

# SIMON FRASER UNIVERSITY

## MEMORANDUM

S.75-110

To..... SENATE

From..... SENATE GRADUATE STUDIES COMMITTEE

Subject..... M. SC. (EDUC) PROGRAM IN MATHEMATICAL  
EDUCATION

Date..... JUNE 10, 1975

**MOTION:**

"That Senate approve, and recommend approval to the Board of Governors, the M.Sc. (EDUC) Program in Mathematical Education, as set forth in S.75-110, including the new courses:

MATH 601-5 - Trends and Developments in Mathematics, I  
MATH 602-5 - Trends and Developments in Mathematics, II

which do not carry credit toward the M.Sc. or the Ph.D. degrees in the Faculty of Science, but toward the M.Sc. (EDUC) degree."

To: Members of Senate

From: Office of the Dean  
of Graduate Studies

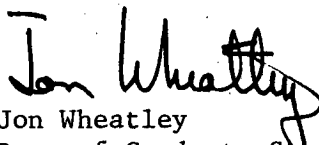
Subject: M.Sc.(Educ) Program  
in Mathematical Education

Date: June 10, 1975

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MOTION: That Senate approve the M.Sc.(Educ) Program in  
Mathematical Education

This program was approved by the Senate Graduate  
Studies Committee on June 9, 1975.

  
Jon Wheatley  
Dean of Graduate Studies

# SIMON FRASER UNIVERSITY

GS. 75-4

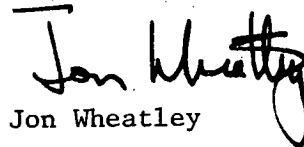
## MEMORANDUM

To..... Marian McGinn for the Executive  
Committee

From..... Jon Wheatley,  
Dean of Graduate Studies

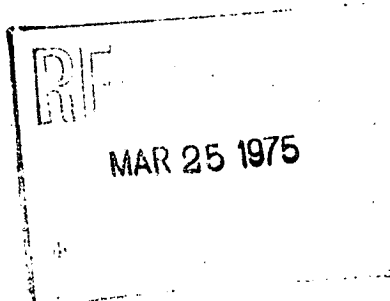
Subject..... Date..... March 24, 1975

I enclose a proposal for an M.Sc. (Ed) Program in Mathematical Education: It is my ruling that it is not a new program. I checked this ruling with the Academic Planning Committee to make sure I would not be over-ruled at a later time with consequent loss of time: the Academic Planning Committee concurred in my ruling. Thus the proposal may go forward to Senate without reference to the Assessment Committee for New Programs. However, because it is a course package, rather than simply one or two new courses, I would like it to go before the Senate Graduate Studies Committee (if it passes the Executive Committee) before it goes to Senate.

  
Jon Wheatley

cc: Dr. B. Wilson, Chairman Academic Planning Committee  
Dr. S. Aronoff, Dean of Science  
Dr. A. H. Lachlan, Chairman Mathematics

enc.



# SIMON FRASER UNIVERSITY

## MEMORANDUM

To M. McGinn, Secretary

Senate Grad Studies Committee

Subject M.Sc. (Ed.) Program in

Mathematics Education

From S. Aronoff

Dean of Science

Date March 5, 1975

At its meeting of February 27, 1975, the Faculty of Science passed the following motions:

"That the Faculty approve the proposal for a Master of Science (Education) Program in Mathematics Education and forward to SGSC for consideration."

"That the Faculty approve course proposal MATH 601-5, 'Trends and Developments in Mathematics, I' and forward to SGSC for consideration."

"That the Faculty approve course proposal MATH 602-5, 'Trends and Developments in Mathematics, II' and forward to SGSC for consideration."

The supporting documentation for these proposals is attached.

/pel  
Encl.

# SIMON FRASER UNIVERSITY

G-74-2

## MEMORANDUM

To	Dr. S. Aronoff Dean of Science	From	Dr. A.H. Lachlan Chairman Mathematics Department
Subject	M.Sc. (Ed.) Program in Mathematics Education	Date	October 22, 1974

This proposed new program has crystallized and the proposers of it would like it to be mounted in the academic year 75-76. In the past I indicated to you that I hoped we could make our contribution to this program without any additional faculty members. At that time it seemed that the requirement would be for six hours teaching a year. The Department now has a very strong feeling that it has been the victim of too tight a squeeze in terms of manpower and that on no account should we undertake anything new without receiving the necessary additional help at faculty level.

The requirements for the program would be 15 hours over two years. I think that the best way to provide the necessary teaching would be to employ persons with recent Ph.D.'s either to teach some of our tutorials or to teach some of our lowest level calculus courses. Of course I should say we are alive to the necessity for all introductory courses to be taught not only competently but well. I feel that a sum in the neighborhood of \$10,000 over two years could be used to fund the teaching in this way. Our Appointments Committee felt that it would be prudent to use this approach rather than requesting yet another faculty position because it is not yet certain that the M.Sc. Education Program can be offered continuously.

*A.H. Lachlan*

A.H. Lachlan

AHL/lh

att. current information about program

# SIMON FRASER UNIVERSITY

## MEMORANDUM

To Prof. A.H. Lachlan

From L. Berggren

Chairman, Math Department

Subject

Date 8 October 1974

Dear Alistair,

I am writing to request that you call an early meeting of the Appointments and Long-Range Planning Committee to consider the implications for future staffing of the new M.Sc. (Ed.) Program in Mathematics Education. The Program itself is to be offered by the Education Faculty but it has been drawn up with close cooperation between two members of that Faculty (Professors Dawson & Trivett) and a committee from the Math. Department.

The mathematics component of the program will consist of two 13-week courses, one of which will be offered each year. (It is a two-year program and all students will take both courses.) Each course will meet one evening per week, from 4:30-9:30 with a 45 minute break for dinner. In addition a member of our department will have the responsibility of supervising the writing of an extended essay (for which the student receives 5 hour credit) by each student in the program. As the program will be based on close cooperation between the person teaching the education courses and the person teaching the mathematics course it will be desirable if each attends a fair portion of the courses given by the other, I thus put the time commitment of a person teaching in the program at 15 hours over 2 years (10 hours teaching the mathematics courses, 5 hours from directing essays) and this is the number of teaching hours I feel must be allocated by the Department. Because of the number of students involved (between 10 and 15) I feel it would be less than fair to give under 5 hours teaching credit to the person supervising the extended essays.

My own view is that there are several persons in the department capable of and interested in teaching in this program. What I would like the ALRP Committee to consider is whether or not we can make our contribution to the program without bringing in a new faculty member to cover the hours we will lose by using one of our present faculty for this program.

I enclose a draft of the description of the program.

Yours very truly,

*Len*

LB:lc

## GRADUATE PROGRAM IN MATHEMATICS EDUCATION

### Introduction

The following brief description of the proposed Graduate Program in Mathematics Education has been generated as a result of discussions between the Faculty of Education and the Mathematics Department.

The proposed program is designed to provide practising teachers with an opportunity to update their knowledge base in the fields of education and mathematics.

### Degree to be awarded

On successful completion of the Graduate Program in Mathematics Education, a candidate will be awarded the degree of Master of Science (Education).

### Admission Requirements

The Graduate Program in Mathematics Education seeks high calibre candidates who are interested in improving the quality of educational practice in their classrooms. Applicants for admission must be practising teachers who <sup>meet</sup> ~~meet~~ the regular admission requirements to the Faculty of Education. In addition, any requirements imposed by the Mathematics Department must be met.

The Graduate Program in Mathematics Education will have an initial intake of fifteen students in September, 1975. If fifteen suitable candidates are not identified, the program will not be mounted.

Applications for admission must be made before May 1, 1975.

Applications will be sent to the Faculty of Education for documentation. A joint Faculty of Education-Mathematics Department committee will rule on the admissibility of candidates, with the final decision for admissibility reserved by the Faculty of Education Graduate Studies Committee.

#### Meeting Times

The Graduate Program in Mathematics Education is designed for practising teachers whose family and occupational responsibilities require them to continue employment while they undertake graduate work. For this reason, meeting times will be Tuesdays and Thursdays commencing at 4:30 p.m. and continuing through the dinner hour until 9:30 p.m.

#### Program Content, Sequencing and Staffing

To complete the Graduate Program in Mathematics Education and to qualify for the M.Sc. (Education) degree, a candidate will be required to complete a minimum of forty semester hours of work including two extended essays of five semester hours work each.



Program content, sequencing and staffing for the two year period is shown on the following pages. It should be noted that all students must follow the program sequencing that is outlined.

SEMESTER	CALENDAR COURSE NUMBER	SHORT CONTENT DESCRIPTION	SEMESTER POINTS
Fall 1975 (75-3)	Education 814	Research Design	5
	Mathematics 601*	Trends & Developments in Math. I	5
Spring 1976 (76-1)	Education ____**	Trends & Developments in Math. Education I	5
	Education 881***	Extended Essay	5
Summer 1976 (76-2)	No formal course work		
Fall 1976 (76-3)	Mathematics 602*	Trends & Developments in Mathematics II	5
	Optional Course****	[Mathematics or Education]	5
Spring 1977 (77-1)	Education ____**	Trends & Developments in Mathematics Education II	5
	Education 882***	Extended Essay	5

- \* See Appendix A
- \*\* See Appendix B
- \*\*\* See Appendix C
- \*\*\*\* See Appendix D

Supervisory Committees

Each candidate will have a Supervisory Committee of two members, one from the Faculty of Education and one from the Mathematics Department. Initiation and supervision of each candidate's program will be undertaken pursuant to Senate Graduate Studies Regulations.

Program Coordinator

\_\_\_\_\_ is recommended as Program Coordinator for the Graduate Program in Mathematics Education. It is further recommended that the Program Coordinator be assisted by a small consultative committee whose members have a major commitment to and involvement in the program [3 or 4 professors at most].

The program Coordinator will work closely with Senior Supervisors of the candidates in the program and the Director of Graduate Studies, Faculty of Education, in order to foster the expedience and orderly progress of candidates towards their degrees.

Financial Assistance

No financial assistance will be available for applicants to the Graduate Program in Mathematics Education.

APPENDIX A

Mathematics 601

&

Mathematics 602

# SIMON FRASER UNIVERSITY

## MEMORANDUM

To Faculty of Science

Graduate Studies Committee

Subject NEW GRADUATE COURSE PROPOSALS

From Dr. S.K. Thomason, Chairman  
Graduate Studies Committee  
Mathematics Department

Date November 25, 1974

Enclosed are New Graduate Course Proposal Forms for Math 601-5 and 602-5, approved by the Department Graduate Studies Committee on November 21, 1974. Please note that they were approved subject to the condition that they will not carry credit towards the M.Sc. or Ph.D. degrees in Mathematics. I presume the Faculty will change "Mathematics" to "Faculty of Science" and will ensure an appropriate notation is made in the Graduate Calendar. (cf. Chemistry entry, 1974-75, p. 127).

SKT/sh  
Encl.

SK Thomason

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: Mathematics Course Number: 601

Title: Trends and Developments in Mathematics, I.

Description: An investigation of the fundamental concepts and techniques of the calculus and modern algebra, with stress on the algorithmic aspects of these areas of Mathematics.

Credit Hours: 5 Vector: \_\_\_\_\_ Prerequisite(s) if any: Permission

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 15 When will the course first be offered: Fall, 1975

How often will the course be offered: Once every two years.

JUSTIFICATION:

The course is needed as the Mathematics Department's contribution to the Graduate Program in Educational Practice (Mathematics Education) to be offered by the Faculty of Education. It is a key part of a program designed to improve the level of mathematics teaching in the Junior and Senior Secondary schools in this province.

RESOURCES:

Which Faculty member will normally teach the course: Drs. Alspach, Berggren, Gerber, Harrop and Thomson.

What are the budgetary implications of mounting the course: Will need \$5,000 to pay a post-doctoral fellow to teach a course that would have been taught by the faculty member assigned to this course.

Are there sufficient Library resources (append details): See attachment.

- Appended:
- a) Outline of the Course
  - b) An indication of the competence of the Faculty member to give the course.
  - c) Library resources

Approved: Departmental Graduate Studies Committee: [Signature] Date: 21.11.74

Faculty Graduate Studies Committee: [Signature] Date: 6 March 75

Faculty: \_\_\_\_\_ Date: \_\_\_\_\_

Senate Graduate Studies Committee: \_\_\_\_\_ Date: \_\_\_\_\_

Senate: \_\_\_\_\_ Date: \_\_\_\_\_

## Library Resources

The existing holdings in Mathematics books are more than adequate for this course. However, the student will be encouraged to find papers which develop further the topics in the course, both at a level which would be useful to him/her and at a level which would be accessible to his/her future students. Consequently, it is important to note that the library subscribes to such journals as:

- (1) The Mathematics Teacher
- (2) Mathematical Gazette
- (3) The Monthly, of the Mathematical Association of America
- (4) Vector, a publication of the B.C. Association of Mathematics Teachers
- (5) Scientific American

All of these regularly publish papers which would serve as supplementary material at a level appropriate to this course.

### Competence of Proposed Faculty

The mathematical material included in the course is such as could be taught by any competent mathematician. Of more importance is the individual's concern for, and knowledge of, problems of mathematics education. Several members of the Proposed Faculty have spoken at length, in both formal and informal settings, with mathematics teachers in the Province and with specialists in mathematics education. All of the Proposed Faculty have been actively involved for more than a year in discussions with Professors Trivett and Dawson of the Education Faculty on both the approach and content of this course. In addition, some of those whose names are listed have published results of their research into problems of mathematics education.

MATHEMATICS 601

TRENDS AND DEVELOPMENTS IN MATH. I

A. Algorithmic Approaches

I. General study of algorithms

- a. Flowcharting
- b. Efficiency of algorithms

II. Examples of algorithms

B. Calculus

I. Concepts of the calculus

- a. The Real Numbers - order and completeness
- b. Functions
- c. Limits
  - 1. Convergence of sequences and series
  - 2.  $\lim_{x \rightarrow a} f(x)$
  - 3. Derivatives
  - 4. Integrals

II. Applications of the calculus

- a. Physical Sciences
- b. Biological Sciences
- c. Social Sciences

C. Algebra

I. Algebra as an extension of High School algebra

- a. Groups
  - 1. Permutation Groups and Counting
  - 2. Symmetry
- b. Rings
  - 1. Rings in number theory
  - 2. Polynomial Rings



C. (continued)

I. c. Fields

1. The fields of High School algebra
2. Constructing other fields
3. Symmetry groups of fields

II. Impossibility of certain geometric constructions

III. Algorithmic aspects of algebra

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: Mathematics Course Number: 602

Title: Trends and Developments in Mathematics, II.

Description: The basic concepts and techniques of linear algebra and statistics, with an emphasis on their applications. A consideration of the axiomatic approach to Mathematics as exemplified by different types of geometry.

Credit Hours: 5 Vector: 5-0-0 Prerequisite(s) if any: Permission

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 15 When will the course first be offered: Fall, 1976

How often will the course be offered: Once every two years.

JUSTIFICATION:

The course is needed as the Mathematics Department's contribution to the Graduate Program in Educational Practice (Mathematics Education) to be offered by the Faculty of Education. It is a key part of a program designed to improve the level of mathematics teaching in the Junior and Senior Secondary schools in this province.

RESOURCES:

Which Faculty member will normally teach the course: Drs. Alspach, Berggren, Gerber, Harrop and Thomson

What are the budgetary implications of mounting the course: Will need \$5,000 to pay a post-doctoral fellow to teach a course that would have been taught by the faculty member assigned to this course.

Are there sufficient Library resources (append details): See attachment.

- Appended:
- a) Outline of the Course
  - b) An indication of the competence of the Faculty member to give the course.
  - c) Library resources

Approved: Departmental Graduate Studies Committee: S. P. [Signature] Date: 21.11.74

Faculty Graduate Studies Committee: [Signature] Date: 6/Nov/75

Faculty: S. [Signature] Date: 6/Nov/75

Senate Graduate Studies Committee: \_\_\_\_\_ Date: \_\_\_\_\_

Senate: \_\_\_\_\_ Date: \_\_\_\_\_

### Competence of Proposed Faculty

The mathematical material included in the course is such as could be taught by any competent mathematician. Of more importance is the individual's concern for, and knowledge of, problems of mathematics education. Several members of the Proposed Faculty have spoken at length, in both formal and informal settings, with mathematics teachers in the Province and with specialists in mathematics education. All of the Proposed Faculty have been actively involved for more than a year in discussions with Professors Trivett and Dawson of the Education Faculty on both the approach and content of this course. In addition, some of those whose names are listed have published results of their research into problems of mathematics education.

## Library Resources

The existing holdings in Mathematics books are more than adequate for this course. However, the student will be encouraged to find papers which develop further the topics in the course, both at a level which would be useful to him/her and at a level which would be accessible to his/her future students. Consequently, it is important to note that the library subscribes to such journals as:

- (1) The Mathematics Teacher
- (2) Mathematical Gazette
- (3) The Monthly, of the Mathematical Association of America
- (4) Vector, a publication of the B.C. Association of Mathematics Teachers
- (5) Scientific American

All of these regularly publish papers which would serve as supplementary material at a level appropriate to this course.

MATHEMATICS 602

TRENDS AND DEVELOPMENTS IN MATH II

- A. Linear Algebra and Matrix Theory
  - I. Systems of Linear Equations
  - II. Vector Spaces
    - a. Linear Operators and Linear Functionals
    - b. Derivative and Integral as Linear Operators
  - III. Applications of Linear Algebra
    - a. Game Theory
    - b. Linear Programming
  
- B. Statistics and Probability
  - I. Descriptive Statistics
  - II. Probability
  - III. Theory of Inferential Statistics
  - IV. Applications
    - a. Experimental Design
    - b. Sample Survey Design
    - c. Quality Control
  
- C. Geometry
  - I. Reasons for Axiomatics and the Evolution of the Method
  - II. Description of the Method
  - III. Examples of Axiom Systems
    - a. Plane Euclidean Geometry
    - b. Finite Geometries
    - c. Projective Geometry
  - IV. Consistency and Independence of Axiom Systems

APPENDIX B

Trends and Developments  
in  
Mathematics Education

The number for this course Education \_\_\_\_, Trends and Developments in Mathematics Education I is yet to be determined. Nonetheless, it is anticipated that at a minimum the course will include the following topics:

A. Affective and Cognitive Factors in Learning Mathematics

- I. Self Concept and School Achievement
- II. Confluent Education as it pertains to mathematics education
- III. Psychology of Learning Mathematics for the young child/for the adolescent
- IV. Subordination of Teaching to Learning

B. Problems in Remedial Work

- I. Principle of Multiple Embodiment
- II. Analysis of Learner Difficulties in arithmetic and algebraic operationals/number systems/geometry

C. Strategies to Develop and Meet Curriculum Designs

- I. Goals and Objectives for Mathematics Teaching
- II. Strategies for Teaching Mathematics
- III. Formative and Summative Evaluation in Mathematics Teaching
- IV. Analysis of Mathematics Curriculum
- V. Research Design

Again, the number for the course Education \_\_\_\_, Trends and Developments in Mathematics Education II is yet to be determined. The following content outline is provided, however, so that one can gain a perspective of the minimum content to be considered in the course.

- A. Strategies to Develop and Meet Curriculum Designs  
(an extension of the topic initiated in Education \_\_\_)
  
- B. Importance of error in learning mathematics
  - I. Computational Error
  - II. Self-correction
  - III. Algebraic error
  - IV. Measurement and estimation
  - V. Personal perception
  - VI. Individual schema: assimilation and accommodation
  
- C. Physical Aids and Manipulative Materials for Learning Mathematics
  - I. Role and organization of mathematics laboratories
  - II. Physical Aids and Manipulative Materials
    - a) Counters
    - b) Attribute blocks
    - c) Coloured rods
    - d) Multibase blocks
    - e) Geoboards, pegboards
    - f) Geometric models
    - g) Mathematical games



**APPENDIX C**

**Extended Essays**

B

The two extended essays required for the Graduate Program in Mathematics Education will conform to the outline for extended essays contained in paper Ed GS 8 and other such regulations which may from time to time be involved by the University.

In addition, one of the extended essays must have an emphasis on the mathematics while the other must focus on the pedagogy of mathematics teaching. In the former case, the major supervisor shall be a member of the Mathematics Department with the second member of the Supervisory Committee coming from the Faculty of Education. In the latter case, the major supervisor shall be from the Faculty of Education with the second member of the Supervisory Committee being from the Mathematics Department.

APPENDIX D

Optional Course

The optional course provided during the 76-3 semester may be either an education course or a mathematics course. A list of approved optional courses is provided below. A candidate must have written approval of his senior supervisor before registering for an optional, such approval to be filed with the Director of Graduate Studies, Faculty of Education, no less than two weeks prior to the commencement of the course.

Courses may be added to or deleted from this list only with the approval of the Graduate Studies Committee of the Faculty of Education acting on the recommendation of the Program Coordinator.

EDUCATION COURSES

Education \_\_\_  
Education \_\_\_  
Education \_\_\_  
Education \_\_\_  
Education \_\_\_

MATHEMATICS COURSES

Mathematics \_\_\_  
Mathematics \_\_\_  
Mathematics \_\_\_  
Mathematics \_\_\_  
Mathematics \_\_\_

Because of the variation in the number of credit hours granted for mathematics courses, it may be necessary for a student to take two mathematics courses in order to obtain the required 5 semester hour credit.

TRENDS AND DEVELOPMENTS IN MATH. I

A. Algorithmic Approaches

- I. General study of algorithms
  - a. Flowcharting
  - b. Efficiency of algorithms

II. Examples of algorithms

B. Calculus

- I. Limits and Continuity
- II. Derivatives
- III. Integrals
- IV. Algorithms in the Calculus

C. Algebra

- I. Algebra as an extension of high school algebra
  - a. Groups
  - b. Rings
  - c. Fields
  - d. Polynomial Rings
- II. Impossibility of certain geometric constructions
- III. Algorithmic aspects of algebra

MATHEMATICS 602

TRENDS AND DEVELOPMENTS IN MATH II

- A. Linear Algebra and Matrix Theory
  - I. Systems of linear equations
  - II. Other uses for linear algebra
  
- B. Statistics and Probability
  - I. Descriptive Statistics
  - II. Probability
  - III. Theory of Inferential Statistics
  - IV. Applications
    - a. Experimental Design
    - b. Sample Survey Design
    - c. Quality Control
  
- C. Geometry
  - I. Reasons for Axiomatics and the evolution of the method
  - II. Description of the method
  - III. Examples of Axiom Systems
    - a. Plane Euclidean Geometry
    - b. Finite Geometries
    - c. Projective Geometry
  - IV. Consistency and Independence of Axiom Systems