

California State University, San Bernardino

CSUSB ScholarWorks

Q2S Enhancing Pedagogy

2020

Math 3100 Mathematical Thinking: Communication and Proof - Sample Syllabus

Cory Johnson
CSUSB, corrine.johnson@csusb.edu

Shawn McMurrin
CSUSB

Laura Wallace
CSUSB

Min-Lin Lo
CSUSB

Follow this and additional works at: <https://scholarworks.lib.csusb.edu/q2sep>



Part of the [Mathematics Commons](#)

Recommended Citation

Johnson, Cory; McMurrin, Shawn; Wallace, Laura; and Lo, Min-Lin, "Math 3100 Mathematical Thinking: Communication and Proof - Sample Syllabus" (2020). *Q2S Enhancing Pedagogy*. 137.
<https://scholarworks.lib.csusb.edu/q2sep/137>

This Course Outline / Syllabus is brought to you for free and open access by CSUSB ScholarWorks. It has been accepted for inclusion in Q2S Enhancing Pedagogy by an authorized administrator of CSUSB ScholarWorks. For more information, please contact scholarworks@csusb.edu.

MATH 3100: MATHEMATICAL THINKING: COMMUNICATION AND PROOF

CALIFORNIA STATE UNIVERSITY, SAN BERNARDINO
DEPARTMENT OF MATHEMATICS
FALL 2020

Welcome to Math 3100! 😊

For thousands of years, mathematics has been part of the human search for understanding. Mathematical discoveries come from a desire to explain some kind of phenomena. A two-fold goal of this course is to explore some foundations of mathematics while developing skill in reading and writing mathematics. As you transition into higher-level mathematics, you will notice that to effectively communicate your thinking you will need to write an argument that will convince any skeptic. To this end, Math 3100 will introduce methods of constructing and writing mathematical proofs. Two major areas of study will be the theory of numbers and the theory of sets, both of which are important tools in modern mathematics. We will incorporate the rules of logic and the role they play in the structure of mathematical arguments.

I hope you will enjoy engaging in thinking and writing like mathematicians.

COURSE DESCRIPTION

Disciplinary ways of thinking in mathematics with emphasis on the construction of valid mathematical arguments, critiques of arguments, and structure of professional mathematical writing including typesetting. Content will include topics from logic, set theory, divisibility, modular arithmetic, properties of real numbers, properties of relations/functions, and methods of proof. Three hours lecture and one hour online. Graded ABC/NC. Satisfies GE Writing Intensive (WI) designation.

Prerequisite: Math 2220 with a grade of C- or better or Math 213

TENTATIVE COURSE OUTLINE

Week	Topic	Subtopic
1-2	Introduction to Writing Proofs (including use of LaTeX)	Elementary number theory
3-5	Logical Reasoning Exam 1	Prime and composite numbers; elementary set theory
6-8	Constructing and Writing Proofs in Mathematics	Divisibility; modular arithmetic; basic properties of real numbers, order relationships
9	Mathematical Induction	Finite sums of integers; geometric series
10-12	Set Theory Exam 2	Properties of real numbers
13-15	Concepts Related to Functions	Injections, surjections, bijections; compositions and inverses

COURSE AND INSTRUCTOR INFORMATION

Class Days/Time: TBD

Class Location: TBD

Webpage: All course materials, announcements, and grades will be posted on the Math 3100 course page on Blackboard. Please check Blackboard regularly.

Instructor: Dr. Cory Johnson

Student Hours: TBD

Office Location: JB – 322

Contact Info: Corrine.Johnson@csusb.edu (preferred) or 909-537-5423

LEARNING GOALS

In your undergraduate mathematics courses, you will: (1) demonstrate a conceptual understanding of mathematics; (2) attain procedural fluency in mathematics; (3) demonstrate adaptive reasoning and problem-solving skills in mathematics; (4) demonstrate mathematical communication skills; and (5) understand and produce correct mathematical proofs. In particular, Math 3100 will emphasize and assess the following learning outcomes:

- SLO 3.3 Students will critique mathematical reasoning both correct and flawed
- SLO 4.1 Students will demonstrate mathematical communication skills using appropriate mathematical vocabulary and references.
- SLO 5.1 Students will understand valid mathematical proofs.
- SLO 5.2 Students will produce valid mathematical proofs.

A complete list of SLOs and department student learning goals can be found on the Math Department webpage at <https://cns.csusb.edu/mathematics/faculty-resources/assessment>.

COURSE MATERIALS

TEXTBOOK

The textbook is required. There is a small fee for a print version or the pdf can be downloaded for free.

Mathematical Reasoning: Writing and Proof (Version 2.1), Ted Sundstrom, ISBN 978-1500143411

OTHER EQUIPMENT

In this course, you will learn how to type in LaTeX, a typesetting system used for the communication and publication of scientific documents. To type in LaTeX and to collaborate with your peers, you will receive a license for Overleaf that is linked to your CSUSB email address. Overleaf is an online collaborative writing and publishing tool that makes the process of writing, editing and publishing scientific documents smooth and efficient.

COURSE STRUCTURE AND PARTICIPATION

In this course, you will be contributing to a student-centered learning community. I would like each student to feel comfortable sharing ideas and learning from mistakes. With this aim, it is important that we all commit to fostering an inclusive, respectful, and professional learning environment. Learning from each other will form a substantial part of the classroom experience as you engage in cooperative work with your classmates, as well as sharing ideas in whole class discussions. You will have the opportunity to present results to others and provide thoughtful

feedback on the work of others. I look forward to watching your understanding grow as you make positive contributions to our learning community during whole group and small group activities, share your ideas, and present your ideas for solutions to problems. There will be regular exit-ticket quizzes at the end of class which will count towards your participation grade and will help me assess class understanding.

Note that this course is designated as a discussion course, so in-class participation is a key component of the course structure. At times, interactive lecture may be included to introduce some material, as well as for clarifying and synthesizing key ideas. Credit for participation will depend on preparation for class and the level of engagement with class activities. I will take attendance daily to be used as part of your participation score. Persistent tardiness and early departures will count as absences. Credit for in-class participation may be made up for at most two absences. If you choose to make up participation credit, you must propose an acceptable plan to be completed within one week of the absence.

ASSESSMENT OF LEARNING

ASSIGNED WORK

Assignments, both in and out of class, will be designed to provide you with the opportunity to learn key concepts in a meaningful way, develop your ability to communicate mathematics precisely and professionally, and help guide you through the learning process. In addressing the student learning outcomes, the goals of homework assignments are to improve the development of valid reasoning skills and the development of mathematical communication skills.

In order to help you pace your learning, homework will be assigned regularly and will consist of solving problems and explaining the work presented, as well as typing assignments in LaTeX. Homework problems will be assessed based on mathematical reasoning, conceptual understanding, communication, explanation, and justification. Homework that is suspected to be plagiarized will earn 0 points (see section on Plagiarism and Cheating).

All submitted assignments must be professionally presented and follow the policy below:

- Solutions to problems from the textbook may be handwritten or typed. The write-up of your assignment must be neat, organized, use appropriate language, and show relevant work. Explanations must be clear and complete.
- You should solve and explain problems clearly, with nothing left to the imagination. Justify each step completely, making sure the structure of your solution is crystal clear!
- Staple multiple pages and tear off “fringe” notebook edges. Do not cram work into the bottom of a page or in the margins, and do not write in columns. Problems should be written in numerical order.
- Assignments in Overleaf must be shared electronically with me by the beginning of class on the due date.
- You may collaborate with other classmates, but you must write up your work independently. As a general rule of thumb, never let your papers out of sight and/or give or show your written work to another student. Identical assignments (or nearly identical) will be considered plagiarism and will not be accepted.
- Homework will be collected at the beginning of class on the due date given. Late homework will not be accepted without PRIOR permission. If you think you might miss class for any reason, you may email me an electronic copy of your assignment, have a classmate turn in your assignment, or turn in your assignment to my mailbox (JB – 370) by the **beginning** of class on the due date.

EXAMS

There will be two midterm exams and one final exam. One of the best ways to prepare for an exam is to do and understand all the problems that are discussed in class, as well as those that are assigned for homework. Assessments will be based on class discussion and assigned work. They may sometimes include problems that ask you to apply the concepts in a somewhat unfamiliar context.

The midterm exams are tentatively scheduled for Weeks 5 and 10. At least one week's notice will be given if the dates change. A make-up midterm exam will be given only in extenuating circumstances and at my discretion. With the exception of emergency situations, the make-up exam must be arranged with me PRIOR to the scheduled midterm date. The final exam will be on TBD. The date of the final exam is set by the University and cannot be changed.

GRADING

Participation: 10%

Homework: 25%

Midterm Exams: 30%

Final Exam: 35%

GRADE BREAKDOWN

A plus/minus may be amended to scores at the far ends of the ranges at the discretion of the instructor.

A (90 – 100%)

B (80 – 89%)

C (70 – 79%)

NC (below 70%)

LEARNING SUPPORT AND TIPS FOR BEING SUCCESSFUL

- If you would like my support to help you build on your understanding, I highly encourage you to visit me during student hours or make an appointment for a time that may be more convenient for you. I am happy to help improve your understanding.
- Expect to struggle through some of the material and build perseverance in problem solving. When you find that your struggle is no longer productive, seek help.
- I will make every effort to facilitate your learning. Working with knowledgeable peers and the personal trainers at the Math Gym (JB-391) can be of great benefit in helping you make connections that deepen your understanding of the content. I encourage you to try to join/form a study group with members from class and take advantage of the Math Gym (JB – 391).
- Starting your homework early and allowing yourself time to carefully work through an assignment is one of the best ways to study. You will build a stronger understanding by studying a little every day and avoid stressful cramming for exams. Once an assignment is complete, it's good practice to review your solutions and reflect upon the ideas explored.

PROFESSIONALISM AND CLASSROOM PROTOCOL

The classroom is preparation for your future profession. In order to help prepare you for your future, I will expect professional behavior and work at all times.

- Please plan to be on time for class and to stay for the entire class period. It can be disruptive when students frequently arrive late and/or leave early. If you must be tardy or leave early for an unavoidable reason, that is understandable; however, it is your responsibility to let me know.

- Please refrain from using electronic devices (cell phones, tablets, computers) during class, unless used for notetaking. Please turn **off** the ringer on your cell phone during class time – this includes “vibrate”. Often, when one student is distracted, that student may unintentionally distract others.
- While I understand that you may need to eat in class due to your schedule, please be considerate of your peers. Avoid eating noisy food or food with a strong odor.
- In the event that class is unexpectedly canceled (e.g., fire, winds), you are still responsible for the day’s work. It is your responsibility to check your email and Blackboard for notifications concerning the material, reading, and homework for that day. Please refer to the [Office of Emergency Management and Business Continuity](#) for information regarding emergency management and safety guidelines.

SOCRATIC DISCOURSE

I may often respond to questions with a follow-up question rather than a direct answer. This questioning approach has a long history—nearly 2500 years!—and is sometimes called the Socratic method. By probing into a subject with questions, we develop an inquiring mind that can seek solutions to problems in a critical and logical way. So, please share your questions and comments! I value your input and it lets me see what you are thinking. If I respond with another question, know it is because I respect your ability to learn.

The fact that you have formulated a question shows that you have made a step in the right direction or identified a key point. Socratic discourse provides you with the opportunity to build on your current knowledge. I want you to develop confidence in your ability to think critically and solve problems. Understanding concepts via your own reasoning leads to powerful learning. Learning is hard work, but the benefits are rewarding!

For more info on the Socratic method, see <http://www.criticalthinking.org/pages/socratic-teaching/606>.
 For more info on the Greek philosopher Socrates see <http://plato.stanford.edu/entries/socrates/>.

INTELLECTUAL HONESTY

Using the internet or looking in the back of the book to find solutions can easily lead to, perhaps unintentional, cases of plagiarism. It may seem that you are learning how to do assigned homework when you use the internet and/or book solutions; however, this practice is very strongly discouraged since this approach often gives a false illusion of learning. How will I know if you are struggling with a problem if the work presented originated from someone else? Furthermore, this kind of “learning” does not translate well to exams or being able to apply the content in future classes.

Have faith in yourself. Some homework problems are intended to be challenging. Know that the problems are chosen with your skillset in mind. True learning occurs when you engage in a productive struggle with a problem and discover how to make use of the problem-solving tools you have developed during your studies. The only way to learn concepts deeply is to work thoughtfully and engage your brain. Did you know that when we learn a new idea, an electric current fires in our brains, crossing synapses and connecting different areas of the brain? (From Jo Boaler – *Mathematical Mindsets*) You are growing your brain when you struggle with new ideas.

PLAGIARISM AND CHEATING

The University has strict guidelines regarding the issues of plagiarism and cheating. Plagiarism and cheating are violations of the Student Discipline Code. Plagiarism is the act of presenting the ideas and writing of another as one’s own. Plagiarism also includes reusing work from a previous term or from another course (even if it is your own work). Cheating is the act of obtaining or attempting to obtain credit for academic work through the use of any dishonest, deceptive, or fraudulent means.

I take intellectual honesty very seriously. Cases of plagiarism or cheating will incur the harshest consequences allowed for in the Academic Regulations (<http://bulletin.csusb.edu/academic-regulations/>):

- First offense of plagiarism: Entire assignment will receive a score of 0 and incident will be reported to the Office of Student Conduct and Ethical Development
- Second offense of plagiarism: Student will fail the course and incident will be reported
- Cheating on an exam: Student will fail the course in the course and incident will be reported

IMPORTANT NOTES

DROPPING AND ADDING

You are responsible for understanding the policies and procedures about add/drops (especially the administrative drop policy), academic renewal, etc. found in the [CSUSB Bulletin](#).

SUPPORT FOR STUDENTS WITH DISABILITIES

If you are in need of an accommodation for a disability in order to participate in this class, please see the instructor and contact Services to Students with Disabilities at (909) 537-5238.

If you require assistance in the event of an emergency, you are advised to establish a buddy system with a buddy and an alternate buddy in the class. Individuals with disabilities should prepare for an emergency ahead of time by instructing a classmate and the instructor.

STATEMENT OF DIVERSITY, INCLUSION, AND EQUITY

It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please contact me (in person or electronically) or submit anonymous feedback if you have any suggestions to improve the quality of the course materials. In addition, if any of our class meetings conflict with your religious events, please let me know so that we can make arrangements for you.

DISCLAIMER

This syllabus may be modified in order to better meet your needs and progress. Notification of any changes will be made in class as well as through the Blackboard Announcements page and/or the Blackboard email feature. You are responsible for monitoring all announcements. It is your responsibility to know all of the information contained in the syllabus and in the University bulletin.