THE UNIVERSITY OF BRITISH COLUMBIA

DEPARTMENT OF MATHEMATICS

math@math.ubc.ca
604-822-2666

2009-2010
UNDERGRADUATE PROGRAM DESCRIPTION BOOKLET

The Department of Mathematics offers programs leading to Undergraduate degrees in three faculties:

BA Minor, Major, Double Major, Mathematics/Economics Major, Honours, Combined Honours, Mathematics/Music Honours. Co-operative Education Program options are also available.

BSc Minor, Major, Double Major, Combined Major, Mathematics/Economics Major, Mathematical Sciences Major, Honours, Combined Honours. A dual-degree BSc/BEd program and Co-operative Education Program options are also available.

BASc Honours Mathematics Option

CAREER OPPORTUNITIES

The Honours degree is the usual route for students intending to proceed to graduate school. It is necessary to have a PhD degree in order to obtain an academic position at a university; an MSc degree may be sufficient to obtain a position at a two-year college, although many such advertised positions give preference to applicants with PhD degrees. An Honours degree, with appropriate courses in analysis, discrete mathematics, probability, and statistics, is an appropriate route to graduate programs in Commerce, especially Management Science (Operations Research).

Currently, a Mathematics degree is one of the best entry routes to BEd programs since there is a very significant shortage of qualified Mathematics teachers at the secondary school level. Students in a Major program intending to enter the BEd program should consider taking courses in geometry, number theory, probability, statistics, and mathematics history, such as MATH 302,

303, 308, 309, 312, 313, 342, 414, 446, and STAT 200. The Department of Mathematics runs workshop programs for BC students in Grades 6-12 and welcomes participation from Mathematics undergraduates interested in teaching as a potential career.

The business world has employed many Mathematics graduates, especially in the actuarial field, investment, and banking. For such employment, it is worthwhile to take courses in Statistics, in particular STAT 200, 305, 306, and 404. Students interested in the actuarial field should contact Dr. Joel Friedman. Note that one can take a Major in Mathematics with a Minor in Commerce (BA or BSc degree) as well as a Mathematics/Economics Major (BA or BSc degree).

One area of great employment opportunity appears to be in the software industry – systems analysis, software engineering, computer programming, and management information systems. Mathematics graduates seeking such employment opportunities should consider taking Computer Science courses such as CPSC 111, 211, 216, 220, 310, and 319.

For career information, students are encouraged to look at *Jobs Rated Almanac* by Les Krantz, which lists the following among the ten best American jobs (out of 250): actuary, computer-systems analyst, software engineer, and statistician. See also the American Mathematical Society website, www.ams.org/employment. For all career choices, good communication skills in both oral and written English are essential.

PROGRAMS OF STUDY

BA PROGRAM

There is no Physics or Chemistry requirement as for students pursuing the BSc program. Students need to satisfy a Computing requirement. This can be fulfilled by taking CPSC 111/211, or CPSC 111 and MATH 210. Arts students must also satisfy Literature and Language requirements. Currently, about one-fifth of all Mathematics Majors are registered in Arts. The Honours program in Arts requires the completion of 120 specified credits with an average of at least 68%. One may take a Mathematics Minor (18 credits of courses in Mathematics numbered 300 or higher) along with another Arts Major. One could also take a Major in Mathematics and a Minor in another Arts or Science subject or Commerce. A Double Major program is available in Arts. There is also a special Mathematics/Economics Major.

BSc PROGRAM

Students intending to pursue an Honours program are strongly urged to take MATH 120, 121, 223, 226, and 227. This eases the transition to the third year of the Honours program. The Honours program in Science requires the completion of 132 credits. One may take a Mathematics Minor (18 credits of courses in Mathematics numbered 300 or higher) along with another Science Major. One could also take a Major in Mathematics and a Minor in another Science or Arts subject or Commerce. A Double Major program is available in Science. There is also a special Mathematics/Economics Major, and a Combined Major in Computer Science and Mathematics.

BASc PROGRAM
(Honours Mathematics Option)

In this option, one must take a number of advanced mathematics courses, in addition to those required by the program. By carefully picking electives and taking some summer courses, it is possible to complete this program within four years. It is advantageous to obtain Advanced Placement credit (Calculus AB or BC) or Challenge credit for MATH 100 and/or MATH 101 prior to entering UBC.

If a student intends to pursue a degree program in Mathematics, it is important to see a Mathematics Advisor or the Undergraduate Chair.

COMMENTS ON SOME SPECIFIC MATHEMATICS COURSES

Detailed information (including prerequisites) for all UBC Mathematics courses is available in the UBC Calendar. Some additional comments are given below.

MATH 001 and MATH 002:	These are non-credit pre-calculus courses offered by UBC Continuing Studies for students who are inadequately prepared to take MATH 180 or MATH 184, which have a prerequisite of at least C+ in Principles of Mathematics 12.
MATH 003 and MATH 004:	These are non-credit calculus courses, at the high-school level, offered by UBC Continuing Studies.
MATH 100:	Prior to entering UBC, students who have taken a high-school calculus course may write the UBC-SFU-UVIC-UNBC Calculus Challenge Exam. Students who obtain a grade of 4 or 5 in the AP Calculus AB exam can obtain credit for MATH 100. A grade of 4 or 5 in the AP Calculus BC exam leads to credit for MATH 100 and MATH 101.
MATH 100 (or 180 or 184) and MATH 101:	This is the first-year calculus stream designed for Engineering and Physical Sciences students who have taken a high-school calculus course. Those without such a course must take MATH 180 or MATH 184 in the first term.
MATH 102 (or 180 or 184) and MATH 103:	This is the first-year calculus stream designed for Life Sciences students who have taken a high-school calculus course. Those without such a course must take MATH 180 or MATH 184 in the first term.
MATH 104 (or 184 or 180) and MATH 105:	This is the first-year calculus stream designed for Commerce and Social Sciences students who have taken a high-school calculus course. Those without such a course must take MATH 184 or MATH 180 in the first term.
MATH 110	This is a full-year alternative to MATH 180 or MATH 184, for students with insufficient high-school preparation.

MATH 120 and MATH 121: These are 4-credit Honours versions of the courses MATH 100 and 101, or MATH 102 and 103, or MATH 104 and 105. Prerequisite: a high-school calculus course, and a score of 65 or higher in the Euclid Contest or a grade of 95% or better in Principles of Mathematics 12. To register, contact the Undergraduate Chair.

MATH 210: This is a mathematical way to satisfy the Computing requirement.

MATH 217: This accelerated course, which contains material from MATH 200 and MATH 317, is intended for students in Honours Physics and Engineering Physics.

MATH 221: This course is open to students who have passed MATH 101 or 103 or 105 or 121, or obtained at least 64% in MATH 100 (180) or 102 or 104 (184) or 120, or have advanced credit for MATH 100.

MATH 230: This is a 3-credit course useful for entry into the BEd Elementary Program. Prerequisite: Principles of Mathematics 11.

MATH 302: This course is equivalent to STAT 302.

MATH 308-312: Note the prerequisite of MATH 220 or MATH 226 or CPSC 121.

MATH 318: This is an accelerated course that contains material from MATH 302 and MATH 303.

MATH 331: This is an Honours course in problem solving.

MATH 335: This is a 4-credit course open to Arts and unclassified students intending to enter the BEd Elementary Program without previous credit for any other Mathematics course.

MATH 342: Note the prerequisite of MATH 220 or MATH 226 or CPSC 121.

COURSE SELECTION IN THE MAJORS PROGRAM

Major students sometimes wonder which third- and fourth-year Mathematics courses to include in their degree. In practice, typical choices come from the following:

MATH 300	Introduction to Complex Variables
MATH 302	Introduction to Probability
MATH 303	Introduction to Stochastic Processes
MATH 307	Applied Linear Algebra
MATH 308	Euclidean Geometry

MATH 309	Topics in Geometry
MATH 310	Abstract Linear Algebra
MATH 312	Introduction to Number Theory
MATH 313	Topics in Number Theory
MATH 316	Elementary Differential Equations II
MATH 317	Calculus IV
MATH 340	Introduction to Linear Programming
MATH 342	Algebra, Coding Theory, and Cryptography
MATH 361	Introduction to Mathematical Biology
MATH 414	Mathematical Demonstrations
MATH 441	Mathematical Modeling: Discrete Optimization Problems
MATH 442	Optimization in Graphs and Networks
MATH 445	Mathematical Modeling: Applications in the Natural and Social Sciences
MATH 446	Topics in the History of Mathematics I

For reasons of breadth, it is a good idea to include MATH 302, 307, 308, 312, and 340, and then to take follow-up courses as interests dictate. Major students, especially those considering graduate school in the Mathematical Sciences, are also encouraged to take some of the courses required in the Honours program, such as MATH 300, 320, 321, and 322. Another suggestion is to take some higher-level elective courses in an area of application, such as Economics, Computer Science, or Statistics.

COURSE SELECTION IN THE HONOURS PROGRAM

Students planning on an Honours or Combined Honours degree are advised to take the Honours version of first- and second-year courses, specifically MATH 120 (Honours Differential Calculus), 121 (Honours Integral Calculus), 223 (Linear Algebra), 226 (Advanced Calculus I), and 227 (Advanced Calculus II). For each of these courses, the syllabus in the regular and the Honours versions is similar enough so that the regular course with a sufficiently high grade will be accepted as a prerequisite for a subsequent Honours course. However, in general, the Honours versions cover the material in greater depth, offer more challenging problems, and anticipate concepts which are important in upper-level courses. Note that an Honours student who takes MATH 200 or MATH 253 instead of MATH 226 must also take MATH 220 (Mathematical Proof).

The core third-year courses are MATH 300 (Introduction to Complex Variables), 320 (Real Variables I), 321 (Real Variables II), and 322 (Introduction to Algebra). Almost all fourth-year courses have these courses as prerequisites. A highly recommended course, MATH 331 (Problem Solving), may be profitably taken in second, third or fourth year. The prerequisites are MATH 223 (152, 221) and MATH 226 (200). The remaining upper-level courses are organized into the areas of analysis, algebra, geometry and topology, applied mathematics, and a few miscellaneous courses in logic, graph theory, and history. See the UBC Calendar for detailed descriptions. Some higher-level courses are not offered every year. Advanced students are encouraged to take 500-level (introductory graduate) courses.

OTHER INFORMATION

APPEAL PROCEDURES

A student who wishes to protest a mark in a midterm or homework assignment should initially approach the instructor concerned. Only if the problem cannot be resolved in this fashion should the student approach the Undergraduate Chair. Students must not, on their own initiative, approach a second instructor.

After the final exam period, students can complete a Viewing of a Final Examination form (available in the Math Office or online) and then meet with their instructor to discuss the exam. If a student then wishes to have the final exam officially re-marked, they must go to Enrolment Services to complete a Review of Assigned Standing form and pay a fee, which is only refunded if the exam mark is raised.

CO-OPERATIVE EDUCATION PROGRAMS

Second-year students can apply to pursue a Co-operative Education Program in Mathematics which involves work placements in addition to regular study. For information concerning the Co-operative Education Program in Science, contact the Science Co-operative Education Office, Room 170, Chemistry and Physics Building, 6221 University Boulevard (604-822-4236). For information concerning the Co-operative Education Program in Arts, contact the Arts Co-operative Education Office, Room C121, Buchanan Building, 1866 Main Mall (604-822-1529).

COMPUTING FACILITIES

The Mathematics Undergraduate Computing Lab is located in Room 310 in the Leonard S. Klinck (LSK) Building. Students can use any of the 40 Mac terminals and a printer networked to the Mathematics Unix servers. Users have access to various installed software to do course work, such as mathematical packages (Maple, Matlab, R), browsers and information readers (Firefox, email readers), editors and word processing (Open Office, TeX), and programming tools (GCC compilers, Java toolkit). **This lab is open Monday to Friday from 7:00 am to 5:00 pm.** In addition, Room 121 in LSK is also available to Mathematics and Statistics undergraduates with lab accounts. This lab consists of 70 CAIL terminals which have Windows and Unix login with access to the same servers as in the Mathematics Undergraduate Computing Lab, as well as to additional software from several Windows 2000 servers (Jumpin, Microsoft Office, Lindo and Lingo, Scientific Notepad). Two printers are available, with a strictly enforced quota of 35 pages per course. **This lab is open Monday to Friday from 7:00 am to 5:00 pm**, provided it has not been reserved by an instructor. All labs will be closed on weekends and holidays.

ADVISING

All undergraduates are expected and strongly encouraged to see their respective Undergraduate Advisor at least once each academic year during the first term, preferably before the end of October. Check at the main Mathematics Office (Room 121 in the Mathematics Building) to obtain the current advisor for your year and program. There are also Actuarial, Putnam, Co-op and School Workshop Advisors, as well as an advisor for students enrolled in programs other than Mathematics.

MATH CLUB (www.ubcmathclub.org)

All Mathematics undergraduates are strongly encouraged to join the Math Club located in Mathematics Annex 1119. The Math Club plays the role of a social centre for Mathematics students. It organizes lectures, study sessions, mentoring, and social functions, and it has a library, telephone, refrigerator, cheap food and pop, etc. The membership fee is nominal. Just prior to the December and April examination periods, the Math Club sells copies of previous exams and their solutions for most first- and second-year Math courses.

MATHEMATICS LIBRARY

All Mathematics undergraduates are strongly encouraged to make full use of the Mathematics Library, located in the Irving K. Barber Learning Centre (Level 4, North Wing).

MATHEMATICS TUTORIAL CENTRE (www.math.ubc.ca/Ugrad/ugradTutorials.shtml)

The Department of Mathematics runs a Tutorial Centre for 100-level Math courses staffed by Undergraduate and Graduate Teaching Assistants. The Tutorial Centre is located in Room 202 in the Leonard S. Klinck Building, which is located across the street from the Mathematics Annex. Check at the Tutorial Centre for the schedule of tutoring times. There is no charge for this service. Beginning in September 2008, some Mathematics Graduate Teaching Assistants will also hold tutoring sessions in the Irving K. Barber Learning Centre.

PUTNAM COMPETITION

Students are strongly encouraged to participate in the prestigious undergraduate Putnam Mathematics Competition. UBC has consistently ranked high in this North American competition for many years. Contact Dr. Greg Martin early in the first term if you are interested. There are special Lawrence Roberts Putnam Awards for UBC students who finish in the top 200.

REGISTRATION PROBLEMS

If you encounter any registration problems, please contact the main Mathematics Office (Room 121 in the Mathematics Building) (604-822-2666).

SUPPLEMENTAL EXAMINATIONS

Supplemental Examinations and Examinations for "Higher Standing" are unavailable in any Mathematics course.

TRANSFER CREDITS

Students with questions concerning transfer credits from other institutions or other faculties should go to the main Mathematics Office (Room 121 in the Mathematics Building) to find out the name and office hours of the appropriate advisor.

Notices of interest to undergraduates are posted on the bulletin board located in the hallway outside the main Mathematics Office (Room 121 in the Mathematics Building).