



## Mathematical Structures and Proofs - MATH 220

### University Studies Program

### Course Outline

COURSE IMPLEMENTATION DATE: January 2011  
OUTLINE EFFECTIVE DATE: September 2020  
COURSE OUTLINE REVIEW DATE: April 2025

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#### GENERAL COURSE 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.

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

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**Delivery:** This course is delivered face-to-face

**COTR Credits:** 3

**Hours for this course:** 45 hours

#### Typical Structure of Instructional Hours:

Instructional Activity	Duration
Lecture Hours	45
Seminars / Tutorials	
Laboratory / Studio Hours	
Practicum / Field Experience Hours	
Other Contact Hours	
<b>Total</b>	45

#### Practicum Hours (if applicable):

Type of Practicum	Duration
On-the-job Experience	N/A
Formal Work Experience	N/A
Other	N/A
<b>Total</b>	

**Course Outline Author or Contact:**

Andrea Hyde, MSc

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Signature

**APPROVAL SIGNATURES:**

Department Head  
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Department Head Signature

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Dean Signature

EDCO

Valid from: September 2020 – April 2025

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Education Council Approval Date

**COURSE PREREQUISITES AND TRANSFER CREDIT**

**Prerequisites:** MATH 104 (Calculus II)

**Corequisites:** 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 (FA):**

Credit can be awarded for this course through FA  Yes  No

Learners may request formal recognition for flexible assessment at the College of the Rockies through one or more of the following processes: External Evaluation, Worksite Assessment, Demonstration, Standardized Test, Self-assessment, Interview, Products/Portfolio, Challenge Exam. Contact an Education Advisor for more information.

**Transfer Credit:** For transfer information within British Columbia, Alberta and other institutions, please visit <http://www.cotr.bc.ca/Transfer>

Students should also contact an academic advisor at the institution where they want transfer credit.

**Prior Course Number:** N/A

## Textbooks and Required 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, 14<sup>th</sup> 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 <http://go.cotr.bc.ca/tuition/tCalc.asp> for a complete list of the currently required textbooks.

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## 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.
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## 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.

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## EVALUATION AND ASSESSMENT

Assignments	% Of total Grade
Assignments	20%
Long Proofs/Research Assignments	20%
Midterm(s)	30%
Final Exam	<u>30%</u>
Total	100%

Please see the instructor's syllabus for specific classroom policies related to this course, such as details of evaluation, penalties for late assignments, and use of electronic aids.

Failure to attain a mark of at least 40% on the Final Exam will result in a failing grade in the course.

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## EXAM POLICY

Students must attend all required scheduled exams that make up a final grade at the appointed time and place.

Individual instructors may accommodate for illness or personal crisis. Additional accommodation will not be made unless a written request is sent to and approved by the appropriate Department Head prior to the scheduled exam.

Any student who misses a scheduled exam without approval will be given a grade of "0" for the exam.

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## COURSE GRADE

Course grades are assigned as follows:

Grade	A+	A	A-	B+	B	B-	C+	C	C-	D	F
Mark (Percent)	≥ 90	89-85	84-80	79-76	75-72	71-68	67-64	63-60	59-55	54-50	< 50

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

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## ACADEMIC POLICIES

See [www.cotr.bc.ca/policies](http://www.cotr.bc.ca/policies) for general college policies related to course activities, including grade appeals, cheating and plagiarism.

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## **COURSE CHANGES:**

Information contained in course outlines is correct at the time of publication. Content of the courses is revised on an ongoing basis to ensure relevance to changing educational, employment, and marketing needs. The instructor endeavours to provide notice of changes to students as soon as possible. The instructor reserves the right to add or delete material from courses.