

# Math 476: Numerical Analysis - Winter 2020 .

## Reading this syllabus:

Please read through items that are **bolded**. These bolded statements contain important policies and then details/ questions about the policies are detailed below. Contact me with any further questions.

Page 1:	Quick Reference course information
Pages 2-3:	Learning Objectives and Expectations
Page 4:	Suggestions from previous students
Pages 5-7:	Course & Grading Requirements
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<b>Class Meeting Time:</b>	Tuesday & Thursday	Noon-12:50 PM	<b>Samuelson 103</b>
	Wednesday & Friday	Noon-12:50 PM	<b>Samuelson Math Ed Lab 138</b>

## Instructor Contact Information

Instructor	Email	Phone	Office	Pronouns
<b>Dr. Brandy Wieggers</b>	<b>brandy.wieggers@cwu.edu</b>	<b>(509) 963-2125</b>	<b>Sam 229C</b>	<b>She/Her/Hers</b>

*The best way to contact the instructor is at office hours or via email. That said, professors often only check email 2-3 times a day so expect a 12-24 hour delay in response. If you haven't received a response within 24 hours of the original email please contact the professor again.*

## Office Hours: Come and ask me your questions!

Tues & Thurs 1:00 pm - 1:50pm Samuelson 229C

Weds & Fri 1:00 pm - 1:50pm Samuelson 138 (computer lab)

Additional office hours are available, visit <https://drbrandymath.youcanbook.me> to schedule.

## Required Course Materials

- **Textbook:** Introduction to Numerical Methods and Analysis. 2nd Edition. Author: James Epperson. Published by Wiley. Available through CWU Library:  
<https://ebookcentral-proquest-com.ezp.lib.cwu.edu/lib/cwu/reader.action?docID=1584988>
- **Course Website:** <http://canvas.cwu.edu> All course information including assignments and course project information will be available on Canvas. The website will provide supplementary resources to support your coursework.
- **Computer Access:** Regular computing assignments will play a role in this course. If you do not have personal computer access make sure to start assignments early and make use of the CWU computing resources. You can find a list of on-campus computer labs here, <http://www.cwu.edu/its-css/computer-labs>. Also, be aware that you can check out laptops from Information Desk at the SURC <https://www.cwu.edu/surc/information-center> or the Samuelson MECC.

## Course Grade Categories

Assessment	%
In-Class participation and homework	15%
Weekly Quizzes	15%
Midterm Exam	15%
Final	15%
Computer Assignments	40%

## Always remember - believe in yourself and your ability to do math:

It is a common myth that some people are good at math and some are not. In reality, there are several skills that go into doing mathematics well, and these skills can be practiced and improved. Your instructor can help you identify your strengths, as well as your challenges in doing math. We will work together to improve these challenges. In this class, everyone can develop the skills and the confidence to do math!

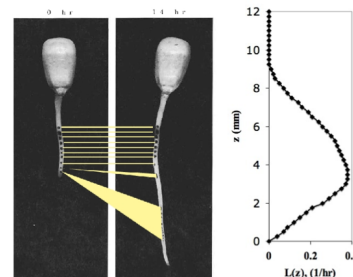
# MATH 476/477: NUMERICAL ANALYSIS

**Course Prerequisites:** To succeed in this course you will need to have mastered basic calculus, proof writing, and matrix manipulation. In addition, this is a mathematics course with a substantial programming component yet the focus of the assignments is on the mathematical analysis of these programs. Any programming language can be used to complete the assignments and note that the programming component will only count for 25% of the grade of the assignment, plan to spend your time accordingly.

## Learning Objectives:

This is a two-course sequence (Math 476 and 477) that together provide an introduction to many basic methods used in numerical analysis.

The main topics may include: Taylor series polynomials, matrices, interpolation and approximation of functions, numerical integration and differentiation, solution of non-linear equations, acceleration and extrapolation, solution of systems of linear equations, and computer programs applying these numerical methods.



## By the end of Math 476 and 477 courses you should be able to...

- Describe, present and analyze numerical methods for a specific data set, and justify their conclusions.
- Construct and analyze computational approximations for different data sets using interpolation and other polynomial approximations.
- Estimate numerical derivatives and numerical integrals for a given dataset.
- Predict and analyze the error propagation that results from mathematical algorithms.
- Evaluate other numerical approximation methods.

In addition to covering these math topics, my primary goal is to create a human experience in mathematical exploration and problem solving while achieving these learning objectives.

## To support this I will ...

- Regularly communicate the expectations for coursework
- Provide assignments to support your coursework and understanding.
- Make any assignments for the following day by the end of the class period.  
(ie: all assignments will be posted on Canvas  $\geq 23$  hours prior to the due date).
- Provide regular opportunities for you to assess what you have learned and provide feedback on what you still need to work on.

## In this course I expect that you will ...

- **Participate actively in group-work and class discussions:** Each class will be designed to engage you in gaining a deeper understanding of the material. You will often work in small groups to provide opportunities for each student to talk about the mathematics in the lesson. A part of building understanding is being able to describe what you are thinking and explain your reasoning. You will also need to listen to, compliment, and also critique the reasoning of other students, in a respectful manner.
- **Ask questions:** In class time is your opportunity to ask lots of questions! I will help you learn how to ask questions, how to answer your own questions, how to use resources like your textbook, classmates, etc. Also, don't forget that professors are human too. Sometimes we make mistakes. If you think I've made an error reach out and ask me, I would be happy to discuss it with you.

## In this course I expect that you will ...

- **Come to class prepared to engage in mathematical thinking:** You will be asked to turn in something each day. Mathematics is a creative endeavor that slowly builds over the course. To do that you need to do a little bit of work each day. Daily activities help you practice the work outside of class. The worksheets will be about the process, the logic and the justification - not the answer!!! If you do not finish the worksheet in class, you will take it home for homework. These will be turned in the next day and graded for completion.

CWU policy states “one credit represents a total time commitment of three hours each week of the quarter. A regular load of 15 credits requires 45 hours of work per week. The total time includes class time, studying, conferring with the instructor, writing, performing laboratory work, exercising, or performing any other activity required of students.” Thus, **you will be expected to spend 8-10 hours a week working outside of class on class materials (around 2 hours a night).**

- **Check your email and Canvas regularly to keep track of your responsibilities.**
- **Communicate in a Professional Manner**

### How to Write an Email to a Professor

First check the syllabus and your notes (and the class website if there is one) to see if your question has indeed been answered there. If you still have a question or comment then send a professional email including the following components:

<b>Subject:</b> Use a Clear Subject Line	Subject: Math 299s question
<b>The Salutation:</b> Start your email to your professor with a “Dear” or “Hello”...	Hello Dr. Brandy,
<b>Provide Context:</b> Some professors have hundreds of students and may need some context to be able to place you and answer your question	I am a student in your Math 299s course.
<b>Request:</b> Super polite restatement of your request	I have a question about ...
<b>Sign Off</b>	Thank you, Your Name. student@cwu.edu

### Other email notes:

- **Send it from your university email address.**
- **Be aware of titles:** Do not use Mrs. or Ms. if they are Dr.
- **Spell it correctly.** Spell out the whole name. If there’s a hyphen in it, use both names and the hyphen.
- **Do NOT use slang, abbreviations, or emoticons.**
- When is it safe to send a follow-up reminder? You have to gauge this based on how quickly the professor usually respond to things and how dire your need for a response truly is. If it can wait a week, let it wait a week (or until you see them in person). If you can’t wait you can resend the request with an added note, “*Just following up on my previous email added to the forwarded email.*”

Here are some additional recommendations: <https://www.wikihow.com/Email-a-Professor>

## Suggestions from previous students on how to be successful in 476-477 course

- Ask for help when needed. Preferably you should start work pretty soon, that way you can go ask for help.
- Start every assignment as early as possible! There is more time to get help this way and you're going to need help.
- Work with other people in your class on the projects, bounce ideas around.
- You really need to show up every single day.
- For this class, it will be hard, but very rewarding. Expect homework every day, but do not dread it. Make sure to manage your time and get ahead as well as ask questions and go to office hours. Again, this class will be hard but with some time management and hard work you will get through.
- Make sure to be in class and do the homework before every quiz day. Ask for help on your projects before turning them in. Become best friends with Taylor's Theorem.
- Start early on the projects. Review for the quizzes. If you don't know Mathematica or Python pick one and roll with it for the next two quarters.
- Get to know the people in your class because they will be a lot of help. It's nice to learn different ways to do things so getting help from the instructor is important but if things still don't make sense reach out to your classmates because they might explain something differently or have a different point of view that could help you out more.
- Start on the projects early. If you find you are spending  $\geq 20$  hours on a project there is a chance you are over thinking it. Don't get overwhelmed by the little stuff.
- Many hours go into the write up of each project, so I would avoid taking more than 12 credits during the quarter Numerical Analysis is taken.
- To be successful in this class, do not miss any days and at least attempt all the homework. A huge part of the grade is the participation.

# Course Requirements and Grading Standards

## Expectation for coursework:

This is a Senior level course that is preparing you to go to graduate school or industry. I am looking for professional quality work.

- **All work must be written in clear handwriting or typed.** If your instructors cannot read your work, they cannot provide you feedback. Also remember to put your name on your work.
- **Put your name on your work, especially any submitted computer files.**  
So instead of receiving 20 Project1.pdf I'll receive name\_project1.pdf
- **Do Not submit Incomplete Work:** Incomplete work will NOT be accepted for credit. In order to receive full credit for an assignment, it MUST be fully attempted and turned in by class time on the specified due date.
- **Consistently submit work on time that meets the assignment format:** You will be asked to turn in something in each day and in order to receive full credit for an assignment, it MUST be completed and turned in by class time on the specified due date. This is so you can receive lots of feedback about your progress in the class and adjust your studying accordingly. To meet the learning objective of technical writing each of the assignments should communicate the fundamental ideas in clear, concise, descriptive English prose. In addition, you will be given many word counts for writing assignments over the course of the quarter. **Please consider these word counts as floors, not ceilings.** So if asked to reflect for 100 words you must write at least 100.
- **Be smart in your collaboration:** You are encouraged to talk to classmates about your computer assignments and other problems from classwork but you must complete all assignments by yourself. This means that you can discuss your algorithms as a group but you need to create individual codes and individual results. If you do talk with others please indicate who your group members were on your assignment. Please be reminded that the Washington State Legislature defines Academic Dishonesty,  
<http://app.leg.wa.gov/WAC/default.aspx?cite=106-120-027>

## Grading

Final grades will be computed by assigning weights to the following categories, described in more detail in the following pages:

Course Grade Categories	
Assessment	%
In-Class participation and homework	15%
Weekly Quizzes	15%
Midterm Exam	15%
Final	15%
Computer Assignments	40%

To track your progress in this course you should be comfortable calculating your own grade. Create a personal class folder to collect all your coursework. These will be needed to calculate your grade and will be useful when reviewing prior to quizzes.

The following table reflects the planned letter grade for the course structure:

Total	100-93	92-90	89-87	86-83	82-80	79-77	76-73	72-70	69-67	66-63	62-60	59-0
Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F

## In-class participation and homework

Attendance will be taken daily and homework will be assigned regularly to be turned in at the beginning of class, often via Canvas or on paper in class. If you are not present, you will miss the points for this work but you should still check on Canvas for the missed worksheet or assignment. Late (up to one class period) homework assignments will be worth partial credit (so you will receive either 10, 5, or 0 points for these assignments and attendance).

Keeping up with the homework is one of the best things you can do to help yourself succeed in this course! Much of the homework will be repurposed for the computing projects. Use the homework to practice communicating your understanding of the problem by writing problems out by hand to gain practice with the process and then coding them via a computing program of your choice to gain the computing practice. Group discussions about the homework are encouraged, but each student must write his/her own solutions and not copy them from anyone else.

Also note, the professor only responds to email two times a day so don't expect an email response to homework inquiries within 12 hours of the due date time. Start early and come to office hours.

## Weekly Quizzes

Quizzes will be given on Wednesday at the start of class. The quizzes will be based on recent sections that we covered in class lectures and worksheets or on homework. The focus of the quizzes will be on computation and vocabulary, and on processes. This will be important feedback for your current understanding of course material.

**Quiz corrections:** Quizzes provide important feedback for your current progress in the course. To support your understanding you are encouraged to review your quiz and correct the work. Submission of the quiz corrections are due within one class period and will be eligible for up to  $\frac{1}{2}$  the missed points. In order to receive these points, you must submit the quiz and staple on a new sheet with corrected work and a reflection of at least 3 complete sentences about what you learned about mathematics by doing the corrections. For example: *"In correcting the quiz, I learned that I made a sign error when finding the roots of the quadratic function. I should have had both a positive and negative root and instead, I only kept the positive root. Next time I will look at the graph of the function to remind myself of the two roots."*

**Question: What if I miss a quiz?** To allow for personal absences, the lowest quiz score will be dropped, so you can have one missed quiz with no effect on your grade. I encourage you to talk to me when you know you will have to miss a quiz. You can pick up the missed quiz and submit for quiz-corrections for up to 50% of the missed points.

## Exams

**Midterm Exam:** Tentatively scheduled for February 21.

**Final :** Thursday, March 19, 2020, Noon-2:00PM, 2 hour.

You must be present at the final exam! Add it to your calendar now.

A missed exam will be given a zero and there will be no make-up exams. The only exceptions to this will be made completely at the discretion of the instructor and will only be granted for serious and compelling reasons. Please contact me ASAP to ensure the likelihood have having your issue taken seriously.

## Computational Projects

There will be five computational projects this quarter and all will be counted toward your final grade. Students will be assigned computer projects throughout the course that will highlight the particular mathematical methods. You are welcome to write your code in any computer language that you feel comfortable with however, it must be a general purpose programming language that does not give any special assistance in implementing the algorithms we're studying. This means you are expected to program the algorithms/methods by hand (rather than using a built-in program). For example, you will code Taylor's polynomials from definition rather than using Taylor[] in Mathematica.

### DRAFT- Assignment Descriptions and Deadlines, subject to change

Assignment	Description	Due Dates
Project 1	Taylor Polynomials	January 17
Project 2	Error Propagation	January 31
Project 3	Interpolating Polynomials	February 14
Project 4	Cubic Splines	February 28
Project 5	Derivation Approximation	March 13

More information will be available on the website and in class.

**LATE Computational Projects Policy:** Incomplete projects will NOT be accepted for credit. In order to receive full credit for an assignment, it MUST be completed and turned in by class time on the specified due date. Any assignment turned in late, but on or before the following class period will have the score reduced by 10% per course day that is late, up to 50%. So if it's due on Friday and turned in on Monday the student will be eligible for 90% full credit, continuing to reduce to 50% credit by the following Monday. Any assignment turned in after this 1-week late date will not be graded and no credit will be given for it. I do this to encourage you to do the assignments on time as previous students who got behind in this course have struggled to ever catch-up.

### Submit work that meets the assignment format

To meet the learning objective of technical report writing, for each of the programming assignments you will write a brief technical report which answers the given questions and illustrates the fundamental ideas in clear, concise, descriptive English prose. The report should separate the required tasks of the given project and document each in the appropriate section, i.e. Analysis, Computer Program, or Results. **Refer to the specific Project Format Directions for more details on each section.**

### Computational Project Grading

Analysis	25%
Computer Program	25%
Results and Discussion	25%
Style	10%
Post Assignment Review and Reflection	15%

As you can see, the focus of the assignments is on the mathematical analysis of these projects, not the program. Please plan your time accordingly.

## University Policies

**Counseling Services:** Students are reminded that they have access to medical and counseling support through the CWU Student Medical and Counseling Clinic, <https://www.cwu.edu/medical-counseling/>. If you have concerns that you might be experiencing symptoms of anxiety or other mental health concerns it might be helpful to talk with a counselor, call the Counseling Clinic (509-963-1391).

**Support Services/ Accommodations:** Central Washington University is committed to creating a learning environment that meets the needs of its diverse student body. If you anticipate or experience any barriers to learning, discuss your concerns with me. Students with disabilities should contact Disability Services to discuss a range of options to removing barriers, including accommodations. Student Disability Services is located in Hogue 126. Call (509) 963-2214 or email [ds@cwu.edu](mailto:ds@cwu.edu) for more information. Also, please let me know if you need me to accommodate for a disability in anyway, I am glad to do so!

**Religious Holidays:** In compliance with RCW 28B.137.010, Central Washington University makes every effort to deal reasonably and fairly with students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. Students must present written notice to their instructor within the first two weeks of class listing the specific dates on which accommodations are required. Contact the Dean of Student Success at (509) 963-1515 for further information or questions.

**Expectations for Student Conduct:** Students in this class are expected to interact with students and the professor professionally. Instances of disruptive conduct, obstructive conduct, or harassment (see Washington Administrative Code 106-125-020) will be referred to the Dean of Student Success.

**Incompletes:** The College Policy on Incompletes states that Incompletes are used when the student was not able to complete the course by the end of the term, but has satisfactorily completed a sufficient portion of it and can be expected to finish without having to re-enroll in it. In this course, students who have not completed substantial coursework should not assume that they will be given an incomplete at the end of the semester. If you have concerns about this you should talk to the course instructor and your academic advisor.

**Summary of Important Dates:** Refer to <https://www.cwu.edu/calendar> to verify

Jan 14	Change of Schedule Period Ends (Add/Drop classes) <i>(Drops completed prior to this date or by the close of business on this date will not appear on transcripts or have tuition assessed).</i>
Jan 14	Deadline to declare audit & credit/no credit grading.
Jan 20	Martin Luther King Jr. Holiday, No class will be held.
Feb 5	Deadline for 50% refund with complete withdrawal
Feb 17	President's Day Holiday, No class will be held.
Feb 21	Uncontested withdrawal period deadline
Mar 13	Withdrawal from classes or university. <i>Not permitted except for "serious and compelling reasons."</i>

**Syllabus Changes:** I reserve the right to change the policies contained in this syllabus as dictated by developments during the quarter.



## Professionalism Expectations

As a member of a peer learning community, a high degree of professionalism is necessary. I measure professionalism based on several aspects including your academic integrity and your support of the inclusion and diversity policies of CWU.

Please be aware of the following expectations.

**Academic Integrity:** While completing this course you must follow the CWU Student Code of Conduct, which is defined by Washington State, including university policies (CWUP 5-90-040(22), CWUR 2-90-040(22), and WAC 106-125-020) which address student conduct, cheating, plagiarism, and other academic expectations. Please be reminded that the Washington State Legislature defines Academic Dishonesty in all its forms including, but not limited to the following: Cheating on tests. Copying from another student's test paper. Using materials during a test not authorized by the person giving the test. Collaboration with any other person during a test without authority. Knowingly obtaining, using, buying, selling, transporting, or soliciting in whole or in part the contents of an unadministered test or information about an unadministered test. Bribing any other person to obtain an unadministered test or information about an unadministered test. Substitution for another student or permitting any other person to substitute for oneself to take a test. "Plagiarism" which shall mean the appropriation of any other person's work and the unacknowledged incorporation of that work in one's own work offered for credit. "Collusion" which shall mean the unauthorized collaboration with any other person in preparing work offered for credit. **If there is any break in academic integrity CWU's policies and recommendations for academic misconduct will be followed, leading to disciplinary action up to and including failing the course.**

**Inclusion and Diversity:** CWU expects every member of the university community to contribute to an inclusive and respectful culture for all in its classrooms, work environments, and at campus events.

As a student in this course, you are expected to behave in a respectful manner in which you treat your professors, fellow students, and other people affiliated with your work at CWU with respect, regardless of their identity (including gender, race and color, religion and creed, national origin, sexual orientation, gender identify and gender expression, disability and use of assistive devices or a service animal, and veteran or military status). In turn, I strive to create a learning environment for my students that supports a diversity of thoughts, perspectives and experiences, and honors your identities. Thus ...

- If you have a name and/or set of pronouns that differ from those that appear in your official CWU records, please let me know!
- If you feel like your performance in the class is being impacted by your experiences outside of class, please don't hesitate to come and talk with me. I want to be a resource for you. Remember that you can also submit anonymous feedback (which will lead to me making a general announcement to the class, if necessary to address your concerns). If you prefer to speak with someone outside of the course, the Chair of the Mathematics Department is an excellent resource.
- I (like many people) am still in the process of learning about diverse perspectives and identities. If something was said in class (by anyone) that made you feel uncomfortable, please talk to me about it. (Again, anonymous feedback is always an option.)
- As a participant in course discussions, you should also strive to honor the diversity of your classmates.

<https://www.k12.wa.us/policy-funding/equity-and-civil-rights/civil-rights-laws-and-regulation>