

## SYLLABUS – MATH 4030 – FALL 2022

### FOUNDATIONS OF ALGEBRA

- **Time:** Monday, Wednesday, Friday 4:10–5:00pm.
- **Location:** LCB 219
- **Instructor:** Aaron Bertram
- **Contact information:**
  - email: [bertram@math.utah.edu](mailto:bertram@math.utah.edu)
  - office: JWB 302
  - website: <http://www.math.utah.edu/~bertram/math4030>
- **Office hours:** TBD (most likely a hybrid of in person and virtual).
- There is no official textbook for this course.

**Grade:** Your grade will be determined by:

- 20% PreDiscussion Homework. Notes due in class each day
- 20% In-Class Discussion
- 20% PostDiscussion Scribing
- 40% Two Presentations

**Discussion Template:**

- Statement (with any needed definitions)
- History (if applicable)
- Context (in the curriculum)
- Proofs (as necessary)
- Examples
- Applications
- Problems

**Presentation:**

- 20 minutes
- Can be a classroom lesson or a Ted talk
- Combines several of the discussion topics
- Contains math content, applications and insights

**Foundations of Algebra/Math 4030/Fall 2022**  
**Discussion Topics (Preliminary Version)**

**Solving Equations Algebraically**

- Balancing equations and solving linear equations (one variable)
- Factoring quadratic polynomials and selected higher degree polynomials
- The quadratic formula
- Discriminants of quadratic and cubic polynomials
- Rational roots of rational polynomials
- Real and complex roots of rational polynomials
- Newton's method for approximating real roots
- Linear equations in more than one variable
- Row and column operations on matrices
- Inverses of (square) matrices and applications
- Presentations

**Algebraic Structure**

- Place value, decimals and scientific notation
- Base two
- Infinite decimal expansions of rational numbers
- Infinite series (especially geometric series)
- Functions and their power series expansions
- Algebraic relations among physical quantities
- The Pythagorean theorem and other algebraic relations in trigonometry
- Algebraic relations among exponentials and logarithms
- Euclid's algorithm for the gcd/linear equation
- Prime numbers and division of integers mod  $p$
- The binomial theorem, Pascal's triangle and Fermat's little theorem
- Presentations

**Symmetry**

- Vectors and vector spaces
- Dot vs cross products
- How to multiply complex numbers in  $re^{i\theta}$  form and as matrices
- The complex  $n$ th roots of a nonzero complex number
- Rotations and reflections of the plane
- Orthogonal transformations (rotations in threespace and beyond)
- Determinants
- Characteristic polynomials and eigenvalues of square matrices
- Permutations and permutation matrices
- Groups of symmetries of regular polygons
- The Platonic solids
- Presentations

**The Americans with Disabilities Act:** The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability & Access, 162 Olpin Union Building, 801-581-5020. CDA will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in alternative format with prior notification to the Center for Disability & Access.

**Addressing Sexual Misconduct:** Title IX makes it clear that violence and harassment based on sex and gender (which includes sexual orientation and gender identity/expression) is a Civil Rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veterans status or genetic information. If you or someone you know has been harassed or assaulted on the basis of your sex, including sexual orientation or gender identity/expression, you are encouraged to report it to the University's Title IX Coordinator; Director, Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or to the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to police, contact the Department of Public Safety, 801-585-2677(COPS).

**Campus safety:** The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit [safeu.utah.edu](https://safeu.utah.edu)

**University Counseling Center:** The UCC staff is committed to supporting the mental health needs of our campus community, while mitigating COVID-19 risks in our department. While the pandemic is ongoing, the UCC is providing all services as telephone and secure video conference appointments. Their phone number is 801-581-6826, Monday-Friday, 8:00am-5:00pm. For after-hours emergencies, contact the 24/7 Crisis Line: 801-587-3000 . More information is at <https://counselingcenter.utah.edu/>

**Office of the Dean of Students:** The Office of the Dean of Students is dedicated to being a resource to students through support, advocacy, involvement, and accountability. It serves as a support for students facing challenges to their success as students, and assists with the interpretation of University policy and regulations. The Office of the Dean of Students is currently closed for in person meetings, but their staff are still available to help you. To contact the Office of the Dean of Students, please email [deanofstudents@utah.edu](mailto:deanofstudents@utah.edu) or call 801-581-7066. There is more information at <https://deanofstudents.utah.edu/>

### CoViD Matters

Students *must* self-report if they test positive for COVID-19 via this website:

<https://coronavirus.utah.edu/>

Follow the instructions at the website for your next steps.

*Note:* If you are unable to attend class in person due to a positive test, quarantine, etc., I will ensure that you are not penalized from the grade perspective and will do my best to make sure you don't fall behind.

**Vaccination:**

Get a COVID-19 vaccination if you have not already done so. Vaccination is proving highly effective in preventing severe COVID-19 symptoms, hospitalization and death from coronavirus. Vaccination is the single best way to stop this COVID resurgence in its tracks. Visit <http://mychart.med.utah.edu/>, <http://alert.utah.edu/covid/vaccine>, or <http://vaccines.gov/> to schedule your vaccination.

**Masks:** I encourage you to wear masks in indoor settings, but they are not now mandatory in my class, though that could change if University policy change