APMA 1110: Single Variable Calculus II

Spring 2026

INSTRUCTOR: Farzad S. Dizaji Email: ffs5da@virginia.edu Office: Small Hall 112 (A)

Office hours:

There will be opportunities for extra help in several ways:

- Instructor Office Hours: see our course site on UVACanvas
- UTA Office Hours (Also known as APMA Workshop. Hours will be posted on UVACanvas.)
- Free Tutoring from the Dean's office

and

Peer Led Learning Program:

Students in this class are invited to participate in the P2L program (Peer Led Learning). P2L is characterized by weekly structured study sessions. The program is voluntary and free for all students. Sessions are planned and facilitated by trained peer coaches who have successfully completed the course in a previous semester. The planned activities will provide opportunities for students to work together to understand key course concepts.

P2L sessions will be held a few times each week, and all students are encouraged to attend on a regular basis. Each week's sessions will cover similar material, so you only need to attend once per week to participate fully. The schedule of sessions will be available on the website: https://advising.virginia.edu/resources/p2l/

by the end of the first week of class.

There is a bonus program for participation in P2L. For every 5 weeks in which you participate, you will earn a 0.5% bonus toward your final letter grade, maximum of 1%.

Resources:

Calculus, Early Transcendentals by Stewart, 9th edition, with WebAssign access: You will have access to this through Inclusive Access on Collab. The fee will be charged to your account as a mandatory student fee This program aims to offer all students accessibility and affordability. If you have any questions regarding the program, please email **UVAInclusiveAccess@virginia.edu.** If you were enrolled in APMA Calculus in a prior semester, you should opt out before the deadline to avoid the fee.

Gradescope: Create an account at Gradescope.com using your UVA email address. There is no charge.

Tablet or Scanner: You must either have a tablet with pen annotation capability by which you can annotate pdf files, or you must have a scanner or scanner app by which you can **scan multiple pages as a single pdf file**.

UVaCanvas: The UVaCanvas site will contain the Class notes, worksheet and test solutions, and other supplementary material as well as a link to the textbook and online homework.

APMA Workshop with undergraduate teaching assistants: The APMA Workshop will be available for you to consult with a UTA for extra help. The hours for the workshop will be posted on UVaCanvas.

Materials provided for this course
are for your use for this course only and
not to be shared with anyone outside of the course.

How has calculus survived over three centuries? What can we use it for?

Can you find the value of the *sine* function on your calculator if the *sine* and *cosine* buttons are broken? While it might be easy to find the center of gravity of a symmetrical object, how can you find the balance point for irregular shaped objects such as  or  ? How can you describe the motion of an object in a plane or in space? The answers lie in calculus!

Throughout the course, we will work together to help you develop the work habits that are necessary for success as an engineering student and beyond. These habits will help you to learn independently and to be able to apply what you know to solve general problems, including those in everyday life.

What is success as a Calculus student?

At the end of this course, you will be able to:

1. Solve integrals using a given toolbox of techniques.
2. Construct integrals to compute physical quantities like fluid force, work, center of mass, arc length, speed, area, and surface area of revolution.
3. Analyze parametric equations and polar equations for graphical features.
4. Analyze sequences and series for convergence, and approximate and integrate functions using their Taylor series.
5. Use Taylor Polynomials as a method of numerical approximation and describe how Taylor Series, complex numbers, trigonometric functions, and exponential functions are related using Euler's Formula.
6. Demonstrate the ability to communicate mathematically both in written work and orally.

Words of Advice and Encouragement

Googling "why is math so hard" leads to many nice, funny and sometimes almost convincing reasons. The truth is that math is tough work and not a spectator sport.
And whether you're an athlete or playing an instrument you know the truth of "**practice makes perfect**".

You also know the unavoidable interim steps that we might call failure, leading to no obvious improvement, no reward or simply a bad performance. Make sure those steps are taken with the in-class worksheets and homework, not the exams.

Group work e.g. is our tool to give you **feedback without pressure** and leaves **room for failure**, but we will also evaluate your progress:

How will your progress be evaluated?

In-Class-Worksheets = Class Participation – (15%) – To participate well **in class**, you must read the section in our book before class. Class sessions will be active, with worksheets to be completed in a collaborative environment. Worksheets will be available before class through Gradescope and will be due the night after class. There is a one-day grace period during which you may submit your worksheets without penalty. After that, no late worksheets will be accepted for any reason.

If you ever forget to submit your worksheet (or your submission didn't go through) accept the consequences with grace. If you have an attendance record of >95% based on the attendance sheet, the two lowest scoring worksheets can be disregarded.

WebAssign Homework (15%) –There are WebAssign assignments for you to complete by Wednesday each week. These problems will help you to consolidate your learning. The Homework assignments are not equally weighted. You may request an extension for one Homework assignment during the semester as long as it is requested by email at least 6 hours before the midnight deadline.

(NEVER wait until Wednesday to start the set since you might forget to finish your HW on Wednesday night and there is no way to make up for lost points here).

Tests (45%) – There will be three mid-term tests to assess your mastery of the skills that you are learning. Check the schedule below for the test dates.

Final Exam (25%) – The final exam will assess your mastery of all the skills that you will need to go forward in your study of calculus. Check the schedule below for the final exam date.

Flexible weight (5%) – the weight of your best exam (out of the total of 4 exams) will be increased by 5%.

Attendance

Attendance in class is expected & required for full pts for the category "In-Class-Worksheets = Class Participation (15%)". Be sure to send an email BEFORE class to explain your absence/lateness so it *can* count as excused absence. You should still turn in the worksheet that night.

BTW, make sure to **be on time**: if you come in late, you will have no clue what we are talking about for the rest of class time, so the time in class is lost **= absence**.

Regrading

If you believe that a mistake has been made in scoring graded work, you may request a regrading up to 7 days after the graded work has been returned in class. After 7 days, your score is final. The 7-day clock begins when the graded work is made available. Regrade requests are submitted through Gradescope.

Honor Code:

I trust every student in this course to fully comply with all of the provisions of the **University's Honor Code**. By enrolling in this course, you have agreed to abide by and uphold the Honor System of the University of Virginia, as well as the following policies specific to this course:

You may give and receive assistance with homework, but your submitted answers should reflect your own work. Classroom work will be collaborative.

On exams, no external help is allowed, all smartphones/watches etc. must be turned off and stored away.

Calculators may be used to check your answers for homework or classroom work, but not to do your work unless expressly permitted, they are not allowed for exams.

Tests will be pledged. No calculators, notes, nor any other aids may be used for tests and quizzes.

Materials provided for this course are for your use for this course only and not to be shared with anyone outside of the course.

Make-up exams

- will be given only in case of an emergency or unavoidable problems such as an illness.
- Students must communicate as early as possible about the problem, email must be received before the start of the exam, no exceptions (oversleeping is not a valid reason for a makeup).
- Leave phones, smartphones and your backpack in professor's office for the duration of the make-up exam.

AI policy Generative AI:

All your learning goals would be out of reach if you use any form of Artificial Intelligence tool. In this class we try to build brain muscles so one must go through the training!

If you use AI for interim steps or to get started on the worksheets, the tools used must be fully disclosed as a source along with the capacity in which they were used. All outputs of not authorized artificial intelligence, both explicitly used and as inspiration in one's submission, must be properly cited to its appropriate source.

Accommodation for Disabilities:

The University of Virginia strives to provide accessibility to all students. If you require an accommodation to fully access this course, please contact the **Student Disability Access Center (SDAC)** We are fortunate to have an SDAC advisor, Courtney MacMasters, physically located in Engineering. You may email her at cmacmasters@virginia.edu to schedule an appointment. For general questions please visit the SDAC website: sdac.studenthealth.virginia.edu. If you have already been approved for accommodation through SDAC, please send me your accommodation letter and meet with me so we can develop an implementation plan together.

Religious Accommodations:

It is the University's long-standing policy and practice to reasonably accommodate students so that they do not experience an adverse academic consequence when sincerely held religious beliefs or observances conflict with academic requirements.

Students who wish to request academic accommodation for a religious observance should submit their request in writing directly to me by email as far in advance as possible. Students and instructors who have questions or concerns about academic accommodations for religious observance or religious beliefs may contact the University's Office for Equal Opportunity and Civil Rights (EOCR) at UVAEOCR@virginia.edu or 434-924-3200.

Safety:

If you witness or are aware of someone who has experienced prohibited conduct, you are encouraged to submit a report to Just Report It (justreportit.virginia.edu) or contact EOCR, the office of Equal Opportunity and Civil Rights.

More information also at www.virginia.edu/sexualviolence

If you would prefer to disclose such conduct to a confidential resource where what you share is not reported to the University, you can turn to Counseling & Psychological Services ("CAPS") and Women's Center Counseling Staff and Confidential Advocates (for students of all genders).

I am here to support you in any way that I can

Student support team

You have many resources available to you when you experience academic or personal stress. Always talk to me as soon as possible and I will try to help. The School of Engineering and Applied Science also has staff members located in Thornton Hall who you can contact to help manage academic or personal challenges. Please do not wait until the end of the semester to ask for help!

Learning

Lisa Lampe, Assistant Dean for Undergraduate Affairs Georgina Nembhard, Director of Student Success Courtney MacMasters, Accessibility Specialist Free tutoring is available for most classes.

Health and Wellbeing

Kelly Garrett, Assistant Dean of Students, Student Safety and Support

Elizabeth Ramirez-Weaver, CAPS counselor*

Katie Fowler, CAPS counselor*

*You may schedule time with the CAPS counselors through Student Health (https://www.studenthealth.virginia.edu/getting-started-caps). When scheduling, be sure to specify that you are an Engineering student. You are also urged to use TimelyCare for either scheduled or on-demand 24/7 mental health care.

Community and Identity

The Center for Connection (**The Connect**) is a dedicated student space within UVA Engineering that fosters academic success and personal growth. Through its programs and initiatives, The Connect helps students strengthen their engineering identity while providing resources to help them thrive during their studies and beyond. Our work centers on three key areas: student belonging and development, academic support, and community programming grounded in intentional, data-driven strategies.

The Connect features an open study area, a flexible event space, and on-site staff who provide direct support and advising to students. It is part of the Office of Community, Opportunity, and Engagement

Week	**Course Schedule** Readings/prepare for class	Learning Targets (as listed below)	**Link** to pre-calc Prep Material
01/12 – 01/16	6.3 Volume by Cylindrical Shells 7.1 Integration by Parts	2c 1a, 1b	 T, S, I, E, L
01/20 - 01/23	7.2 Trigonometric Integrals 7.3 Trigonometric Substitution	1c, 1d 1e, 1f	TD T, TU
01/26 – 01/30	7.4 Method of Partial Fractions 7.7 Approximation Integration 7.5 Strategy of Integration	1g, 1h 1i, 1j 1a – 1h	S, P S, E S, E, L
02/02 – 02/06	Q&A for Test 1 TUESDAY: Test 1 (6.3, 71 -7.5, 7.7) 8.1 Arc Length 8.2 Area of a Surface of Revolution	1a – 1j, 2c 2d 2e	 QA Q
02/09 -02/13	8.3 Applications to Physics and Engineering – Hydrostatic Pressure and Force 6.4 Work	2a 2b	Q T
02/16 – 02/20	8.3 Applications to Physics and Engineering – Moments and Center of Mass 7.8 Improper Integrals. Review of Limits to Infinity.	2f 3	N LF, LC
02/23 – 02/27	Q&A for Test 2 TUESDAY: Test 2 (6.4, 7.8, 8.1 – 8.3) 11.1 Sequence 11.2 Series	 4a 4b	 LC LF
02/28 - 03/08	Spring Break		
03/09 – 03/13	11.3 Integral Test and Estimates of Sums 11.4 Comparison Test 11.5 Alternating Series	4b 4b 4b, 4f	LF GP, TG
03/16 – 03/20	11.6 Absolute Convergence and the Ratio and Root Tests 11.7 Strategy for Testing Series 11.8 Power Series	4b 4b 4c	LF, NA T T, TD
03/23 – 03/27	11.9 Representations of Functions as Power Series 11.10 Taylor and Maclaurin Series 11.11 Applications of Taylor Polynomials	4e, 4g, 4h 4d 4f	T T, TD GE
03/30 – 04/03	Q&A for Test 3 TUESDAY: Test 3 (11.1 – 11.11) 10.1 Curves defined by Parametric equations	 5a, 5b	

04/06 – 04/10	10.2 Calculus with Parametric Curves 10.3 Polar Coordinates	5c, 5d, 5e, 5f 5g 6a, 6b	
04/13 – 04/17	10.3 Polar Coordinates – continued 10.4 Calculus of Polar Curves	6c, 6d, 6e, 6f	
04/20 – 04/24	10.4 Calculus of Polar Curves, cont. Supplement – Complex numbers	7a, 7b, 7c, 7d, 7e	
04/27, 04/28	Q&A		
May 2nd	Final exam on Saturday May 2nd, 7- 10pm.	Room TBD, then in your SIS account	

APMA 1110 Learning Targets

1. Methods of integration.
   a. Can recognize when to use Integration by Parts.
   b. Can successfully integrate using Integration by Parts.
   c. Can successfully integrate integrals of the form $\int sin^m x\, cos^n x\, dx$ for integer values of m and n.
   d. Can successfully integrate integrals of the form $\int tan^m x\, sec^n x\, dx$ for integer values of m and n.
   e. Can recognize when to use trigonometric substitution.
   f. Can successfully integrate when the integrand includes factors of the form $\sqrt{a^2 - x^2}$, $\sqrt{a^2 + x^2}$, or $\sqrt{x^2 - a^2}$.
   g. Can decompose a rational function into a sum of partial fractions of the forms $\frac{1}{x+a}$, $\frac{1}{x^2+a^2}$, and $\frac{1}{(x+a)^n}$.
   h. Can integrate fractions that result from decomposition.
   i. Can use Simpson's Rule to estimate an integral.
   j. Can determine an error bound for a Simpson's Rule approximation.
2. Applications of integration.
   a. Can set up an integral to compute fluid force.
   b. Can set up an integral to compute work.
   c. Can set up an integral to compute a volume of revolution by cylindrical shells.
   d. Can set up an integral to compute arc length.
   e. Can set up an integral to compute surface area of revolution.
   f. Can determine the centroid of a plane region that might be comprised of multiple components.
3. Can formally compute the value of an improper integral and determine convergence or divergence.
4. Sequences and Series
   a. Can determine the limit of an infinite sequence and classify as convergent or divergent.
   b. Can formally show whether a series is absolutely convergent, conditionally convergent or divergent using one or more of these tests appropriately:
      Divergence Test
      Geometric Series Test
      P-series Test
      Integral Test
      Comparison Test

Limit Comparison Test
Ratio Test
Root Test
Alternating Series Test

c. Can determine the radius and interval of convergence of a power series.
d. Can derive a Taylor series for a function by knowledge of $c_n = \frac{f^{(n)}(a)}{n!}$.
e. Can use multiplication and/or substitution to derive a Maclaurin Series. (Requires knowledge of important Maclaurin Series.)
f. Can use the alternating series estimation theorem to approximate a series, including approximating a function.
g. Can determine the derivative of a power series.
h. Can determine the anti-derivative of a power series.

5. Parametric equations.
   a. Can match sets of parametric equations in x and y to their graphs.
   b. Can recognize familiar parametric equations/curves, including those for circles and cycloids.
   c. Can compute the length of a parametric curve.
   d. Can compute the distance traveled by a particle on a parametric curve when the parameter is time.
   e. Can compute the speed of a particle on a parametric curve when the parameter is time.
   f. Be able to determine slope and concavity direction of a parametric curve.
   g. Be able to find a plane area bounded by a parametric curve.

6. Polar coordinates
   a. Can plot polar coordinates.
   b. Can sketch basic polar curves, including curves of the forms:

      $r = a + b\ sin\ \theta$ (Including the special cases where $a = 0$ or $b = 0$.)

      $r = a + b\ cos\ \theta$ (Including the special cases where $a = 0$ or $b = 0$.)

      $r = b\ sin\ n\theta$ (For positive integer n.)

      $r = b\ cos\ n\theta$ (For positive integer n.)

   c. Can compute the area of a simple polar region.
   d. Can compute the area of a polar region that is defined by two polar curves.
   e. Can compute the length of a polar curve.
   f. Can determine the slope of a polar curve.

7. Complex numbers.
   a. Can plot complex numbers in the Argand plane.
   b. Can express complex numbers in polar form.
   c. Can express complex numbers in exponential form.
   d. Can add, subtract, multiply, and divide complex numbers.
   e. Can determine the roots of complex numbers.