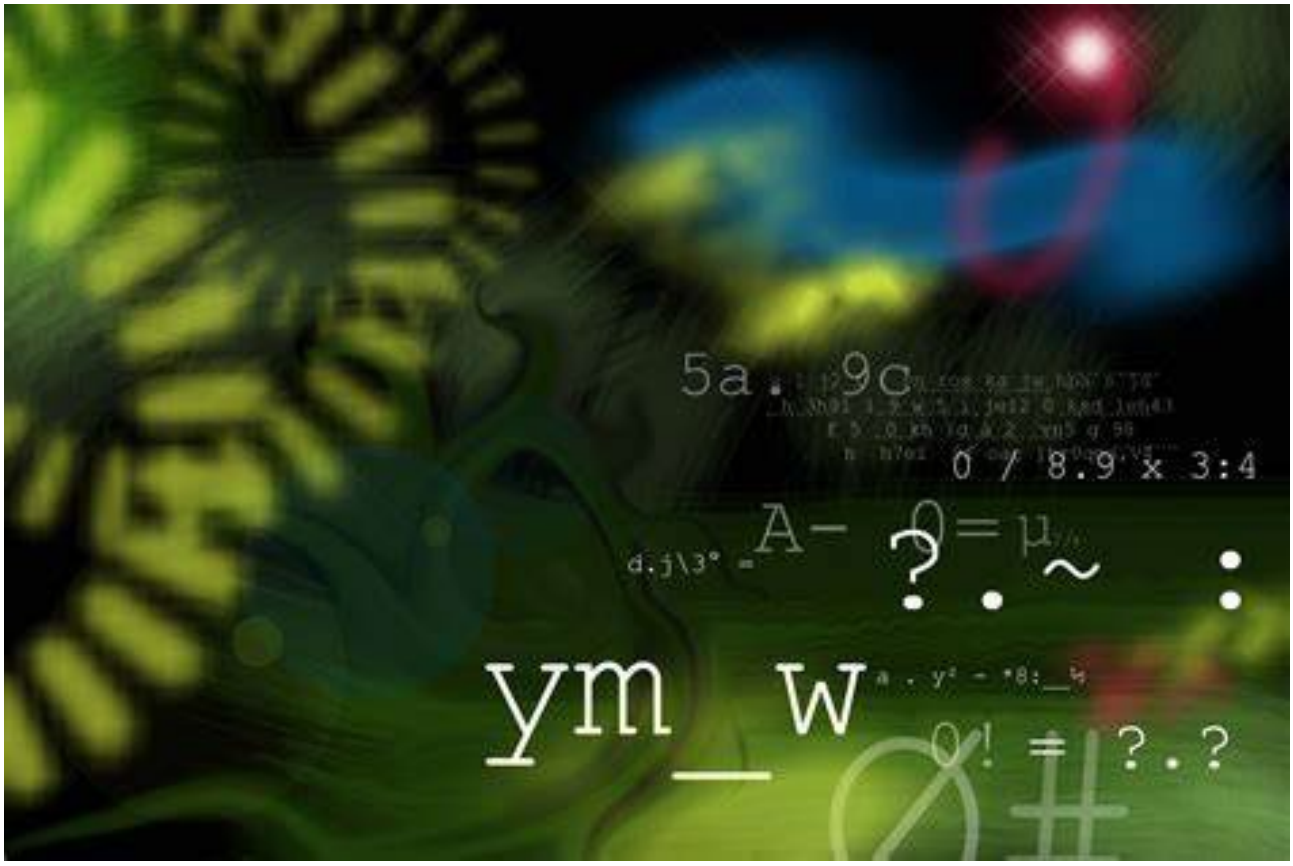
2024

Undergraduate courses

Mathematics, Statistics & Data Science



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VICTORIA UNIVERSITY OF WELLINGTON
TE HERENGA WAKA

CONTENTS

BACHELOR OF SCIENCE (BSc)

Bachelor of Science Degree Requirements

- A total of 360 points.
- At least 210 points must be from 200 and 300-level courses, including:
  - At least 120 points must be from courses listed for the BSc
  - At least 75 points must be from 300-level courses listed for the BSc.
- 90 points can be from outside science (some majors also permit an additional 30 outside points).
- At least one Major, and a second Major may be from science or from any other first degree with a maximum of 150 points permitted from outside science.

Science Major Requirements

- 60 points at 300-level.
- 60–80 points at 200-level.
- 45–60 points at 100-level.

Science Minor Requirements

- 60 points above 100-level specified in the major, of which 15 points must be at 300-level.

BACHELOR OF ARTS (BA)

Bachelor of Arts Degree Requirements

- 360 approved points including:
  - maximum of 180 points at 100-level
  - minimum of 180 points at 200/300 level, including at least 75 points at 300 level
  - at least 180 points must be in subjects from Part A of the BA Schedule*.

*Note that Data Science and Mathematics courses are in Part B of the BA Schedule.

GRADUATE CERTIFICATE IN SCIENCE

- 60 points courses for the BSc at 200 and 300 level.
- 40 points must be at 300 level.
- With approval, you may substitute 20 points worth of courses from other programmes at the University.

GRADUATE DIPLOMA IN SCIENCE

- Complete 200 and 300 level courses worth at least 120 points from the BSc schedule.
- At least 75 points must be at 300 level.
- With approval, you may substitute 30 points worth of courses from other programmes at the University.

PLEASE NOTE

CANCELLATION OF COURSES

The courses offered by the University and listed in this prospectus may be cancelled by the University as a result of insufficient resources or student demand, or if other unforeseen circumstances arise.

TIMETABLE CHANGES

Check the timetable online for confirmation of course times.
http://www.victoria.ac.nz/students/study/timetables

ENTRY REQUIREMENTS 100-LEVEL MATHEMATICS AND STATISTICS

There are four levels of entry to Mathematics and Statistics courses:

1. Well-prepared calculus students may enrol directly in MATH 142 (Calculus 1B).
   You will need to have passed NCEA Level 3 Achievement Standards:
   - 3.6 (Differentiation, AS91578) achieved with excellence
   - 3.7 (Integration, AS91579)
   - one of 3.1 (Conics, AS91573), 3.3 (Trigonometry, AS91575), or 3.5 (Complex numbers, AS91577)
   - a Merit or Excellence grade in at least one of 3.1, 3.3, 3.5, or 3.7.

   If you don't have these qualifications (or their equivalent), you'll require MATH 141 (Calculus 1A) or QUAN 111 (Mathematics for Economics and Finance).

2. Reasonably well-prepared students who have gained 16 NCEA Level 3 Achievement Standard credits in Mathematics (or some equivalent qualification) are given direct entry to MATH 141 (Calculus 1A) and MATH 151 (Algebra).

   Entry to MATH 161 (Discrete Mathematics and Logic), requires 16 NCEA Level 3 Achievement Standard credits in Mathematics with one of 3.5 (Complex numbers, AS91577), 3.6 (Differentiation, AS91578), 3.7 (Integration, AS91579)) achieved with Merit or Excellence. If you don't have these qualifications (or their equivalent), you need one of the following:
   - a pass in one course from ENGR 121–123, MATH 141–177, or QUAN 111, or
   - a grade of B+ or higher in MATH 132 (Introduction to Mathematical Thinking) or equivalent background in mathematics.

   Entry to MATH 177 (Probability and Decision Modelling) requires 16 NCEA Level 3 Achievement Standard credits in Mathematics, including 3.6 (Differentiation, AS91578) and 3.7 (Integration, AS91579), If you don't have these qualifications (or their equivalent), you need a pass in one of these courses: ENGR 122–123, MATH 141, or QUAN 111.

3. Less prepared students may enter MATH 132 (Introduction to Mathematical Thinking) and STAT 193 (Statistics in Practice), provided they have met university entrance numeracy requirements, preferably with NCEA Level 2 Achievement Standard 2.6 (Algebra, AS91261) as well. A pass in MATH 132 gives entry into MATH 141 and MATH 151, while a B+ grade gives you entry into MATH 161.

4. Advanced students may be granted direct entry to 200-level courses. Entry is at the discretion of the appropriate programme director.

PREREQUISITES AND RESTRICTIONS

Starting at 200-level, courses are listed with prerequisites and restrictions.

Prerequisites are the courses that are required for entry into the course. For example, If STATXXX has (STATYYY, ZZZ) listed as prerequisites, then you must have passed STATYYY **AND** STATZZZ before you can enrol in STATXXX.

Restrictions are the courses that you **should not have already passed** before enrolling in the course. For example, if MATHXXX has MATHYYY listed as restriction, it probably means that MATHYYY contains more advanced material than MATHXXX. If you have already passed MATHYYY, or if you are currently enrolled in MATHYYY, then you will usually not be allowed to enrol in MATHXXX.

MATHEMATICS (MATH)

The BSc in Mathematics is a three-year qualification. Here, we describe the regulations concerning the MATH major within the degrees.

MAJOR REQUIREMENTS

MATH major requirements from 2022 onwards:

- MATH 142, MATH 151, MATH 161
- 15 points from (COMP 100-199, DATA 202, ENGR 222, MATH 245, STAT 293)
- 120 points from MATH 200-399 and ENGR 222, of which at least 60 points must be from MATH 300-399

MATH major requirements before 2022*:

- MATH 142, MATH 151, MATH 161
- 60 points from MATH 300-399
- 60 further points from MATH 200-399

***** Students enrolled in a MATH major before 2022 will graduate under the regulations in place when they enrolled.

MINOR REQUIREMENTS

MATH minor requirements from 2024 onwards:

- 60 points from MATH 200-399, ENGR 222 of which at least 15 points must be from MATH 300-399

MATH minor requirements before 2024*:

- 60 points from MATH 200-399, DATA 202, ENGR 222, STAT 293 of which 15 points must be from MATH 300-399 and at most 15 points can be from DATA 202, ENGR 222 or STAT 293.

***** Students enrolled in a MATH minor before 2024 will graduate under the regulations in place when they enrolled.

STATISTICS (STAT)

The Statistics major can have a theoretical (mathematical statistics) emphasis, an applied emphasis, or incorporate computational modelling, depending on the courses you take.

MAJOR REQUIREMENTS

- MATH 177 or STAT 193; 15 further points from MATH 100–199, STAT 100–199
- (MATH 243, 277) or (STAT 292, 293); 30 further 200–level points from the Science schedule or other approved courses
- STAT 332 or 393; 15 further points from STAT 300–399; 30 further 300-level points from (DATA 303, 304, MATH, STAT)

- **MATH 177** is needed for a major in **Statistics** with a **mathematical statistics** or **computational modelling** emphasis, and for a major in **Actuarial Science.**
- **STAT 193** is highly recommended for a major in **Statistics** with an **applied statistics** emphasis, and for a major in **Data Science**.

MINOR REQUIREMENTS

- One of (MATH 277, STAT 292) and one of (MATH 377, STAT 332, 393, 394)
- 15 further points from (DATA 303, 304, MATH 277, 353, 377, STAT 292, 293, 300-399)
- 15 further points at 200- or 300-level from the Science schedule.

ACTUARIAL SCIENCE (ACTS)

The role of an actuary is to quantify risk and uncertainty to help businesses manage those risks. Actuaries are employed by banks, insurance companies, investment firms and other companies. They give advice on insurance, pension schemes, company mergers, the management of financial projects and investments.

The Actuarial Science major introduces students to the technical and professional aspects of actuarial science and may enable students to gain accreditation towards qualifying as an actuary with one of the internationally recognised actuarial institutes.

Students enrolling in this major, available in both the Bachelor of Science (BSc) and Bachelor of Commerce (BCom), may consider taking it alongside a second major in Economics, Finance, Mathematics or Statistics. Graduates will be qualified to work in the fields of actuarial work, risk management, financial and statistical analysis.

MAJOR REQUIREMENTS

a. ACCY 130, ECON 130, 141, MATH 142, 177 (MATH 151 or at least a B+ in QUAN 111)
b. ACTS 201, ECON 201, FINA 201 or 202, MATH 277
c. ACTS 301, 336, STAT 335
d. one further course from 200- or 300-level FINA, MATH or STAT

	Trimester 1	**Trimester 2**
Year 1	ACCY 130: Accounting for Decision Making ECON 130: Microeconomic Principles MATH 141: Calculus 1A MATH 151: Algebra	ECON 141: Macroeconomic Principles MATH 142: Calculus 1B MATH 177: Probability and Decision Modelling
	+ 15 further points	
Year 2	ACTS 201: Financial Mathematics ECON 201: Intermediate Microeconomics FINA 201: Introduction to Corporate Finance MATH 277: Mathematical Statistics	MATH 243: Multivariable Calculus
	+ 30 further points	
Year 3	MATH 377: Probability and Random Processes STAT 335: Statistical Models for Actuarial Science	ACTS 301: Actuarial Science ACTS 306: General Insurance Techniques FINA 303: Derivatives
	+ 45 further points	

MINOR REQUIREMENTS

ACTS 201, 301, MATH 277 and one further course from part (b) or (c) of the major requirements.

DATA SCIENCE (DATA)

Data literacy is an essential component of future citizenry – the ability to make sense of data, critique its use and communicate with and about it, are becoming hugely valuable skills. Data Science combines ideas from statistics, computing and mathematics to provide new insights that are crucial to the survival of businesses, governments and institutions that want to transform their data into information, insights and novel data products. Pair your Data Science major alongside another subject to extract and provide meaningful insights to any field, including actuarial science, biology, chemistry, economics, geography, linguistics and media studies.

MAJOR REQUIREMENTS

a. DATA 101; one of (COMP 102, 112, 132, INFO 102); one of (MATH 177, QUAN 102, STAT 193).
b. DATA 201, 202; one of (MATH 277, QUAN 203, STAT 292), one further course from (AIML 231, 232, COMP 261, GEOG 215, INFO 264, MATH 245, 251, 261, 277, PHIL 269, QUAN 201, 203, STAT 292, 293).
c. DATA 301, 303, one of (DATA 302, COMP 309*); one of (DATA 304-399, AIML 331-339, COMP 307, ECON 303, GEOG 315, INFO 304, 310, 311, 377, MARK 317, MATH 353, MGMT 315, 316, STAT 391, 392, 394, SWEN 304).

Sample programme for BSc major:

	Trimester 1	**Trimester 2**
Year 1	DATA 101: Introduction to Data Science STAT 193: Statistics in Practice MATH 141: Calculus 1A MATH 151: Algebra	COMP 132: Programming for the Natural and Social Sciences INFO 151: Databases MATH 142: Calculus 1B MATH 177: Probability and decision Modelling
Year 2	DATA 202: Data Management & Programming STAT 292: Applied Statistics 2A CYBR 171: Cybersecurity Fundamentals PHIL 269: Ethics and Data	DATA 201: Techniques of Data Science GEOG 215: Introduction to GIS MATH 245: Computational Mathematics STAT 293: Applied Statistics 2B
Year 3	DATA 303: Statistics for Data Science DATA 304: Simulation and Stochastic Models SCIS 211: Contemporary Issues in Science, Environment and Technology	DATA 301: Data Science in Practice COMP 309: Machine Learning Tools and Techniques DATA 351: Data Science Internship STAT 394: Multivariate Statistics

MINOR REQUIREMENTS

DATA 201, 202, one course from (DATA 301, 302, 303, COMP 309), and one further course from parts (b) or (c) of the major requirements.

PLANNING YOUR PROGRAMME

Course code ↓	Course reference number ↓	Title ↓	Points ↓	Trimester ↓
MATH 151	**CRN 17161**	**ALGEBRA**	**15 PTS**	**T1**

Prerequisites: Courses you must have passed before taking this course.
Restrictions: You can't enrol in this course if you have passed any of the restricted courses.

Use this template to plan your programme. Start by adding in the core papers for your degree.

Year 1:							120 points
Year 2:							**120 points**
Year 3:							**120 points**

100-LEVEL COURSES

DATA 101	CRN 31056 CRN 31191	INTRODUCTION TO DATA SCIENCE	15 PTS	T1 T3
This course provides a solid foundation in data handling, covering various aspects such as data sources, types, cleaning, analysis, visualization, and quality assessment. Students will gain practical experience working with data from diverse fields like science, humanities, and commerce, using their skills to propose solutions for real-world problems. We'll also introduce important considerations like data accuracy, privacy, and ethics, along with the legal framework governing data collection, storage, and usage. Additionally, we'll delve into the specific aspects of Māori data sovereignty relevant to the field of data science.				

ENGR 121	CRN 26052 CRN 31158	ENGINEERING MATHEMATICS FOUNDATIONS	15 PTS	T1 T2
Prerequisites:	16 AS credits NCEA level 3 Mathematics (or equivalent) or MATH 132			
Restrictions:	Any pair (MATH 141/QUAN 111, MATH 151/161/177)			
An introduction to the range of mathematical techniques employed by engineers, including functions, calculus, linear algebra, vector geometry, set theory, logic and probability. This course emphasises engineering applications and modelling.				

ENGR 122	CRN 26053	ENGINEERING MATHEMATICS WITH CALCULUS	15 PTS	T2
Prerequisites:	ENGR 121 or MATH 141			
Restrictions:	The pair MATH 142 and MATH 151			
Further mathematical techniques employed by electronic and computer systems engineers, with emphasis on methods of calculus, differential equations and linear algebra. There is an emphasis on engineering applications and use of software.				

ENGR 123	CRN 27044 CRN 31159	ENGINEERING MATHEMATICS WITH LOGIC AND STATISTICS	15 PTS	T2 T3
Prerequisites:	ENGR 121			
Restrictions:	The pair MATH 161 and (MATH 177 or QUAN 102 or STAT 193)			
Mathematical techniques employed by cybersecurity and software engineers, including combinatorics, logic, probability distributions, model fitting and estimation. The course emphasises engineering applications.				

MATH 132	CRN 17150 CRN 17286	INTRODUCTION TO MATHEMATICAL THINKING	15 PTS	T1 T3
Restrictions:	ENGR 121-123, MATH 100–199, QUAN 111			
This course provides an introduction to, or review of, fundamental skills and ideas in mathematics. The course is designed for students who require some mathematics in their degree, but who may not have a lot of mathematical experience. Topics include elementary arithmetic, algebra, coordinate geometry, and functions. There is an emphasis on mathematical ideas and how they have evolved: the goal is not only to apply mathematical tools correctly, but to understand them.				

MATH 141	CRN 17151	CALCULUS 1A	15 PTS	T1
Prerequisites:	16 AS credits NCEA Level 3 Mathematics (or equivalent) or MATH 132			
Restrictions:	ENGR 122, MATH 142, QUAN 111			
Determining the rate of change of a function as its dependent variable changes is a key question in many sciences. It is also the basis for differential calculus, which is the first part of mathematical analysis. This course provides a thorough development of differential calculus. It builds on the ideas of functions and limits to define derivatives and derives rules for computing them. These rules are demonstrated in scientific applications.				

MATH 142	CRN 17160	CALCULUS 1B	15 PTS	T2
Prerequisites:	MATH 141 or QUAN 111, or NCEA Level 3 Achievement Standards 3.6 (Differentiation, AS91578) achieved with excellence, 3.7 (Integration, AS91579), one of (3.1 (Conics AS91573), 3.3 (Trigonometry, AS91575), 3.5 (Complex numbers, AS91577)) with at least one of (3.1, 3.3, 3.5, 3.7) achieved with merit or excellence, or an equivalent background in mathematics.			
Integration looks at summing continuous variables, providing a way to define and compute areas and volumes, which are essential for many applications. This course develops integral calculus, including the view of integration as anti-differentiation, leading to the Fundamental Theorem of Calculus. Sequences and series are introduced, and functions are approximated using their Taylor polynomials. Techniques of integration are developed, including substitution and integration by parts. Differential equations are introduced, many of which arise from physical systems, and the course also introduces basic methods for solving them.				

MATH 151	CRN 17161	ALGEBRA	15 PTS	T1
Prerequisites:	16 AS credits NCEA Level 3 Mathematics (or equivalent) or MATH 132			
Linear algebra is central to mathematics, and essential in science and engineering. This course introduces linear algebra, motivated by some of these applications, and maintaining a practical approach using fundamental mathematical objects such as matrices and vectors. Methods to solve systems of linear equations using matrices are introduced, as are eigenvectors, which can be used to characterise matrices amongst many other applications. The concept of an algebraic structure is introduced, as are complex numbers, which allow the solution of many equations that did not previously have solutions.				

MATH 161	CRN 17162	DISCRETE MATHEMATICS AND LOGIC	15 PTS	T2
Prerequisites:	Approved level of achievement in NCEA Level 3 Calculus or one of (ENGR 121-123, B+ or better in MATH 132, MATH 141-177, QUAN 111) or equivalent background in mathematics.			
Logic underlies all of mathematics. This course introduces the basic notions of logic and discusses what makes some arguments good or valid, and others invalid. This leads to a definition of a mathematical proof, whereby the truth of mathematical statements is guaranteed. Particular attention is paid to mathematical induction. Other topics include sets, relations, functions, elementary counting principles, and an introduction to number theory. The second half of the course introduces the fundamental concepts of graph theory, which is the study of networks, which have applications from computing to disease transmission.				

MATH 177	CRN 19803	DISCRETE MATHEMATICS AND LOGIC	15 PTS	T2
Prerequisites:	16 AS credits NCEA level 3 Mathematics or Statistics, including AS 3.6 (Differentiation, AS91578) and 3.7 (Integration, AS91579), or one of (ENGR 122, 123, MATH 141, QUAN 111) or equivalent background in mathematics.			
An introduction to probability models in statistics, decision making and operations research, including key concepts of probability, random variables and their distributions, decision theory and utility theory. Goodness-of-fit tests are used to check the validity of fitted models.				

STAT 193	(SEE STREAMS)	STATISTICS IN PRACTICE	15 PTS	T1 T2 T3
Restrictions:	MATH 277, QUAN 102			
Streams:	Stream A (CRN 1791), Stream B (CRN 11333)			T1
	Stream A (CRN 4442), Stream B (CRN 6164)			T2
	Steam A (CRN 17069)			T3
An applied statistics course for students who will be advancing in other disciplines as well as those majoring in Statistics. It is particularly suitable for students majoring in Biological Science subjects, Geography, Health, Linguistics, Psychology, social sciences such as Education, and is also suitable for BCom students. This course assumes no previous knowledge of statistics, but mathematics to Year 12 is preferred. Topics covered include estimation, confidence intervals and hypothesis testing, comparison of means and proportions, simple regression and correlation, and analysis of variance.				

200-LEVEL COURSES

ACTS 201	CRN 29082	FINANCIAL MATHEMATICS	15 PTS	T1
Prerequisites:	QUAN 102 (or STAT 193 or MATH 177), QUAN 111 (or MATH 141/142, 151)			
Mathematical principles of compound interest, geometric series and annuities; valuation of loans; returns on financial transactional duration and immunisation theory; term structure of interest rates; stochastic interest rates.				

DATA 201	CRN 31057	TECHNIQUES OF DATA SCIENCE	15 PTS	T2
Prerequisites:	DATA 101, one of (COMP 102, 112, 132, INFO 151), one of (ENGR 123, MATH 177, QUAN 102, STAT 193)			
Discover the essential computational techniques at the heart of data science, encompassing the realms of data integration and encryption. Dive into the mathematical concepts and techniques that underpin the entire data lifecycle, from generation and representation to transformation.				

DATA 202	CRN 31058	DATA MANAGEMENT AND PROGRAMMING	15 PTS	T1
Prerequisites:	One of (COMP 102, 112, 132) or C INFO 226			
Restrictions:	SCIE 201 in 2017-2018			
Explore the practical side of data management in this course designed for those working with data sources. Students will get hands-on experience in programming and data management using a high-level language and SQL. Topics covered include web scraping, data transformation, data cleaning, and the creation of data summaries and visualisations.				

ENGR 222	CRN 33042	COMPUTATIONAL ALGEBRA AND CALCULUS	15 PTS	T1
Prerequisites:	(ENGR 121, 122) or (MATH 142, 151)			
This course covers fundamental concepts in linear algebra and multivariable calculus, with an emphasis on their applications to physical and engineering problems. Topics covered include linear transformations, matrix decomposition including the singular value decomposition, Taylor series, calculus of vector-valued functions, multivariate functions and vector fields. Mathematical software will be used extensively.				

MATH 212	CRN 31091	INTRODUCTION TO REAL ANALYSIS	15 PTS	T1
Prerequisites:	MATH 142 or engineering-math equivalent.			
Restrictions:	MATH 211			
The theoretical underpinnings of calculus took many years to develop rigorously. This course provides insight into the basic techniques of real analysis in the familiar context of single-variable differential calculus. There is a focus on the proof techniques that have been developed to analyse classical analytic functions.				

MATH 243	CRN 18323	MULTIVARIABLE CALCULUS	15 PTS	T2
Prerequisites:	(MATH 142, 151) or engineering-math equivalent			
In order to apply calculus to many physical systems, its concepts have to be extended to higher dimensions. The course introduces vector-valued functions of one variable (curves in the plane and in space), real-valued functions of several variables, and vector fields, which are vector-valued functions of two or three variables. Integration over lines and surfaces, together with double and triple integrals, are defined, together with methods to solve them. Applications are used to motivate and demonstrate these methods.				

MATH 244	CRN 18324	MODELLING WITH DIFFERENTIAL EQUATIONS	15 PTS	T1
Prerequisites:	(MATH 142, 151) or engineering-math equivalent			
Ordinary Differential Equations (ODEs) have motivated a lot of mathematics, both for themselves and for their applications, particularly in the wider sciences. This course introduces ODEs, covering their classification, and various solution methods for both linear and nonlinear equations. Systems of ODEs are introduced, together with the linear algebra needed to solve them. The course also presents the Laplace transform and its use in solving ODEs.				

MATH 245	CRN 30099	COMPUTATIONAL MATHEMATICS	15 PTS	T2
Prerequisites:	ENGR 122 or ENGR 123 or (MATH151 and (141 or 142))			
Combining mathematics with computational techniques allows us to study a wide variety of applications in science, for example, solving physics problems by approximating integrals and derivatives, and compressing digital images using singular-value decomposition. This course develops mathematical, numerical, and computational techniques for practical problems that utilise optimisation, simulation, interpolation, and approximation. Some previous experience in programming is highly desirable.				

MATH 251	CRN 18325	LINEAR ALGEBRA	15 PTS	T2
Prerequisites:	MATH 151 or engineering-math equivalent			
Linear algebra is a fundamental part of mathematics. This is a second course in linear algebra, focusing on more abstract representations and giving an axiomatic treatment of vector spaces. The course introduces the underlying concepts of linear algebra, including linear transformations, subspaces, isomorphisms, dimensions, eigenvectors, inner products, and diagonalisation. Applications are used to motivate and demonstrate these concepts.				

MATH 261	CRN 18326	GROUPS AND GRAPHS	15 PTS	T1
Prerequisites:	MATH161 or engineering-math equivalent			
This course explores two fundamental mathematical structures: groups and graphs. Both have wide applications in mathematics, as well as in fields such as computer science, cryptography, physics, and chemistry. The course starts with basic group theory and explores permutations, matrices, and symmetries. The graph section uses an algorithmic lens to investigate graph complexity, study network flows, construct shortest paths, and find matchings in graphs.				

MATH 277	CRN 19804		15 PTS	T1
Prerequisites:	(MATH 142, 177) or B+ or better in both (ENGR 122, 123)			
Topics will be chosen from: basic probability theory; introduction to random variables and expectation; joint distributions, correlation and linear combinations of random variables; introductory estimation and hypothesis testing; nonparametric methods; one-way analysis of variance; linear regression; goodness of fit tests and contingency tables. The statistical software R will be used.				

STAT 292	CRN 18331	APPLIED STATISTICS 2A	15 PTS	T1
Prerequisites:	STAT 193 or ENGR 123 or QUAN 102 or a comparable background in Statistics			
This course is central to the Applied Statistics stream. Topics are statistical methods and their application in the biological, environmental, health and social sciences, including design of experiments, one-way and multi-way ANOVA and t-tests for difference of means, regression, analysis of covariance, binomial and Poisson distributions, contingency tables, models for binary response variables, and loglinear models for contingency tables. Examples from the biological, environmental, health, behavioural and social sciences are used for illustration, using statistical computing software.				

STAT 293	CRN 18332	APPLIED STATISTICS 2B	15 PTS	T2
Prerequisites:	STAT 292			
Following on from STAT 292, this course presents further topics in ANOVA and regression with examples in the biological, environmental, health and social sciences. Topics covered include algebra of expectations and variances, one-way ANOVA theory, permutation tests, randomised block designs, nested designs, multiple linear regression, data exploration, use of AIC for model comparisons in exploratory studies, Poisson regression models. Illustrative examples use the statistical software R. No previous experience with R is assumed.				

300-LEVEL COURSES

ACTS 301	CRN 27135	ACTUARIAL SCIENCE	15 PTS	T2
Prerequisites:	ACTS 201, ECON 141, MATH 277			
This is a capstone course for the Actuarial Science major that brings together skills and knowledge from prior courses to develop an understanding of their practical application in the actuarial profession. It provides grounding in the mathematical techniques that can be used to model risks and contingencies.				

ACTS 336	CRN 31125	GENERAL INSURANCE TECHNIQUES	15 PTS	T2
Prerequisites:	MATH 277			
This course provides the mathematical foundation necessary to set premiums and reserves for general insurance contracts. It provides an overview of the various techniques used in general insurance, including loss distributions, ruin theory, credibility, run-off triangles and general insurance modelling.				

DATA 301	CRN 32011	DATA SCIENCE IN PRACTICE	15 PTS	T2
Prerequisites:	DATA 201, one of (DATA 202, SCIE 201 in 2017-18), DATA 303			
Take your data science skills to the next level with our capstone course. Dive into interactive displays, infographics, and dashboards to sharpen your communication and reporting abilities through visualisation. This course seamlessly combines statistical and mathematical modelling with programming, while also exploring the social and ethical aspects of data science.				

DATA 303	CRN 32012	STATISTICS FOR DATA SCIENCE	15 PTS	T1
Prerequisites:	STAT 293 or (DATA 202 (or SCIE 201 in 2017-2018) and one of (MATH 277, QUAN 203, STAT 292))			
Explore the foundations of data science. You'll delve into statistical modelling and inference, including the handling of binary, count, and ordinal data. Additionally, we'll examine the pivotal role of data and modelling in decision-making across various practical contexts.				

DATA 304 COMP 312	CRN 32013 CRN 10444	SIMULATION AND STOCHASTIC MODELS	15 PTS	T1
Prerequisites:	COMP 102 or 112 or 132 or DATA 202, one course from (MATH 177, 277, STAT 292, ENGR 123); 15 further 200-level COMP, DATA, MATH, NWEN, STAT or SWEN points			
Restrictions:	OPRE 354			
Simulation and modelling of stochastic systems, covering examples from operations research and computer science, including queues, networks and computer systems. Design, analysis and validation of simulation experiments. Previous experience with computer programming is required before starting this course.				
NOT OFFERED IN 2024				

DATA 351	CRN 32015	DATA SCIENCE INTERNSHIP	15 PTS	T2
Prerequisites:	DATA 201, one of (MATH 277, STAT 292), one of (DATA 202, QUAN 203, SCIE 201 in 2017/18), 15 further 200-level points all with B+ average. This course is limited entry.			
Students will complete an approved and supervised project in a public, private or non-profit organisation with established data science work stream. It will enable students to gain professional work experience in the application of data science and to develop teamwork and communication skills in a relevant organisation.				

MATH 301	CRN 3305	PARTIAL DIFFERENTIAL EQUATIONS	15 PTS	T1
Prerequisites:	MATH 243, 244			
This course is an introduction to Partial Differential Equations (PDEs), including those of importance for the natural sciences. The course covers solution methods for linear PDEs, including the use of boundary values and initial values. The course develops Fourier series and Fourier transforms and discusses their use in solving PDEs, and also develops Green's functions.				

MATH 309	CRN 7528	MATHEMATICAL LOGIC	15 PTS	T2
Prerequisites:	MATH 161 and 30 pts from 200-level MATH			
This course examines symbolic languages, which are a foundational pillar of mathematics as well as the basis of computer science. Their semantics and proof theory are studied, explaining the role of logic in describing mathematical structures and formalising reasoning about them. Topics covered include propositional logic, first-order logic of quantifiers and predicates, and the beginnings of model theory, including completeness and compactness theorems. Some computability theory is covered, culminating in Gödel's incompleteness theorem.				

MATH 311	CRN 9591	ALGEBRA	15 PTS	T1
Prerequisites:	(MATH 251 or 261) and 15 further 200-level MATH pts			
The abstraction of algebra to sets with extra structure has led to many important mathematical developments. The basic algebraic structures, groups, rings and fields, are the focus of this course, together with some of their applications, such as solving systems of polynomial equations. There is an emphasis on general concepts, such as subgroups, homomorphisms, and factorization. Some familiarity with groups is expected.				

MATH 318	CRN 31093	HILBERT SPACES	15 PTS	T1
Prerequisites:	MATH 212 and 251			
This course extends the techniques of linear algebra and real analysis so that problems of an intrinsically infinite-dimensional nature can be studied. A Hilbert space is an inner product space with the analytic structure suitable for studying such problems. Hilbert spaces, and linear maps on them, are of interest to both mathematicians and physicists.				

MATH 321	CRN 19910	APPLIED MATHEMATICS I	15 PTS	T2
Prerequisites:	MATH 243 and 244			
Many practical problems can be modelled and analysed using differential equations. This course introduces some fundamental methods for such modelling and analysis. The course begins by developing techniques such as dimensional analysis and perturbation methods, and then applies them to solve problems including reaction kinetics, diffusion, and traffic flow.				

MATH 324	CRN 15668	CODING AND CRYPTOGRAPHY	15 PTS	T2
Prerequisites:	MATH 251			
Encoding messages so that they can be transmitted robustly and efficiently, while being safe from eavesdroppers, is an important part of modern communication. This course starts with modern coding theory, introducing linear codes, coding bounds, perfect codes, and cyclic codes to develop codes that can deal with communication over a noisy channel. Moving on to cryptography, the course covers topics such as classical ciphers, one-way pads, Shannon's Theorem, public key cryptography, one-way functions, the RSA cryptosystem, key distribution and digital signatures.				

MATH 361	CRN 29085	GRAPH THEORY	15 PTS	T1
Prerequisites:	MATH 161 and 30 pts from 200-level MATH			
Graphs provide an abstraction that enables many different systems to be modelled and analysed, from computer networks to disease spread. This course introduces graphs as mathematical objects and covers topics including: connectivity and Menger's Theorem; colourings and Brooks' Theorem; topological graph theory and Kuratowski's Theorem; and Ramsey Theory.				

MATH 377	CRN 19805	PROBABILITY AND RANDOM PROCESSES	15 PTS	T1
Prerequisites:	MATH 243; MATH 277 or STAT 232			
The course provides a firmer foundation in probability theory and an introduction to random processes. Main topics: conditional distributions and effects of conditioning; martingales in discrete time; Poisson point processes; birth and death processes; renewal processes.				

MATH 381	CRN 3512	SPECIAL TOPIC: COMPLEX ANALYSIS	15 PTS	T2
Prerequisites:	(MATH 212 or 243) and 15 further 200 level MATH pts			
Complex analysis extends real analysis to functions of complex variables. This course covers the fundamentals of complex analysis, including the Cauchy-Riemann equations, holomorphic functions, harmonic functions, the Cauchy integral formula, power series, and the residue theorem. Applications include evaluating real integrals, a proof of the fundamental theorem of algebra, and solving 2D problems relating to steady temperature distribution, inviscid fluid flow and electrostatics.				

STAT 332	CRN 19809	STATISTICAL INFERENCE	15 PTS	T2
Prerequisites:	MATH 243, 277			
This course covers distribution theory; estimation including minimum variance unbiased estimators and sufficiency; hypothesis testing and an introduction to order statistics. The topics of estimation and hypothesis testing met in MATH 277 will be looked at in greater depth. Optimal estimation procedures and tests will be developed.				
NOT OFFERED IN 2024				

STAT 335	CRN 27136	STATISTICAL MODELS FOR ACTUARIAL SCIENCE	15 PTS	T2
Prerequisites:	MATH 277			
This course introduces a range of models used in actuarial science, including Markov chains, Markov processes and transition, survival models and estimation with graduation methods and binomial models for mortality.				

STAT 391	CRN 19810	MATHEMATICAL METHODS FOR APPLIED STATISTICS	15 PTS	T1
Prerequisites:	STAT 292			
Restrictions:	MATH 243, and both (ENGR 122/MATH 142, 251)			
This course covers key mathematical methods used in the construction and maximisation of likelihoods, analyses of experimental data and general linear models, and exploration of probability distributions. Topics will include differentiation and optimisation of functions, matrices and their properties, probability distributions and integration. The statistical software R will be used.				

STAT 392	CRN 3048	SAMPLE SURVEYS	15 PTS	T1
Prerequisites:	STAT 193 (or equivalent), 30 approved points from 201-399			
Restrictions:	STAT 439			
An introduction to practical aspects of survey sampling, including writing a survey proposal, costing, non-sampling errors, rudiments of sampling theory, questionnaire design, fieldwork, basic analytic techniques, and report writing. This course is co-taught with STAT 439.				

STAT 393	CRN 19811	LINEAR MODELS	15 PTS	T2
Prerequisites:	(MATH 243, 277) or (STAT 293, 391)			
This course will cover general linear models: theory and applications, including maximum likelihood estimation, model selection, AIC, tests of hypotheses, confidence intervals, and residual diagnostics. It includes longitudinal analysis for continuous responses using fixed or random effects methods. The course covers the theory of generalised linear models and gives examples for binary and count data. The statistical software R will be used.				

STAT 394	CRN 19808	MULTIVARIATE STATISTICS	15 PTS	T2
Prerequisites:	MATH 277 or (STAT 292, 391)			
General concepts and various practical analysis techniques are introduced for multivariate data. Topics will be chosen from: principal component analysis, cluster analysis, factor analysis, discriminant analysis, canonical correlations, the multivariate general linear model and multidimensional scaling. Statistical software will be used to apply the techniques to multivariate data.				

CONTACT INFORMATION

SCHOOL OF MATHEMATICS AND STATISTICS

Te Kura Mātai Tatauranga

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Deputy Head of School	Prof Richard Arnold	538	04-463 5668
School Manager	Ginny Whatarau	357	04-886 4566
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STAFF CONTACTS

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TEACHING STAFF	ROLE / RESEARCH INTERESTS	ROOM	EMAIL
MATHEMATICS			
Dr Steven Archer	Lecturer (teaching)	363	steven.archer@vuw.ac.nz
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DATA SCIENCE			
Prof Richard Arnold	Biostatistics, Bayesian statistics, statistics in geophysics	538	richard.arnold@vuw.ac.nz
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Prof Stephen Marsland	Shape analysis, diffeomorphism groups, machine learning, complexity	443	stephen.marsland@vuw.ac.nz
Dr Binh Nguyen	Image analysis, visualization	535	binh.p.nguyen@vuw.ac.nz
Dr David Huijser	Bayesian statistics, data modelling	542	david.huijser@vuw.ac.nz

STATISTICS			
Dr Ryan Admiraal	Social network analysis, disease modelling	536	ryan.admiraal@vuw.ac.nz
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A/Prof Ivy Liu	Categorical data analysis	424	ivy.liu@vuw.ac.nz
Dr Louise McMillan	Model-based clustering, statistical ecology	429	louise.mcmillan@vuw.ac.nz
Dr Nokuthaba Sibanda	Biomedical statistics, statistical process control, applications of Bayesian statistics	543	nokuthaba.sibanda@vuw.ac.nz
Prof Peter Smith	Telecommunications, statistics in engineering	539	peter.smith@vuw.ac.nz
Dr Budhi Surya	Levy process, optimal stopping, applied probability, financial stochastics	544	budhi.surya@vuw.ac.nz
Dr Yuan Yao	Statistical learning, high-dimensional data analysis, survival analysis, empirical processes	533	yuan.yao@vuw.ac.nz

STUDENT SUPPORT

TĪTOKO—CENTRE FOR STUDENT SUCCESS

The Student Success team offers a range of services that cover all student-related matters from applications and enrolment to graduation. Our aim is to create a client-focused, friendly environment where all who visit our area not only feel welcome, but also receive support and advice of high quality.

Address	CO144, Level 1, Cotton Building
Phone	0800 04 04 04
Email	info@vuw.ac.nz
Hours	9.00 – 4.00pm Monday, Wednesday, Thursday, Friday 9.30am–4.00pm Tuesday

Email
We encourage you to use email for enquiries. You can contact our team at info@vuw.ac.nz.
Please include your full name and ID number in the subject line of your email.

In-person appointments
If you are coming to the office, you will need to make an appointment in advance.
If you need to meet with a specific adviser, please contact them in advance.

STAFF		PHONE
Greg Ambrose	Manager, Student Success	04-887 3195
Lisa Reynolds	Team Leader (Student Success)	04-887 3971
Caleb Hochstetler	Senior Student Success Adviser	04-887 4034
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ĀWHINA | MĀORI STUDENT SUPPORT

Āwhina is the on-campus whānau for Māori students to work together to share knowledge, achieve academic success, and build strong communities and leaders.

Address	CO133, Level 1, Cotton Building
Phone	04 463 9546
Email	awhina@vuw.ac.nz
Website	www.wgtn.ac.nz/awhina

At Āwhina, our kaupapa (goal) is to help students successfully transition from secondary education or work into tertiary education, and to provide academic support for Māori students enrolled at the University. Our experienced staff offer one-to-one advising and mentoring sessions, tutorials, study wānanga, and a range of workshops to help you achieve your study goals. Our culturally inclusive environment includes whānau rooms with computer facilities, study areas, kitchen facilities, and space to meet with peers or tuākana (older students).