

CURRICULUM PROPOSAL COVER SHEET  
University-Wide Undergraduate Curriculum Committee

LSC Use Only  
Number LS 54  
Action A  
Date 2-2-89

UWUCC Use Only  
Number \_\_\_\_\_  
Action \_\_\_\_\_  
Date \_\_\_\_\_

I. TITLE/AUTHOR OF CHANGE

COURSE/PROGRAM TITLE MA151- Math for Elementary Teachers I  
DEPARTMENT Mathematics  
CONTACT PERSON John Broughton

II. THIS COURSE IS BEING PROPOSED FOR:

Course Approval Only  
 Course Approval and Liberal Studies Approval  
 Liberal Studies Approval only (course previously has been approved by the University Senate)

III. APPROVALS

John Mueller  
Department Curriculum Committee  
Douglas Wilson  
College Curriculum Committee  
Chad Cobble  
Director of Liberal Studies  
(where applicable)

John Broughton  
Department Chairperson  
Ann H. Katz  
College Dean\*  
\_\_\_\_\_  
Provost  
(where applicable)

\*College Dean must consult with Provost before approving curriculum changes. Approval by College Dean indicates that the proposed change is consistent with long range planning documents, that all requests for resources made as part of the proposal can be met, and that the proposal has the support of the university administration.

IV. TIMETABLE

Date Submitted to LSC \_\_\_\_\_  
to UWUCC \_\_\_\_\_  
Semester/Year to be implemented \_\_\_\_\_  
Date to be published in Catalog \_\_\_\_\_

INDIANA UNIVERSITY OF PENNSYLVANIA  
MATHEMATICS DEPARTMENT

COURSE NUMBER: MA 151  
COURSE TITLE: Mathematics for Elementary Teachers I  
CREDITS: 3 Semester Hours  
PREREQUISITES: none

CATALOG DESCRIPTION:

Topics included are sets, concepts of logic, mathematical systems, systems of numeration, developing the set of integers, rational numbers, and real numbers.

COURSE OUTLINE:

- I. Problem Solving
  - A. Polya's Four-Step Process
  - B. Problem-Solving Strategies and Additional Problems
- II. Sets, Whole Numbers, and Numeration
  - A. Sets as a Basis for Whole Numbers
  - B. Whole Numbers and Numeration
- III. Whole Numbers - Operations and Properties
  - A. Addition, Subtraction, and Ordering
  - B. Multiplication, Division, and Exponents
- IV. Whole-Number Computations
  - A. Algorithms for the Addition and Subtraction of Whole Numbers
  - B. Algorithms for the Multiplication and Division of Whole Numbers
  - C. Algorithms in Other Bases
- V. Number Theory
  - A. Primes, Composites, and Tests for Divisibility
  - B. Counting Factors, Greatest Common Factor, and Least Common Multiple
- VI. Fractions
  - A. The Set of Fractions
  - B. Fractions - Operations and Properties
- VII. Decimals, Percent, Ratio, and Proportion
  - A. Decimals and Their Operations
  - B. Percent
  - C. Ratio and Proportion
- X. Statistics

- A. Organizing and Picturing Information
- B. Analyzing Data

XIII. Measurement

- A. Measurement with Nonstandard and Standard Units

Special Section 2: Programming in BASIC

\* Need to caution about integrating working with different bases throughout development of numeration systems and computational algorithms.

\*\* Packets from BASIC Discoveries are available as supplementary activities for integrating the computer.

\*\*\* Calculator usage is integrated throughout the text.

Students should have:

1. text
2. blank computer disk
3. calculator

# LIBERAL STUDIES COURSE APPROVAL FORM

**About this form:** Use this form only if you wish to have a course included for Liberal Studies credit. The form is intended to assist you in developing your course to meet the university's Criteria for Liberal Studies, and to arrange your proposal in a standard order for consideration by the LSC and the UWUC. If you have questions, contact the Liberal Studies Office, 353 Sutton Hall; telephone, 357-5715.

**Do not** use this form for technical, professional, or pre-professional courses or for remedial courses, none of which is eligible for Liberal Studies. **Do not** use this form for sections of the synthesis course or for writing-intensive sections; different forms will be available for those.

## PART I. BASIC INFORMATION

**A. For which category(ies) are you proposing the course? Check all that apply.**

### LEARNING SKILLS

- First English Composition Course
- Second English Composition Course
- Mathematics *Approved 2-9-89*

### KNOWLEDGE AREAS

- Humanities: History
- Humanities: Philosophy/Religious Studies
- Humanities: Literature
- Fine Arts
- Natural Sciences: Laboratory Course
- Natural Sciences: Non-laboratory Course
- Social Sciences
- Health and Wellness
- Non-Western Cultures
- Liberal Studies Elective

**B. Are you requesting regular or provisional approval for this course?**

- Regular**       **Provisional** (limitations apply, see instructions)

*new course*

**C. During the transition from General Education to Liberal Studies, should this course be listed as an approved substitute for a current General Education course, thus allowing it to meet any remaining General Education needs?**     **yes**     **no**

**If so, which General Education course(s)?**    MA 151

**PART II. WHICH LIBERAL STUDIES GOALS WILL YOUR COURSE MEET? Check all that apply and attach an explanation.**

All Liberal Studies courses must contribute to at least one of these goals; most will meet more than one. As you check them off, please indicate whether you consider them to be primary or secondary goals of the course. [For example, a history course might assume "historical consciousness" and "acquiring a body of knowledge" as its primary goals, but it might also enhance inquiry skills or literacy or library skills.] Keep in mind that no single course is expected to shoulder all by itself the responsibility for meeting these goals; our work is supported and enhanced by that of our colleagues teaching other courses.

	Primary	Secondary
<b>A. Intellectual Skills and Modes of Thinking:</b>		
1. Inquiry, abstract logical thinking, critical analysis, synthesis, decision making, and other aspects of the critical process.	✓ _____	_____
2. Literacy--writing, reading, speaking, listening	_____	✓ _____
3. Understanding numerical data	✓ _____	_____
4. Historical consciousness	_____	✓ _____
5. Scientific inquiry	_____	✓ _____
6. Values (ethical mode of thinking or application of ethical perception)	_____	_____
7. Aesthetic mode of thinking	✓ _____	_____
<b>B. Acquiring a Body of Knowledge or Understanding Essential to an Educated Person</b>	✓ _____	_____
<b>C. Understanding the Physical Nature of Human Beings</b>	_____	_____
<b>D. Certain Collateral Skills:</b>		
1. Use of the library	_____	✓ _____
2. Use of computing technology	✓ _____	_____

ADDENDUM TO LIBERAL STUDIES PROPOSALS: PART II

The Liberal Studies Goals met by the Courses MA 151 and MA 152:

A. Intellectual Skills and Modes of Thinking:

1. Inquiry, abstract logical thinking, critical analysis, synthesis, decision making, and other aspects of the critical process is a primary goal of the course. It is apparent that the study of Mathematics requires that the student learn to apply the pattern of using these categories to collect data, clearly state the problem under study, apply the methods known to affect a solution to the problem, and then to analyze and interpret the resulting solution. These concepts are especially important for those students who will someday be instructing young children in elementary and middle school in the rudiments of mathematics.
2. Literacy-writing, reading, speaking, listening, is a secondary goal of this course. All of these areas can be applied and improved during a course of study in mathematics. Reading skills are absolutely necessary for a clear understanding of the material; the writing of solutions to mathematical problems requires clarity of mind and organization of thought; the requirement of discussing mathematics in the classroom shows the student the importance of clear patterns of thinking and of the expression of those thoughts orally; and listening skills are very important in the understanding of mathematics. These skills can be improved through the writing of tests and of assigned papers, through the oral response to classroom questions, and through the reading of assignments.
3. Understanding numerical data is a primary goal of this course. This course stresses understanding and appreciation on the part of the student for the importance and usefulness of mathematics in our society. Topics studied in this course will develop in the student with limited mathematical preparation a confidence in the handling of numerical problems.
4. Historical consciousness is a secondary goal. Students should have some awareness of the historical significance of the role of mathematics in the development of western and other civilizations, and its importance in the education of children in the elementary and middle schools.
5. Scientific inquiry is a secondary goal. Students should be made aware of the importance of mathematical logic and its role in the technical and scientific evolution of mankind. Of interest is the manner in which man uses the structure of mathematics to construct problem solving techniques, and improve methods of decision making and deductive reasoning.
6. Aesthetic mode of thinking is a secondary goal. Mathematics can be appreciated as a beautiful art form for communication and learning. An effort should be made to develop in the student a sense of this beauty and an awareness for its power and utility.

B. Acquiring a Body of Knowledge or Understanding Essential to an

Educated Person:

Secondary Goal

Although specific mastery of mathematics is not required of any students in this course, it is important that students develop a sense of its importance and utility for society. Moreover, this course of study should develop in the student a feeling of confidence toward elementary deductive reasoning, rudimentary problem solving skills, decision making, and the use and interpretation of the basic language of mathematics.

D. Certain Collateral Skills:

2. Use of computing technology is a secondary goal. Students need to be aware of the importance of computers in the educational process in the elementary and middle schools. In addition, the students in this course need to develop computer skills applicable to the instruction of young children in elementary and middle school.



**PART III. DOES YOUR COURSE MEET THE GENERAL CRITERIA FOR LIBERAL STUDIES?** Please attach answers to these questions.

- A. If this is a multiple-section, multiple-instructor course, there should be a basic equivalency (though not necessarily uniformity) among the sections in such things as objectives, content, assignments, and evaluation. Note: this should not be interpreted to mean that all professors must make the same assignments or teach the same way; departments are encouraged to develop their courses to allow the flexibility which contributes to imaginative, committed teaching and capitalizes on the strengths of individual faculty.

**What are the strategies that your department will use to assure that basic equivalency exists?** Examples might be the establishment of departmental guidelines, assignment of responsibility to a coordinating committee, exchange and discussion of individual instructor syllabi, periodic meetings among instructors, etc.

- ✓ B. Liberal Studies courses must include the perspectives and contributions of ethnic and racial minorities and of women wherever appropriate to the subject matter. **If your attached syllabus does not make explicit that the course meets this criterion, please append an explanation of how it will.**

- C. Liberal Studies courses must require the reading and use by students of at least one, but preferably more, substantial works of fiction or nonfiction (as distinguished from textbooks, anthologies, workbooks, or manuals). **Your attached syllabus must make explicit that the course meets this criterion.**

[The only exception is for courses whose primary purpose is the development of higher level quantitative skills; such courses are encouraged to include such reading, but are not expected to do so at the expense of other course objectives. If you are exercising this exception, please justify here.]

- D. If this is an introductory course intended for a general student audience, it should be designed to reflect the reality that it may well be the only formal college instruction these students will have in that discipline, instead of being designed as the first course in a major sequence. That is, it should introduce the discipline to students rather than introduce students into the discipline. **If this is such an introductory course, how is it different from what is provided for beginning majors?**



ADDENDUM TO LIBERAL STUDIES PROPOSALS: PART III

B. Whenever appropriate, information will be introduced into the classroom discussion which will reflect the contributions made to mathematics by women and by minorities. Particular attention will be given to the following areas as they relate to this topic:

1. The classroom discussion will be sensitive to gender balancing with respect to language.
2. Quizzes, tests, examinations, and any other written information distributed to the students will be sensitive to gender balancing, especially in problem construction, and to minorities whenever possible.
3. Specific names and contributions made by women and other members of minority groups will be discussed in the classroom when the discussion of such is germane to the material being studied. It should be noted though that mathematics has been the domain of the male throughout history and only in recent time has there been numbers of women involved. Even today, there are too few women in the field of mathematics.

E. The Liberal Studies Criteria indicate six ways in which all courses should contribute to students' abilities. To which of the six will your course contribute? Check all that apply and attach an explanation.

1. Confront the major ethical issues which pertain to the subject matter; realize that although "suspended judgment" is a necessity of intellectual inquiry, one cannot live forever in suspension; and make ethical choices and take responsibility for them.
2. Define and analyze problems, frame questions, evaluate available solutions, and make choices
3. Communicate knowledge and exchange ideas by various forms of expression, in most cases writing and speaking.
4. Recognize creativity and engage in creative thinking.
5. Continue learning even after the completion of their formal education.
6. Recognize relationships between what is being studied and current issues, thoughts, institutions, and/or events.

**PART IV. DOES YOUR COURSE MEET THE CRITERIA FOR THE CURRICULUM CATEGORY IN WHICH IT IS TO BE LISTED?**

Each curriculum category has its own set of specific criteria in addition to those generally applicable. The LSC provides copies of these criteria arranged in a convenient, check-list format which you can mark off appropriately and include with your proposal. The attached syllabus should indicate how your course meets each criterion you check. If it does not do so explicitly, please attach an explanation.

PART III (MA 151)

A. There will be a common syllabi of topics that should be covered by each of the individual instructors teaching this course. Such common syllabi should include but not be limited to topics which introduce the student to deductive reasoning, develop in the student problem solving skills, and enable the student not only to understand the underlying principles of formulae but also to have the ability to use and interpret numerical data. If time permits, additional optional topics may be covered based on individual instructor preference.

B. Whenever appropriate, information will be introduced into the classroom discussion which will reflect the contributions made to mathematics by women and by ethnic, racial, and other minorities. Readings will be provided to instructors of all classes by the Elementary Mathematics Curriculum Committee as another means of disseminating that information.

C. Reading lists of appropriate magazine/journal/etc. articles pertinent to the mathematics material discussed in this course will be provided to instructors of all courses by the Elementary Mathematics Curriculum Committee. Additionally, instructors could require the students to report in writing on articles they have discovered through their reading which pertain to mathematics education and/or applications of mathematics education.

D. The thrust of MA 151 is not to be remedial in nature but rather to develop in the student an awareness of and an appreciation for the power and usefulness of mathematics and its important role in a technological society. Additionally, this course provides appropriate background for future teachers at the elementary and middle school level. The goal of this course is to provide the student with an understanding of the underlying principles of topics such as problem solving; sets, whole numbers, and numeration; whole numbers - operations and properties; whole number computations; number theory; fractions; decimals, percent, ratio, and proportion; statistics, measurement; and programming in BASIC. These topics would provide the course with a suitable mathematical strata accessible to students with limited mathematical preparation, would enable the student to develop confidence in handling numerical problems, would present the student with an opportunity to develop an appreciation for mathematics, and would allow the introduction to students of hand held calculators and possibly computers.

E. #2.- The very nature of mathematical study requires that problems be clearly analyzed and defined, that solutions be generated for such problems, and that an interpretation be assigned to each possible solution in order that a correct choice may be made.

#4.- Mathematics is exactly the art of creative thinking. One moves from the collection of data to the definition of the problem to the abstract generalization in which a solution or solutions are constructed to the interpretation of the solution or solutions to the application of the solution(s). This process requires one to recognize creativity and to engage in creative thinking.

#5.- One is constantly exposed to information which needs the principles of mathematics for proper interpretation. Skills mastered in this course can last one a life time.

## ADDENDUM TO THE SYLLABI FOR THE COURSES MA 151 AND MA 152

### Course Objectives for the Courses MA 151 and MA 152:

#### I. General Objectives:

- A. Students will develop an appreciation for the nature, the breadth, and the power of mathematics and for its role in a technological society.
- B. Students will be introduced to the requirements for the teaching of mathematics in the elementary school.
- C. Students will develop elementary skills in the use of deductive reasoning and critical thinking.
- D. Students will learn to communicate in the language of mathematics. This learning will involve reading, writing, listening, and speaking.
- E. Students will be exposed to basic problem solving skills founded on the principles of mathematics and will learn to apply these skills to situations outside the classroom.
- F. Students will become confident in their mathematical awareness and will become adept at the application of basic numerical skills.
- G. Students will become aware of the meaningful role played in our society by calculators and computers.
- H. Students will develop those skills necessary for the successful teaching of mathematics at the elementary and middle school level.

#### II. Some Specific Course Objectives:

- A. Students will study basic problem solving techniques.
- B. Students will study the concepts of sets, whole numbers, and enumeration.
- C. Students will master the basic properties of whole numbers.
- D. Students will study algorithms related to the operations of whole numbers.
- E. Students will explore the elementary results of number theory and will learn to compute prime factorizations, greatest common multiple, and least common multiple.
- F. Students will study fractions and their operations.
- G. Students will study the topics of decimal representation, ratios, and proportions.
- H. Students will explore the basic properties of data collection and analysis through the study of statistics.
- I. Students will be exposed to the application and use of calculators.
- J. Students will interact with computers on an elementary level as applicable to preparation for the teaching of mathematics at the elementary level.
- K. Students will investigate the properties of integers and their associated operations.
- L. Students will study rational numbers and will work problems which require an understanding of this topic.
- M. Students will be involved in problem solving in geometry and

will study geometric relations.

- N. Students will explore the concepts of geometric measurement and will use this knowledge as a basis for the study of geometrical transformations.
- O. Students will investigate the basic properties of probability and the graphical representation of probability data.
- P. Students will study the elementary concepts of mathematical logic and will see the relationship of this topic to proofs.

**CHECK LIST -- MATHEMATICS**  
**(Learning Skills Area)**

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**Mathematics Criteria which the Course must meet:**

- Introduce students to deductive reasoning
- Develop in the student problem solving techniques appropriate for the course.
- Enable the student to understand the underlying principles of formulas.
- Enable the student to use and interpret numerical information.

**Courses appropriate to the Mathematics Learning Skills Area must be either:**

- A.** Mathematics courses that develop significant mathematical skills required by a major discipline.
- B.** Mathematics courses designed for Liberal Studies.

**Additional criteria which courses in Category B must meet:**

- Develop the student's confidence in handling numerical problems and data.
- Be sensitive to the diverse background characteristics of the student.
- Include elements on the history or appreciation of mathematics.
- Introduce the hand-held calculator or the computer as a tool.