

1078

FACULTY OF ARTS & SCIENCE  
NEW PROGRAM FORM for 2010-2011 CALENDAR

1. Department or Program Mathematics

Major program:

(7.5 full courses or their equivalent including at least 2.5 full courses at the 300+level <sup>and</sup> including at least .5 full courses at the 400 level )

First Year:

MAT135Y1/MAT137Y1/MAT157Y1, MAT223H1/MAT240H1

Second Year:

MAT224H1/MAT247H1, MAT235Y1/MAT237Y1, MAT244H1, MAT246H1;

PHL275H1 or PHL265H1/PHL268H1/PHL271H1/PHL273H1

NOTE:

MAT224H1 may be taken in first year.

PHL275H1 or PHL265H1/PHL268H1/PHL271H1/PHL273H1 may be taken in any year.

Higher Years:

1. MAT301H1, MAT309H1, MAT334H1
2. One half course at the 200+level from: ACT240H1, APM236H1, STA247H1/STA250H1/STA257H1; MAT315H1/MAT335H1/MAT337H1
3. One additional half course at 300+level from: APM346H1, MAT315H1, MAT332H1/MAT344H1, MAT335H1, MAT337H1, MAT475H1; HPS390H1, HPS391H1, PSL432H1
4. MAT401H1/MAT402H1

Note:

1. In the major and minor programs, higher levels courses within the same topic are acceptable substitutions. With a judicious choice of courses, usually including introductory computer science, students can fulfil the requirements for a double major in mathematics and one of several other disciplines.
2. Students planning to take specific 4<sup>th</sup> year courses should ensure they have the necessary 2<sup>nd</sup> and 3<sup>rd</sup> year prerequisites.

## 2. Academic Rationale

Students in this program acquire fluency in the language of mathematics, with its insistence on precision, and they acquire basic knowledge of the methodology of mathematics, which demands creative thought expressed in the framework of rigorous proof. Teaching these skills is central to the curriculum, and these goals are emphasized in *all of our courses*. In the Mathematics Major Program, students still learn a great deal of mathematics. Since the Major only requires 7.5 full courses, students have the opportunity to deepen their knowledge and understanding of mathematics and use this enhancement of their mathematical expertise to explore its interconnection with related areas of study.

## 3. Learning Outcomes

In this program, students use the foundations of mathematics (single and multivariable calculus, linear algebra, ordinary differential equations, group theory, and analysis - real and/or complex). They will learn through a progression of lecture and coursework.

Students acquire a significant foundation in algebra (MAT223H1, MAT224H1, MAT301H1, MAT401H1/MAT402H1) and analysis (MAT135Y1/MAT137Y1, MAT235Y1/MAT237Y1, MAT244H1, MAT334H1) which can be enhanced by choosing MAT335H1 or MAT337H1.

In order to make the transition from courses without emphasis on proof to those with it, students are required to take MAT246H1. Their understanding of the structure of proofs is extended in Introduction to Mathematical Logic MAT309H1. They can also acquire increased skill in problem solving by taking Problem Solving Seminar MAT475H1.

## 4. Degree Objectives

### a. DEPTH OF KNOWLEDGE

This question has been fully addressed under Learning Outcomes (Heading 3 above).

### b. COMPETENCIES

#### i. *Critical and Creative Thinking*

Every mathematics course demands and develops the ability to analyze logical arguments, and moreover assigns students from time to time problems unlike any that they have seen before. Solving such problems is a challenge that requires creative thinking.

ii. *Communication*

Mathematical communication skills (in particular, the ability to express mathematical insights clearly and correctly, in the form of rigorous proofs) are developed throughout the curriculum and are explicitly emphasized in the core analysis and algebra sequences (MAT135Y1/MAT137Y1, MAT223H1/240H1, MAT224H1/MAT247H1, MAT235Y1/MAT237Y1, MAT301H1, MAT334H1,). In addition, rigorous proofs are emphasized in MAT246H1 with additional development in either MAT309H1.

Currently, extra TA hours have been assigned in MAT157Y1 and MAT246H1 to help students with their proof-writing skills.

iii. *Information Literacy*

References for research in Mathematics, as in other fields, now include not only traditional sources, but also a tremendous range of online resources, including searchable review databases (MathSciNet), preprint servers (arXiv.org), specialized Math Wikis (such as the *Dispersive PDE Wiki*, housed at the university of Toronto Math Department), *wiki*-style online pedagogical resources (eg the *Tricki*, initiated by Fields medallist Tim Gowers) and Math Blogs (eg that of Fields Medalist Terence Tao). Students gain familiarity with these resources in the 300- and 400-level courses of the program.

iv. *Quantitative Reasoning*

Quantitative reasoning is a central part of all mathematics courses.

v. *Social and Ethical Responsibility*

A fundamental respect for honest argument is omnipresent in mathematics courses. Moreover, in the Major Program, students must also reflect on ethical questions by taking one of

PHL275H1 or PHL265H1/PHL268H1/PHL271H1/PHL273H1.

c. **AN INTEGRATIVE, INQUIRY-BASED ACTIVITY**

MAT401H1/MAT402H1, as the most advanced course taken by most Majors, requires all the mathematical sophistication and algebraic knowledge students have acquired up to that point. As well, MAT334H1 makes use of all the analysis they have learned.

**5. Departmental/College Resource Implications** The Office of the Dean requires a statement of the resource requirements for the proposed program, and an indication of whether you can meet these requirements through your existing resources, or have received additional resources from the Dean. Please give details of the resource areas below.

<b>Estimated Enrolment per Academic Year in this program (please explain)</b>	All years, including 1 <sup>st</sup> and 2 <sup>nd</sup> round = 495  This figure is taken from total POST enrolment supplied by the Faculty of Arts and Science.
<b>New courses necessary to mount for this program</b>	MAT332H1, MAT475H1
<b>Additional Instructor(s) Requirements</b>	0
<b>Teaching Assistant(s) Requirements</b>	40 hrs.
<b>Laboratory Equipment Requirements</b>	0
<b>Computing Resources Requirements</b>	0
<b>Other</b>	0

**DELETE the statement that DOES NOT apply:**

I will provide these resources required for this Program from my existing budget.

**DATE:** October 7, 2009

**Name of Chair/Program Director:** Kumar Murty (Professor)