UCLouvain

lmat1121

2021

Diffenrential and integral calculus

5.00 credits	30.0 h + 30.0 h	Q1

Teacher(s)	Claeys Tom ;
Language :	French
Place of the course	Louvain-la-Neuve
Prerequisites	Calculation and geometric interpretation of one-variable derivatives, primitives and simple integrals.
Main themes	Using the acquired skills of differential and integral calculus from high school and from different problems, inspired in particular by physics, economics or geometry, tools, methods and mathematical intuitions will be proposed allowing in the following fields : • Geometric description of functions of R in R² and of R² in R (tangent lines and planes, contour lines). • Optimization of functions of two variables • Differential equations of the first and second order • Simple and double integrals (Cavalieri principle) • Taylor expansion, including estimating the remainder and observing the convergence of the series Graphical manipulations will be done on paper and with didactic software (such as the free dynamic geometry software GeoGebra). Learning sequences will be planned to allow students to reactivate and reinforce their skills on exponential and trigonometric functions, complex numbers and differential and integral calculus in one variable. Students will be invited to ask themselves mathematical questions about the limitations of the proposed tools.
Learning outcomes	**At the end of this learning unit, the student is able to :** At the end of this activity, the student will be able to : • describe geometrically the graph of a function from R in R² or from R² in R, using level sets and its derivatives, • model optimization problems with one and two variables, solve these problems using extremum conditions on the first and second derivatives and interpret geometrically and with the help of the model the method and the result, 1 • model using a first-order differential equation or a second-order linear equation, solve this equation graphically and/or analytically and interpret the solution found geometrically and/or within the framework of the model • model by an integral or double different situations, in particular geometrical and physical situations in the plane and in space, approach numerically with the help of a didactic software or calculate analytically this integral • approximate a function by a Taylor polynomial and evaluate the quality of this approximation by estimating the remainder.
Evaluation methods	Learning will be assessed by tests during the semester and by a final examination. **The questions will ask students to** : - judge whether a given proposition is correct or not - reproduce the subject matter, especially definitions, theorems, methods, and examples - select and apply methods from the course to solve problems and exercises - adapt methods from the course to new situations -summarise and compare topics and concepts. **Assessment will focus on** : - knowledge, understanding and application of the different mathematical methods and topics from the course - precision of calculations - rigour of arguments, reasonings, and justifications - quality of construction of answers.

Teaching methods	Learning activities consist of lectures and exercise sessions, complemented by short videos on the Moodle page of the course. The lectures aim to introduce fundamental concepts, to explain them by showing examples and by determining their results, to show their reciprocal connections and their connections with other courses in the programme for the Bachelor in Mathematics. The exercise sessions aim to teach how to select and use methods to solve problems and calculation methods.
Content	• Introduction to functions • Vectors and vector-operations • Functions of several variables: geometric desciption, limits, continuity, differentiability, optimisation of functions of two variables • Multiple integrals: polar and spherical coordinates, change of variables • Differential equations of first and linear of second order • Taylor expansions
Inline resources	**https://moodleucl.uclouvain.be/course/view.php?id=7583**
Bibliography	Livre "Calculus - Early Transcendentals" par W. Briggs, L. Cochran et B. Gillet, éditeur: Pearson, distribué par la Duc. ---- Book "Calculus - Early Transcendentals" by W. Briggs, L. Cochran and B. Gillet, publisher: Pearson, distributed by the Duke.
Faculty or entity in charge	MATH

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Bachelor in Physics	PHYS1BA	5		
Bachelor in Mathematics	MATH1BA	5		