

**Math 4170/5170—Advanced Mathematical Topics for Early Adulthood Teachers, Bowling Green State University**  
3 Credit Course

**Course Purpose & Outcomes:** The purpose of this course is to provide opportunities for prospective and current secondary math teachers to engage gain a deeper understanding and appreciation of high school mathematics content. You will also have the opportunity to explore connections between high school and college mathematics topics. *This course is not a course in high school mathematics content*; rather it will integrate topics from many undergraduate mathematics courses in order to give you insight and understanding of high school mathematics from an advanced viewpoint.

This course is structured around the major content strands from the secondary school curriculum (Common Core State Standards for Mathematics), in four units: Unit 1— *Number & Quantity*, Unit 2— *Algebra & Functions*, Unit 3—*Geometry (& Algebra)*, and Unit 4—*Statistics & Probability*. Students will study these content areas by examining some historical development of these topics, exploring activities that highlight these ideas in middle and high school, and explaining college-level ideas/content that underlie the concepts. During the semester students will be engaged in problem-solving activities that incorporate the use of technological resources. Students also shall complete individual research projects.

**Expected Outcomes:** By the completion of this course, participants will:

- Deepen their knowledge of critical concepts in mathematics
- Begin to recognize how students understand and misunderstand these concepts
- Develop an appreciation for connections between and among high school and college mathematics topics

**Course Materials & Policies**

**The Textbook Required for the Course:** Sultan, A & Artzt, A. F. (2011). *The Mathematics that Every Secondary School Math Teacher Needs to Know*, NY: Routledge. ISBN: 978-0-415-99413-2

**Additional Resources:** Other readings will be assigned from other sources; available through Canvas.

**Technology:** The assignments, readings, and expectations of this course are communicated via the course Canvas site, and therefore require the use of a PDF reader, reliable computer with Internet access, and a willingness to use new technologies to communicate with classmates in an online course environment. Furthermore, readings should be *read actively*—that is with paper and pencil in hand—checking the author’s assertions, considering examples and strategies described for yourself, and thinking critically about the methods explored. The use of a graphing calculator may be helpful at certain points in the course.

**Missed Work:** Only assignments submitted on time will be considered for full credit. No late work will be accepted unless the instructor has provided written approval well *in advance*.

**Academic Honesty:** The standards of academic honesty as stated in the *Student Handbook* will be enforced. The minimum penalty for a violation by submitting work other than your own will be failure on the assessment/assignment. Refer to the end of this syllabus for further information regarding academic honesty and plagiarism policies.

**Communicating with the Instructor:** If you have questions or need clarification on concepts or course expectations, there at least three ways to contact me. (1) The first module on canvas has a discussion board for anyone to post general, course-structure, or expectation-related questions. (2) Email me directly or message me through Canvas. (3) Come to my office hours or schedule a different time to meet in-person or virtually. If our schedules do not align for in-person meetings we can arrange to talk virtually using Canvas or Skype-type technology. To arrange alternative days/times to meet with me it is helpful to send a few options for me to choose from and to give some advanced notice. I want you to succeed in this course, and am happy to work with you to help you understand the ideas presented. For discussion board or email communications, I typically respond within 24 hours during weekdays. Therefore, I do my best to reply to questions sent after 5pm on Fridays (and over the weekend) by the end of the day on Monday.

**Important Dates:** Throughout the semester, refer to the Canvas Course page and calendar for relevant due dates and important dates.

**Instructional Methods and Structure:** This web-based course is structured around four major units {each is at least 3 weeks long}, one course project, and an in-person final exam. All materials, readings, and assignments are accessible within **modules** in the Canvas course. Reading assignments, explorations, and short videos/presentations are available and organized in a specific order for every unit and constitute the primary focus of this course. The readings will include chapters from the required textbook, chapters from supplemental

textbooks provided via canvas, and some journal articles about mathematical ideas, connections between mathematical topics, or student misconceptions. Therefore, you are expected to *read actively* and are encouraged to ask your classmates or me questions if clarification is needed. When watching videos/presentations for the course, there will be opportunities for you to pause and try problems or examples for yourself before continuing on. You should take advantage of those opportunities to make sense of the ideas for yourself. Your understanding of these readings, explorations, and content will be evaluated via discussion boards within the unit (due two weeks into the unit) and one homework assignment due at the end of the unit. After the four units of content, the remaining weeks of the semester will be focused around the course project, with some further explanation below and more details on Canvas. There is also an in-person final exam during finals week.

### Assessments & Grading

**Grades:** 90% - 100%: A; 80% - 89%: B; 70% - 79%: C; 60% - 69%: D; 0% - 59%: F, calculated as follows:

Homework	45%
Discussion Board Responses and Critically Commenting on Classmates' Responses	15%
Course Project	20%
Final Exam	20%

**Homework:** Each of the four units will include one homework assignment (due at the end of the unit). If responses are handwritten (as can sometimes be easier with mathematics), you may take digital photos of your work and embed them into a single word document, or use a software or copy machine to create a PDF of your handwritten work. Either way, be sure your work is legible, incorporated into a single document submitted on Canvas, and you include your name on what you submit. You are welcome to discuss homework assignments with others, including The course instructor, but what you write up and submit should be your own explanation and understanding of the processes, proofs, and ideas. Homework responses will be assessed on a combination of completion of all questions using methods from the assigned unit, correctness, legibility/following directions, and *clearly* explaining/communicating your mathematical solutions and ideas. Overall, the focus of the homework assignments is to provide opportunities for you to apply the strategies, methods, and content from the unit and to synthesize the ideas for yourself.

**Discussion Board Responses and Critically Commenting on Classmates' Responses:** When working through the material provided within each unit on Canvas, there will be multiple opportunities for you to try example problems for yourself. Sometimes you will be asked to provide your solutions, ideas, or approaches for working through the content on discussion boards within canvas. During the first unit, an introductory discussion board is due by the end of the first week of classes and all discussion boards about content relevant to the first unit are due by midnight on Monday after the second week of classes. Similarly, for units 2, 3, and 4, the discussion board responses within the units are due by Monday evening after the second week for that unit. The reason for these specific deadlines for discussion boards is to have all students' discussion board posts available for everyone to read and comment on during the last week of the unit. The suggested pacing for each unit is as follows: First, working through the major material/content from the unit during the first two weeks by completing all discussion boards and viewing the audible presentations. Then, during the third week you can build on your understanding by commenting on your peer's discussion board posts (e.g., specific comments about solution processes, highlighting how their approach compared or contrasted with your own, or explicit connections between their work and other ideas/units/concepts in mathematics or the course) and finish your solutions to the homework assignment.

**Course Project:** For this project you are expected to analyze hypothetical high school students' ideas by preparing and creating a short presentation about the assigned questions. You will create a 15-20min presentation to address a "question from the classroom." The goal is for you to clearly explain the prevalent mathematical ideas related to the question from the classroom and how a teacher could address the students' conjecture, alternative way of thinking, or misconception. Project questions will be selected before mid-semester, and a first draft of an outline for your presentation is due one month after selecting your topic. Preparing for your presentation will involve additional research (e.g., searching for related articles on the topic and relevant sections of the textbook or supplemental textbooks) and you are encouraged to schedule an appointment with The course instructor well in advance of your presentation for guidance. Additional details about the expectations and grading criteria and due dates will be posted on Canvas. Your course project will be due during the last week of the semester, and then classmates will view and comment on one another's presentations during finals week. For students enrolled in MATH 5170, additional expectations for this course project will be communicated directly during the semester via Canvas or Email.

**Final Exam:** An in-person final exam is scheduled during finals week. The exam is cumulative and will assess your understanding of content from each of the four units. Reviewing the homework and discussion board problems and solutions, as well as your own notes and textbook readings from the four units will help you prepare. The final exam is cumulative and will assess your individual understanding of ideas from each of the four major content areas in the course.

### Important Statements Regarding Universities Policies

**Statement on Students with Disabilities:** In accordance with the University policy, you have a documented disability and require accommodations to obtain equal access in this course, contact the instructor at the beginning of the semester and make this need known. Students with disabilities must verify their eligibility through the [Office of Disability Services](#)

**Statement on Academic Honesty:** The instructor and students in this course will adhere to the University's general Codes of Conduct defined in the BGSU Student Handbook. Students are required to be honest in all of their university class work. Specifically, the Code of Academic Conduct (Academic Honesty Policy) requires that students do not cheat, fabricate, plagiarize or facilitate academic dishonesty. For details, refer to: [The Academic Charter, B.II.H](#) and [Student Conduct](#)  
*Any student who violates the Academic Honesty Policy as presented in the BGSU Student Handbook will receive a zero for the corresponding assignment or exam, and will be at risk for failing the course.* Read this policy and consult the professor regarding any questions.

**Statement on Plagiarism:** Plagiarizing has become easier and more prevalent in today's educational systems. Recent events indicate this is a problem at all levels of the educational system. We want to emphasize this policy to ensure students are aware of what plagiarism is and steps to take in avoiding plagiarism. Merriam-Webster's Online Dictionary states that to plagiarize is: to steal and pass off (the ideas or words of another) as one's own: use (another's production) without crediting the source: to commit literary theft : present as new and original an idea or product derived from an existing source.

Examples of plagiarism/academic dishonesty include:

- Using words, sentences, ideas, or organization from a source (book, webpage, etc.) without providing proper citation
- Submitting the same assignment/paper for multiple classes
- Submitting an assignment obtained from commercial firms, websites, fraternity/sorority files, or any other group or individual.

Often students believe they can use materials that are not their own by claiming their actions are protected by the Fair Use section of the Copyright Laws. This is often not the case. All materials put in a tangible form after January 1, 1978 are copyrighted. A work does not need the copyright symbol © to be copyrighted. In the 1976 Copyright Act, educators have been given fair use guidelines. In order to be able to claim fair use, you must meet all four of the following factors:

1. Purpose of the use is for nonprofit educational reasons
2. The nature of the work and spontaneity
3. Amount and substance of the work
4. Financial impact on the market

Additional information about Copyright can be found at the Copyright Office (<http://www.copyright.gov/>) and Stanford University Fair Use website (<http://fairuse.stanford.edu>). The Bowling Green State University Library system also has a website for students about plagiarism <http://libguides.bgsu.edu/content.php?pid=7599&sid=49116>

**Statement on Religious Holidays:** It is the policy of the University to make every reasonable effort allowing students to observe their religious holidays without academic penalty. In such cases, it is the obligation of students to provide the instructor with reasonable notice of the dates of religious holidays on which they will be unable to complete class requirements. Following this notification, the student should consult with the instructor to determine what appropriate alternative opportunity will be provided, allowing the student to fully complete his or her academic responsibilities.

**Statement on University Closure:** In most cases, the University will not close for winter conditions unless the Wood County Sheriff's Department declares a Level 3 emergency. If the weather results in dangerous conditions, and university classes are cancelled on days when a major assignment is due, two things will happen: (a) an announcement will be placed on Canvas and (b) an email will be sent to each student. If you do not receive an email and/or see an announcement on Canvas then you can assume that no changes have been made to assignments.

**TENTATIVE Course Schedule (subject to change)**

<b>Semester Weeks</b>	<b>Unit Titles and <i>Tentative</i> Topics</b>
<b>Weeks 1-3</b>	<i>Number &amp; Quantity Unit</i> <ul style="list-style-type: none"> <li>• Reasoning &amp; Proving</li> <li>• Division Algorithm</li> <li>• Rational &amp; Irrational Numbers</li> <li>• Real (&amp; Complex) Numbers</li> </ul>
<b>Weeks 4-6</b>	<i>Algebra &amp; Functions Unit</i> <ul style="list-style-type: none"> <li>• Solving Equations</li> <li>• Polynomials</li> <li>• Function Notation, Definitions, and Representations</li> <li>• Completing the Square</li> <li>• Quadratic Formula</li> </ul>
<b>Weeks 7-9</b>	<i>Geometry (&amp; Algebra) Unit</i> <ul style="list-style-type: none"> <li>• Geometric Constructions</li> <li>• Transformations</li> <li>• Matrices</li> <li>• Area</li> <li>• Fractal Geometry</li> </ul>
<b>Weeks 10-13</b>	<i>Statistics &amp; Probability Unit &amp; Some Course Project Stuff</i> <ul style="list-style-type: none"> <li>• Find Resources and Draft an Outline for Your Project Presentation</li> <li>• Classic Problems in Probability</li> <li>• Fair &amp; Unfair Games</li> <li>• Measures of Central Tendency</li> <li>• Statistical Literacy</li> </ul>
<b>Weeks 14-15</b>	<i>Course Project Due &amp; Prepare for Final Exam</i> <ul style="list-style-type: none"> <li>• Refine Presentation Based on Feedback from The course instructor about your Outline</li> <li>• Feel Free to Make an Appointment to Discuss your Project with the course instructor before the Due Date</li> <li>• Begin studying for final exam by reviewing discussion boards, assessments, and course material from previous four units</li> </ul>
<b>Finals Week</b>	<i>Final Exam &amp; Watch Peer's Presentations</i> <ul style="list-style-type: none"> <li>• Complete in-person Final Exam</li> <li>• Once all presentations are submitted, Canvas will assign two peer reviews for you to watch and make</li> </ul>

\*Note: All due dates, except for during finals week, are on Mondays for consistency; every time there is a due date it means “due by 11:59pm” on that date. Working ahead and submitting things early is OK, but it is not acceptable to submit something late without prior approval.