MATH-089: SUPPORT FOR CALCULUS II

Effective Term
Fall 2026

BOT Approval Date
12/11/2025

Discipline
MATH - Mathematics

Course Number
089

Course Title
Support for Calculus II

Short Title
Support for Calc II

Credit Status (CB 04)
D - Credit - Degree applicable

Units

Lab Units
1.00

Total Units
1.00

Hours

Lab Contact Hours
48-54

Out of Class Hours Lab
0.00

Total Contact Hours
48 - 54

Total Out of Class Hours
0 - 0

Total Student Learning Hours
48 - 54

Is this an existing Extensive Lab?
No

Do you want to propose this for Extensive Lab?
Yes

Distance Education
No

Catalog Description
This course covers topics necessary to be successful in Calculus II. It covers topics from Precalculus, such as conic sections, partial fraction decomposition, and polar coordinates. The course will also cover some topics from Calculus I such as limits, derivates, and basic integrals.

Requisites

Corequisite(s)

Corequisite(s) (must be taken simultaneously)
MATH-C2220

Codes

TOP Code (CB 03)
1702.00 - Mathematics Skills

CIP Code
27.0101 - Mathematics, General.

Repeatability Code
No

Grading Option
P/NP only

Minimum Qualifications

Minimum Qualifications	And/Or
Mathematics (Masters Required)	End

Learning Objectives

Learning Objectives

Learning Objective
1. Formulate strategies to address effective learning skills and affective domain by promoting diversity, inclusion, and equity.
2. Evaluate limits with or without technology.
3. Compute the derivative of a function.
4. Evaluate definite and indefinite integrals.
5. Graph and identify conic sections from their equations.
6. Simplify trigonometric expressions using trigonometric identities.
7. Analyze continuity and differentiability of a function on a given interval.

Learning Outcome Information

Course Learning Outcomes

Learning Outcome
1. Students will produce the derivative of a composition of two functions.
2. Students will analyze the limit of a function given its graph.
3. Students will convert polar equations into rectangular equations and vice versa.

Content

Course Lab Content

1. Affective learning skills
   a. Study skills
   b. Metacognitive reflection on diversity, equity, and inclusion in mathematics
   c. Additional resources
      i. Peer study groups
      ii. Computer resources

iii. Lab resources
iv. Tutoring resources

2. Algebra and other topics
   a. Completing the square
   b. Laws of exponents
   c. Properties of logarithms
   d. Factoring of polynomials
   e. Systems of equations
   f. Partial fraction decomposition
3. Trigonometry
   a. Trigonometric identities
      i. Double angle
      ii. Half-angle
      iii. Pythagorean identities
   b. Right triangle trigonometry
   c. Unit circle
   d. Graphs of sine and cosine
   e. Compositions of trigonometric and inverse trigonometric functions
4. Equations and graphs of conic sections
   a. Parabolas
   b. Circles
   c. Ellipses
   d. Hyperbolas
5. Limits of functions
   a. Limit laws
   b. Graphical and numerical approaches
   c. L'Hôpital's rule
6. Continuity
   a. Domain of a function
   b. Points of discontinuity of a function
   c. Differentiability
7. Derivatives of functions and rules of differentiation
   a. Power rule
   b. Product rule
   c. Quotient rule
   d. Chain rule
   e. Implicit differentiation
   f. Logarithmic differentiation
8. Integrals of functions and basic techniques of integration
   a. Power rule
   b. Substitution

Methods of Instruction

Method

In-class Exercises

Integration

In class exercises will be completed individually and in group settings. Exercises will be used to practice expressing mathematical information visually, symbolically and numerically. An example of this would be graphing parabolas, circles, ellipses, and hyperbolas. Students will identify important characteristics of each graph.

Method

Activity

Integration

Students will work in groups of 3 to 4 people to help each other model real-world applications in practical and meaningful ways. For example, students may compute the surface area and volume of their favorite soda fountain drink using the correct formulas of integration. The activity will foster collaboration among students and strengthen critical thinking skills.

Method

Lecture

Integration

Lectures will be used to review notation and present content necessary to succeed in Calculus II. For example, instructors will lecture on limits of functions using various techniques such as the graphical approach, the limit laws, and L'Hôpital's rule before introducing improper integrals in Calculus II. Lectures will support the infusion of student feedback and interaction with the instructor.

Method

Discussion

Integration

In discussions, students will use mathematical models in practical and meaningful ways to solve real world applications that are culturally relevant. For example, students can choose a country of their liking and gather data on population trends. Students will then discuss in groups of 3 or 4 how to model population growth using a differential equation. Discussions will foster collaboration and help create an inclusive learning environment.

Methods of Evaluation

Method

Class Participation

Integration

The instructor may incorporate in-class activities as a means of participation to evaluate students' comprehension of the material and their ability to apply key learning objectives. For example, before introducing polar equations, students will engage in discussions on evaluating trigonometric functions. The instructor will then review their work, confirm their understanding of the process, and provide constructive feedback to strengthen their learning.

Method

Class Work

Integration

Students will be given a worksheet as part of the classwork, aimed at helping them review and reinforce their understanding of trigonometric identities. After completing the exercise, the instructor will provide the correct answers along with the supporting work, and students will then grade and correct their own assignments. This will be followed by a reflection to ensure they have thoroughly grasped the material.

Method

Group Projects

Integration

The instructor may assign group or individual projects to offer focused feedback, helping students deepen their understanding of key learning objectives. For example, students could be tasked with completing the square of an expression, requiring them to clearly demonstrate each step from start to finish. They will then present their solutions and explain their reasoning. The class will engage in a discussion, asking questions and reflecting on the importance of mastering this concept for success in the Calculus II course. To assess their performance, the instructor will provide a brief summary, commending their efforts and offering any necessary corrections.

Method

Quizzes

Integration

Quizzes may be administered to assess students' proficiency in solving different types of differentiation problems. Each problem will be evaluated for completeness and accuracy, with scores assigned according to a point-based grading scale.

Method

Oral Presentation

Integration

Presentations will be incorporated to assess students' understanding and recognition of the importance of diversity, inclusion, and equity in the classroom. The instructor will evaluate based on students' level of participation, the depth of their insights, and their ability to link their reflections to their personal experiences.

Assignments

Assignment Type

Writing

In-class and/or outside of class

In-class

Formative or Summative

Summative

Assignment

Create a "Study Poster" that includes all derivative rules such as the Power Rule, the constant multiple, sum and difference rule, product rule, quotient rule, chain rule, and the derivatives of all basic functions. Use color, visual images, and varied font sizes to emphasize important ideas in your own words. Also, include worked-out examples of each type of derivative rules.

Assignment Type

Writing

In-class and/or outside of class

In-class

Formative or Summative

Formative

Assignment

Solve the following limit problems. For problems that require L'Hôpital's Rule, indicate when and why you are applying it.
Evaluate the following limits:
1. \lim_{x \to 3} (2x + 5)
2. \lim_{x \to -2} (x^2 + 4x + 4
3. \lim_{x \to 1} \frac{x^2 - 1}{x - 1}
4. \lim_{x \to 0} \frac{\sin(5x)}{x}
5. \lim_{x \to 0} \frac{e^x - 1}{x}
6. \lim_{x \to 0} \frac{\tan(x)}{x}
7. \lim_{x \to \infty} \frac{3x^2 + 5}{2x^2 - 4x + 1}
8. \lim_{x \to -\infty} \left(2 - \frac{1}{x}\right)
9. \lim_{x \to 1} \left(\sqrt{x + 3} - 2 \right)
10. \lim_{x \to 0} x^2 \sin\left(\frac{1}{x}\right) = 0

Bonus: Provide a brief explanation of how the Squeeze Theorem applies.
\lim_{x \to 0} \frac{x^3}{\sin(x^3)}

Assignment Type

Writing

In-class and/or outside of class

In-class

Formative or Summative

Formative

Assignment

Part A: Basic Integration
Integrate the following functions:
1. \(\int (3x^2 + 5) , dx\)
2. \(\int (5/x^3) , dx\)
3. \(\int (7 \sin(x)) , dx\)
4. \(\int (e^{2x}) , dx\)
5. \(\int (sec x tan x) , dx\)

Part B: U-Substitution
For the following integrals, use a substitution to find the solution. Be sure to define your substitution clearly and show all steps.
6. \(\int (2x) \cos(x^2) , dx\)
7. \(\int (3x^2 + 1) e^{(x^3 + x)} , dx\)
8. \(\int \frac{x}{\sqrt{x^2 + 1}} , dx\)
9. \(\int (5x^4) \cdot (x^5 + 1)^6 , dx\)
10. \(\int \sin(2x) \cos(2x) , dx\)

Bonus Problem
Solve the following integral using either basic integration or a substitution:
\(\int (x^3 + 2x)^{10} \cdot (3x^2 + 2) , dx\)

Assignment Type

Writing

In-class and/or outside of class

In-class

Formative or Summative

Formative

Assignment

Decompose the following rational functions into partial fractions. Show all your work including setting up the equations and solving for the constants. Compare your answers with the answer key provided.
a. \frac{3x + 5}{(x + 1)(x^2 + 2)}
b. \frac{4x^2 + 3x + 1}{(x - 2)(x^2 + 1)}
c. \frac{4x^2 + 3x + 1}{(x - 2)(x^2 + 1)}
d. \frac{2x^2 + 3x + 1}{(x + 1)(x^2 - x + 1)}
e. \frac{2x^2 + 3x + 1}{(x + 1)(x^2 - x + 1)}
f. \frac{5}{(x^2 + 4)(x - 1)}

Assignment Type

Reading

In-class and/or outside of class

In-class

Formative or Summative

Formative

Assignment

1. Read the Article: “The Importance of Diversity in Mathematics” by the Mathematical Association of America (MAA) https://blogs.ams.org/matheducation/2017/03/06/six-ways-mathematics-instructors-can-support-diversity-and-inclusion/
Take notes on key points, particularly those that highlight the benefits of diversity in mathematical research and education.

2. Reflect on the article and consider the following questions as you read:
-What are the main arguments presented in the article regarding the importance of diversity in mathematics?
-How does diversity contribute to innovation and problem-solving in mathematics?
-What challenges are mentioned in the article that hinder diversity and inclusion in the field?

3. Participate in the Discussion:
-Prompt 1: Share one key takeaway from the article and explain why it stood out to you.
-Prompt 2: Discuss a specific example from the article where diversity led to a positive outcome in mathematics. How can we apply similar principles in our own math club or classroom?
-Prompt 3: Identify a challenge to DEI mentioned in the article. What strategies can we implement to overcome this challenge within our community?
-Prompt 4: Share any personal experiences or observations related to DEI in mathematics with the group.

4. As a group, brainstorm and develop an action plan to promote DEI in our math classroom. Consider activities, events, or initiatives that can help create a more diverse and inclusive environment for all students.

Course Materials

Textbooks

Cohen, David; Lee, Theodore B. ; Sklar, David (2017). Precalculus, 7th Cengage. ISBN: 13: 9781305663107
Stewart, J., et al. (2021). Calculus: Single Variable Calculus Early Transcendentals. 9th ed.: Cengage. ISBN: 13: 9780357022269
Hass, J., et al. (2023). Thomas' Calculus: Early Transcendentals. 15th ed.: Pearson. ISBN:13: 9780137728657

Open Educational Resources

Abramson, J. P. (2021). Precalculus 2E. OpenStax. ISBN 978-1-951693-39-8 - Web Version updated on Jun 16, 2025.
Strang, G (2022), Calculus Volume 1. OpenStax. ISBN-13: 978-1-947172-13-5

Class Size Information

Class Size

30

Class Size Category

C - Remedial or advanced math 30

Diversity and Inclusion

Course Design and Materials: Course will incorporate diverse perspectives, authors, and examples that reflect a variety of cultures, identities, and lived experiences. Instructional materials will be reviewed regularly to ensure representation, inclusivity, and alignment with equity-minded practices across disciplines.

Inclusive Learning Environment: Instructors will establish classroom norms and policies that promote respect, civil discourse, and belonging in both online and face-to-face classes. Clear expectations for communication and engagement will support a learning space where all students feel valued and heard.

Accessible Instruction: Course content will be delivered using accessible design. Materials will follow accessibility guidelines within the CMS, including captioned media, readable document formats, and multiple means of engagement to support diverse learning.

Equitable Teaching Practices: Instructors will use transparent and grading criteria, varied assessment methods, and timely feedback to promote fairness and student success. Opportunities for revision, reflection, and multiple demonstrations of learning may be incorporated when appropriate to the discipline.

Culturally Responsive Pedagogies: Instructional strategies will encourage critical thinking about diverse perspectives and systems of power relevant to the course content. Faculty will foster opportunities for students to connect course material to real-world contexts.

Ongoing Reflection and Improvement: Faculty will engage in continuous professional development related to IDEAA principles and reflect on course practices using metacognition to identify opportunities for increased equity, inclusion, and accessibility.

Explain how diversity and inclusion(e.g., gender, culture/race, sexuality, etc.) is infused into the course.

The content highlights and includes affective learning skills revolving around metacognitive reflections on diversity and inclusion in mathematics. Assignments include readings and discussions around the implementation of diversity and inclusion in the classroom, while the method of evaluation will provide an opportunity for the instructor to ensure students appreciate diversity in mathematics. The objectives include formulating strategies to promote a diverse and inclusive learning environment.

Describe how assignments, instruction, evaluation, course content, and interactions are contextualized for diverse learners promoting an equitable course.

We have incorporated a variety of assignments that include formative, summative, reading, and writing. The methods of evaluation have also been designed to allow for a variety of assessments such as quizzes, discussions, and group work. Also, an OER textbook is included which promotes equity by significantly lowering the cost of taking the course and removing additional barriers for learners.

Interactions

Explain how the course will incorporate student-to-student interaction.

Students will interact with each other through in-class discussions on different topics. Students will answer each other's questions and share their diverse perspectives as well as relevant outside information related to the course. Group activities may be used to develop a deeper understanding of topics and provide opportunities for collaboration while centering student voices. For example, students could work together in a group to compare the evaluation of a limit graphically and numerically.

Explain how the course will incorporate instructor-to-student interaction.

The instructor will introduce the course material, explain concepts and relationships between concepts, and demonstrate the techniques for solving problems. Instructor will grade the assignments according to the rubric and provide timely feedback on all assessments. For example, the instructor can lecture on limits of functions using various techniques before introducing improper integrals.

Explain how the course will incorporate student-to-content interaction.

Students will interact with accessible materials such as the textbooks, written lecture materials or transcripts of lectures, illustrative images, charts and graphs, video or audio lectures. In-class activities will allow students to practice content material such as graphing and analyzing conic sections.

Explain how the course will incorporate student-to-self interaction (metacognitive).

This course incorporates metacognition by encouraging students to actively monitor and modify their thought processes. For example, after reviewing rules of differentiation students will reflect on the proper way of applying each rule and will be encouraged to develop an appropriate strategy to find the derivative of a function.

Key: 3185