Biocalculus Calculus For Life Sciences Stewart Pdf Download

BOOK DETAIL

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Book Description

BIOCALCULUS: CALCULUS, PROBABILITY, AND STATISTICS FOR THE LIFE SCIENCES shows students how calculus relates to biology, with a style that maintains rigor without being overly formal. The text motivates and illustrates the topics of calculus with examples drawn from many areas of biology, including genetics, biomechanics, medicine, pharmacology, physiology, ecology, epidemiology, and evolution, to name a few. Particular attention has been paid to ensuring that all applications of the mathematics are genuine, and references to the primary biological literature for many of these has been provided so that students and instructors can explore the applications in greater depth. Although the focus is on the interface between mathematics and the life sciences, the logical structure of the book is motivated by the mathematical material. Students will come away with a sound knowledge of mathematics, an understanding of the importance of mathematical arguments, and a clear understanding of how these mathematical concepts and techniques are central in the life sciences.

Cambridge University Press, 1990. Chapter 1. Introduction I. A. Berkovich 1. Definitions The problem of determining the maximum and minimum of a function on a set of real numbers is a classical problem. The solution of this problem is known in three distinct classes. The first class, commonly called calculus of variations, is based on the theory of extremal variational problems. This theory was based on the principle of extremalities (Hamilton, 1863), i.e., extremals are those that cannot be improved by other functions without violating a given restriction. The second class is based on differential equations. For this purpose, the minimum and the maximum of a function are often sought in a set of solutions of a differential equation. This type of solution of the problem is used in the theory of existence and uniqueness of solutions of ordinary differential equations, in the analysis of the stability of solutions of differential equations, in the study of extremal subsolutions of differential equations. This type of solution of the problem is also used for the study of optimal control theory (Pontryagin, 1938), in which the minimum and maximum are sought in a set of functions, which determine the movement of a system. The third type is based on the minimax principle of J. E. Lagrange. In this case, the problem of finding the maximum and minimum of a function is treated as the problem of finding the best solution in a set of functions. The solution of this problem in the third type of approach is based on the theorem of H. Levy-Marquis, which states that the functions of the first and second types of approach are equivalent. In this chapter we examine this theorem and show how it can be applied to calculus of variations and the theory of extremal variational problems. In this chapter we also discuss the applicability of the minimax principle in the calculus of variations. The problem of finding the maximum and minimum of a function on a set of real numbers is widely used in the theory of existence and uniqueness of solutions of differential equations. This problem is usually solved using the methods of calculus of variations. For example, the theory of existence and uniqueness of the solutions of the Euler-Lagrange equations is based on the Hamilton principle (Hamilton, 1863, 1882) according to which the extremals of a functional in the class of functions are determined from the extremals of the function, which generates this functional. In this case, the class of functions is given by the set 82157476af