

# Notes Template

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## Abstract

This is a template for taking lecture notes in mathematics/physics. Feel free to adapt it or to make suggestions. I must thank Pingbang Hu, who made the original template which I have adapted [Hu23].

# 1 Introduction

## 1.1 A subsection

Let's showcase some of the environments.

**Definition 1.1 (Template)** A document or file having a preset format, used as a starting point for a particular application so that the format does not have to be recreated each time it is used.

**Definition** This definition is not numbered and does not have a title.

We can also reference such environments in our [template](#).

Theorems can be proved in the same box,

**Theorem 1.1**

$$1 + 1 = 2$$

**Proof** Trivial ■

or in a separate box, as seen in [Appendix A.1](#).

There are similar environments for the following:

- propositions
- conjectures
- corollaries
- lemmas

Exercises and answers behave like theorems and proofs.

**Exercise 1.1** Show that

$$\int_0^{2\pi} dx = 2\pi$$

**Answer**

$$\begin{aligned} \int_0^{2\pi} dx &= \left[ x \right]_0^{2\pi} \\ &= 2\pi - 0 \\ &= 2\pi \end{aligned}$$

⊗

**Example** Calculate  $\partial_v f(x, y)$  for the function  $f(x, y) = x^2 - y^2$  in the direction of  $v = (a, b)$ .

**Solution**

$$\begin{aligned} f((x, y) + t(a, b)) &= (x + ta)^2 - (y + tb)^2 = x^2 + 2tax + t^2a^2 + y^2 - 2tby - t^2b^2 \\ \therefore \frac{d}{dt} f(x + tv) &= 2ax + 2ta^2 - 2by - 2tb^2, \\ \partial_v f(x, y) &= \left. \frac{d}{dt} f(x + tv) \right|_{t=0} = 2ax - 2by. \end{aligned}$$

⊗

**Note** Environments can be nested.

**Notation** For  $1 \leq i \leq n$ ,  $\partial_{v_i} f(x)$  is called the  $i^{\text{th}}$ -partial derivative of  $f : U \rightarrow \mathbb{R}^k$  at  $x \in U$ .

## 2 Other environments

### 2.1 Algorithms

The following example is taken from the `algorithm2e` [package documentation](#).

#### Algorithm 2.1 Example

```
Data: this text
Result: how to write algorithm with LATEX2ε
1 initialization;
2 while not at end of this document do
3   read current;
4   if understand then
5     go to next section;
6     current section becomes this one;
7   else
8     go back to the beginning of current section;
```

### 2.2 Formulas

Useful for physics notes.

#### Gibb's entropy

$$S := -k_{\text{B}} \sum_i P_i \ln P_i \quad (2.2.1)$$

# Appendices

## A Additional Proofs

### A.1 Proof of Theorem 1.1

We can now prove Theorem 1.1.

**Proof of Theorem 1.1** See the Principia Mathematica. ■

## References

[Hu23] Pingbang Hu. *Note Template*. Last accessed 14 September 2023. 2023. URL: <https://github.com/sleepymalc/LaTeX-Template/tree/main/Note>.