$
end while
return T

Adjust the width of the algorithm environment

Algorithm 2 Euclid's algorithm

```
procedure EUCLID(a, b)                          ▷ The g.c.d. of a and b
    r ← a mod b
    while r ≠ 0 do                              ▷ We have the answer if r is 0
        a ← b
        b ← r
        r ← a mod b
    end while
    return b                                    ▷ The gcd is b
end procedure
```

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Chapter 2

The second chapter

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2.1 Table Environment

Additional results are available in the supplement in Table 2.1.

Table 2.1: Numerical error

degree	step-size h	L^2-errors	order	H^1-errors	order	L^∞-errors	order
1	1/128	9.18E-06	2.02	7.70E-03	1.01	6.46E-07	2.02
	1/256	2.29E-06	2.01	1.92E-03	1.00	1.61E-07	2.01
	1/512	5.70E-07	2.00	9.56E-04	1.00	4.01E-08	2.00
2	1/128	1.39E-08	3.01	1.15E-05	2.01	3.48E-12	4.02
	1/256	1.73E-09	3.01	2.88E-06	2.01	3.27E-13	3.94
	1/512	2.17E-10	3.00	7.24E-06	2.00	6.66E-13	1.55
3	1/32	2.28E-09	4.05	6.92E-07	3.04	1.45E-15	8.21
	1/64	1.42E-10	4.03	8.65E-08	3.02	2.06E-14	3.85
	1/128	8.91E-12	4.01	1.08E-08	3.01	3.86E-14	0.91

Use the `tabularx` environment to generate tables.

Table 2.2: Table description

N	A	B	C	D	E
2	9.20E-05	9.90E-05	1.00E-06	8.00E-06	1.50E-05
4	9.80E-05	8.00E-05	7.00E-06	1.40E-05	1.60E-05
6	4.00E-06	8.10E-05	8.80E-05	2.00E-05	2.20E-05
8	8.50E-05	8.70E-05	1.90E-05	2.10E-05	3.00E-06
10	8.60E-05	9.30E-05	2.50E-05	2.00E-06	9.00E-06
12	1.70E-05	2.40E-05	7.60E-05	8.30E-05	9.00E-05

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2.2 Figure Environment

Figure 2.1 shows some example results.

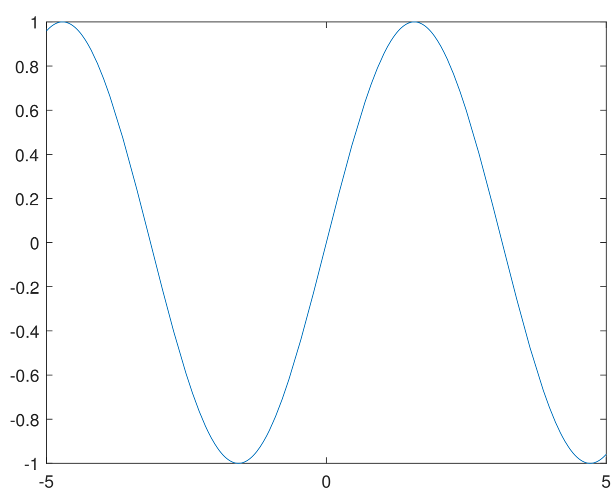

Figure 2.1: Example figure using external image files.

The two figures are placed side by side, sharing the same title.

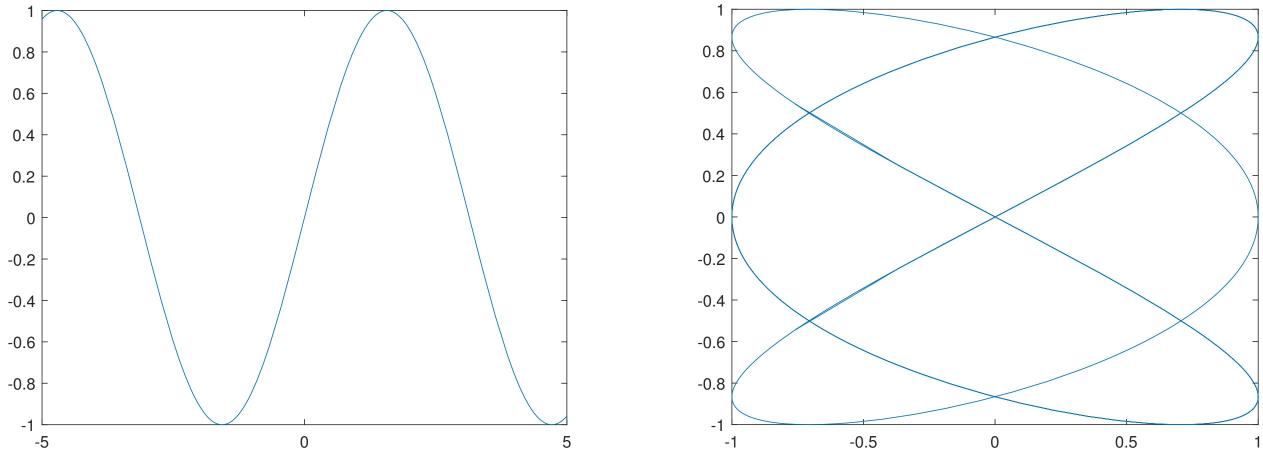

Figure 2.2: Left: Caption 1, Right: Caption 2.

Use `minipage` package to set up images side-by-side, each with its own title.

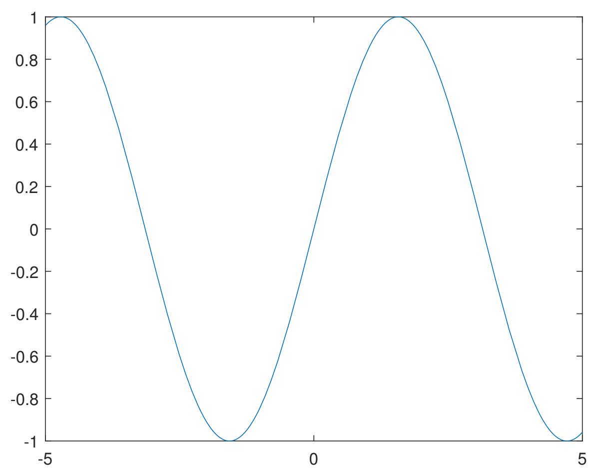

Figure 2.3: Caption A

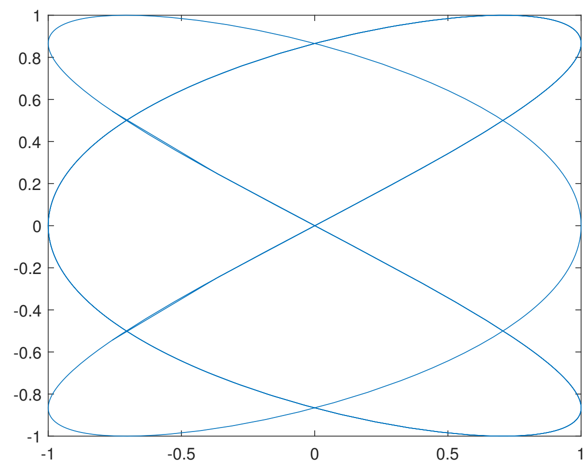

Figure 2.4: Caption B

2.3 Discussion of $\boldsymbol{Z} = \boldsymbol{X} \cup \boldsymbol{Y}$

Some discussions here. Some discussions here. Some discussions here.

2.3.1 A sub section

LaTeX is not a word processor! Instead, LaTeX encourages authors not to worry too much about the appearance of their documents but to concentrate on getting the right content. For example consider this document:

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

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2.4 The second section

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2.4.1 A sub section

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Appendix A

This is the first appendix

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A.1 A sub section

$$a^2 + b^2 = c^2. \tag{A.1}$$

Lemma A.1. *This is a lemma environment.*

This is Figure A.1.

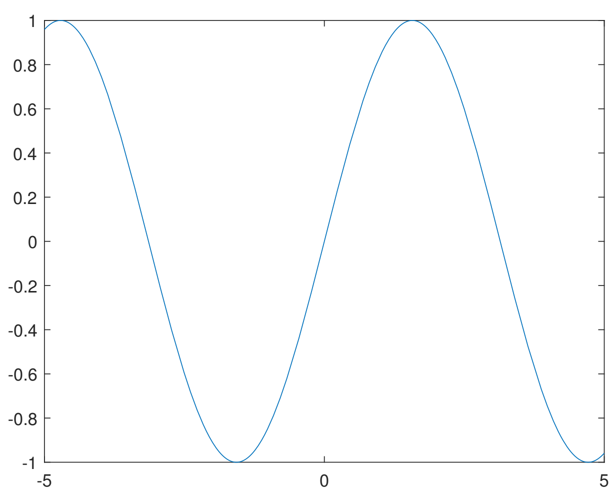

Figure A.1: Example figure using external image files.

Table A.1: A sample of the height and weight of students.

Number	Age	Height	Weight
1	14	156	42
2	16	158	45
3	14	162	48
4	15	163	50
Mean	15	159.75	46.25

The following table: Table A.1. Use `autoref`: Table A.1.

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

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A.2 A sub section

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Appendix B

This is the second appendix

B.1 A sub section

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B.2 A sub section

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