
*Template for the class ``Note for
Myself' in sectionlevel=book*



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Template for the class “Note for Myself” in sectionlevel=book

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Chapter 1

In sectionlevel=book

1.1 Section name

1.1.1 Fonts in math mode

We use the unicode-math package to support Unicode math symbols. Below is a list of common math symbols, grouped by font/style, with their names:

- Greek letters: $\text{A, B, \Gamma, \Delta, E, Z, H, \Theta, I, K, \Lambda, M, N, \Xi, O, \Pi, P, \Sigma, T, Y, \Phi, X, \Psi, \Omega}$;
- $\alpha, \beta, \gamma, \delta, \epsilon, \zeta, \eta, \theta, \iota, \kappa, \lambda, \mu, \nu, \xi, \omicron, \pi, \rho, \sigma, \tau, \upsilon, \phi, \varphi, \chi, \psi, \omega$;
- Numbers and operators: $0, 1, 2, 3, 4, 5, 6, 7, 8, 9, +, -, \times, \div, =, <, >, \leq, \geq$
- Common math symbols: $\infty, \partial, \nabla, \forall, \exists, \neg, \wedge, \vee, \implies, \iff, \subset, \subseteq, \supset, \supseteq, \cup, \cap, \setminus, \emptyset, \hookrightarrow, \twoheadrightarrow, \dashrightarrow, \varprojlim, \varinjlim$;
- Musical symbols: \sharp, \flat, \natural ;
- math italic: $A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z$;
- $a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z$;
- Calligraphic: $\mathcal{A}, \mathcal{B}, \mathcal{C}, \mathcal{D}, \mathcal{E}, \mathcal{F}, \mathcal{G}, \mathcal{H}, \mathcal{I}, \mathcal{J}, \mathcal{K}, \mathcal{L}, \mathcal{M}, \mathcal{N}, \mathcal{O}, \mathcal{P}, \mathcal{Q}, \mathcal{R}, \mathcal{S}, \mathcal{T}, \mathcal{U}, \mathcal{V}, \mathcal{W}, \mathcal{X}, \mathcal{Y}, \mathcal{Z}$,
- $\mathfrak{a}, \mathfrak{b}, \mathfrak{c}, \mathfrak{d}, \mathfrak{e}, \mathfrak{f}, \mathfrak{g}, \mathfrak{h}, \mathfrak{i}, \mathfrak{j}, \mathfrak{k}, \mathfrak{l}, \mathfrak{m}, \mathfrak{n}, \mathfrak{o}, \mathfrak{p}, \mathfrak{q}, \mathfrak{r}, \mathfrak{s}, \mathfrak{t}, \mathfrak{u}, \mathfrak{v}, \mathfrak{w}, \mathfrak{x}, \mathfrak{y}, \mathfrak{z}$
- Blackboard bold: $\mathbf{A}, \mathbf{B}, \mathbf{C}, \mathbf{D}, \mathbf{E}, \mathbf{F}, \mathbf{G}, \mathbf{H}, \mathbf{I}, \mathbf{J}, \mathbf{K}, \mathbf{L}, \mathbf{M}, \mathbf{N}, \mathbf{O}, \mathbf{P}, \mathbf{Q}, \mathbf{R}, \mathbf{S}, \mathbf{T}, \mathbf{U}, \mathbf{V}, \mathbf{W}, \mathbf{X}, \mathbf{Y}, \mathbf{Z}$;
- $\mathbf{a}, \mathbf{b}, \mathbf{c}, \mathbf{d}, \mathbf{e}, \mathbf{f}, \mathbf{g}, \mathbf{h}, \mathbf{i}, \mathbf{j}, \mathbf{k}, \mathbf{l}, \mathbf{m}, \mathbf{n}, \mathbf{o}, \mathbf{p}, \mathbf{q}, \mathbf{r}, \mathbf{s}, \mathbf{t}, \mathbf{u}, \mathbf{v}, \mathbf{w}, \mathbf{x}, \mathbf{y}, \mathbf{z}$;
- Fraktur: $\mathfrak{A}, \mathfrak{B}, \mathfrak{C}, \mathfrak{D}, \mathfrak{E}, \mathfrak{F}, \mathfrak{G}, \mathfrak{H}, \mathfrak{I}, \mathfrak{J}, \mathfrak{K}, \mathfrak{L}, \mathfrak{M}, \mathfrak{N}, \mathfrak{O}, \mathfrak{P}, \mathfrak{Q}, \mathfrak{R}, \mathfrak{S}, \mathfrak{T}, \mathfrak{U}, \mathfrak{V}, \mathfrak{W}, \mathfrak{X}, \mathfrak{Y}, \mathfrak{Z}$;
- $\mathfrak{a}, \mathfrak{b}, \mathfrak{c}, \mathfrak{d}, \mathfrak{e}, \mathfrak{f}, \mathfrak{g}, \mathfrak{h}, \mathfrak{i}, \mathfrak{j}, \mathfrak{k}, \mathfrak{l}, \mathfrak{m}, \mathfrak{n}, \mathfrak{o}, \mathfrak{p}, \mathfrak{q}, \mathfrak{r}, \mathfrak{s}, \mathfrak{t}, \mathfrak{u}, \mathfrak{v}, \mathfrak{w}, \mathfrak{x}, \mathfrak{y}, \mathfrak{z}$;
- Script: $\mathcal{A}, \mathcal{B}, \mathcal{C}, \mathcal{D}, \mathcal{E}, \mathcal{F}, \mathcal{G}, \mathcal{H}, \mathcal{I}, \mathcal{J}, \mathcal{K}, \mathcal{L}, \mathcal{M}, \mathcal{N}, \mathcal{O}, \mathcal{P}, \mathcal{Q}, \mathcal{R}, \mathcal{S}, \mathcal{T}, \mathcal{U}, \mathcal{V}, \mathcal{W}, \mathcal{X}, \mathcal{Y}, \mathcal{Z}$;
- $\mathcal{a}, \mathcal{b}, \mathcal{c}, \mathcal{d}, \mathcal{e}, \mathcal{f}, \mathcal{g}, \mathcal{h}, \mathcal{i}, \mathcal{j}, \mathcal{k}, \mathcal{l}, \mathcal{m}, \mathcal{n}, \mathcal{o}, \mathcal{p}, \mathcal{q}, \mathcal{r}, \mathcal{s}, \mathcal{t}, \mathcal{u}, \mathcal{v}, \mathcal{w}, \mathcal{x}, \mathcal{y}, \mathcal{z}$;

- **Upright:** A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z;
- a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z;
- **Bold :** A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z;
- **a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z.**
- **Sans-serif:** A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z;
- a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z;
- **Roman:** A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z;
- a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z;

1.1.2 Theorems and definitions

There are two types of theorem environments, one is with background color, the other is without background color. The following is a list of theorem environments supported by this template:

Definition 1.1.1 (this is a definition). A *locally ringed space* is a pair (X, \mathcal{O}_X) , where X is a topological space, and \mathcal{O}_X is a sheaf of rings on X , such that for every point $x \in X$, the stalk $\mathcal{O}_{X,x}$ is a local ring.

Proposition 1.1.2 (this is a proposition). test

Proof. This is a proof environment, it is used to prove theorems, propositions, lemmas, corollaries, etc. We allow to use step environments inside the proof environment, such as:

Step 1. This is a step environment, it is used to break down the proof into smaller steps.

Step 2. This is another step environment, it is used to break down the proof into smaller steps.

And the step environment should be used inside the proof environment. The proof environment will automatically end with a square box. \square

Theorem 1.1.3 (this is a theorem). test

Proof. This is a proof environment. The step environment is labelled in the proof environment. A new proof environment will refresh the step environment counter.

Step 1. Goal 1.

Proof of Goal 1.

Step 2. Goal 2.

Proof of Goal 2.

Here we test the hyperlink to the step environment [Step 1](#).

You can also use the claim environment to make a claim in the proof environment, such as:

Claim 1.1.4. This is a claim environment, it is used to make a claim in the proof environment.

And the claim environment should be used inside the proof environment. \square

Proof of [Claim 1.1.4](#). This is a proof for the [Claim 1.1.4](#). Here we test the case environment.

Case 1. This is a case environment, it is used to break down the proof into smaller cases.

Case 2. This is another case environment, it is used to break down the proof into smaller cases.

And the case environment should be used inside the proof environment. \square

Lemma 1.1.5 (this is a lemma). test

Proof. Here we test case environment again.

Case 1. This is a case environment, it is used to break down the proof into smaller cases.

Case 2. This is another case environment, it is used to break down the proof into smaller cases. \square

Corollary 1.1.6 (this is a corollary). test here we test the hyperlink to the code environment [Code 1.1](#).

Question 1.1.7 (this is a question). test

Conjecture 1.1.8 (this is a conjecture). test

Example 1.1.9 (this is an example). test

Exercise 1.1.10 (this is an exercise). test

Remark 1.1.11 (this is a remark). test Here we test the hyperlink to the case environment [Case 1](#).

this is a proof. test, here we test [Section 1.1](#) and [Subsection 1.1.2](#). \square

Here we test the code block environment:

```
1 def hello():
2     print("Hello, world!")
3
```

Listing 1.1: Python code example

```
1 import numpy as np
2 from numpy.polynomial import Polynomial
3
4 # Example: create two integer matrices
5 A = np.array([[1,1,0], [4,0,1], [1,0,0]], dtype=int)
6 B = np.array([[2,1,0], [4,1,1], [1,0,1]], dtype=int)
7
8 # Matrix addition
9
10 # Matrix multiplication
11 def M(i, j):
12     return np.linalg.matrix_power(A, i) @ np.linalg.matrix_power(B, j)
13
14 mul_result = M(1, 1)
15
16 def rho(A):
17     eigvals = np.linalg.eigvals(A)
18     return np.max(np.abs(eigvals))
```

```

19
20 # Spectral radius
21 results = {}
22 for i in range(-10, 11):
23     for j in range(-10, 11):
24         m = M(i, j)
25         results[(i, j)] = rho(m)
26
27 # Print results
28 # for key in sorted(results.keys()):
29 #     print(f"rho(M({key[0]}, {key[1]})) = {results[key]}")
30
31 print("A =" , A)
32 print("B =" , B)
33 print("A * B =" , mul_result)
34 print("B * A =" , np.matmul(B, A))
35
36 print("Eigenvalues of A:", np.linalg.eigvals(A))
37 print("Eigenvalues of B:", np.linalg.eigvals(B))
38
39 def char_poly(matrix):
40     # Get coefficients of the characteristic polynomial
41     coeffs = np.poly(matrix)
42     # Format as a string
43     terms = []
44     deg = len(coeffs) - 1
45     for i, c in enumerate(coeffs):
46         power = deg - i
47         if power == 0:
48             terms.append(f"{c:.2f}")
49         elif power == 1:
50             terms.append(f"{c:.2f}*x")
51         else:
52             terms.append(f"{c:.2f}*x^{power}")
53     return " + ".join(terms)
54
55 print("Characteristic polynomial of A:")
56 print(char_poly(A))
57 print("Characteristic polynomial of B:")
58 print(char_poly(B))

```

Listing 1.2: Python code example from file

1.1.3 sectionlevel=book

In this mode, the chapter is the highest level. The section is the second level, and the subsection is the third level. The section is numbered with the chapter number, such as 1.1, 1.2, etc. There is a title page, a table of contents, and a cover image. All theorem and definition environments are labelled in the form of chapter.number, such as 1.1, 1.2, etc.

Chapter 2

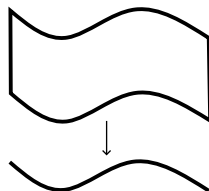
Test

Test references [[Har77](#)].

2.1 Test Section

2.1.1 Test Subsection

Test plots:



There are some test texts here, and some test equations:

References

- [Har77] Robin Hartshorne. *Algebraic geometry*. Vol. No. 52. Graduate Texts in Mathematics. Springer-Verlag, New York-Heidelberg, 1977, pp. xvi+496. ISBN: 0-387-90244-9 (cit. on p. [9](#)).