

Main

# Introduction to Formal Theorem Proving in Lean

**Classroom:** Technology & Science Complex 1 (TASC1) 9204

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**Time:**

Aug 25th - 29th, 2:30-5pm

## Description

Historically, mathematics has been conveyed primarily through natural-language narratives that outline each logical step. In this course, you will learn to write and verify mathematical definitions, theorems, and proofs using Lean, a powerful interactive proof assistant and programming language. Unlike traditional mathematics in natural language, Lean enables you to express ideas precisely and have a computer check your reasoning for correctness. By the end of the course, you'll be able to interact with Lean to construct your own machine-checked proofs, gaining insight into both programming and rigorous mathematical thinking.


## Target Audience

Students who want to learn about formalizing mathematics are the primary audience. The goal of the course is not to learn advanced mathematical concepts since the mathematical part stops at differential calculus. Students only need a reasonable aptitude in mathematics as a prerequisite. The secondary audience are researchers in various fields (e.g., machine learning, formal methods) interested in using Lean.

## Prerequisites

Students are expected to have a basic understanding of programming, mathematical proofs, linear algebra, and calculus. Students are also expected to be familiar with VSCode/Cursor and GitHub.

## Resources:

-  How to Start Using Lean
- [Mathematics in Lean](#)
- Lean4 Online: <https://live.lean-lang.org/>
- Lean Finder: <https://www.leanfinder.org/>
- Learning resources on the Lean website:  
<https://leanprover-community.github.io/learn.html>
- Symbols in Lean  
[https://drive.google.com/file/d/1iL2QqNRvPbm7J\\_Hd2gK8beum5ZWwN\\_e](https://drive.google.com/file/d/1iL2QqNRvPbm7J_Hd2gK8beum5ZWwN_e) (or you can

use `Ctrl-Shift-P` and then type and access the `Lean 4: Show Unicode Input Abbreviations`)

- Lean Operator Precedence `† Lean Operator Precedence`
- All tactics in Lean 4 `pdf lean4_tactics_all.pdf`
- Forum for Lean: <https://leanprover.zulipchat.com/>

### Course Schedule and Materials (tentative)

⇒ Lecture notes can be found at `html`

\*The passcode to all recordings will be `mathlib`

Date	Topic	Materials <code>html</code>	Recording
08/25	Lean Basics, Interacting with Lean	<code>Intro to Formal Theorem ...</code> C01_Introduction.html C02_Basics.html	<a href="#">link</a>
08/26	Logic	C03_Logic.html	<a href="#">link</a>
08/27	Sets, Functions	C04_Sets_and_Functions.html	<a href="#">link</a>
08/28	Induction and Recursion, Inductive Types, Structure	C05_Elementary_Number_Theory.html C06_Discrete_Mathematics.html C07_Structures.html	<a href="#">link</a>
08/29	Linear Algebra, Metric Space, Differential Calculus, Integration	C10_Linear_Algebra.html C11_Topology.html C12_Differential_Calculus.html C13_Integration_and_Measure_Theory.html	<a href="#">link</a>