



Center International Programs & Sustainability Studies

Course name: Foundations of Single-Variable Calculus

Course code: MATH 1231

Total contact hours: 48

Pre-requisites: Introduction to Calculus

COURSE DESCRIPTION

Learn to perform differentiation, optimization, and integration like you have never seen before. Students will learn calculus by analyzing case studies, participating in round tables, conducting research, and with many more tools.

COURSE PRE-REQUISITES

Introduction to Calculus: concepts such as factorization, functions, equation-solving techniques, and graph interpretation of functions are required to take Calculus of Functions in One Variable I effectively.

AUDIENCE

This course is structured for international students attending the Study Abroad Program at an LCI Education university campus who are students looking to pursue a career in any branch of basic sciences and engineering. However, courses are not exclusive to foreigners so local degree-seeking students may enroll in this course. Some of the courses are also taught in Spanish as part of our Bachelor's in Sustainability Management or Business Administration programs.

This is a theoretical-practical course and explores/responds to the following inquiry according to the professional/disciplinary profile:

How to apply derivatives and integrals to understand rates of change, function graphs, and optimization by performing collaborative work and research?

In order to respond this question, we will study the following generative topics:

- Limit concepts and techniques
- Continuity
- Differentiation rules
- Rate of change concepts
- Chain rule
- Function graphs
- Optimization
- Anti-derivative
- Integral techniques

Along the course, the following **skills** will be fostered:

- Ability to solve limits, derivatives, and integrals.
- Application of optimization to real-life cases.
- Utilization of derivatives and integrals to solve real problems.

Among the **values** and **attitudes** that will be promoted among students are the following:

- Teamwork and leadership.
- Systemic thinking.
- Logical and communicative intelligence.
- Problem solving.
- Learning how to learn.
- Thinking outside the box.

- Learning to apply theoretical concepts.

COMPETENCIES, CRITERIA AND EVIDENCE

The competencies for the Veritas University are reflexive and integral actions that respond to the professional profile and to the problems of the context, with suitability and ethical commitment, integrating the know-how, and the knowledge to know in a perspective of improvement.

Below are both the disciplinary and general competencies, linked to their criteria and evidence of performance for this course.

Competencies	Key competencies	Learning Assessments
Specific		
Applies the theoretical-practical foundations of calculus to address problems in various areas of basic sciences, according to modern research standards.	○ Comprehends the basic concepts and procedures of calculus.	○ Oral presentations. ○ Mind maps.
	○ Applies techniques and methods of research considering current tools.	○ Reports. ○ Research. ○ Presentation of results.
	○ Utilizes calculus concepts and procedures to solve research questions.	○ Case studies. ○ Discussions. ○ Presentations.
General/Core		
Integrates knowledge, skills and attitudes to learn continuously and through one's life pursuing an efficient	○ Learning to learn.	○ Report. ○ Research. ○ Discussions. ○ Case studies.

development in the knowledge-based society.		
Integrates the necessary knowledge, skills and attitudes to learn interpersonal communication techniques.	<ul style="list-style-type: none"> ○ Relates well to others ○ Manage and solve conflicts. ○ Negotiates reliably and empathetically ○ Speaks responsibly ○ Listens attentively. 	<ul style="list-style-type: none"> ○ Round table. ○ Reports. ○ Presentation of results. ○ Research.
Builds the necessary knowledge, skills and attitudes to learn how to communicate orally and in written form in the different disciplines that make up the curriculum.	<ul style="list-style-type: none"> ○ Communicates thoughts of the discipline orally, graphically, and in written form. 	<ul style="list-style-type: none"> ○ Presentations. ○ Mindmaps.

CONTENT

Unit I. Limits and Continuity

- Limit concept.
- Limit technique.
- Infinity and limits.
- Properties of continuity and types of discontinuity.

Unit II. Derivatives

- Derivative concept.
- Differentiation rules.

- Derivatives of products, quotients, trigonometric functions, logarithms, exponentials, and inverse functions.
- Rate of change.
- Chain rule.
- Implicit differentiation.
- Extrema, mean value theorem.
- Graph analysis.
- Optimization.
- L'Hopital Rule.

Unit III. Integrals

- Anti-derivative.
- Areas under curve.
- Definite integral.
- Fundamental Theorem of Calculus.
- Integral techniques.

METHODOLOGY

The professor will instruct the course through guided lectures where concepts from all three units will be explained and demonstrated. Specific examples will be used to understand all concepts better and provide a tool for students to mimic in other activities. At the end of each unit, discussions will be held. In these spaces, the groups or individuals will be assigned case studies related to applications of Calculus concepts to solve in groups or individually as an assignment for a later date, where research will be a crucial point of emphasis. To present the results, each group will present orally to the rest of the class. In addition to the presentation, students will submit a written report to back up their work. After the presentations, there will be round tables to discuss the value of the techniques implemented and determine if the chosen route was the best. Students will create mind maps weekly to summarize the lessons and to gain insights about their learning process

specific to each subject. As a final assignment, students will create a written report containing an updated mind map for the entire course and a description.

EDUCATIONAL RESOURCES

In order to guarantee a good development of the course, therefore, to guarantee learning, the following resources are available: an updated bibliographic database, multimedia equipment that students can use for their individual presentations, whiteboards and other school equipment for weekly sessions, and readings provided by the educator. All of these complement the suggested projects and provide the students with higher possibilities of knowledge ownership. Most of the lessons will take place in the classroom.

During independent work periods students will be able to attend the institution. A campus library, study rooms, and computer labs are available for the students' independent work time. Free Wi-Fi connection for students, educators, and staff is provided on campus, which gives students the possibility to work not only in the library or computer labs, but also around campus.

LEARNING ASSESSMENT

Evaluation compiles and evaluates evidence by taking into account feedback providing pre-established criteria. The course evaluation must be aligned with the competencies and the teaching methodology. There is a rubric for each evaluation resource, and the details will be provided in **CANVAS LMS**. Even though the rubric grants a grade, it is also a quantitative and qualitative description of the students' performance. The rubrics include the core and discipline key competences.

ASSIGNMENTS	PERCENTAGE VALUE
Oral presentations to present the results of the case studies (3 in total)	20 %
Round tables (3 in total)	10 %

Written reports (3 in total)	30 %
Mind maps (12 in total)	20 %
Final assignment (1 in total)	20 %
Total	100%

LEARNING STRATEGIES AND RUBRICS

The following learning strategies will be developed:

1. Oral presentations:

This work aims to challenge the student in a public-speaking setting.

There will be three oral presentations throughout the course, which will be used to present the results of 3 separate case studies. The conclusion of each unit will assign each case study so that the case studies will be regarding specific topics for each unit. This method intends to showcase real-life scenarios where students must apply Calculus-related concepts.

These presentations will comprehend 20 % of the course, split equally across the three assignments for this specific evaluation.

2. Round tables:

These activities promote oral expression by creating a space to discuss topics, contrary to the more direct approach of oral presentations. However, the discussions will be centered around the group/individual presentations and will look to expand the conversation. Students will debate about specific points moderated by the professor: how useful Calculus tools were for solving the case study, other resources that could have been useful, and further technical questions related to each unit. These round tables will comprehend 10 % of the course, split equally across the three assignments for this evaluation.

3. Written reports:

In addition to the evaluations described in points 1 and 2, written reports will be requested to examine in a detailed way the methodologies applied by the students to solve the case studies. A specific structure will be required to assure quality. These reports will comprehend 30 % of the course, split equally across the three assignments for this particular evaluation.

4. Mind maps:

These methods will be used as the most frequent way of evaluating lessons learned and class practices. Students will have complete freedom to create mind maps in a way that better identifies their thought process when facing specific Calculus concepts. These maps will comprehend 20 % of the course, split equally across the three assignments for this particular evaluation and assigned at the end of the last lesson of each week.

5. Final assignment:

This assignment is designed to recapitulate and synthesize the contents of the course. The structure will be the same as the reports for the case studies. Given that the assignment will be a written report, the same rubric will be applied. It must include an updated mind map of the entire course and a description of the mind map with detailed information about each point highlighted. The value of this assignment will be 20 %.

ATTENDANCE

Regarding classes:

1. Students are only allowed a two (2) **non-consecutive (back-to-back) class absences**. A student shall fail the course if more than two absences are registered by the professor. Administration does not control attendance.

2. Three **late arrivals** to class (arrival after the first 15 minutes) are treated as one absence. Attending class 30 minutes late without an official justification will also count as an absence.
3. In the case of an **absence from any assignment evaluated in class** (presentations, evaluations, field trips, etc.) a student will be given a grade of zero unless an official document is presented within **one week** of the absence.
4. If a student presents an official document to excuse the absence, the missed assignment is to be presented on that same day.

Regarding field trips:

5. An unjustified **absence on a field trip** will immediately result in the loss of all points assigned to that specific trip. However, if an official document justifying the absence is presented, 50% of the assignment points may be obtained upon presentation of a complementary research assignment, to be agreed upon with the professor, within one week of the field trip.
6. An absence on a field trip may be justified should two course field trips coincide. In such a case, and to avoid losing points, students shall be able to opt for carrying out a research assignment.

CODE OF CONDUCT

Professors have the right to expel a student from the classroom should he / she/ they:

1. Be disruptive in the classroom.
2. Behave in a disrespectful way.
3. Be under the influence of alcohol.
4. Be under the influence of any illegal drug.
5. Shows hygiene or odor problems that may disturb other students.

ELECTRONIC DEVICES

The use of cell phones, smartphones, or other mobile communication devices is disruptive and is therefore prohibited during class. **Please turn all devices OFF and put them away** when class begins. Devices may be used only when the professor assigns a specific activity and allows the use of devices for internet search or recording. Those who fail to comply with the rule must leave the classroom for the remainder of the class period. Using devices while the professor or other peers are lecturing, or presenting is perceived as a lack of interest and disrespectful.

STUDY ABROAD PROGRAM POLICIES

The student must comply with the provisions of the Study Abroad Program Policies available on the Canvas platform.

BIBLIOGRAPHY

1. Calculus: Early Transcendentals (3rd edition) by S. Briggs, L. Cochran, B. Gillet, E. Schulz.
2. Cálculo 1 de una variable (2nd ed.) by Larson, R. and Edwards, B.

CHRONOGRAM

Week	Contents	Learning strategies
Week 1	<ul style="list-style-type: none"> ○ Limit concept (Unit I) ○ Limit techniques (Unit I) 	<ul style="list-style-type: none"> ○ Mind map

	<ul style="list-style-type: none"> ○ Infinity and limits (Unit I) ○ Properties of continuity (Unit I) 	
Week 2	<ul style="list-style-type: none"> ○ Types of discontinuity (Unit I) ○ Derivative concept (Unit II) 	<ul style="list-style-type: none"> ○ Assignment of case study for unit I
	<ul style="list-style-type: none"> ○ Derivative concept (Unit II) ○ Differentiation rules (Unit II) 	<ul style="list-style-type: none"> ○ Mind map
Week 3	<ul style="list-style-type: none"> ○ Differentiation rules (Unit II) 	<ul style="list-style-type: none"> ○ Mind map
Week 4	<ul style="list-style-type: none"> ○ Entire unit I 	<ul style="list-style-type: none"> ○ Oral presentation for unit I ○ Written report for unit I ○ Round table for unit I
Week 5	<ul style="list-style-type: none"> ○ Rate of change (Unit II) 	<ul style="list-style-type: none"> ○ Mind map

Week 6	○ Chain rule (Unit II)	○ Mind map
	○ Implicit differentiation (Unit II)	
Week 7	○ Extrema, mean value theorem (Unit II) ○ Graph analysis (Unit II)	○ Mind map ○ Assignment of case study for unit II
	○ Optimization (Unit II)	
Week 8	○ Optimization (Unit II)	○ Mind map
	○ L'Hopital Rule (Unit II)	
Week 9	○ Anti-derivative	○ Oral presentation for unit II
	○ Areas under curve	○ Oral presentation for unit II ○ Written report for unit II ○ Round table for unit II ○ Mind map
	○ Definite integral	○ Assignment of case study for unit III

Week 10	○ Fundamental Theorem of Calculus	○ Mind map
Week 11	○ Integral techniques	○ Assignment of final assessment
		○ Mind map
Week 12	○ Entire unit III	○ Oral presentation for unit III ○ Written report for unit III ○ Round table for unit III
	○ Entire unit III	○ Oral presentation for unit III ○ Written report for unit III ○ Round table for unit III ○ Final assignment

Please note that this chronogram is tentative and subject to change.