



MATH-220 – Mathematical Structures and Proofs

University Arts and Science

Effective Term & Year: Fall 2022

Course Outline Review Date: 2025-04-01

Program Area: Math and Sciences

Description:

This course provides students with a transition from mathematics courses at the first-year level to rigorous, theoretical courses at the upper-division in which mathematical proof is emphasized. The nature and purpose of mathematical proof are examined. Many common techniques of proofs are studied and applied in analyzing a large number of elementary proofs. Students spend a considerable amount of time analyzing sample proofs and constructing their own proofs. No single area of mathematics will be emphasized; examples may be chosen from abstract algebra, number theory, analysis and combinatorics.

Program Information:

This course can be used as an elective in several University Studies Programs. Refer to the College Program Guide for additional information.

Delivery Methods: On-campus (Face-to-Face)

Credit Type: College of the Rockies Credits

Credits: 3

Course type/s: Sciences

Instructional Activity and Hours:

Activity	Hours
Classroom, Directed Studies or Online Instruction	45
Seminar/Tutorials	

Laboratory/Studio	
Practicum/Field Experience	
Co-op/Work Experience	
Other	
Total	45

Course Requisites:

- Complete all of the following
 - Completed the following:
 - [MATH104](#) – Integral Calculus (3)
 - Completed or concurrently enrolled in at least 1 of the following:
 - [MATH201](#) – Multivariable Calculus (3)
 - [MATH205](#) – Multivariable & Vector Calculus (3)
 - [MATH221](#) – Elementary Linear Algebra (3)
 - [MATH203](#) – Differential Equations (3)
 - [MATH202](#) – Vector Calculus (3)
 - At least one second year Mathematics course. MATH 201 (Calculus III), MATH 205 (Calculus III and IV) or MATH 221 (Linear Algebra) are recommended.

Flexible Assessment: Yes

In some cases students may be able to apply for recognition of prior learning outside the classroom. This flexible assessment process provides equivalent course credit. It is a rigorous process that may include external evaluation, worksite assessment, demonstration, standardized test, self-assessment, interview, products/portfolio, and challenge exam, or other measures as appropriate. Tuition fees apply. Contact an education advisor for more information.

Course Transfer Credit:

For information about receiving transfer credit for courses taken at other BC institutions, please see <http://www.bctransferguide.ca>. All requests for course transfer credit from institutions in BC or elsewhere should go to the College of the Rockies Enrollment Services office.

Textbook Resources:

Textbook selection varies by instructor and may change from year to year. At the Course Outline Effective Date the following textbooks were in use:

Daniel Solow, *How to Read and Do Proofs: An Introduction to Mathematical Thought*

Processes. Wiley, John and Sons, 2013

Robert S. Wolf, *Proof, Logic, and Conjecture: The Mathematician's Toolbox*. W H Freeman and Co., 1998.

Hass, Heil, Weir, *Thomas' Calculus*. Pearson, 2018, 14th edition

Kevin Houston, *How to Think Like a Mathematician: A Companion to Undergraduate Mathematics*. Cambridge University Press, 2009

Optional Texts:

Keith Devlin, *The Millennium Problems: The Seven Greatest Unsolved Mathematical Puzzles of Our Time*. Basic Books, 2002.

Other readings may be assigned throughout the course

Please see the instructor's syllabus or check COTR's online text calculator <https://textbook.cotr.bc.ca/> for a complete list of the currently required textbooks.

Learning Outcomes:

Upon the successful completion of this course, students will be able to:

- recognize and use a variety of techniques used in mathematical logic and proofs, including formal logic, truth tables, logical connectives, and logical quantifiers;
- recognize and use the different kinds of statements found in proofs including conditional, biconditional, converse, inverse, and contra-positive statements;
- use what you have learned to analyse proofs found in a variety of branches of mathematics and
- use what you have learned to construct your own proofs.

Course Topics:

- An Introduction to Proofs and Logic
- Forward/Backward Method and Direct Proofs
- Limits and Continuity
- Set Theory Proofs

- Proofs by Contradiction and Indirect Proofs
- Proofs by Mathematical Induction
- Functions and Relations
- Branches of Mathematics
- Millennium Problems
- Fermat's Last Theorem

See instructor's syllabus for the detailed outline of weekly readings, activities and assignments.

Evaluation and Assessments

Assessment Type: On-Campus (face-to-face)

Assessment Type	% of Total Grade
Assignments	20%
Long Proofs/Research Assignments	20%
Midterm(s)	30%
Final Exam	30%
Total	100%

Grade Scheme

A+	A	A-	B+	B	B-	C+	C	C-	D	F
>=90	89-85	84-80	79-76	75-72	71-68	67-64	63-60	59-55	54-50	<50

Pass requirements: A passing average overall (50% or higher) and 40% on the final exam.

Evaluation Notes: A grade of "D" grants credit, but may not be sufficient as a prerequisite for sequential courses.

Exam Attendance:

Students must attend all scheduled exams at the appointed time and place. Instructors may approve an alternate exam to accommodate an illness or personal crisis. Department heads will consider other written requests. Any student who misses a scheduled exam without prior approval will receive a "0" on the exam.

Academic Policies:

College of the Rockies policies related to courses can be found at <https://cotr.bc.ca/about-us/college-policies/> and include the following:

- Policy 2.4.3 Students with Documented Disabilities

- Policy 2.4.4 Student Conduct (plagiarism, other cheating, behavioral misconduct)
 - Policy 2.5.8 Academic Performance
 - Policy 2.5.3 Grade Appeal
 - Policy 2.4.9 Student Concerns Re Faculty
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Course Changes:

The College of the Rockies updates course outlines regularly to meet changing educational, employment and marketing needs. The instructor will notify students in writing of any updates to this outline during the semester. The instructor reserves the right to revise, add or delete material while meeting the learning outcomes of this course outline.