MATH 421: Problem Solving for Secondary Teachers  
Western Kentucky University – Spring 2017

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Classroom: COHH 3125  
Class Times: TR 12:45 – 2:05

Course Description: 3 Credit Hours - Utilizes various techniques and technology to solve mathematical problems. Integrates concepts from algebra, geometry, trigonometry, probability, statistics, number theory, discrete mathematics, linear algebra, and calculus.

Learning Objectives: Upon completion of this course, successful students will be able to:
1. Employ both inductive and deductive reasoning appropriately.
2. Choose appropriate strategies to solve non-routine problems and recognize when multiple strategies will work to reach a solution.
3. Recognize and find multiple solutions when appropriate.
4. Construct visual representations as needed and then analyze those constructs to reach a solution.
5. Identify patterns and predict other outcomes using the patterns they identified.
6. Analyze and evaluate the mathematical thinking and strategies of others.
7. Communicate their mathematical thinking orally and in writing to peers, faculty, and others.

Prerequisites: MATH 307 or MATH 310, with a grade of C or better; or permission of instructor.

Materials: You should bring pencils (not pens) and plenty of paper with you to every class.

Internet Access: You must have regular and reliable access to your WKU email account and Blackboard. Lack of Internet access or failure to login to these systems may not be used as an excuse for failing to obtain materials or turn in homework assignments. You should check your WKU email account daily, as all announcements for the class will be sent there.

Course Content: MATH 421 is designed to provide students with opportunities to solve a variety problems using mathematics from different branches. In this course, you will develop your skills in mathematical problem solving, reasoning, abstraction, generalization, justification, and proof.
**Instruction:** This course will be delivered using an inquiry-based format. This means that you will be asked to attempt to solve problems and answer questions on your own without receiving any direct instruction or seeing an example in advance. This will hopefully lead us to a rich mathematical discussion about the nature of the problem, the challenges to solving it, some tools that might help us, some ideas that don’t work out, and ultimately (hopefully) a solution. The goal is that you will be discovering mathematics in much the same way that a mathematician does, by solving problems, conjecturing, experimenting, exploring, creating, and communicating. Instead of giving you rules and facts to memorize, or showing you a recipe that provides a clear, smooth path to a solution, the instructors will be guiding and mentoring you via problems and discussions through an adventure in mathematical discovery. Your experience in this class will likely be a departure from the way you have interacted with mathematics in the past, and at times you may become frustrated and discouraged. We encourage you to keep an open mind and trust the process as the payoff can be enormous!

**Attendance and Absences:** Attendance and participation in class is crucial to your success in this course. If you miss a class for any reason, you will be responsible for obtaining any materials and/or information from your fellow classmates, not from the instructor.

Because this class is taught in a cooperative inquiry-based format, small group and whole class participation is an essential part of the experience for both you and your classmates. Consequently, absences by individual students hurt not only that student, but also the rest of the class. Furthermore, as a future educator, you must get in to the habit of showing up on time every day ready for work! Excessive (more than three) absences from class will result in a lowering of your overall grade in the course as follows:

<table>
<thead>
<tr>
<th>Number of Absences</th>
<th>0 – 2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Grade Lowered By</td>
<td>None</td>
<td>One Letter</td>
<td>Two Letters</td>
<td>Three Letters</td>
<td>Four Letters</td>
</tr>
</tbody>
</table>

The only exceptions to this policy will be those absences that are caused by University approved activities or religious observances for which documentation has been provided to the instructor in advance. All other absences (sickness, death in the family, grandmother in hospital, vacation, car issues, and so on) will not be excused. You get three free absences to cover these unexpected events. If you have extenuating circumstances, you may be eligible for other options including medical withdrawal, incomplete, audit, and so on.

**Academic Dishonesty:** Students who commit any act of academic dishonesty will receive from the instructor a failing grade in the course without possibility of withdrawal. The instructor will also present the case to the Office of Student Conduct for disciplinary sanctions.

**ADA Statement:** In compliance with university policy, students with disabilities who require academic and/or auxiliary accommodations for this course must contact the Student Accessibility Resource Center in Downing Student Union, 1074. The phone number is 270 745-5004/V or 270 745-3030/TDD. Please DO NOT request accommodations directly from the professor or instructor without a letter of accommodation from the Student Accessibility Resource Center.

**Withdrawal Dates:** The last day to withdraw from this course without a grade and without paying a fee is Monday, January 30, 2017. The last day to withdraw from this course with a W, or change from credit to audit, is Friday, March 10, 2017.
Assessment and Grading: Your grade in the course will be based on the following assessments:

**In-class Assessments:** There will be three exams (worth 100 points each) to measure your understanding of the course material. Dates for exams will be announced in advance, and all exams must be taken at the scheduled dates and times. The final exam will be administered per the schedule published by the WKU Registrar’s Office.

**Take-home Assessments:** There will be three take-home assessments (worth 50 points each) to check your problem-solving skills. These assessments will be graded in detail, and feedback will be provided, that should help you improve your problem solving. The details of these assessments will be announced in advance.

**Daily Homework Assignments:** Daily homework will be assigned nearly every class period, and will be due at the beginning of the very next class period. In general, your homework will be checked for satisfactory completion during every class. Additionally, any homework assignment may be collected at the discretion of the instructors. Late homework will not be accepted for any reason. Homework assignments will be graded as either satisfactory or unsatisfactory based on a variety of factors including, but not limited to, completeness and correctness. Completing these assignments before class is a critical component of the learning design of the course. Excessive unsatisfactory homework assignments (more than two) will result in a lowering of your final course grade as follows: for every two unsatisfactory assignments after the first two, your course grade will be lowered by one letter grade.

**Participation:** Because this is a cooperative, inquiry-based learning environment, it is vitally important that you are fully engaged during each class meeting. Engagement means discussing problems and working with others to develop a deeper understanding of mathematics. If a specific concept is easy for you, then you should be developing your pedagogical skills by helping your classmates who are struggling. You begin the course with 10 participation points. If you actively engage in group-work during each class, you will earn all 10 points at the end of the semester. However, if you engage in activities that prevent you or other class members from fully participating in and learning from the activities, you will receive a deduction in points. The following activities will result in deductions: (a) refusing to participate in small group or whole class activities and discussions; (b) engaging in conversations not related to the assigned task that interfere with your group members’ learning; or (c) using your cell phone or any other electronic device during class (cell phones and other devices should remain in a bag or pocket for the entire class period). All of these behaviors are inconsistent with the professionalism required of teachers and have detrimental effects on your and your classmates’ learning and grades.

**Determination of Final Course Grade:** The above assessments provide a total of 460 possible points in the course. Final course grades will be determined using the following scale:

<table>
<thead>
<tr>
<th>Percentage</th>
<th>0% – 67%</th>
<th>68% – 75%</th>
<th>76% – 83%</th>
<th>84% – 91%</th>
<th>92% – 100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Letter Grade</td>
<td>F</td>
<td>D</td>
<td>C</td>
<td>B</td>
<td>A</td>
</tr>
</tbody>
</table>
**Note:** All missed exams, quizzes, and assignments will be given a grade of 0. Late homework assignments will not be accepted. The only exceptions to this policy will be those absences that are caused by University approved activities or religious observances for which documentation has been provided to the instructor in advance. The instructors will evaluate unexpected illnesses or unforeseen catastrophic circumstances on a case-by-case basis and determine whether a make-up is appropriate. Every effort must be made by the student to notify the instructor as soon as possible in these cases.

**Understanding Course Grades:**

**A** Pre-service teacher consistently demonstrates competencies that signal that s/he is proficient in the mathematical topics covered in the course. This qualification includes a deeper level of understanding than that expected of the students s/he is preparing to teach. Pre-service teacher demonstrates this level of understanding by consistently going beyond the information explicitly presented by the course instructor to completing new kinds of tasks. This ability to apply one’s knowledge to new contexts and to put together various ideas is essential for effective classroom teaching because good teachers are able to respond to children’s questions, to support and assess children’s mathematical proficiency, and to interpret new curricula.

**B** Pre-service teacher occasionally demonstrates the competencies and the knowledge transfer abilities that characterize the mathematical proficiency of A-level students, but at times is limited to learning well just the information explicitly presented by the course instructor. Pre-service teacher shows evidence of better-than-acceptable level of mathematical proficiency in the topics studied and a deeper level of understanding than that expected of the students s/he is preparing to teach.

**C** Pre-service teacher consistently demonstrates good levels of performance on tasks measuring straightforward learning of course content, but rarely completes knowledge transfer tasks successfully. Shows evidence of an acceptable level of mathematical proficiency of the topics studied and shows evidence, although inconsistent, of a deeper level of understanding than that expected of the students s/he is preparing to teach.

**D** Pre-service teacher does not consistently show acceptable levels of performance, even on tasks measuring content explicitly presented by the course instructor. Although the pre-service teacher may have mastered some of the course content, and s/he shows signs of considerable effort, serious questions persist about her/his mathematical proficiency and whether s/he has developed a deeper level of understanding than that expected of the students s/he is preparing to teach.

**F** Pre-service teacher shows a profile similar to that of the D student but, in addition, appears to be unprepared to teach others at this time. Pre-service teacher consistently exhibits lack of effort, profound and persistent misconceptions, and/or the failure to master some of the course topics.

**Disclaimer:** The instructor reserves the right to change, alter, modify, or tweak anything in this document at any time and for any reason.