MAT 250 Fundamentals of Mathematics

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Class times, Fall 2024: Mon and Wed 12:20–1:35

Class meeting location, Fall 2024: Barbelin Hall 303 (HH campus).

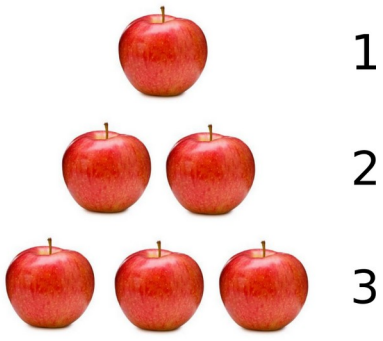
Website: http://liavas.net (with material which substitutes a traditional textbook)
Canvas: The solutions of any graded material (assignments, projects, and exams) will be posted on Canvas and, also, emailed to you.

Office hours, Fall 2024 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 2024:

Exam 1. During week 4 (Sept 18) Exam 2. During week 7 (Oct 9)
Exam 3. During week 12 (Nov 11) Final Exam. During the finals week

Grading:

Three semester exams	20% each
Exam 4 (during the finals week)	20%
Homework assignments	20%
TOTAL	**100%**

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 academic accommodations may be provided to students who submit appropriate documentation of their disability. If students have need of assistance or questions with this issue, they are encouraged to contact the Office of Student Disability Services (SDS) at sds@sju.edu or by phone at 610.660.1774. The Office of SDS also provides an appeal/grievance procedure for complaints regarding requested or offered reasonable accommodations. More information can be found at: www.sju.edu/sds.

Health and Wellness Statement: Saint Joseph's University recognizes that physical and mental health strongly impact one's ability to do well in school and in life. As a result, there are many helpful campus resources designed to help students to care for their physical, mental, and spiritual health. Students may experience stressors that can impact both their academic experience and their personal well-being. These may include academic pressure and challenges associated with relationships, mental health, alcohol or other drugs, identities, finances, etc. All of us benefit from support during times of struggle and challenges. If you are experiencing concerns, seeking assistance sooner rather than later is a courageous thing to do for yourself and those who care about you. The resources at https://sites.sju.edu/counseling/ can help you to cope with stress and to achieve your academic and personal goals.