MATH-135: CALCULUS FOR SOCIAL SCIENCE AND BUSINESS

Effective Term
Fall 2023

BOT Approval Date
06/23/2022

Discipline
MATH - Mathematics
Course Number
135

Course Title
Calculus for Social Science and Business

Short Title
Calculus for Social Sci/Bus

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

Units

Lecture Units
3.00

Total Units
3.00

Hours

Lecture Contact Hours
48-54
Out of Class Hours Lecture
96-108

Total Contact Hours
48 - 54

Total Out of Class Hours
96 - 108

Total Student Learning Hours
144 - 162

Distance Education
Yes

Distance Education

Distance Education Type
Both Fully Online and Hybrid Online

Fully Online Delivery Requirements:
a. Students must be notified via the college schedule of classes and the syllabus for the class if proctored tests are required for this course
b. Any planned face-to-face meetings, such as an orientation or study session, must be optional

c. The MSJC curriculum committee requires the use of accessible, asynchronous discussion as a component of every fully online course

Are you using publisher content?
Yes

Attach VPAT
VPAT - Calculus Accessibility Conformance Report WCAG Edition.pdf

Regular Substantive Interaction
Instructor-to-student, student-to-student, and student-to-content contact shall be distributed in a manner that will ensure regular substantive interaction (RSI) is maintained not only weekly but also for the duration of the course. Instructor interactions should be equivalent in time, quality and consistency to the engagement students would receive in a face-to-face course—for example, through announcements, discussion participation, personalized feedback, video messages, or other instructional communications. Instructors are expected to be responsive to student inquiries within a 24-72 hour time frame excluding holidays. RSI will be maintained through a variety of methods: • Orientation - Students must be oriented to the online and face-to-face portions at the start of the course. • Announcements - Announcements using the course management system must be posted at least weekly to keep students current on course events, due dates, materials, etc. • Discussion Forums - Content-related discussion forums within the designated CMS will include appropriate instructor participation and will be initiated and maintained, with timely feedback provided. Instructors are required to monitor the discussions and related activities to provide guidance and direction. Open-ended discussion boards may be used to further learning and interaction. • MSJC Communication – Instructor will use MSJC-administered communication tools (such as email or the designated CMS communication tools) to regularly communicate with and provide ease of access to students. • Timely Feedback - Timely feedback on student work will be provided by the instructor, which may include comments and/or rubrics, within the Grades area of the designated CMS. • Scheduled Meetings – Hybrid and synchronous courses will meet at regularly scheduled times. ADA Compliance - All course interactions and content must be designed with accessibility in mind and meet ADA requirements.

C-ID (Admin Only)
C-ID MATH 140

Catalog Description
This course covers functions and their graphs, including exponential and logarithmic functions, limits, differentiation and integration with emphasis placed on the application of these concepts to social science, economics, business and management related problems.

Requisites

Prerequisite(s)

Prerequisite(s) (must be taken before)
MATH-105 (with a grade of C or better) or appropriate placement into MATH-135.

Codes

TOP Code (CB 03)
1701.00 - Mathematics, General

CIP Code
27.0101 - Mathematics, General.

Repeatability Code
No

Grading Option
Letter grade OR P/NP

GE Information

Check GE Types Requested
AA/AS G - Math Competency

Cal-GETC Areas

Approved Cal-GETC Area
AREA-2

Learning Objectives

Learning Objectives

Learning Objective
1. Formulate limits using numerical or graphical data;
2. Evaluate limits to determine whether a function is continuous at a given value;
3. Formulate the derivative utilizing the difference quotient;
4. Compute derivatives utilizing the Power, Sum, Difference, Product, Quotient and Chain rules;
5. Evaluate derivatives to find rates of change and tangent lines.
6. Calculate derivatives of polynomial, rational, exponential, and logarithmic functions;
7. Analyze and compute the marginal cost, profit and revenue of an appropriate function;
8. Construct graphs of functions using horizontal and vertical asymptotes, intercepts, first and second derivatives to determine intervals of increase, decrease, and concavity, including maximum and minimum values, and inflection points;
9. Derive maxima and minima in optimization problems using derivatives;
10. Analyze revenue, cost and profit of real-world companies from diverse cultures and historically marginalized groups using calculus;
11. Evaluate definite and indefinite integrals by using the general integral formulas, u-substitution, and other integration techniques;
12. Calculate integrals to investigate business and economics applications using examples from different cultures and socioeconomic backgrounds.

Learning Outcome Information

Course Learning Outcomes

Learning Outcome
1. Students will understand, write, and communicate information symbolically, visually, and numerically with clarity and precision.
2. Evaluate and synthesize evidence from a business or Economics application to draw valid conclusions.
3. Implement a solution that thoroughly addresses multiple contextual factors of the problem.

Program Learning Outcomes

Learning Outcome
1. Students will develop problem-solving and scientific and technological modeling skills to solve mathematical problems. They will be able to reflect on their own thoughts, question and propose problems, and apply past knowledge to new situations.
2. Students will develop the ability to think critically, independently, as well as interdependently, express ideas concisely, and reason logically.
3. Students will be able to synthesize ideas and apply mathematical reasoning and logic to relevant real-world applications.
4. Students will be able to understand, write, and communicate mathematical information symbolically, visually, and numerically with clarity and precision.
5. Students will be able to refine understanding of mathematical concepts by discussion and explanation with other students from different kinds of backgrounds, including different socioeconomic backgrounds, different cultures, different ethnic backgrounds, as well as at-risk students.

Institutional Learning Outcomes

Critical Thinking: The student will analyze problems, gather and synthesize relevant information, evaluate ideas, information, and evaluate alternative points of view to create, innovate and implement effective solutions.
Cultural Awareness and Humility: The student will demonstrate knowledge of and sensitivity toward individuals of diverse ethnicity, age, gender, sexual orientation, and religious affiliations, as well as toward those individuals with diverse abilities and socio-economic classes to respectfully interact with individuals of diverse perspectives, beliefs and values while being mindful of the limitation of their own cultural frameworks.

Scientific Awareness: The student will apply the scientific method of inquiry to assess potential solutions for real-life challenges by employing science-based knowledge and methodologies in daily life.
Personal
and Professional Responsibility
Civic

Content

Course Lecture Content

1. Functions
   a. Linear Functions
   b. Nonlinear Functions
   c. Exponential Functions
   d. Logarithmic Functions
2. Limits
   a. Numerical and Graphical Approaches
   b. Properties of Limits
   c. Continuity
   d. Average Rates of Change
   e. Increments and Tangent lines
3. Differentiation
   a. Limit of the Difference Quotient
   b. The Power Rule and the Sum-Difference Rule
   c. The Product Rule and the Quotient Rule
   d. The Chain Rule
   e. Differentiation of Exponential Functions
   f. Differentiation of Logarithmic Functions
   g. Higher-order Derivatives
   h. Implicit Differentiation
4. Applications of the Derivative
   a. Intervals of Increasing and Decreasing
   b. Relative Maxima and Minima
   c. Absolute Maxima and Minima
   d. Sketching Graphs using First and Second Derivatives
   e. Optimization Problems
   f. Business and Economics Applications of Different Cultures, Historically Marginalized Groups and Socioeconomic Backgrounds
   g. Marginals and Differentials
   h. Elasticity of Demand
5. Integration
   a. Antidifferentiation
   b. Antidifferentiation as Area
   c. Approximating Definite Integrals as a Sum
   d. Definite and Indefinite Integrals
   e. Properties of Definite Integrals
   f. Integration by u-Substitution
   g. Integration by Parts
   h. Integration using Tables
6. Applications of Integration
   a. Economics: Consumer and Producer Surplus
   b. Area between curves
   c. Growth and Decay
   d. Improper Integrals
   e. Business and Economics Applications of Different Cultures, Historically Marginalized Groups and Socioeconomic Backgrounds
7. At Least One of the Following Topics:

a. Probability
b. Volume
c. Functions of Several Variables
    i. Partial Derivatives
    ii. Maxima and Minima Problems
    iii. Least Squares Technique
    iv. Constrained Optimization

Methods of Instruction

Method

Discussion

Integration

Instructors will guide the class in discussions on how to formulate derivatives utilizing the Power, Sum-Difference, Product, Quotient and Chain rules, and evaluate definite and indefinite integrals utilizing different methods of integration. Instructors will encourage student interaction to discuss business and economics applications using examples from different countries and of different socioeconomic backgrounds.

DE Adaptations for MOI

Instructors will guide the class in discussions on how to formulate derivatives utilizing the Power, Sum-Difference, Product, Quotient and Chain rules, and evaluate definite and indefinite integrals utilizing different methods of integration. Instructors will encourage student interaction to discuss business and economics applications using examples from different countries and of different socioeconomic backgrounds.
Course discussions are asynchronous using accessible CMS tools such as discussion boards or synchronous via accessible video conferencing tools. Instructor feedback can be posted in the gradebook comments and/or in the discussions.

Method

In-class Exercises

Integration

In-class exercises will allow students to develop a better understanding of how to formulate limits using numerical or graphical data, use the limit to identify whether a function is continuous at a given domain value and to formulate derivatives of exponential and logarithmic functions.

DE Adaptations for MOI

Exercises in the CMS will allow students to develop a better understanding of how to formulate limits using numerical or graphical data, use the limit to identify whether a function is continuous at a given domain value and to formulate derivatives of exponential and logarithmic functions.
Exercises are posted using accessible CMS tools such as course pages and/or delivered synchronously via accessible video conferencing tools. Instructor feedback can be posted in the gradebook comments and/or during synchronous meetings.

Method

Lecture

Integration

Instructors will lecture to model effective problem-solving strategies, and form the foundation for students to learn how to formulate and evaluate derivatives to solve optimization problems, analyze marginal cost, marginal revenue and marginal profit, and elasticity of demand. Instructors will also lecture to construct graphs of functions using horizontal and vertical asymptotes, intercepts, first and second derivatives to determine intervals of increase, decrease, and concavity, including maximum and minimum values, and inflection points.
Lecture will support the infusion of student feedback and interaction with the instructor.

DE Adaptations for MOI

Instructors will lecture to model effective problem-solving strategies, and form the foundation for students to learn how to formulate and evaluate derivatives to solve optimization problems, analyze marginal cost, marginal revenue and marginal profit, and elasticity of demand. Instructors will also lecture to construct graphs of functions using horizontal and vertical asymptotes, intercepts, first

and second derivatives to determine intervals of increase, decrease, and concavity, including maximum and minimum values, and inflection points.
Lectures will be delivered in accessible written or video format and presented by the instructor in the CMS using accessible course pages and/or synchronously using accessible video conferencing tools.

Method

Activity

Integration

Students will work in groups of 3 to 4 people to apply derivatives in optimization problems to minimize costs, maximize revenues and profits, and integrals to analyze consumer surplus and producer surplus for companies from different cultural origin. Students will work in groups to apply different method of integration to compute accumulated future and present values for individuals of different economic backgrounds.

DE Adaptations for MOI

Students will work in groups of 3 to 4 people to apply derivatives in optimization problems to minimize costs, maximize revenues and profits, and integrals to analyze consumer surplus and producer surplus for companies from different cultural origin. Students will work in groups to apply different method of integration to compute accumulated future and present values for individuals of different economic backgrounds.
Group activities will use a variety of CMS tools including but not limited to accessible group pages, group discussions and group conversations. Synchronous group interactions will take place via accessible video conferencing tools. Instructor feedback can be posted in the gradebook comments and/or in the discussions.

Methods of Evaluation

Method

Exams/Tests

Integration

Exams will be used as required summative assessments and will be graded on completeness, clarity and precision. Students will be evaluated on their ability to understand, write, and communicate mathematical information symbolically, visually, and numerically. Students will be evaluated for their conceptual understanding and correct computation of limits, derivatives and integrals, and analysis of these tools to applications in business and economics.

DE Adaptations for MOE

Exams will be used as required summative assessments and will be graded on completeness, clarity and precision. Students will be evaluated on their ability to understand, write, and communicate mathematical information symbolically, visually, and numerically. Students will be evaluated for their conceptual understanding and correct computation of limits, derivatives and integrals, and analysis of these tools to applications in business and economics.
Exams and/or tests are delivered online within the CMS and submitted via the CMS. Exam/test grades are delivered privately to students via the CMS and instructor feedback will be provided within the CMS within a week form the exam's due date.

Method

Class Work

Integration

Class work will be used as a formative assessment and will be graded individually on their correctness. Students will work either individually or in groups. Students will be evaluated on their ability to apply derivatives to solve optimization problems and integrals to analyze consumer surplus and producer surplus for companies from different cultural origin. Students will also be graded on the application of correct integration techniques to compute accumulated future and present values for individuals of different economic backgrounds.

DE Adaptations for MOE

Class work will be used as a formative assessment and will be graded individually on their correctness. Students will work either individually or in groups. Students will be evaluated on their ability to apply derivatives to solve optimization problems and integrals to analyze consumer surplus and producer surplus for companies from different cultural origin. Students will also be graded on the

application of correct integration techniques to compute accumulated future and present values for individuals of different economic backgrounds.
Evaluation of student or group work is done by observing their work posted in the CMS. Written instructor feedback are returned to the student/group via CMS within a week from the due date. Rubrics and clear instructions are provided via the CMS.

Method

Homework

Integration

All homework will be used as formative assessments and will be graded on completeness and accuracy. Students will be graded on their ability to accurately evaluate limits, derivatives and integrals.
Students will also be evaluated on correctly graphing functions using horizontal and vertical asymptotes, intercepts, first and second derivatives to determine intervals of increase, decrease, and concavity, including maximum and minimum values, and inflection points.

DE Adaptations for MOE

All homework will be used as formative assessments and will be graded on completeness and accuracy. Students will be graded on their ability to accurately evaluate limits, derivatives and integrals.
Students will also be evaluated on correctly graphing functions using horizontal and vertical asymptotes, intercepts, first and second derivatives to determine intervals of increase, decrease, and concavity, including maximum and minimum values, and inflection points.
Homework assignments are submitted through the CMS and are evaluated via rubric and/or individual instructor feedback in the CMS within a week from the due date.

Method

Quizzes

Integration

Quizzes will be used as formative assessments and will be graded on completeness and accuracy. Students will be evaluated on computing derivatives using differentiation rules and apply them to analyze and compute marginal cost, profit and revenue of a given function.
Students will be also graded on evaluating integrals and use them to investigate business and economics applications.

DE Adaptations for MOE

Quizzes will be used as formative assessments and will be graded on completeness and accuracy. Students will be evaluated on computing derivatives using differentiation rules and apply them to analyze and compute marginal cost, profit and revenue of a given function.
Students will be also graded on evaluating integrals and use them to investigate business and economics applications.
Quizzes are submitted via the CMS. Quizzes feedback and grades are delivered privately to students via the CMS within a week from the due date.

Method

Self-Evaluation

Integration

Self-evaluation essays will be used as formative assessments and will be graded on thoughtfulness, completeness of self-reflection, application of critical thinking and clarity of presentation. Students will reflect on study skills and habits to be successful in math classes. Students will recognize their personal growth by analyzing how math concepts are used in applications in business and economics.

DE Adaptations for MOE

Self-evaluation essays will be used as formative assessments and will be graded on thoughtfulness, completeness of self-reflection, application of critical thinking and clarity of presentation. Students will reflect on study skills and habits to be successful in math classes. Students will recognize their personal growth by analyzing how math concepts are used in applications in business and economics.
Self-Evaluation Essays will be submitted via the CMS as an assignment. Instructor will provide feedback and grades in the CMS within a week from the due date.

Method

Final Performance

Integration

The final exam will be used as a required summative assessment and will be graded on accuracy and completeness. Students will be evaluated on course objectives such as evaluating limits, derivative and integrals and constructing graphs of functions using calculus techniques. Students will be also evaluated on their ability to apply calculus concepts to marginal analysis, optimization problems, elasticity of demand, and consumer and producer surplus.

DE Adaptations for MOE

The final exam will be used as a required summative assessment and will be graded on accuracy and completeness. Students will be evaluated on course objectives such as evaluating limits, derivative and integrals and constructing graphs of functions using calculus techniques. Students will be also evaluated on their ability to apply calculus concepts to marginal analysis, optimization problems, elasticity of demand, and consumer and producer surplus.
The final exam is delivered online within the CMS, and submitted via the CMS. The final exam grades are delivered privately to students via the CMS and instructor feedback will be provided within the CMS within a week from the due date. Final course grade will only be available requesting a transcript or using SelfService.

Assignments

Assignment Type

Other

In-class and/or outside of class

Outside of class

Formative or Summative

Formative

Assignment

Use Google Finance online at https://www.google.com/finance/ to access the world stock market in real time. Select a company of your choice and access the latest five-day summary using the 5D tab. For each of the five days, record the stock quote reported at 10 am, and compute the average rate of change from one day to the next. On what day did the company show the greatest rate of increase? On what day did it show the greatest rate of decrease?

How assignment will be adapted in online format

Use a content rich editor program with a math based symbol bank to type it out and submit it through the CMS, or Scan your answer either with a scanner or your phone and submit it as a pdf through the CMS. Instructor feedback can be posted in the gradebook comments and/or in the discussions within a week from the due date.

Assignment Type

Writing

In-class and/or outside of class

In-class

Formative or Summative

Summative

Assignment

Solve the following problems and show your work:

1. Find the following limits:
(a) lim (x^2 + 8x + 7)

x#3
(b) lim sqrt(x^2-16)
x#−5

2. Differentiate:
(a) y= (x^2-3x+1)^3
(b) f(x)=3 ln(x)+sqrt(x)
(c) g(x)= 2e^x+2/x^3

3. Integrate the following functions
(a) y= 3/x+4/x^2
(b) y=e^(2x)
(c) y=4x^3+5 from x=1 to x=2

4. Consider the price p = D(x) = x^2-10x+25, in dollars per unit, that the consumer is wiling to pay for x units of an item, and the price p = S(x) = x^2 + 2x + 1, in dollars per unit, that the producer is willing to accept for x units. Find the equilibrium point, the consumer surplus at the equilibrium point, and the producer surplus at the equilibrium point.

5. Find the maximum profit and the number of units that must be produced and sold in order to yield the maximum profit. Assume that the revenue, R(x)= 52x − 0.5x^2, and the cost, C(x) = 22x − 1 are in thousands of dollars, when x units are produced and sold.

6. Consider the demand function q = D(x) = 120-5x, where x is the price per unit in dollars. First, find the elasticity function in terms of x. Then, compute the elasticity when the unit price is x = 10 and when the unit price is x = 14. For each case, state whether the demand is elastic or inelastic, and whether the total revenue is increasing or decreasing. Justify your answer.

7. Following the birth of a child, a parent wants to make an initial investment that will grow to $50, 000 by the child's 25th birthday. Interest is compounded continuously at 6%.
What should the initial investment be? Round to the nearest cent.

8. At age 27, Amanda accepts a position as vice president of a company. Assume that she will retire at the age of 60, having received an annual salary of $125, 000, and that the interest rate is 5%, compounded continuously. What is the accumulated future value of her position? Round to the nearest cent.

9. For the function f(x) = 2x^3 - 6x^2 + 7, determine the following:
(a) the intervals where the function is increasing and decreasing;
(b) the maximum and minimum points;
(c) the intervals of concavity;
(d) the inflections points;
(e) use the information from parts (a) through (d) to sketch the graph of f(x).

How assignment will be adapted in online format

Write this down using a content rich editor program with a math based symbol bank to type it out and submit it through the CMS, or Scan your answer either with a scanner or your phone and submit it as a pdf through the CMS. Instructor feedback can be posted in the gradebook comments in the CMS within a week from the due date.

Assignment Type

Writing

In-class and/or outside of class

Outside of class

Formative or Summative

Formative

Assignment

For this assignment, choose a historically marginalized group. Use the internet to research the number of people from your chosen group that earned a bachelor's degree in the United States in 1980 and in 2020. Determine an exponential function that fits the data, and specify the exponential growth rate, rounded to the nearest hundredth of a percent. Then use the exponential function to predict

the number of people in your chosen group that will earn a bachelor's degree in 2030. Write an analysis on how the number of people in your chosen group has changed throughout the years. Specify the internet source of your data.

How assignment will be adapted in online format

Use a content rich editor program with a math based symbol bank to type it out and submit it through the CMS, or Scan your answer either with a scanner or your phone and submit it as a pdf through the CMS. Instructor feedback can be posted in the gradebook comments and/or in the discussions within a week from the due date.

Assignment Type

Reading

In-class and/or outside of class

In-class
Outside of class

Formative or Summative

Formative

Assignment

Read the section on Consumer Surplus and Producer Surplus in your textbook at home. Be ready to discuss in class how the equilibrium point is reached, and how to compute the consumer surplus and producer surplus using techniques of calculus.

How assignment will be adapted in online format

Read the section on Consumer Surplus and Producer Surplus in your textbook at home. You will engage in a discussion with your peers in the CMS environment on how the equilibrium point is reached, and how to compute the consumer surplus and producer surplus using techniques of calculus. Instructions will provide feedback and grades through the CMS within a week from the due date.

Course Materials

Textbooks

Bittenger, Ellenbogen, Surgent and Kramer (2020). Calculus and its Applications, 12th Edition, Publisher: Pearson. ISBN: 10: 0135164885 and ISBN-13: 978-0135164884

Open Educational Resources

Calaway, Hoffman, Lippman (2014), Applied Calculus (OpenTextBookStore), available at http://www.opentextbookstore.com/details.php?id=14 and free in pdf format http://www.opentextbookstore.com/appcalc/appcalc.pdf

Class Size Information

Class Size

40

Class Size Category

A - Lecture/discussion 40

Diversity and Inclusion

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

In the objectives and course content, we included business and economics applications of multicultural, historically marginalized and socio-economic backgrounds. In the method of instructions and evaluations, discussions and in-class group activities will give students the opportunity to discuss business and economics applications using examples from different countries, historical marginalized groups and socioeconomic backgrounds. In assignments, students will investigate companies of different socio-economic backgrounds to analyze the rates of increase or decrease of their stock values. Assignments will be also used to deduce exponential functions and growth rates of the number of people from a historically marginalized group to earn a bachelor's degree.

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

To better support diverse learners, we incorporated formative and summative active learning strategies and included in-class and out-of-class assignments that explored content material through the lens of equity and diversity. In instructions, we have specified that discussions and class activities are spaces in which students can bring in their own cultural experiences through the application of mathematical concepts. The methods of evaluation feature the necessity of formative and summative assessments that align with the revised course objectives and content. Discussions, group activities, and lectures have been revised to support the infusion of student feedback and interaction with the instructor. The DE addendum includes the use of content rich editor program with a math based symbol bank, which reads math symbols and formulas for visually challenged students. The course materials have been revised to include an OER option.

Interactions

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

For both face-to-face and online modalities, group work will give students the opportunity to collaborate on application of derivatives to solve optimization problems and application of integrals to analyze consumer surplus and producer surplus for companies from different cultural origin. In both modalities, students will be given frequent opportunities to engage in peer-to-peer discussions designed to foster community and encourage students to experience business and economics applications from different countries and of different socioeconomic backgrounds.

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

In both face-to-face and online modalities, instructors will use discussions to interact with students asking them to graph functions using horizontal and vertical asymptotes, intercepts, first and second derivatives to determine intervals of increase, decrease, and concavity, including maximum and minimum values, and inflection points. Instructors will clarify concepts, pose questions, and or/ encourage students to make connections between course concepts and their application in business and economics.

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

In both face-to-face and online modalities, students will reference accessible materials such as textbooks, written lecture materials or transcripts of lectures, illustrative images, charts and graphs, video or audio lectures. In-class exercises and/or at-home assignments will allow students to practice content material such as evaluating limits, computing derivatives and integrals using different techniques, and applying calculus concepts to applications in business and economics.

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

In both face-to-face and online modalities, students will use self-evaluation essays to reflect on study skills and habits to be successful in math classes. Students will recognize their personal growth by analyzing how math concepts are used in applications in business and economics. The course emphasizes thinking flexibly and considering different method of solutions by engaging in discussions, assessments, and writing activities.

Key: 2100