

**Math 344**  
**Mathematical Analysis 1**  
**Section 1**  
**Fall 2018**

**Prerequisites:** (Effectively) Math 313 and Math 341.

**Associated Lab Course:** Math 345.

**Course Description:** Development of the theory of vector spaces, linear maps, inner product spaces, spectral theory, and metric space topology.

**Minimal Learning Outcomes:** Students will have a solid understanding of the concepts listed below. They will be able to prove theorems that are central to this material, including theorems that they have not seen before. They will understand connections between the concepts taught, and be able to relate them to other mathematical material that they have studied. They will be able to perform the related computations on small, simple problems.

1. Abstract Vector Spaces
  - Vector Algebra
  - Spans and Linear Independence
  - Products, Sums, and Complements
  - Dimension
  - The Replacement Theorem
  - Quotient Spaces
2. Linear Transformations and Linear Systems
  - Definitions and Examples
  - Rank, Range and Nullity
  - The First Isomorphism Theorem
  - Matrix Representations
  - Composition, Change of Basis, and Similarity
  - Linear Systems
    - Elementary Matrices
    - Row Echelon Form
    - Inverses
    - Determinants
3. Inner Product Spaces
  - Definitions and Examples
  - Orthonormal Sets
  - Gram-Schmidt Orthogonalization
4. Spectral Theory
  - QR Decomposition
  - Normed Linear Spaces
  - Adjoint
  - Fundamental Subspaces
  - Projectors
  - Least Squares
5. Metric Space Topology
  - Eigenvalues and Eigenvectors
  - Invariant Subspaces
  - Diagonalization
  - Schur's Lemma
  - The Singular Value Decomposition
  - Metric Spaces
  - Limits
  - Open and Closed Sets
  - Continuous and Uniformly Continuous Mappings
  - Cauchy Sequences and Completeness
  - Compactness
  - Connectedness
  - Banach-valued Integration

**Text:** *Foundations of Applied Mathematics, Volume I: Mathematical Analysis* by Humpherys, Jarvis, and Evans. We will cover Chapters 1 through 5 this semester.

**Websites:** See [math.byu.edu/~bakker](http://math.byu.edu/~bakker) for the schedule and a copy of this syllabus. See BYU Learning Suite for quizzes, homework assignments, and (estimated) grades.

**Assessment:** Your understanding of course material will be assessed through quizzes, homework, midterms, and a final exam.

**Quizzes:** With the exception of the first day of class, there will be an online quiz due at 9 a.m. on each day that we are scheduled to cover new material. These quizzes are available on Learning Suite. The quizzes are to encourage you to read the text, since there is insufficient class time to talk about all the course material. Your four lowest quiz scores will be dropped. You should plan on reserving these quiz drops for days that you are sick.

**Homework:** Homework is due almost every class day, as listed on the schedule. It will be collected at 9:00 a.m. in your 320 class by a TA. Each homework assignment should be written or printed on  $8.5 \times 11$  paper with your name, the course, and the section written in the upper right-hand corner of the first page. Do not fold your assignments. If there are multiple pages, staple them together. For full credit, your homework should provide complete, clear, precise arguments justifying your answers to the assigned problems. Your three lowest homework scores will be dropped. You should plan on reserving these homework drops for days that you are sick, have trouble getting to campus on time, etc.

**Midterms:** Your midterms are scheduled for October 9-12 and November 9-13. As required by the Testing Center, those taking a midterm on the last day of the exam period will be assessed a late fee.

**Final Exam:** Your final exam will be in the Testing Center during the Final Exam period. The final exam will open on Sat. Dec. 15 and close on Wed. Dec. 20. NOTICE THE LAST DAY FOR YOUR FINAL EXAM IS NOT THE LAST DAY OF THE FINAL EXAM PERIOD. Anticipate using 3 hours for your final exam.

**Course Grades:** Quizzes will account for 5% of your grade, homework will account for 35%, midterms will account for 30%, and the final exam will account for 30%. The instructor will try to assign letter grades in accordance with BYU's official scale: A = Excellent, B = Good, C = Satisfactory, D = Minimum passing, E = Failure. Additionally, for this class the following formula holds: If  $p \in [0, 100]$  is your overall percentage, then the numerical value of your course grade is guaranteed to be **strictly greater than**  $(\min\{p, 95\})/10 - 5.6$ . For example, if you ended up with 83% of points possible, then you'd receive at least a B, since  $(\min\{83, 95\})/10 - 5.6 = 2.7$ , and the numerical value of a B- is a 2.7.

### Academic Honesty:

- You should not copy other students' homework.
- During an exam period, those who have taken the exam should not share information about the exam with those who haven't taken it. When you take the exam, you will be asked to sign a statement asserting that you have complied with this requirement.

**Miscellaneous:**

**Classroom:** 108 TMCB.

**Class Time:** 10:00-10:50 a.m. MWF.

**Instructor:** Dr. Lennard Bakker, 366 TMCB, bakker@mathematics.byu.edu, 801-422-5882.

**Instructor Office Hours:** 1:00-1:50 p.m. Tuesday. 1:00-1:50 p.m. Thursday. 1:00-1:50 p.m. Friday.

**Teaching Assistant:** Cache Thompson.

**Teaching Assistant Office Hours:** 2-2:50 Tuesday. 2-2:50 Thursday.

**Studying:** The BYU Catalog says: “The expectation for undergraduate courses is three hours of work per week per credit hour for the average student who is appropriately prepared; much more time may be required to achieve excellence.” You should plan your study time for this course accordingly. It will be to your advantage not to postpone working on homework until shortly before it is due.

## University Policies:

**Honor Code:** In keeping with the principles of the BYU Honor Code, students are expected to be honest in all of their academic work. Academic honesty means, most fundamentally, that any work you present as your own must in fact be your own work and not that of another. Violations of this principle may result in a failing grade in the course and additional disciplinary action by the university. Students are also expected to adhere to the Dress and Grooming Standards. Adherence demonstrates respect for yourself and others and ensures an effective learning and working environment. It is the university's expectation, and every instructor's expectation in class, that each student will abide by all Honor Code standards. Please call the Honor Code Office at 422-2847 if you have questions about those standards.

**Preventing Sexual Misconduct:** As required by Title IX of the Education Amendments of 1972, Brigham Young University prohibits sex discrimination against any participant in its education programs or activities. The university also prohibits sexual harassment—including sexual violence—committed by or against students, university employees, and visitors to campus. As outlined in university policy, sexual harassment, dating violence, domestic violence, sexual assault, and stalking are considered forms of “Sexual Misconduct” prohibited by the university. University policy requires any university employee in a teaching, managerial, or supervisory role to report incidents of Sexual Misconduct that come to their attention in any way, including but not limited to face-to-face conversations, a written class assignment or paper, class discussion, email, text, or social media post. Incidents of Sexual Misconduct should be reported to the Title IX Coordinator at [t9coordinator@byu.edu](mailto:t9coordinator@byu.edu) or 801-422-8692. Reports may also be submitted through EthicsPoint at <https://titleix.byu.edu/report> or 1-888-238-1062 (24-hours). BYU offers confidential resources for those affected by Sexual Misconduct, including the university's Victim Advocate, as well as a number of non-confidential resources and services that may be helpful. Additional information about Title IX, the university's Sexual Misconduct Policy, reporting requirements, and resources can be found at <http://titleix.byu.edu> or by contacting the university's Title IX Coordinator.

**Student Disability:** Brigham Young University is committed to providing a working and learning atmosphere that reasonably accommodates qualified persons with disabilities. If you have any disability which may impair your ability to complete this course successfully, please contact the University Accessibility Center (UAC), 2170 WSC or 422-2767. Reasonable academic accommodations are reviewed for all students who have qualified, documented disabilities. The UAC can also assess students for learning, attention, and emotional concerns. Services are coordinated with the student and instructor by the UAC. If you need assistance or if you feel you have been unlawfully discriminated against on the basis of disability, you may seek resolution through established grievance policy and procedures by contacting the Equal Employment Office at 422-5895, D-285 ASB.