

KINGSBOROUGH COMMUNITY COLLEGE  
The City University of New York

CURRICULUM TRANSMITTAL COVER PAGE

Department: Math and Computer Science

Date: 01/14/2019

Title Of Course/Degree/Concentration/Certificate: Intro. to Math. Concepts in Proof (MAT 3000 )

Change(s) Initiated: (Please check)

- |   |   |
|---|---|
| <input type="checkbox"/> Closing of Degree            | <input type="checkbox"/> Change in Degree or Certificate                              |
| <input type="checkbox"/> Closing of Certificate       | <input type="checkbox"/> Change in Degree: Adding Concentration                       |
| <input type="checkbox"/> New Certificate Proposal     | <input type="checkbox"/> Change in Degree: Deleting Concentration                     |
| <input type="checkbox"/> New Degree Proposal          | <input type="checkbox"/> Change in Prerequisite, Corequisite, and/or Pre/Co-requisite |
| <input checked="" type="checkbox"/> New Course        | <input type="checkbox"/> Change in Course Designation                                 |
| <input type="checkbox"/> New 82 Course (Pilot Course) | <input type="checkbox"/> Change in Course Description                                 |
| <input type="checkbox"/> Deletion of Course(s)        | <input type="checkbox"/> Change in Course Title, Number, Credits and/or Hours         |
|   | <input type="checkbox"/> Change in Academic Policy                                    |
|   | <input type="checkbox"/> Pathways Submission:   |
|   | <input type="checkbox"/> Life and Physical Science                                    |
|   | <input type="checkbox"/> Math and Quantitative Reasoning                              |
|   | <input type="checkbox"/> A. World Cultures and Global Issues                          |
|   | <input type="checkbox"/> B. U.S. Experience in its Diversity                          |
|   | <input type="checkbox"/> C. Creative Expression                                       |
|   | <input type="checkbox"/> D. Individual and Society                                    |
|   | <input type="checkbox"/> E. Scientific World  |
- Change in Program Learning Outcomes
- Other (please describe): \_\_\_\_\_

PLEASE ATTACH MATERIAL TO ILLUSTRATE AND EXPLAIN ALL CHANGES

DEPARTMENTAL ACTION

Action by Department and/or Departmental Committee, if required:

Date Approved: \_\_\_\_\_ Signature, Committee Chairperson: \_\_\_\_\_

If submitted Curriculum Action affects another Department, signature of the affected Department(s) is required:

Date Approved: \_\_\_\_\_ Signature, Department Chairperson: \_\_\_\_\_

Date Approved: \_\_\_\_\_ Signature, Department Chairperson: \_\_\_\_\_

I have reviewed the attached material/proposal

Signature, Department Chairperson: *Rina Yau* 1/14/2019



TO: Spring 2019 Curriculum Committee

FROM: Department of Mathematics & Computer Science

DATE: 01/14/2019

RE: New Course Introduction for Mathematical Concepts in Proof (MAT 3000)

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The Department of Mathematics & Computer Science is proposing to change one of the requirements for the A.S. Mathematics degree in the following manner:

**ADD:**  
MAT 3000 - Introduction to Mathematical Concepts in Proof

**Rationale for Change:** Program assessment in A.S. Mathematics has for several years observed one notable weak spot for terminal students: reading and writing mathematical proofs. Arguably, this is the essential skill for any math program (re: A.S. Mathematics Program Objective #2, "Give proofs by direct and inductive methods"), and we would like to bolster our students' chance for success in the next step of their careers.

**KINGSBOROUGH COMMUNITY COLLEGE  
THE CITY UNIVERSITY OF NEW YORK**

**NEW COURSE PROPOSAL FORM**

1. **DEPARTMENT, COURSE NUMBER, AND TITLE (SPEAK TO ACADEMIC SCHEDULING FOR NEW COURSE NUMBER ASSIGNMENT):**

Department of Mathematics & Computer Science,  
MAT 3000 – Introduction to Mathematical Concepts in Proof

2. **DOES THIS COURSE MEET A GENERAL EDUCATION/CUNY CORE CATEGORY? No.**

- Life and Physical Science  
 Math and Quantitative Reasoning  
 A. World Cultures and Global Issues  
 B. U.S. Experience in its Diversity  
 C. Creative Expression  
 D. Individual and Society  
 E. Scientific World

**IF YES, COMPLETE AND SUBMIT WITH THIS PROPOSAL A CUNY COMMON CORE SUBMISSION FORM.**

3. **DESCRIBE HOW THIS COURSE TRANSFERS (REQUIRED FOR A.S. DEGREE COURSE). IF A.A.S. DEGREE COURSE AND DOES NOT TRANSFER, JUSTIFY ROLE OF COURSE, E.G. DESCRIBE OTHER LEARNING OBJECTIVES MET:**

Hunter College: MATH 156: Introduction to Mathematical Proof Workshop (2 hrs, 1 cr.)

In other cases, without directly transferring, this course can prepare students for the following critical courses in the mathematical discipline (usually in the sophomore year):

Brooklyn College: MATH 2001 Transition to Advanced Mathematics (3 cr)

City Tech: MAT 2071: Introduction to Proofs and Logic (4 cr)

CCNY: MATH 30800: Bridge to Advanced Mathematics (3 cr)

Medgar Evers College: MTH 206: Introduction to Mathematical Proof (4 cr)

4. **BULLETIN DESCRIPTION OF COURSE:**

This course introduces majors in mathematics to the critical skill of reading and writing formal proofs; and serves as a bridge to the more advanced mathematics they will study at the baccalaureate level and beyond. Expected topics include: Basic set theory, logic, counting principles, direct proof, contrapositives, contradictions, non-conditionals, counterexamples, induction, relations, functions, and cardinality.

5. **CREDITS AND HOURS\* (PLEASE CHECK ONE APPROPRIATE BOX BELOW BASED ON CREDITS):**

1-credit:	<input type="checkbox"/> 1 hour lecture <input checked="" type="checkbox"/> 2 hours lab/field/gym
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2-credits:	<input type="checkbox"/> 2 hours lecture <input type="checkbox"/> 1 hour lecture, 2 hours lab/field <input type="checkbox"/> 4 hours lab/field
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3-credits:	<input type="checkbox"/> 3 hours lecture <input type="checkbox"/> 2 hours lecture, 2 hours lab/field
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<input type="checkbox"/> 1 hour lecture, 4 hours lab/field <input type="checkbox"/> 6 hours lab/field
<b>4-credits:</b> <input type="checkbox"/> 4 hours lecture <input type="checkbox"/> 3 hours lecture, 2 hours lab/field <input type="checkbox"/> 2 hours lecture, 4 hours lab/field <input type="checkbox"/> 1 hour lecture, 6 hours lab/field <input type="checkbox"/> 8 hours lab/field
<b>More than 4-credits:</b> <input type="checkbox"/> Number of credits: _____ (explain mix lecture/lab below)  <div style="text-align: center;">         _____ Lecture                  _____ Lab       </div> <b>Explanation:</b> _____

**\*Hours are hours per week in a typical 12-week semester**

6. **NUMBER OF EQUATED CREDITS IN ITEM #5:** N/A.
  
7. **COURSE PREREQUISITES AND COREQUISITES (IF NONE PLEASE INDICATE FOR EACH)**
  - A. **PREREQUISITE(S):**                  MAT 1400
  - B. **COREQUISITE(S):**                  NONE
  - C. **PRE/COREQUISITE(S):**          None
  
8. **BRIEF RATIONALE TO JUSTIFY PROPOSED COURSE TO INCLUDE:**
  - A. **ENROLLMENT SUMMARY IF PREVIOUSLY OFFERED AS AN 82 (INCLUDE COMPLETE 4-DIGIT 82 COURSE NUMBER)**  
N/A.
  
  - B. **PROJECTED ENROLLMENT**  
Expect roughly 15 students in the math major to take this course each year (based on 50 students in math major each year, and prerequisite of MAT 14, as informed by the Office of Research, Planning, and Assessment).
  
  - C. **SUGGESTED CLASS LIMITS:**                  25
  
  - D. **FREQUENCY COURSE IS LIKELY TO BE OFFERED:**  
Expect the course to be offered at least once each academic year.
  
  - E. **ROLE OF COURSE IN DEPARTMENT'S CURRICULUM AND COLLEGE'S MISSION:**  
Deductive mathematical proof is the primary skill and tool used in the mathematical discipline from at least the sophomore year onward. Whereas Kingsborough currently has no course aimed specifically at math majors in the subject, prior assessment of program learning objectives (PLOs) have shown a recurring weakness in this area for students in the years 2014-2017. In order that our math majors should be aware and prepared for transfer to a baccalaureate degree program, we seek to remedy this gap with a short course specifically in the topic of proof.
  
9. **LIST COURSE(S), IF ANY, TO BE WITHDRAWN WHEN COURSE IS ADOPTED (NOTE THIS IS NOT THE SAME AS DELETING A COURSE):**  
None.

**10. IF COURSE IS AN INTERNSHIP, INDEPENDENT STUDY, OR THE LIKE, PROVIDE AN EXPLANATION AS TO HOW THE STUDENT WILL EARN THE CREDITS AWARDED. THE CREDITS AWARDED SHOULD BE CONSISTENT WITH STUDENT EFFORTS REQUIRED IN A TRADITIONAL CLASSROOM SETTING:**

N/A.

**11. PROPOSED TEXT BOOK(S) AND/OR OTHER REQUIRED INSTRUCTIONAL MATERIAL(S):**

Hammack, Richard H. *Book of proof*. Richard Hammack, 2013.

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**12. REQUIRED COURSE FOR MAJOR OR AREA OF CONCENTRATION?**

Yes.

**IF YES, COURSE IS REQUIRED, SUBMIT A SEPARATE CURRICULUM TRANSMITTAL COVER PAGE INDICATING A "CHANGE IN DEGREE OR CERTIFICATE REQUIREMENTS" AS WELL AS A PROPOSAL THAT MUST INCLUDE A RATIONALE AND THE FOLLOWING ADDITIONAL PAGES: A "CURRENT" DEGREE WITH ALL PROPOSED DELETIONS (STRIKEOUTS) AND ADDITIONS (BOLDED TEXT) CLEARLY INDICATED, AND A "PROPOSED" DEGREE, WHICH DISPLAYS THE DEGREE AS IT WILL APPEAR IN THE CATALOG (FOR A COPY OF THE MOST UP-TO-DATE DEGREE/CERTIFICATE REQUIREMENTS CONTACT AMANDA KALIN, EXT. 4611).**

**NYSED GUIDELINES OF 45 CREDITS OF LIBERAL ARTS COURSE WORK FOR AN ASSOCIATE OF ARTS DEGREE (A.A.), 30 CREDITS FOR AND ASSOCIATE OF SCIENCE DEGREE (A.S.), AND 20 CREDITS FOR AN APPLIED ASSOCIATE OF SCIENCE DEGREE (A.A.S.) MUST BE ADHERED TO FOR ALL 60 CREDIT PROGRAMS.**

**13. IF OPEN ONLY TO SELECTED STUDENTS SPECIFY POPULATION:**

Registration restricted to Mathematics majors.

**14. EXPLAIN WHAT STUDENTS WILL KNOW AND BE ABLE TO DO UPON COMPLETION OF COURSE:**

1. Read and write formal mathematical proofs.
2. Correctly use symbolic set notation.
3. Establish valid explanations for basic facts of number-theory.
4. Identify congruence classes of integers modulo  $n$ .
5. Use the principle of mathematical induction.
6. Succeed at future proof-based courses at the baccalaureate level.

**15. METHODS OF TEACHING –E.G. LECTURES, LABORATORIES, AND OTHER ASSIGNMENTS FOR STUDENTS, INCLUDING ANY OF THE FOLLOWING: DEMONSTRATIONS, GROUP WORK, WEBSITE OR E-MAIL INTERACTIONS AND/OR ASSIGNMENTS, PRACTICE IN APPLICATION OF SKILLS, ETC.:**

1. Lecture and guided discussion
2. Written and online assignments

**16. ASSIGNMENTS TO STUDENTS:**

Written mathematical proofs.

**17. DESCRIBE METHOD OF EVALUATING LEARNING SPECIFIED IN #15 - INCLUDE PERCENTAGE BREAKDOWN FOR GRADING. IF A DEVELOPMENTAL COURSE INCLUDE HOW THE NEXT LEVEL COURSE IS DETERMINED AS WELL AS NEXT LEVEL PLACEMENT.**

1. Written homework: 25%
2. Midterm Exams (2): 40%
3. Final Exam: 35%

**18. TOPICAL COURSE OUTLINE FOR THE 12 WEEK SEMESTER (WHICH SHOULD BE SPECIFIC**

**REGARDING TOPICS COVERED, LEARNING ACTIVITIES, AND ASSIGNMENTS):**

Hour	Ch.	Topics	Lab
1	1.1-1.4	Sets, subsets, products, and power sets	
2	1.5-1.7	Union, intersection, difference, complement, and Venn diagrams	L
3	1.8-1.10	Indexed sets, number systems, and Russell's Paradox	
4	2.1-2.4	Statements, and-or-not, conditionals, and biconditionals	
5	2.5-2.8	Truth tables, equivalence, and quantifiers	L
6	2.9-2.12	Translating English to symbolic logic, negations, and logical inference	L
7	3.1-3.2	Counting lists; factorials	
8	3.3-3.4	Counting subsets; the binomial theorem	L
9	-	MIDTERM EXAM 1	L
10	4.1-4.2	Theorems and definitions	
11	4.3	Direct proof	
12	4.4-4.5	Using cases; similar cases	L
13	5.1-5.2	Contrapositives; congruence of integers	
14	5.3	Mathematical writing	L
15	6.1-6.2	Proving statements with contradiction	
16	6.3-6.4	Combining techniques; words of advice	L
17	-	MIDTERM EXAM 2	L
18	7.1-7.2	If-and-only-if; equivalent statements	
19	7.3-7.4	Existence proofs; non-constructive proofs	L
20	8.1-8.2	How to Prove $a \square A$ ; $A \square B$	
21	8.3-8.4	How to Prove $A = B$ ; Perfect Numbers	
22	9.1-9.4	Counterexamples and disproof	L
23	10.1-10.3	Mathematical induction	
24	-	Review for final	L

**19. SELECTED BIBLIOGRAPHY AND SOURCE MATERIALS:**

- Cupillari, Antonella. *The Nuts and bolts of proofs: An Introduction to mathematical proofs*. Academic Press, 2011.
- Gilbert, William J., and Scott A. Vanstone. *An introduction to mathematical thinking: algebra and number systems*. Pearson Prentice Hall, 2005.
- Lay, Steven R. *Analysis with an Introduction to Proof*. Pearson Education, 2013.
- Solow, Daniel. *How to Read and Do Proofs: an Introduction to Mathematical Thought Processes*. (2002).
- Sundstrom, Ted. *Mathematical Reasoning: Writing and Proof*. (2013). [OER]
- Velleman, Daniel J. *How to prove it: A structured approach*. Cambridge University Press, 2006.

Daniel R. Collins 10/2018

Revised/Dec.2015/AK