

# MAT 250 Fundamentals of Mathematics

Lia Vas

E-mail: [lvas@sju.edu](mailto:lvas@sju.edu)

Office: BL 228

Website: <http://liavas.net> (with material which substitutes a traditional textbook)

**Class times and location, Fall 2025:** Mon and Wed 12:20–1:35 in Barbelin Hall 221 (HH campus).

**Canvas:** The solutions of any graded material (assignments and exams) will be posted on Canvas and, also, emailed to you.

**Office hours, Fall 2025** are by appointment: email me and we will find a time for us to meet. I will be glad to answer all of your questions about the course material, go over some problems together with you, check your assignment work, review together for an exam, or discuss any course content you may have questions about.

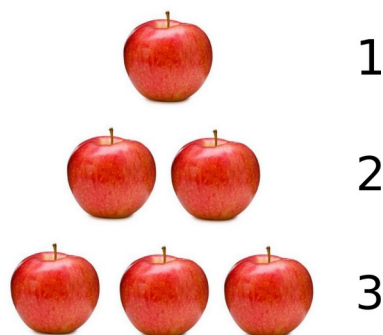
## Topics covered:

1. **Fundamentals of Logic:** logical connectives, necessary and sufficient conditions, statements of propositional logic, tautologies, contradiction, contingent and consistent sentences.
2. **Predicate logic:** quantifiers, predicates, well-defined formulas, scope of a quantifier, bound and free variables, interpretation of a formula, logical implications and equivalences, satisfiable sets of formulas, restricted quantification.
3. **Fundamentals of Set Theory:** “naive” set theory, Russell’s paradox, subset and equality relations, operations on sets, power set, Cartesian product, cardinality
4. **Relations:** binary relations, equivalences, partial orders, greatest, least, maximal, and minimal elements, supremum and infimum, total order.
5. **Functions:** maps, domains, codomains, injective, surjective and bijective functions, composition of functions, inverse, inverse images.
6. **Counting and cardinality:** cardinality, total order of cardinals, finite and infinite sets,



Cardinals?

or



Cardinals?

- Cantor's Theorem, Continuum Hypothesis, addition and multiplication of cardinals
7. **Natural numbers and induction:** counting, addition and multiplication, mathematical induction, double, limited and complete induction.
  8. **Fundamentals of Modern Algebra:** homomorphisms and congruences.
  9. **From natural to rational numbers:** from natural numbers to integers, addition, multiplication and the usual order, the cardinality of integers, from integers to rationals, operations and order of rationals, cardinality of the rationals.
  10. **Fundamentals of Real Analysis:** from rationals to reals, Cauchy sequences, the limit of a recursive sequence, formation of the reals via Cauchy sequences, the cardinality of the reals, the rationals are dense in the reals.
  11. **Complex numbers:** Euler's formula and powers of complex numbers, the field of complex numbers, Fundamental Theorem of Algebra, Galois and solvability of polynomials.



**Text:** No textbook required. The course material on my website substitutes a traditional textbook. It also includes practice problems with solutions.

**Tentative Exam Schedule, Fall 2025:**

- Exam 1. During week 5 (Sept 22)                      Exam 2. During week 9 (Oct 22)  
 Exam 3. During week 12 13 (Nov 12 Nov 17)      Exam 4. During the finals week (Dec 15)

**Grading:**

Three semester exams	20% each
Exam 4 (during the finals week)	20%
Homework assignments	20%
<b>TOTAL</b>	<b>100%</b>

Grades are computed according to the following system:

letter grade	A	A-	B+	B	B-	C+	C	C-	D+	D	F
number grade	93 to 100	90 to 92	87 to 89	83 to 86	80 to 82	77 to 79	73 to 76	70 to 72	67 to 69	60 to 66	0 to 59

**Relevant Course Elements.**

**Number of credits:** 3

**Prerequisites:** Calculus 1 or the permission of instructor.

**Attendance:** It is important to attend classes. Students are responsible for all material covered in class, even if attendance is not checked or assignments collected.

**Exams:** There will be **three semester exams and one exam during the final's week** (this exam will not be cumulative). No makeup exam will be given unless the excuse for missing the scheduled exam is acceptable to the instructor. Any makeup exam must be taken **before**

the next regularly scheduled exam. **No exam grade will be dropped.**

**Assignments:** There will be **four assignments** during the semester, one before each exam. There will be no makeup assignments. Assignments turned in after their due date will receive an automatic reduction in grade. **No assignment grade will be dropped.**

**Course Objectives.**

- The course introduce students to basics of mathematical proofs and mathematical reasoning.
- The course is intended to deepen students' knowledge of problem formulation and problem solving techniques applicable to a variety of areas of mathematics.
- The course introduces the students to the language and symbolic notation to express mathematical reasoning and it cultivates the analytical skills required for the efficient use and understanding of mathematics.

**Learning outcomes.**

- Students will develop an understanding of the basics of fundamental principles of mathematics reasoning, arguments, and proofs.
- Students will develop a cognizance of main areas of mathematics and will be able to prove the statements related to these areas.
- Students will be able to identify the appropriate method to solve a specific mathematical problem, and an appropriate proof technique to prove a specific mathematical statement.

**Academic Integrity Statement:** Saint Joseph's University encourages the free and open pursuit of knowledge; we consider this to be a fundamental principle and strength of a democratic people. To this end, SJU expects its students, its faculty, its administrators, and its staff to uphold the highest standards of academic integrity. The University expects all members of the University community to both honor and protect one another's individual and collective rights.

**Students with Disabilities Statement:** Reasonable accommodations are provided to eligible students by the Office Student Disability Services (SDS). For more information, please contact SDS at [sds@sju.edu](mailto:sds@sju.edu) or 610.660.1774, or visit the website at [www.sju.edu/sds](http://www.sju.edu/sds).

**Class Recording:** Be advised that by taking this course, you consent to some or all class sessions being recorded by the instructor (and in some cases with assistance from the SJU Office of Information Technology). Recordings are intended to focus on the instructor, but the voices or likenesses of other individuals in the class may also be recorded. Video or sound recordings will be used only for educational or academic purposes, e.g., to allow for remote learning for those students not physically present in class or unable to attend a synchronous class session. If you have questions about the use of such technology or you do not consent to being recorded, you must discuss and resolve your concerns with your instructor before the end of the drop/add period.

**Statement on AI use:** The assignments in this course should be completed without any use of artificial intelligence platforms. Note that students will not have access to such platforms on in-class exams.