



ALES 291 / MATH 120

MATHEMATICS FOR THE LIFE SCIENCES

In Winter 2021, Math 120, *Mathematics for the Life Sciences*, is being offered at Yukon University concurrent with the University of Alberta's ALES 291, *Mathematics for the Life Sciences*, as part of the Northern Environmental and Conservation Sciences, B.Sc. Program. All students registered in Math 120 or ALES 291 must adhere to requirements outlined in this course syllabus. University of Alberta students must also be aware of, and adhere to, the University's Code of Student Behaviour, referenced in the outline; Yukon University students must be aware of, and adhere to, Yukon University's Academic Regulations, also referenced in the outline.

INSTRUCTOR: Dr. Tim Topper, Ph.D. Professor Emeritus
OFFICE HOURS: Mondays, Wednesday and Fridays 10:30-11:30 am (via Zoom)
OFFICE: N.A.
E-MAIL: ttopper@yukonu.ca

CLASS DAYS & TIMES: There will be no "live" classes in this course. Instead course notes and pre-recorded presentations will be available online for viewing at your convenience.

COURSE DESCRIPTION:

This course provides a survey of finite mathematics and calculus focussing on the concepts and modelling techniques used in the life sciences. To this end it covers common families of functions (polynomial, logarithmic and exponential) and their derivatives and integrals, linear programming, simple and conditional probability and Bayes theorem, and network analysis. The topics are illustrated using problems drawn from the life sciences.

STUDENT LEARNING OUTCOMES AND COMPETENCIES:

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

- Take everyday situations, translate them into mathematical representations (equations, graphs, tables, or network diagrams), manipulate these representations, and interpret the results in terms of the original situation.
- Solve linear programming problems graphically, and using the simplex method.
- Categorize quantities' variations as being polynomial, exponential, logarithmic or 'other'.
- Find the derivatives and integrals of polynomial, exponential and logarithmic functions and solve problems requiring their application.
- Apply Bayes theorem.
- Solve a variety of networking problems, e.g. critical path, shortest route, maximal flow, using both graphical and matrix representations.

COURSE FORMAT:

This is an online offering of ALES 291/Math 120.

Content. All the content for the course is provided online. Web pages provide notes on the topics and online pencast videos demonstrating and illustrating key points and procedures.

Coursework. Each week students will complete and submit a guided exercise, and an assignment, and receive feedback via email.

Student-teacher interaction. Every effort will be made to provide rich student-teacher and student-student interaction. To this end students are able to interact with the instructor and each other by email, in Moodle discussion forums, and in Zoom "office hour" meetings.

Workload: Students with a sound mathematical background can expect to spend 6 to 10 hours a week on the course.

COURSE PREREQUISITES AND/OR CO-REQUISITES:

For students taking the course as Math 120: Pre-Calculus 12 or Foundations of Mathematics 12 or MATH 060.

For students taking the course as ALES 291: Registration in Yukon College/University of Alberta BSc in Environmental and Conservation Sciences degree program, **and** one of Pre-Calculus 12 or Foundations of Mathematics 12 or MATH 060.

REQUIRED TEXTBOOKS/MATERIALS:

A variety of online resources will be used in place of a printed textbook.

COURSE WEBSITE

Material for the course will be available on the ALES 291/Math 120 class site on Yukon University's Moodle system (moodle.yukonu.ca).

YUKON UNIVERSITY ACADEMIC STANDARDS AND REGULATIONS

Information on academic standing and student rights and responsibilities can be found in the current Academic Regulations that are posted on the Student Services/ Admissions & Registration web page.

Plagiarism

Plagiarism is a serious academic offence. Plagiarism occurs when a student submits work for credit that includes the words, ideas, or data of others, without citing the source from which the material is taken. Plagiarism can be the deliberate use of a whole piece of work, but more frequently it occurs when students fail to acknowledge and document sources from which they have taken material according to an accepted manuscript style (e.g., APA, CSE, MLA, etc.). Students may use sources which are public domain or licensed under Creative Commons; however, academic documentation standards must still be followed. Except with explicit permission of the instructor, resubmitting work which has previously received credit is also considered plagiarism. Students who plagiarize material for assignments will receive a mark of zero (F) on the assignment and may fail the course. Plagiarism may also result in dismissal from a program of study or the University.

UNIVERSITY OF ALBERTA ACADEMIC INTEGRITY AND CODE OF STUDENT BEHAVIOUR

Academic Integrity

The University of Alberta is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Code of Student Behaviour (online at www.governance.ualberta.ca) and avoid any behaviour which could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.

Code of Student Behaviour

All students at the University of Alberta are subject to the Code of Student Behaviour, as outlined at:

<http://www.governance.ualberta.ca/en/CodesofConductandResidenceCommunityStandards/CodeofStudentBehaviour.aspx> Please familiarize yourself with it and ensure that you do not participate in any inappropriate behavior as defined by the Code. Key components of the code include the following statements.

30.3.2(1) No Student shall submit the words, ideas, images or data of another person as the Student's own in any academic writing, essay, thesis, project, assignment, presentation or poster in a course or program of study.

30.3.2(2) c. No Student shall represent another's substantial editorial or compositional assistance on an assignment as the Student's own work.

PROFESSIONALISM AND CLASSROOM RULES OF ENGAGEMENT

Students are expected to be courteous, supportive, and encouraging in all course communications and interactions.

COURSE REQUIREMENTS/EVALUATION:

Homework/Guided Exercises (30%)

Mathematics can only be learned by doing it. Reading the course notes or watching the videos is just the first step in learning the material. Guided exercises give you problems to attempt and the solutions to them in case you get stuck. Each week's guided exercise is due the next Monday morning. They are marked for completion.

Assignments (30%)

There will be *weekly* assignments over the course of the term worth 30% of the final mark. Where the homework problems are intended to assist the student in *learning* new material, the assignments are meant to reinforce and *extend* the student's understanding of material that has already been *learned* (i.e. they are more interesting). The assignment covering each week's material is due the following Friday. *Late assignments are not accepted*, but your lowest assignment mark will be discarded.

Final Examination (40%)

A final examination which will cover the entire course, and be worth 40% of the final mark, will be held on April 23 from 9:00 am to 12:00 pm.

Students taking the course as ALES 291 must ensure that they are familiar with the University of Alberta's Academic Regulations governing missed and deferred final exams (<http://www.registrar.ualberta.ca/calendar/Regulations-and-Information/Academic-Regulation/23.5.html#23.5>).

Evaluation

The course grade will be determined as follows:

	Percent
Homework/Guided exercises	30%
Assignments	30%
Final exam	40%
Total	100%

Assignment of grades

The total numerical score will be converted to a grade on Yukon University's letter grading system.

ELECTRONIC DEVICES:

Students will **require** a scientific calculator, but it must **not** include graphing capabilities. More detail will be provided in the first week of class.

YUKON FIRST NATIONS CORE COMPETENCY

Yukon University recognizes that a greater understanding and awareness of Yukon First Nations history, culture and journey towards self-determination will help to build positive relationships among all Yukon citizens. As a result, to graduate from ANY Yukon University program, you will be required to achieve core competency in knowledge of Yukon First Nations. For details, please see www.yukonu.ca/yfnccr.

ACADEMIC ACCOMMODATION

Reasonable accommodations are available for students requiring an academic accommodation to fully participate in this class. These accommodations are available for students with a documented disability, chronic condition or any other grounds specified in section 8.0 of the Yukon University Academic Regulations (available on the Yukon University website). It is the student's responsibility to seek these accommodations. If a student requires an academic accommodation, they should contact the Learning Assistance Centre (LAC): lac@yukonu.ca.

EQUIVALENCY/TRANSFERABILITY:

Math 120 transfers for 3 credits of first year math at many BC colleges and universities. You can see the complete list at <http://www.bctransferguide.ca>

Successful completion of MATH 120/ALES 291 fills the requirement for a first-year math course in the University of Alberta B.Sc. ENCS Program, Northern Systems Major.

TENTATIVE SCHEDULE AND TOPIC OUTLINE:

Week	Content
1	Linear Models: Introduction
2	Linear Models: Systems of Equations Solving systems of linear equations and inequalities algebraically, graphically and using matrices.
3	Linear Models for Optimization Linear programming: Graphical Solution
4	Linear programming: The Simplex Method
5	Nonlinear Models Quadratic, Exponential and Sinusoidal models.
6	Modelling change: Derivatives Average rate of change. Instantaneous rate of change. Rules for differentiation: basic, products, quotients, the chain rule.
7	Applications of the Derivative: Function sketching Optimization problems
8	<i>Reading Week</i>
9	Modelling Accumulation: Integrals
10	Modelling Uncertainty: Probability Simple and conditional probability. Combinatorics.
11	Bayes' Theorem.
12	Modelling Structure: Graph theory Diagrammatic representation. Matrix representation.
13	Euler circuits and paths; minimal spanning trees. Hamiltonian circuits and paths; shortest routes. Shortest route algorithm.
14	Synthesis Matrix multiplication applied to graphs. Markov processes.
15	Review and Exam Preparation
16-17	Examination Period