AP Calculus B/C

2023-24 School year

Instructor: Michael Wolverton
michael.wolverton@aps.edu

Location: Computer Science, Engineering & Robotics Lab
Web Page: https://cec-code-lab.aps.edu
Times: CEC Session I A:
Mon. Virtual* Tue. / Thurs. 8:40 – 11:00 am

Course Description

There is significant curriculum overlap between calculus A/B and B/C. The B/C curriculum differs in having the addition of challenging special topics such as vector functions, parametric equations, more topics in infinite series and certain differential equations topics. Classroom discussion will include quick glances at the importance of calculus in some science and engineering disciplines. Instruction on the use of graphing calculators to generate numerical approximations and relevant graphical information will be provided as needed.

Text & Learning Resources

Our class will work extensively with the following calculus text book:

Larson, Hostetler, Edwards Calculus 8th ed. Houghton Mifflin, 2006.

This text is available for physical copy check-out through the CEC main office, but is also available electronically in pdf format at the course home page below.

`https://cec-code-lab.aps.edu`

The class web page will also link to instructional videos, note, course information, meeting times and assignment information.

Course Format & Grading Policy

Instruction

While students are expected to read the text, the more significant portion of the course material will be presented by instructor lecture, solving demonstrations, and proof construction. Ideally, these will be delivered by live written and oral presentation. If needed, the same content will be delivered through virtual meetings, videos and web pages.

Assignments

Graded items will typically fall into one of the below categories.

- Homework
- Tests & Quizzes
- Semester (Final) Exams

Grading Weights

Overall grades are semester cumulative. The relative weighting may be as follows.

(Weights are subject to change based on changes in course due to scheduling and public health orders)

Tests & Quizes: 62%	Homework: 28%	Finals: 10%

0-59% **F**	60-69% **D**	70-79% **C**	80-89% **B**	90-100% **A**

Virtual Mondays

Monday class sessions will be virtual the entire semester – do not physically come to class at CEC. Most Mondays will likely have video lessons, written notes or other content for you to review and written assignments. On some occasions, we may have a video meeting via Google Meet (or similar) beginning around 9:00 am and lasting no more than an hour. Monday activities will be clearly posted and up to date at cec-code-lab.aps.edu before day's end on Friday.

AP Test & College Credit

At the end of the second semester, students may optionally attempt the AP Calculus B/C test administered by College Board. This course will include preparation for the College Board AP Test. This test will result in a typical AP Calculus B/C test score from 1-5, with an additional AP Calculus A/B sub-score from 1-5 equivalent to attempting both AP tests.

Many colleges (e.g. UNM) will award credit for college Calculus I for A/B scores of 4 or 5, or for a B/C score of 3,4 or 5.

Most colleges (e.g. UNM) will award credit for college Calculus II for B/C scores of 4 or 5.

Please note that award of college credit is institution dependent. For instance, The New Mexico Institute of Mining and Technology in Socorro (N.M. Tech.) will award Cal. II credit for a B/C 4 or 5 *but only if Cal. III is completed with a C or higher in the freshman year,* Otherwise Cal. II credit for the AP Calc. B/C is revoked.

Tentative Curriculum Sequence

The class will progress through programming topics in the following order. Pacing will be adjusted based on the progression of the students and course scheduling changes due to public health orders. As such some topics may be excluded, reordered or revisited.

Semester I				
Unit		**Topics**		**Text Sections**
1.	Limit and Derivative Review	Limit Rules & Def. Derivative Rules & Def. Continuity & Differentiability Implicit DE	Related rates Inverse Functions Transcendental Derivatives	1.2 – 1.5 2.1 – 2.6 3.1 – 3.7 5.1, 5.3, 5.4.i 5.6
2.	Basic Integrals	Fundamental Theorem of Calculus Substitution Integral Numeric Methods	Funciton Arc Length Revoloved Volumes Distance Travelled vs Displacement	4.1 – 4.6 5.2, 5.4.ii, 5.7 7.1, 7.2, 7.4
3.	Integral Methods I	Integration By Parts	Partial Fractions	8.2, 8.5
4.	Integral Methods II	Trigonometric Integrals	Trigonometric Substitution	8.3, 8.4
5.	Introductory Differential Equations	Separation of Variables Euler's Method Slope Fields	Exponential and Logistic Differential Equations	6.1-6.3

Semester II				
Unit		**Topics**		**Text Sections**
6.	L'Hopital's Rule & Improper Integrals	L'Hopital's Rule Indeterminate Forms	Rates of growth Improper Integrals	8.7, 8.8
7.	Parametric Equations	Parametric Equations Parametric Derivatives	2d Motion Parametric Arc Length	10.2, 10.3
8.	Polar Coordinates	Polar Coordinates Polar Derivatives	Polar Area	10.4, 10.5
9.	Series of Constants	Sequences Series Properties	Series Convergence	9.1-9.6
10.	Power Series	Taylor Polynomials Power Series	Power Series Operations	9.7-9.10

Learning Objectives

Students will be required to demonstrate their understanding of calculus in a variety of ways on a daily basis. While all homework, quizzes and tests will emphasize traditional analytic manipulation of functions, assignments and assessments will also include numeric problem solving (such as working with tabular data), written responses emphasizing conceptual understanding, as well as implementing the calculus functions of their graphing calculators to interpret results and experiment with methods. All students are expected to participate in classroom concept discussion, and provide oral response explanations to questions posed each lecture.
Calculus B/C students will develop the following proficiencies during this class:

Robust Analytical Technique

The central emphasis for student proficiency will be the development of their analytical technique. Students will expand their retinue of calculus analytic techniques such that by the end of the year they should be capable of limiting, differential and integral operations with *all* elementary functions. We will spend a considerable amount of time discussing how to select appropriate analytic techniques and identify the most efficient analytic method for as many situations as possible. Students will need to use correct, proper and explicit mathematical notation at all times.

Efficient Communication of Conceptual Understanding and Reasoning

Portions of both homework and exams will require students to explain calculus concepts in written sentences using precise language and correct terminology. All students will be required to explain (in both oral and written paragraph form) logical arguments for technique selection and result interpretation. Students will also need to clearly express their interpretation of central theorems and calculus concepts in their own words.

Graphing Calculator use for Numerical Approximations and Supplemental Interpretation

While my primary emphasis will be on analytic proficiency and conceptual understanding, both homework and exams will regularly present students with problems that are either analytically intractable, or unsolvable. In order approach these problems, student will learn to use calculator based numeric methods. For example, students should be able to use a combination of graph and table values to evaluate limits, evaluate derivatives at a point, and fit tangent lines graphically as well as numerically approximate definite integrals. We will discuss techniques for identifying when analytic methods are more desirable versus when numeric methods are best used.

We will also employ graphing calculators as a conceptual learning visual aid and exploration tool. For instance the calculator generated graph of an unfamiliar function can be manipulated to extracting information on extrema, periodicity, zeros and solutions to equations by intersection or intercept. Students will become proficient at using calculator functions, generated graphs and tables for, as well as key characteristics polar and parametric functions. Additionally, we will discuss how all of these aforementioned methods can be used to check analytically derived solutions.