APPLICATION FOR NEW COURSE

1. Submitted by the College of Arts and Sciences Date: 1 September 2009

Department/Division proposing course: Mathematics

2. Proposed designation and Bulletin description of this course:

a. Prefix and Number MA 308

b. Title* Mathematical problem solving for middle school teachers

*If title is longer than 24 characters, offer a sensible title of 24 characters or less: Problem solving-middle school

c. Courses must be described by at least one of the categories below. Include number of actual contact hours per week..

(_ _) CLINICAL (_ _) COLLOQUIUM (_ _) DISCUSSION (_ _) LABORATORY (_ 3 _) LECTURE

(_ _) INDEPEND. STUDY (_ _) PRACTICUM (_ _) RECITATION (_ _) RESEARCH (_ _) RESIDENCY

(_ _) SEMINAR (_ _) STUDIO (____) OTHER – Please explain:

d. Please choose a grading system: ☒ Letter (A, B, C, etc.) ☐ Pass/Fail

e. Number of credit hours: 3

f. Is this course repeatable? YES ☐ NO ☒ If YES, maximum number of credit hours: _____

g. Course description:

Heuristics of problem solving. Practice in solving problems from algebra, number theory, geometry, calculus, combinatorics, and other areas. Primarily for middle school teachers. This course may not be counted towards a mathematics major or minor.

h. Prerequisite(s), if any:

Prereq: MA 123 or MA 113 or MA 137 or consent of the instructor.

i. Will this course also be offered through Distance Learning? YES ☐ NO ☒

If YES, please check one of the methods below that reflects how the majority of the course content will be delivered:

Internet/Web-based ☐ Interactive video ☐ Extended campus ☐

3. Supplementary teaching component: ☐ N/A or ☐ Community-Based Experience ☐ Service Learning ☐ Both

4. To be cross-listed as: NA / _____ / _____

Prefix and Number printed name Cross-listing Department Chair signature

5. Requested effective date (term/year): Fall / 2010

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6. Course to be offered (please check all that apply): ☐ Fall ☒ Spring ☐ Summer

7. Will the course be offered every year? ☒ YES ☐ NO

If NO, please explain: _____

8. Why is this course needed?
We currently offer two sections of MA 310, Mathematical problem solving for teachers. This course is quite successful at developing prospective teachers ability to use new mathematics. At the moment, we offer two sections every semester. One section is targeted at middle-school teachers and another for secondary school teachers. These two courses are very different and we propose to teach them with different numbers. The change will decrease the number of students who sign up for the wrong course and will remove the middle-school course from the mathematics major.

9. a. By whom will the course be taught? Mathematics faculty

b. Are facilities for teaching the course now available? ☒ YES ☐ NO

If NO, what plans have been made for providing them?

10. What yearly enrollment may be reasonably anticipated?
25

11. a. Will this course serve students primarily within the department? ☐ Yes ☒ No

b. Will it be of interest to a significant number of students outside the department? ☒ YES ☐ NO
If YES, please explain.
The course is intended for students who choose the Mathematics option in the Middle School Education program in the Department of Curriculum and Instruction in the College of Education.

12. Will the course serve as a University Studies Program course†? ☐ YES ☒ NO

If YES, under what Area? _____

†AS OF SPRING 2007, THERE IS A MORATORIUM ON APPROVAL OF NEW COURSES FOR USP.

13. Check the category most applicable to this course:

☒ traditional – offered in corresponding departments at universities elsewhere

☐ relatively new – now being widely established

☐ not yet to be found in many (or any) other universities

14. Is this course applicable to the requirements for at least one degree or certificate at UK? ☒ Yes ☐ No

15. Is this course part of a proposed new program? ☐ YES ☒ NO

If YES, please name: _____

16. Will adding this course change the degree requirements for ANY program on campus? ☒ YES ☐ NO
If YES‡, list below the programs that will require this course:

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Middle School Education will require the course. The mathematics major and minor descriptions will need to be changed to exclude this course.

‡In order to change the program(s), a program change form(s) must also be submitted.

17. ☒ The major teaching objectives of the proposed course, syllabus and/or reference list to be used are attached.

18. ☐ Check box if course is 400G or 500. If the course is 400G- or 500-level, *you must include a syllabus showing differentiation* for undergraduate and graduate students by (i) requiring additional assignments by the graduate students; and/or (ii) the establishment of different grading criteria in the course for graduate students. (See *SR 3.1.4)*

19. Within the department, who should be contacted for further information about the proposed new course?

Name: Russell Brown Phone: 859 257 3951 Email: russell.brown@uky.edu

20. Signatures to report approvals:

November 30, 2009	ZHONGWEI SHEN /		
DATE of Approval by Department Faculty	printed name	Reported by Department Chair	signature
12/1/09	/		
DATE of Approval by College Faculty	printed name	Reported by College Dean	signature
2/2/2010	Sharon Gill /		
* DATE of Approval by Undergraduate Council	printed name	Reported by Undergraduate Council Chair	signature
	/		
* DATE of Approval by Graduate Council	printed name	Reported by Graduate Council Chair	signature
	/		
* DATE of Approval by Health Care Colleges Council (HCCC)	printed name	Reported by Health Care Colleges Council Chair	signature
* DATE of Approval by Senate Council		Reported by Office of the Senate Council	
* DATE of Approval by University Senate		Reported by Office of the Senate Council	

Digitally signed by Sharon Gill
DN: cn=Sharon Gill, o, ou=Undergraduate Education, email=sgill@uky.edu, c=US
Date: 2010.02.03 08:38:58 -05'00'

*If applicable, as provided by the *University Senate Rules. (http://www.uky.edu/USC/New/RulesandRegulationsMain.htm)*

MA 308 001 Mathematical problem solving for middle-school teachers

Time: TR 9:30–10:45, DH 331
Instructor: Carl Lee
Office: 967 Patterson Office Tower
Mailbox: 715 Patterson Office Tower
Phone: 859 257-1405 (or 859 257-3336 to leave a message)
Email: lee@ms.uky.edu
Office Hours: TR 11:00–12:15, and by appointment.

Text: Johnson, Herr, and Kysh, Crossing the River with Dogs, Wiley, 2008.

Course Web Page: www.ms.uky.edu/~lee/ma310sp09/ma310sp09.html

Course overview: My desires are well reflected in this statement of Polya from the introduction to his book, *How to Solve it.*

"A great discovery solves a great problem but there is a grain of discovery in the solution of any problem. Your problem may be modest; but if it challenges your curiosity and brings into play your inventive faculties, and if you solve it by your own means, you may experience the tension and enjoy the triumph of discovery. Such experiences at a susceptible age may create a taste for mental work and leave their imprint on mind and character for a lifetime.

Thus, a teacher of mathematics has a great opportunity. If he fills his allotted time with drilling his students in routine operations he kills their interest, hampers their intellectual development, and misuses his opportunity. But if he challenges the curiosity of his students by setting them problems proportionate to their knowledge, and helps them to solve their problems with stimulating ques tions, he may give them a taste for, and some means of, independent thinking.

Also a student whose college curriculum includes some mathematics has a singular opportunity. This opportunity is lost, of course, if he regards mathematics as a subject in which he has to earn so and so much credit and which he should forget after the final examination as quickly as possible. The opportunity may be lost even if the student has some natural talent for mathematics because he, as everybody else, must discover his talents and tastes; he cannot know that he likes raspberry pie if he has never tasted raspberry pie. He may manage to find out, however, that a mathematics problem may be as much fun as a crossword puzzle, or that vigorous mental work may be an exercise as desirable as a fast game of tennis. Having tasted the pleasure in mathematics he will not forget it easily and then there is a good chance that mathematics will become something for him: a hobby, or a tool of his profession, or his profession, or a great ambition.

The author remembers the time when he was a student himself, a somewhat ambitious student, eager to understand a little mathematics and physics. He listened to lectures, read books, tried to take in the solutions and facts presented, but there was a question that disturbed him again and again. "Yes, the solution seems to work, it appears to be correct; but how is it possible to invent such a solution? Yes, this experiment seems to work, this appears to be a fact; but how can people discover such facts? And how could I invent or discover such things by myself?" Today the author is teaching mathematics in a university; he thinks or hopes that some of his more eager students ask similar questions and he tries to satisfy their curiosity. Trying to understand not only the solution of this or that problem but also the motives and procedures of the solution, and trying to explain these motives and procedures to others, he

was finally led to write the present book. He hopes that it will be useful to teachers who wish to develop their students' ability to solve problems, and to students who are keen on developing their own abilities."

Student learning outcomes:

Students will apply select and apply problem solving strategies.

Students will apply mathematical knowledge in new contexts to solve problems.

Students will communicate solutions to mathematical problems orally and in writing.

Course calendar by week.

Week of 15 January, Polya's four phases of problem solving.

Week of 20 January, Introduce NCTM standards,

Week of 27 January, Counting problems, systematic lists. Homework 1 due.

Week of 3 February, More counting problems, multiplication principle. Homework 2 due.

Week of 10 February, Permutations and combinations. Homework 3 due.

Week of 17 February, Pascal's triangle. Recursively defined sequences. Homework 4 due.

Week of 24 February, Review, exam 1

Week of 3 March, Sequences generated by polynomials and finite differences.

Week of 10 March, Problems in geometry. Homework 4 due.

Week of 17 March, Spring break.

Week of 24 March, Volumes and surface areas, Homework 5 due.

Week of 31 March, Use of units in problem solving. Homework 6 due.

Week of 7 April, Combinatorial games. Homework 7 due.

Week of 14 April, Review, exam 2.

Week of 21 April, Transformations, symmetry.

Week of 28 April, Review, prepare for final..Homework 8 due.

Final examination: 10:30-12:30, 4 May in DH 331.

Class Attendance and Participation: This class is designed for active involvement of

the students. You will be actively supporting each other as you gain experience and understanding. Multiple ideas and points of view are important. You will benefit from hearing others' approaches to problem solving, and they will benefit from you. So attendance and active participation are expected and contribute toward your grade.

Homework: There will be frequent homework assignments, usually assigned weekly. Most homework assignments will consist of problems to solve and write up, and reflections on certain techniques of problem solving.
Exams: There will be two exams during the semester.
Final Exam: Friday, May 8, 10:30 am, in our regular room, DH 331.
Grading:

Class attendance and participation	10%
Homework	45%
Exams	30%
Final	15%

A	90–100%
B	80–89%
C	70–79%
D	60–69%
E	0–59%

Undergraduate students will be given a midterm grade.

Working Together: It is OK to work together on homework. However, when it comes time for you to write up the solutions, I expect you to do this on your own, and it would be best for your own understanding if you put aside your notes from the discussions with your classmates and wrote up the solutions entirely from scratch. Working together on exams, of course, is expressly forbidden.

Absences: See Students Rights and Responsibilities,
www.uky.edu/StudentAffairs/Code/part2.html,
Section 5.4.2.2, for information about valid excused absences and their verification, and making up of missed assignments.

Cheating: Cheating and plagiarism can lead to significant penalties. See Sections 6.3 and 6.4 of Student Rights and Responsibilities,
www.uky.edu/StudentAffairs/Code/part2.html.
Expectations: I expect that everyone will maintain a classroom conducive to learning. I like an informal atmosphere, but it must be orderly. Thus, everyone is expected to behave with basic politeness, civility, and respect for others. In particular, talking in class is OK if it's part of a class discussion or directed to me. Private communications are not, especially during quizzes and tests. Neither are reading extraneous materials, using electronic equipment, or sleeping.

Accommodation of students with disabilities: If you have a documented disability that requires academic accommodations, please see me as soon as possible during scheduled office hours. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center (Room 2, Alumni Gym, 257-2754, email address jkarnes@email.uky.edu)for coordination of campus disability services available to students with disabilities."

Suggestions: Suggestions for improvement are welcome at any time. Any concern about the course should be brought first to my attention. Further recourse is available through the offices of the Department Ombud and the Department Chair, both accessible from the Main Office in 715 Patterson Office Tower.