

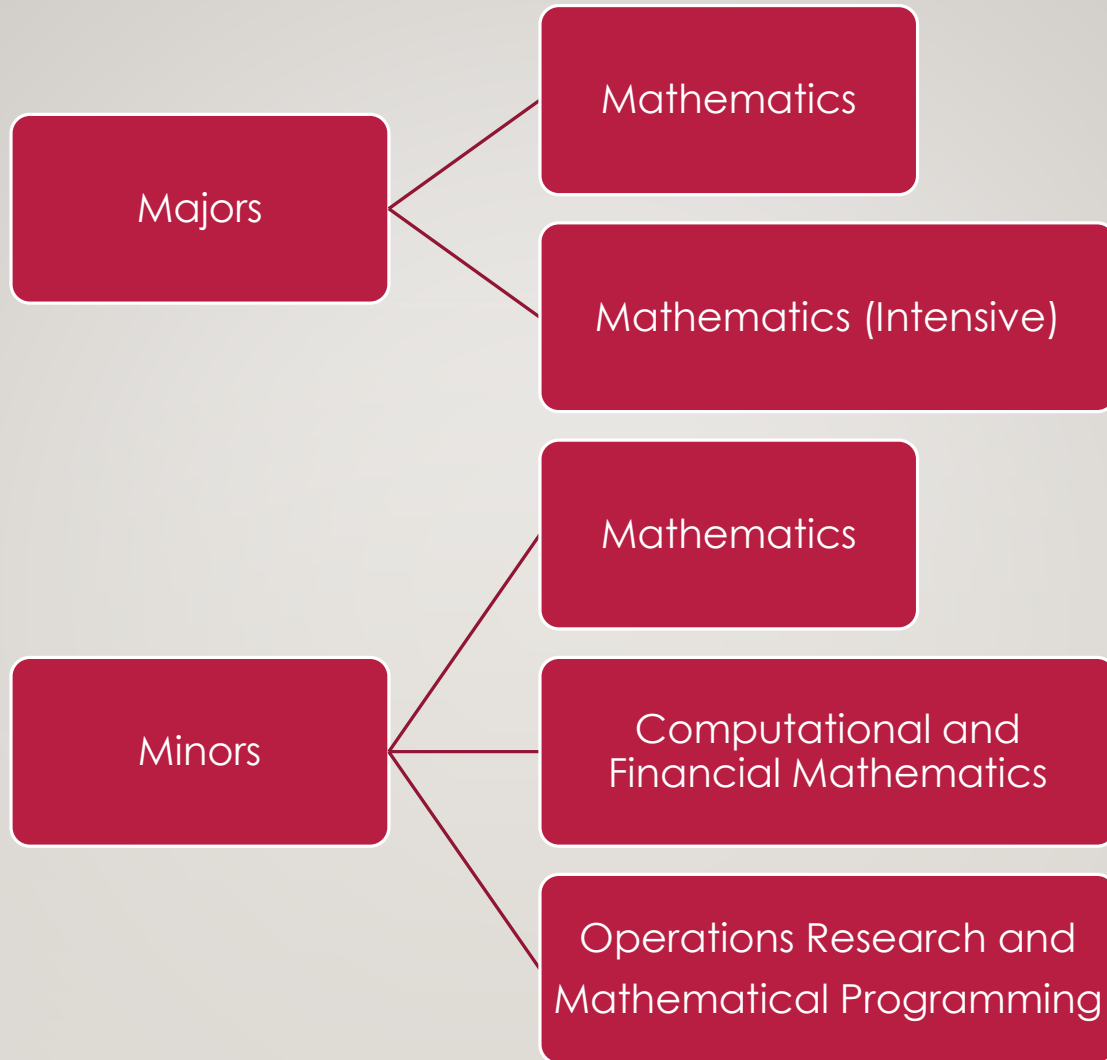
INTRODUCTION TO MATHEMATICS MAJORS AND MINORS

APR 2021

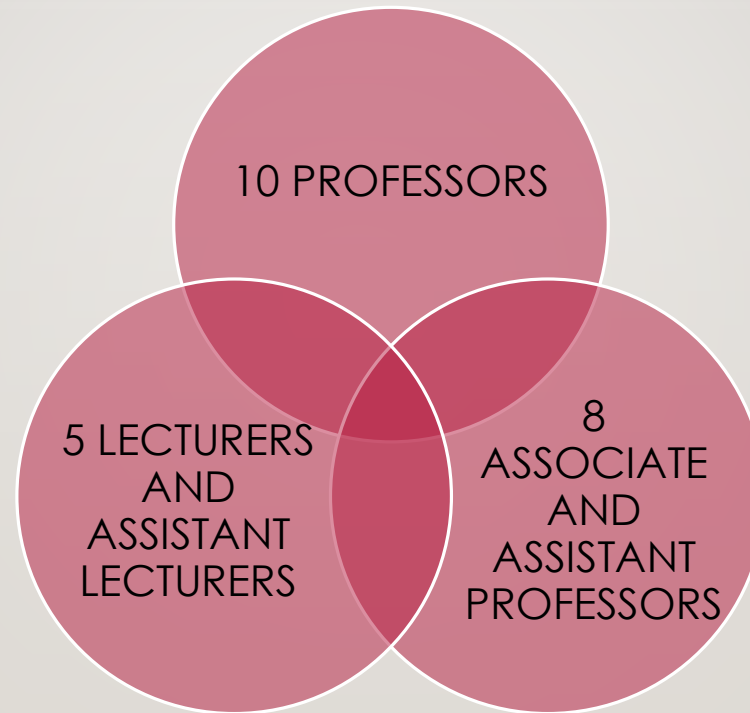
DEPARTMENT OF MATHEMATICS

DR. C.W. WONG





OUR DEPARTMENT FACULTY MEMBERS



MAJORS

Mathematics

Mathematics (Intensive)

MAJORS

MAJOR IN MATHEMATICS

Level	Credits (96)
Introductory	48
Advanced	42
Capstone	6

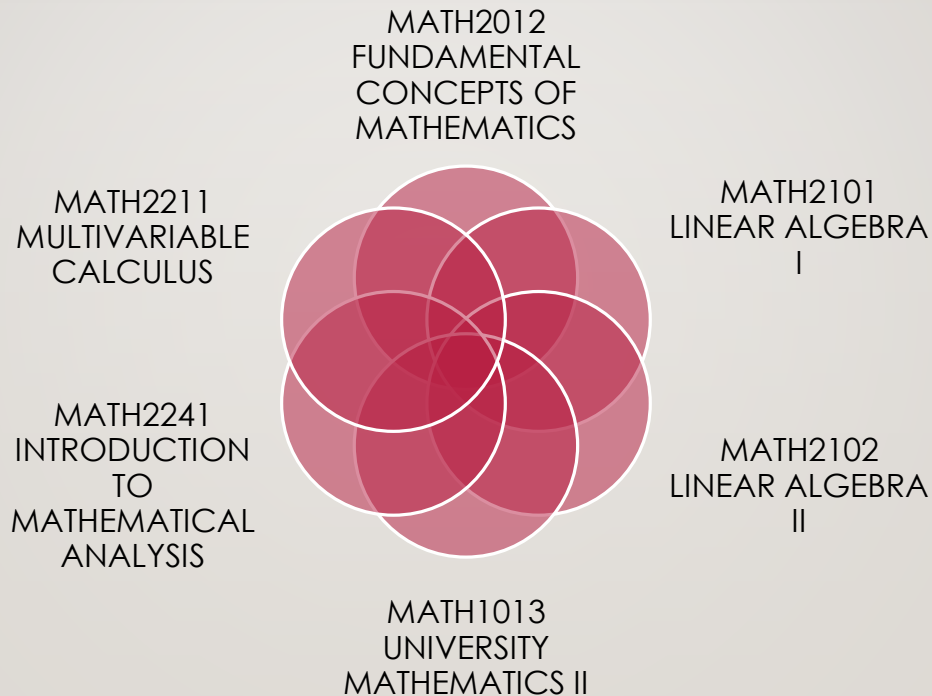
MAJOR IN MATHEMATICS (INTENSIVE)

Level	Credits (144)
Introductory	48
Advanced	84
Capstone	12

If you are Science students,

- you have to declare your primary Science major online during the course selection period in August before the start of your third year of study, the latest;
- however, even if you have declared your major/minor, you can still change it as long as the online course selection system is opened in the 1st semester of your last academic year for graduation.

INTRODUCTORY LEVEL COURSES (MAJORS)



ADVANCED LEVEL COURSES (MAJORS)

	MATH	MATH (INTENSIVE)	
Disciplinary Core (6 credits)	MATH 3401	MATH 3002, 3301 , 3401 , 3403 , 3405, 3600, 3603 , 3904 , 4404, 4406	Disciplinary Core (60 credits)
Disciplinary Electives (36 credits) List A plus List B		Disciplinary Electives (24 credits) Stream A or Stream B	
List A	≥12 credits from MATH 3301, 3403, 3601, 3603, 3904	24 credits 12 credits from level 7	Stream A Pure Math
List B	A+B = 36 credits ≥ 12 credits from Level 4 or above	24 credits 12 credits from level 4 or 7	Stream B Applied Math

MAJORS

Capstone Requirement

CAPSTONE REQUIREMENT (MAJORS)

Courses	Credits
MATH3999 Directed studies in mathematics	6
MATH4910 Senior mathematics seminar	6
MATH4911 Mathematics capstone project	6
MATH4966 Mathematics internship	6
MATH4999 Mathematics project	12
Notes	
Major in Math	6
Major in Math(Intensive)	12

CAPSTONE REQUIREMENT (MAJORS)

- Our capstone courses are for Mathematics / Mathematics (Intensive), and Mathematics/Physics Majors students only.
- The earliest that a student is allowed to take a capstone course is their year 3 study.
- Pass in at least 24 credits of advanced level disciplinary core/elective mathematics courses (MATH3XXX, MATH4XXX, or MATH7XXX) in the Mathematics/ Mathematics (Intensive), and Mathematics/Physics Majors; and subject to approval by the Department.

MAJORS

Capstone Requirement

Directed Studies and Projects

CAPSTONE REQUIREMENT SELECTED TOPICS OF MATH3999

This course is designed for students who would like to have early experiences on research related independent studies.

- Analyzation and improvement of algorithms in image recognition with convolutional neural networks
- Circle Method in Number Theory
- Commutative Algebra
- Complexity and approximation of the quadratic maximization problem
- Geometry and Function Theory on the Unit Disk
- Stochastic Approximation and Stochastic Optimization Algorithms in Q-learning

CAPSTONE REQUIREMENT SELECTED TOPICS OF MATH4999

The aim of the course is to provide students with the opportunity to formulate and to investigate, in depth, problems of practical interest and/or to have a foretaste of mathematical research. The work, to be done on an individual basis, is considered a highly desirable part of the training of a mathematician.

- Bounded symmetric domains and their quotient manifolds
- Computational Optimal Transport
- Introduction to algebraic geometry
- Modular functions and modular forms
- Open Problems in Information Theory
- Optimization problems in deep learning and artificial intelligence
- Probabilistic Boolean Networks
- Transcendental Number Theory and Complex Analysis



OUR DEPARTMENT RESEARCH GROUPS

Geometry

Number
Theory

Optimization
and
Operations
Research

Computational
Mathematics

INSTITUTE OF MATHEMATICAL RESEARCH (IMR)

The Institute of Mathematical Research (IMR) was inaugurated in 1999. It was set up with the mission to **lead mathematical research within the University** and it has played a vital role in the **promotion of pioneering and impactful mathematical research across tertiary institutions in Hong Kong**. It vouches also to **provide a platform for enhancing the role of Mathematics in interdisciplinary research**. The IMR strives to generate an inspiring and stimulating intellectual atmosphere for students and researchers of Mathematics, providing them with opportunities for international exposure that will enhance their learning and research.

The Institute of Mathematical Research (IMR) has established **strong collaborative ties with various well-known centres of mathematical research around the world** in the United States, Canada, France, Germany, UK, Russia, China, Korea, Singapore and Israel. It **provides opportunities and a stimulating ambiance for the training of future research mathematicians**.



INSTITUTE OF MATHEMATICAL RESEARCH (IMR)

Under the leadership of eminent mathematicians, IMR runs a variety of rigorous and comprehensive programs in mathematical research. Key areas covered include

- (a) Several Complex Variables and Complex Geometry,
- (b) Algebra and Number Theory,
- (c) Geometry and Lie Groups,
- (d) Probability, Stochastics and Mathematical Finance
- (e) Optimization, Computational Science and Information Theory.

Research programs in new directions are being launched to capitalize on the changing landscape of research in Hong Kong and in the world.



INSTITUTE OF MATHEMATICAL RESEARCH (IMR)

Several interdisciplinary programs in Information Theory, Random Matrix Theory and Mathematical Finance have been launched to increase the interest of researchers and students in the mathematical sciences.

With our expertise in Optimization Theory, we envisage future interdisciplinary programs in Data Science and Scientific Computing with applications to Artificial Intelligence, Machine Learning and Data Analytics.



MAJORS

Capstone Requirement

Internship

CAPSTONE REQUIREMENT

MATH4966

This course aims to offer students the opportunities to gain work experience in the industry related to their major of study.

The workplace learning experience would be of great benefits to the students to apply their knowledge gained in the study to the real work environments.

Students have to take on at least 160 hours of internship work either within the University or outside the University arranged by the department.



CAPSTONE REQUIREMENT SELECTED INTERNS OF MATH4966

Offers within Department

- Conjectures about Representations of Integers as Sums of Squares
- Contract Bridge Combinatorics
- Deep Learning with PyTorch
- On Multiple Unicast Conjecture
- Preparation and Development of Teaching Materials



CAPSTONE REQUIREMENT SELECTED INTERNS OF MATH4966

Offers outside Department

- Actuarial Intern (Deloitte China)
- Applications of Deep Learning (Hanlun Artificial Intelligence Limited)
- Mathematical Modelling in a STEM Education (Education Bureau)
- Editorial Assistant (HK Educational Publishing Company Ltd.)
- Quantitative Trading Interns (China Merchants Securities International Company Limited)

CAPSTONE REQUIREMENT SELECTED INTERNS OF MATH4966

Intern Opportunities found by Students

- Teaching assistants in secondary schools as well as tertiary institutes
- Internship program arranged by other institutes (e.g., Berkeley Global Internship program)
- Insurance/Securities Companies

Applicants should consult Course coordinator if the intern is suitable for the course.

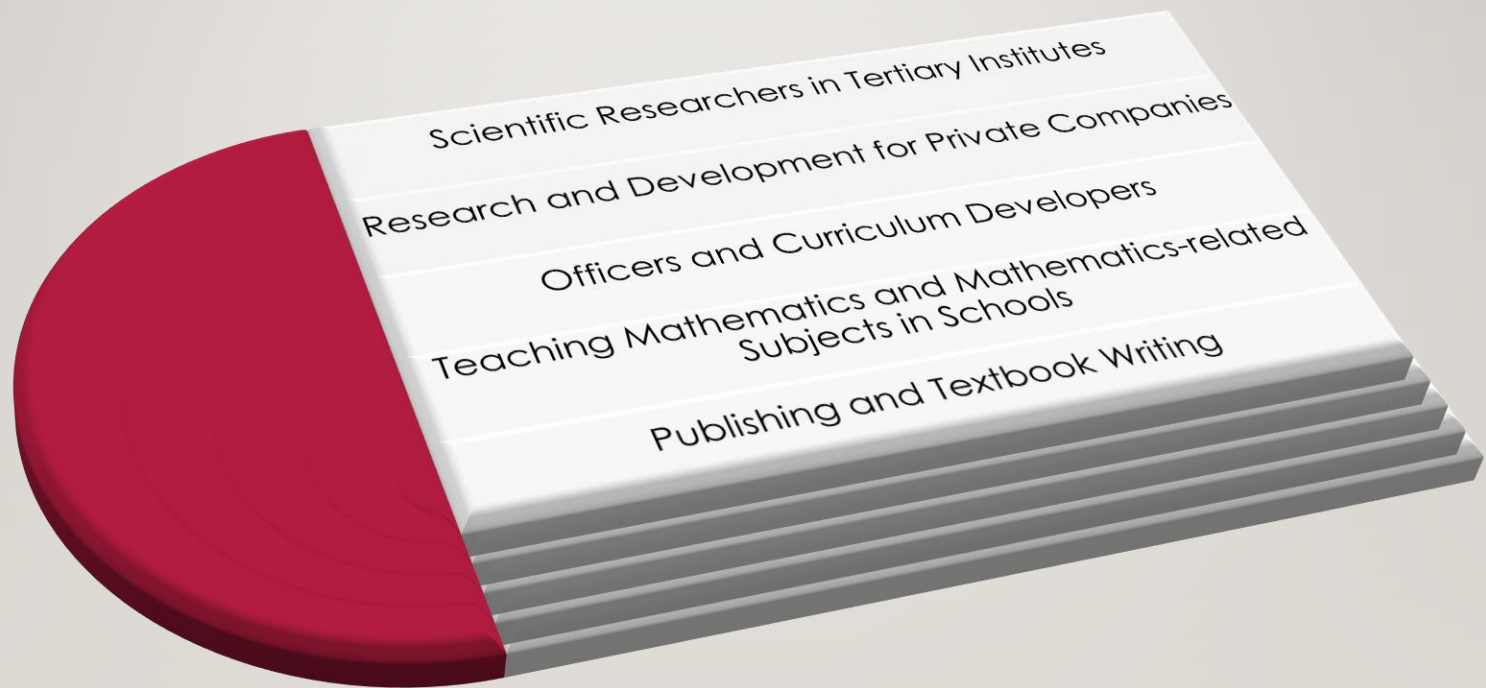


CAPSTONE REQUIREMENT

MATH4966

- Our department usually offers interns in the summer semester. Relevant major students would receive emails around late April/early May.
- Students can enroll the course in any semester. They should apply before the commencement of the intern and before specific due dates (set by the Faculty).
- **WARNING:** Final year students may not be able to enroll in this course in the summer semester of their final year!

CAREER PROSPECTS AND GRADUATE STUDIES



CAREER PROSPECTS AND GRADUATE STUDIES

Software
companies

Airport
Authority HK

Transportation
Consulting
Firms

HK
Observatory

Bank (Data
Mining)

Insurance
Company

AI
Technology

Logistics

Science

Finance

MATH MINORS

Mathematics

Computational and Financial Mathematics

Operations Research and Mathematical Programming

CORE COURSES AND DISCIPLINARY ELECTIVES (MINORS)

Minor in Mathematics (18+18)	Minor in Computational and Financial Mathematics (18+24)	Minor in Operations Research and Optimization (18+24)
MATH1013 plus List A: MATH2101, MATH2211 or List B: MATH2012, MATH2014		
+ 18 credits in Disciplinary electives	MATH3601, MATH3906 +12 credits in Disciplinary electives	MATH3901, MATH3904 +12 credits in Disciplinary electives

MINOR IN COMPUTATIONAL AND FINANCIAL MATHEMATICS

The Minor in Computational & Financial Mathematics provides students with fundamental knowledge in both computational mathematics and financial mathematics.

It is specifically designed for students who are interested in the above subjects and those whose majors require sophisticated mathematical skills.

It aims to nurture quantitative reasoning, logical, analytical and critical thinking, innovative imagination, meticulous care to work, ability to conceptualize, skills for problem-solving and skills to tackle novel situations and ill-defined problems.

It is particularly useful for solving mathematical problems arising from computational sciences and financial industry.



QUANTS: THE ROCKET SCIENTISTS OF WALL STREET

As financial securities become increasingly complex, demand has grown steadily for people who not only understand the complex mathematical models that price these securities, but who are able enhance them to generate profits and reduce risk. These individuals are known as quantitative analysts, or simply “quants.”

Due to the challenging nature of the work – a blend of mathematics, finance and computer skills – quants are in great demand and able to command very high salaries.

<http://www.forbes.com/sites/investopedia/2013/06/07/quants-the-rocket-scientists-of-wall-street/>

RENAISSANCE TECHNOLOGIES LLC RECRUITMENTS (2021)

Renaissance Technologies LLC is an investment management company dedicated to producing superior returns for its clients and employees by adhering to mathematical and statistical methods.

Research Scientist

Use machine-learning, applied mathematics, and techniques from modern statistics to develop and refine models of the financial markets and to develop trading algorithms based on those models.

An ideal candidate will have

- a degree in computer science, mathematics, physics, statistics, or a related discipline
- a demonstrated capacity to do first-class research
- strong computer programming skills

Experience in finance is not required.

MINOR IN OPERATIONS RESEARCH & MATHEMATICAL PROGRAMMING

The Minor in Operations Research & Mathematical Programming provides students with fundamental knowledge in optimization, computational algorithm, mathematical modeling, and decision making.

It is specifically designed for students who are interested in the above subjects and those whose majors require sophisticated mathematical skills.

It aims to nurture quantitative reasoning, logical, analytical and critical thinking, innovative imagination, meticulous care to work, ability to conceptualize, skills for problem-solving and skills to tackle novel situations and ill-defined problems.

It is particularly useful for solving mathematical problems arising from decision sciences and logistic industry.



OPERATIONS RESEARCH AND LOGISTICS

Logistics problems are ill structured and real- world problems.

- Network optimization and queueing theory are used to predict the waiting time of the trucks for loading/unloading purposes.
- Selection of transport route which minimizes the time and cost of transportation.

COURSE REPLACEMENT

BSc (ActuSci)

BSc (DA/QFin/RM/Stat)

BEcon&Fin

BEng

COURSE REPLACEMENT

	BSc (ActuSci)	BASc (AppliedAI) BSc (DA/QFin/RM/Stat)	BEcon&Fin	BEng
Core Course	MATH1821 MATH2822	MATH1013 MATH2014	MATH1013*	MATH1851 MATH1853
Exemption	MATH1013 MATH2014	MATH1013 MATH2014	MATH1013	MATH1013
Replacement	Any 6-credit level 2 or above Mathematics Disciplinary Elective chosen from the Programme/Major/Minor structure in which MATH1013 and MATH2014 are the disciplinary core courses MATH2012 or MATH2241 <i>(if not the disciplinary core course in the structure)</i>			

* If MATH1013 is used to fulfill the major requirement.

If MATH2101 and MATH2211 are disciplinary core courses, then MATH2014 would be exempted and should be replaced.

Q&A



FURTHER ENQUIRIES



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THANK YOU