# Spring 2026 Math 3310-002 Introduction to Proof

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| **Instructor:** Dr. Alexander Solynin | **Place:** MATH 015 |
| **Office Hours:** TR 9:00-10:30<br>W 10:00-12:00<br>or by appointment | **Text:** *Mathematical Proofs: A Transition to Advanced Mathematics*, 4th Edition<br>by Chartrand, Polimeni and Zhang. Pearson (2018). |
| **Office:** MA 231 | **Time:** 12:30-13:50 pm TR |
| **Email:** alex.solynin@ttu.edu | **Prerequisites:** MATH 2350 or 2450 |

**About the Course:** The goal of this course is to teach students how to construct and organize their mathematical reasoning and develop skills for reading and writing mathematical proofs. The plan is to cover Sections 1.1–1.6, 2.1–2.10, 3.1–3.4, 4.1, 5.1–5.2, 5.4, 6.1–6.3, 9.1–9.6, 10.1–10.5, and 11.1–11.3.

**Student Learning Outcomes:** The students will understand and be able to use the following concepts:

- Sets (element, subset, union, intersection, product, cardinality)
- Functions (injective, surjective, bijective, composition)
- Equivalence relations (equivalence class, congruence module $n$, modular arithmetic)

The students will become proficient in reading and writing mathematical proofs. To this end the following concepts will be covered:

- Truth tables and logic (statements, negation, implications, quantifiers, logical equivalence)
- Direct proofs
- Contrapositive proofs
- Proof by contradiction
- Proof by cases
- Proof by mathematical induction

**Methods for Assessment of Learning Outcomes:** The expected learning outcomes for the course will be assessed through graded activities and ungraded activities. The graded activities include exams, homework and quizzes. The ungraded activities will be used to monitor your progress. A variety of these ungraded assessment techniques may be employed, including problems to be completed during class, direct questioning of students, answering students questions in class, one-minute classroom assessment techniques, and discussions during office hours.

**Formula sheets:** At least one class before the Final and in-class exams, I will provide students with a one-quarter page, valid for that particular exam, where you may write (do not type!) formulas and theorems, which you are going to use in class. Students are not allowed to use their own pages as formula sheets in the class.

**General Policies:**

***Absence due to religious observance*:** The Texas Tech University OP 34.19 states that a student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence. A student who is absent from classes for the observance of a religious holy day shall be allowed to take an examination or complete an assignment scheduled for that day within a reasonable time after the absence. As your instructor, I request that notification be made in writing and submitted no later than the 15th class day of the semester. Absence due to officially approved trips - The Texas Tech University OP 34.04 states department chairpersons, directors, or others responsible for a student representing the university

on officially approved trips must notify the student's instructors of the departure and return schedules. The instructor so notified must not penalize the student, although the student is responsible for material missed. Any student absent because of university business must be allowed to make up missed work within a reasonable span of time or have alternate grades substituted for work due to an excused absence. Students absent because of university business must be given the same privileges as other students.

***Academic Integrity*** **(extracted from OP 34.12):** It is the aim of the faculty of Texas Tech University to foster a spirit of complete honesty and high standard of integrity. The attempt of students to present as their own any work not honestly performed is regarded by the faculty and administration as a most serious offense and renders the offenders liable to serious consequences, possibly suspension.
Scholastic dishonesty includes, but it not limited to, cheating, plagiarism, collusion, falsifying academic records, misrepresenting facts, and any act designed to give unfair academic advantage to the student (such as, but not limited to, submission of essentially the same written assignment for two courses without the prior permission of the instructor) or the attempt to commit such an act.

***Civility in the Classroom:*** Incivility is any action that interferes with the classroom learning environment. This includes, but is not limited to, eating, arriving late, leaving early, a ringing cell phone, text messaging, sleeping, chatting during class, dominating the class discussion by not allowing other students to speak, and putting books away before the end of class. Be respectful to the instructor and to your fellow students. I will ask anyone participating in what I perceive to be inappropriate behavior to stop immediately.

***Accommodation for Students with Disabilities*** **(extracted from OP 34.22):** Any student who, because of a disability, may require some special arrangements in order to meet course requirements should contact the instructor as soon as possible to make the necessary arrangements. Students should present appropriate verification from Student Disability Services during the instructor's office hours. Please note instructors are not allowed to provide classroom accommodations to a student until the appropriate verification from Student Disability Services has been provided. For additional information, you may contact the Student Disability Services office at 335 West Hall or 806-742-2405.

***Absence due to officially approved trips:*** The Texas Tech University Catalog states that the person responsible for a student missing class due to a trip should notify the instructor of the departure and return schedule in advance of the trip. The student may not be penalized and is responsible for the material missed.

**Title IX Syllabus Statement - TTU Resources for Discrimination, Harassment, and Sexual Violence:** Texas Tech University is committed to providing and strengthening an educational, working, and living environment where students, faculty, staff, and visitors are free from gender and/or sex discrimination of any kind. Sexual assault, discrimination, harassment, and other Title IX violations are not tolerated by the University. Report any incidents to the *Office for Student Rights & Resolution*, (806)-742-SAFE (7233) or file a report online at titleix.ttu.edu/students. Faculty and staff members at TTU are committed to connecting you to resources on campus. Some of these available resources are: **TTU Student Counseling Center,** 806-742-3674, https://www.depts.ttu.edu/scc/ *(Provides confidential support on campus.)* **TTU Student Counseling Center 24-hour Helpline**, 806-742-5555, *(Assists students who are experiencing a mental health or interpersonal violence crisis. If you call the helpline, you will speak with a mental health counselor.)* **Voice of Hope Lubbock Rape Crisis Center**, 806-763-7273, voiceofhopelubbock.org *(24-hour hotline that provides support for survivors of sexual violence.)* **The Risk, Intervention, Safety and Education (RISE) Office**, 806-742-2110, rise.ttu.edu *(Provides a range of resources and support options focused on prevention education and student wellness.)* **Texas Tech Police Department**, 806-742-3931, http://www.depts.ttu.edu/ttpd/ *(To report criminal activity that occurs on or near Texas Tech campus*.)

**Important Dates:**
Wednesday, January 14 – Classes begin

January 19 - Martin Luther King Jr. Day.
March 14-22 - Spring Vacation.
April 27 - Last day to drop a course.
April 6 - No Classes.
May 5 - Last Day of classes.
April 30 - May 6 – Period of no examinations.

**Friday, May 8, 7:30 p.m. to 10:00 p.m. Final Exam.**

Wednesday, May 13 at noon - Grades Due for Graduating Students via Raiderlink.
Monday, May 18 at 5:00 p.m. - Final Grades Due via Raiderlink.

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## STUDENT EVALUATION:

- Final examination – comprehensive, course wide exam written by the instructor.

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♦ **Friday, May 8, 7:30 p.m. to 10:00 p.m. FINAL EXAMINATION 140 pts (23%)**
This exam is scheduled before the semester begins.
Students should **eliminate any conflicts NOW.**

- **IN-CLASS EXAMS:** February 26, April 16 **2×100 = 200 pts (34%)**
  Each exam consists of 10-12 problems
- 15-min **QUIZZES**: **5×20 = 100 pts (17%)**
  Each 15-minute quiz consists of 2 problems**:** 2×10 = 20 pts
- 5-min **QUIZZES**:
  There will be several 5-minute quizzes (usually first 5 minutes of a class), total = **20 pts (3%)**
  where students will be asked to write a particular formula/definition/theorem/etc.
- **HOMEWORK**: I will collect homework seven times – approximately every fourth class and I will grade 8-10 problems of these homework assignments.
  Each homework is worth 20 pts: **6×20 = 120 pts (20%)**
- **Perfect attendance** (≤3 missed classes,
all excused absences must be supported by official notes). **20 pts (3%)**

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- **MAXIMAL TOTAL:** **600 pts (100%)**

## GRADING PROCEDURE:

**A - 90 - 100%**
**B - 80 - 89%**
**C - 70 -79%**
**D - 60 - 69%**
**F - ≤ 59%**

# Course Calendar

| Date | Textbook | Tentative Lecture Topics |
|---|---|---|
| Jan. 15 | | Sections 1.1 Describing a set, 1.2 Subsets. |
| Jan. 20 | | Sections 1.3 Set operations, 1.4 Indexed collections of sets. |
| Jan. 22 | | Sections 1.5 Partitions of sets, 1.6 Cartesian product of sets. |
| Jan. 27 **Q1** | | Sections 2.1 Statements, 2.2 Negations. |
| Jan. 29 | | Sections 2.3 Disjunctions and conjunctions, 2.4 Implications. |
| Feb. 3 | | Sections 2.5 More on implications, 2.6 Biconditionals. |
| Feb. 5 | | Sections 2.7 Tautologies and contradictions, 2.8 Logical equivalence. |
| Feb. 10 | | Section 2.9 Some fundamental properties of logical equivalence. |
| Feb. 12 | | Section 2.10 Quantified statements. |
| Feb. 17 **Q2** | | Section 3.1 Trivial and vacuous proofs, 3.2 Direct proofs. |
| Feb. 19 | | Section 3.3 Proof by contrapositive. |
| Feb. 24 | | Review for Exam #1. |
| **Feb. 26** | | **Lecture Exam #1 covered Sections 1.1 – 3.3.** |
| Mar. 3 | | Section 3.4 Proof by cases. |
| Mar. 5 | | Section 4.1 Proofs involving divisibility of integers. |
| Mar. 10 | | Sections 5.1 Counterexamples, 5.2 Proof by contradiction. |
| Mar. 12 | | Section 5.4 Existence proofs. |
| Mar. 24 **Q3** | | Section 6.1 The principle of mathematical induction. |
| Mar. 26 | | Section 6.2 A more general principle of mathematical induction. |
| Mar. 31 | | Section 6.3 The strong principle of mathematical induction. |
| Apr. 2 | | Sections 9.1 Relations, 9.2 Properties of relations. |
| Apr. 7 **Q4** | | Sections 9.3 Equivalence relations, 9.4 Properties of equivalence classes. |
| Apr. 9 | | Sections 9.5 Congruence modulo n, 9.6 The integers modulo n. |
| Apr. 14 | | Review for Exam #2. |
| **Apr. 16** | | **Lecture Exam #2, covered Sections 3.4 – 9.6.** |
| Apr. 21 | | Sections 10.1 The definition of function, 10.2 One-to-one, onto functions. |
| Apr. 23 **Q5** | | Sections 10.3 Bijective functions, 10.4 Composition of functions. |
| Apr. 28 | | Sections 10.5 Inverse functions, 11.1 Numerically equivalent sets. |
| Apr. 30 | | Sections 11.2 Denumerable sets, 11.3 Uncountable sets. |
| May 5 | | Review of the course. |
| **May 5** | **Friday** | **4:30 p.m. – 7:00 p.m. FINAL EXAM** |

# Tentative Homework Assignments

| Chapter | Assignment |
|---|---|
| **HW1** | **Due January 27** |
| Chapter 1 | 1.2,1.4,1.6, 1.10,1.14,1.16,1.18, 1.22,1.28,1.30,1.36,1.44,1.48,1.50,1.56, 1.60,1.62,1.66 |
| **HW2** | **Due February 10** |
| Chapter 2 | 2.2,2.4,2.8,2.14,2.16,2.18,2.20,2.22,2.26,2.30,2.32,2.36,2.42,2.46,2.50,2.52 |
| **HW3** | **Due February 19** |
| Chapter 2 | 2.54,2.56,2.60,2.66,2.70,2.72,2.80 |
| Chapter 3 | 3.2,3.4,3.6,3.8,3.10 |
| **HW4** | **Due March 24** |
| Chapter 3 | 3.16,3.20,3.24,3.26,3.30 |
| Chapter 4 | 4.2,4.4,4.8 |
| Chapter 5 | 5.2,5.4,5.12,5.16,5.42,5.46 |
| **HW5** | **Due April 14** |
| Chapter 6 | 6.2,6.4,6.10,6.22,6.24,6.34 |
| Chapter 9 | 9.4,9.8,9.16,9.28,9.30,9.38,9.40,9.44,9.50 |
| **HW6** | **Due April 30** |
| Chapter 10 | 10.4,10.10,10.20,10.24,10.28,10.30,10.32,10.38,10.46,10.50 |